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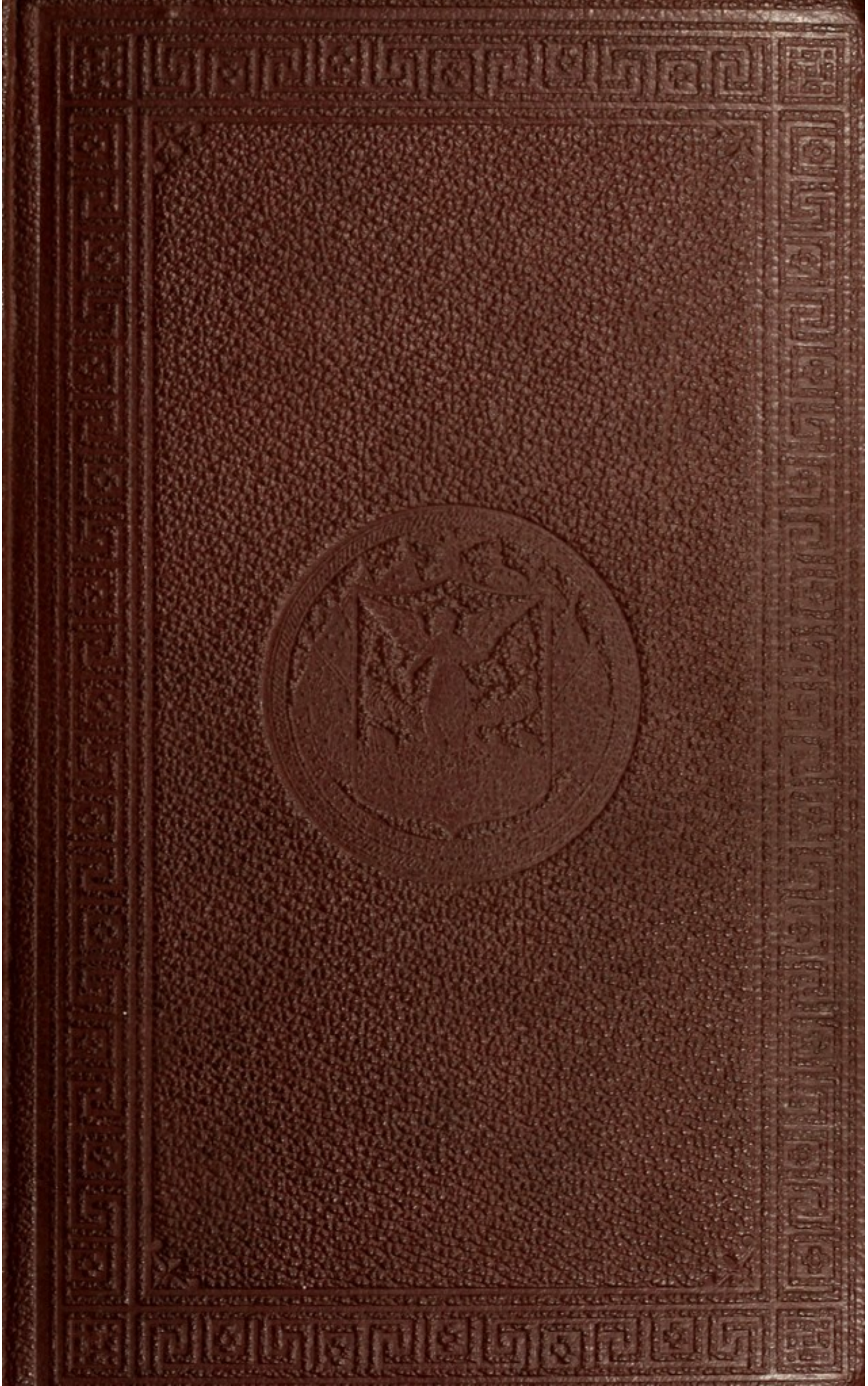
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SANITARY MEMOIRS

OF THE

WAR OF THE REBELLION.

COLLECTED AND PUBLISHED

BY THE

UNITED STATES SANITARY COMMISSION.

CONTRIBUTIONS

RELATING TO THE

CAUSATION AND PREVENTION OF DISEASE,

AND TO

CAMP DISEASES;

TOGETHER WITH

A REPORT OF THE DISEASES, Etc., AMONG THE PRISONERS AT ANDERSONVILLE, GA.

EDITED BY

AUSTIN FLINT, M. D.



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PREFACE BY THE EDITOR.

After the termination of the late war of the rebellion, the United States Sanitary Commission resolved to publish a series of volumes, with a view to the diffusion and permanent availability of important information, acquired during the war, relating to the grand object of the labors of the Commission, namely, to lessen the evils of warfare as far as possible by the systematic and efficient employment of sanitary measures. Much valuable material for the proposed volumes had already accumulated in the Historical Bureau, consisting of reports and various documents received from appointed inspectors and agents, as also from medical officers and others interested in the labors of the Commission. To this material has been added much obtained by means of a printed circular, inviting contributions from all who had had "opportunities for special studies in hospitals or in the field," or who had "made professional observations upon any subject connected with military Hygiene, Camp Diseases, and Surgery." In addition, elaborate papers have been furnished, upon personal application, by members of the medical profession, distinguished for researches or large experience in the departments of inquiry to which their papers relate. These measures and all arrangements connected with the preparation of the volumes, have been under the immediate direction of the Medical Committee of the Commission, the committee consisting of Professor Wm. H. Van Buren, M. D., Cornelius R. Agnew, M. D., Elisha Harris, M. D., Professor Wolcott Gibbs, M. D., and Professor J. S. Newberry, M. D. — the last-named member of the Commission having been recently added to the Committee.

This volume is devoted to topics pertaining to medicine, in a

restricted sense of the term; that is, as distinguished from surgery. The larger portion is occupied by Camp Diseases. The Causation and the Prevention of Disease form a portion of the volume; but Military Hygiene comprehensively considered, the Construction and the Administration of Hospitals, the Transportation of the Sick and Wounded, together with other kindred topics, and all those which belong to surgery, are assigned to other volumes.

As regards arrangement of topics, that which suggested itself as the most simple and natural, was a division corresponding to General and Special Pathology. In accordance with this arrangement, contributions relating to the Causation and Prevention of Disease are embraced in the first section of the volume, and those relating to Camp Diseases are embraced in the second section. A third and the last section consists of an elaborate Report on the Diseases, etc., prevailing among the prisoners confined at Andersonville, Ga. This Report could not well be divided into separate parts, and distributed in the foregoing sections, and it seemed to require a distinct portion of the volume. The author, Professor Joseph Jones, was a Confederate medical officer, and the Report which is published in this volume, and which was placed by him at the disposal of the Sanitary Commission, is an official account of personal investigations made by authority of the Surgeon-General of the Confederate Army. The Report is published as received from the author, no alterations having been made in any part, the title-page, the division into chapters, and the headings of the latter being included in this statement. Some portions, however, owing to the great length of the Report, have been omitted, but care has been taken that the omissions should not in any way alter its character or impair its value.

It has been the duty of the editor to examine the mass of material relating to the topics belonging properly to this volume, and to select therefrom the contributions which form the contents of the volume. It is proper to state that in the performance of this duty, there have been no restrictions placed upon him by the Medical Committee of the Commission, and that he is therefore alone responsible for the manner in which the duty has been performed. It has also been his duty to arrange the matter for publication, and to supervise its passage through the press. To these editorial

duties he has confined himself, taking no part as a contributor; and he may, therefore, without impropriety express the belief that the volume will be found to possess interest for all classes of readers, and to have much value as a repository of an important part of the sanitary experience of the war.

A. F.

New York, *August*, 1867.

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* Resigned, December, 1864.
† Resigned, February, 1864.
‡ Resigned, December 17th, 1864.
§ These gentlemen never took their seats.
‖ Resigned, 1864.

NAMES OF THE AUTHORS OF CONTRIBUTIONS TO THIS VOLUME.[1]

Abbott, Samuel W., Surgeon 1st Massachusetts Cavalry.
Adams, Samuel L., Assistant Surgeon, U. S. A.
Anderson, H. P., Surgeon 60th Ohio Infantry.
Andrew, G. L., Inspector U. S. Sanitary Commission.

Bartholow, Roberts, Assistant Surgeon U. S. A., in charge of the McDougal General Hospital.
Batwell, E., Surgeon 14th Regiment Michigan Infantry.
Bidwell, Edwin C., Surgeon 31st Regiment Massachusetts Infantry.
Bailhache, J. H., Surgeon 14th Regiment Illinois Cavalry.
Brock, Jesse W., Surgeon 66th Regiment Ohio Infantry.
Benedict, M. D., Surgeon 75th Regiment New York Infantry.

Clark, A. M., Surgeon U. S. Volunteers, and Medical Inspector of Prisons.
Clark, H. W., Surgeon 15th Regiment Ohio Infantry.
Coe, Agemon S., Surgeon 147th Regiment New York Infantry.
Cook, T. M., Surgeon 15th Regiment Ohio Infantry.
Crawford, S. P., Surgeon Confederate Army.

Denig, C. E., Surgeon 28th Regiment Ohio Infantry.
Dwyer, R. A., Surgeon 175th Regiment Ohio Infantry.
Dibble, Frederick L., Surgeon 6th Regiment Connecticut Infantry.
Dunster, Edward S., Assistant Surgeon U. S. A., and Medical Director of Hospital Transportation.
Da Costa, J. M., Assistant Surgeon, U. S. A.

Everts, Orpheus, Surgeon 20th Regiment Indiana Infantry, and Medical Inspector Second Corps d'Armée.
Eve, Paul F., Surgeon Confederate Army.
Ewing, George C., Surgeon 115th Regiment Pennsylvania Infantry.

Flagg, Samuel, Assistant Surgeon 25th Regiment Massachusetts Infantry.

[1] To the names in this list are attached titles denoting official positions held during the war. Most of the contributors have retired from the service since the termination of the war. Other titles, denoting positions held before and since the war, are not here introduced.

Galloupe, I. F., Surgeon 17th Regiment Massachusetts Infantry.
Green, Samuel A., Surgeon 24th Regiment Massachusetts Infantry.
Gennet, ———, Surgeon 17th Regiment Ohio Infantry.
Gay, Norman, Surgeon U. S. Volunteers.
Gill, H. Z., Surgeon 95th Regiment Ohio Infantry.

Heise, A. W., Surgeon 100th Regiment Illinois Infantry.
Hand, A., Surgeon 8th Regiment Illinois Cavalry.
Houston, Wm. M., Surgeon 122d Regiment Ohio Infantry.
Habersham, S. E., Surgeon Confederate Army.
Hunt, Sanford B., Surgeon U. S. Volunteers.
Harvey, Wm. A., Surgeon U. S. Volunteers, in charge Sickles U. S. A. General Hospital, Alexandria, Va.
Hamilton, Frank H., Medical Inspector, U. S. A.
Howard, B., Assistant Surgeon, U. S. A.
Harris, Elisha, M. D., Member U. S. Sanitary Commission.

Jewett, Chas. C., Surgeon 16th Regiment Massachusetts Infantry.
Jones, Amos S., Surgeon 40th Regiment Wisconsin Infantry.
Jones, Joseph, Surgeon Confederate Army.

Lidell, John A., Surgeon U. S. Volunteers, and Inspector Medical Department Army of the Potomac.
Long, Owen M., Surgeon 11th Regiment Illinois Infantry.
Leavitt, D. F., Surgeon 3d Regiment Massachusetts Cavalry.
Lee, Chas. A., Medical Inspector U. S. Sanitary Commission.

Mitchell, S. Weir, Acting Assistant Surgeon, U. S. A.
Manfred, Henry, Surgeon 22d Regiment Kentucky Infantry.
Miller, George D., Surgeon 5th Regiment Wisconsin Infantry.
McDonald, Alex., Inspector U. S. Sanitary Commission.

New, George W., Surgeon 7th Regiment Indiana Infantry.

Powers, Cyrus, Acting Assistant Surgeon Stanton Hospital.
Phelps, A. J., Surgeon U. S. Volunteers.
Page, J. W., Inspector U. S. Sanitary Commission.

Ramsay, A. W., Surgeon Confederate Army.
Russell, Ira, Surgeon U. S. Volunteers.

Stevenson, B. F., Surgeon 22d Regiment Kentucky Infantry.
Southwell, Charles, Surgeon 18th Regiment Michigan Infantry.
Sanborn, J. E., Surgeon 27th Regiment Iowa Infantry.

Teal, Norman, Surgeon 88th Regiment Indiana Infantry.
Thrall, S. B., Assistant Surgeon 13th Regiment Iowa Infantry.

Upham J. Baxter, Surgeon U. S. Volunteers, in charge Stanley U. S. A. General Hospital, Beaufort, N. C.

Varian, William, Surgeon U. S. Volunteers.

Woodward, Benj., Surgeon 22d Regiment Illinois Infantry.
Whitaker, John, Assistant Surgeon 81st Regiment Ohio Infantry.
Wright, John, Surgeon 107th Regiment Illinois Infantry.
Willis, Wm. S., Surgeon 1st Regiment New Jersey Cavalry.
Williams, J. H., Surgeon 123d Regiment Ohio Infantry.
White, A. A., Surgeon Massachusetts Cavalry.
Windsor, I. W., Surgeon 49th Regiment Massachusetts Infantry.
Walton, C. J., Surgeon 21st Regiment Kentucky Infantry.
Wilbur, George D., Surgeon 5th Wisconsin.
Wragg, W. T., M. D., of Charleston, S. C.

CONTENTS.

SECTION FIRST.

CHAPTER FIRST.

THE VARIOUS INFLUENCES AFFECTING THE PHYSICAL ENDURANCE, THE POWER OF RESISTING DISEASE, ETC., OF THE MEN COMPOSING THE VOLUNTEER ARMIES OF THE UNITED STATES.

Influences previous to Enlistment. — Qualifications for Military Service, relating to Race, Temperament, Occupation, Age, etc. — Causes affecting Physical Stamina subsequent to Enlistment, relating to Exposure, Diet, Overcrowding, and the Lack of Cleanliness. — The Mental and Moral Effects of Association. — Liability to specific Febrile Affections. — Causes affecting the Physical Stamina in Active Service, Climatic, Dietetic, Accidental, Specific, Moral, and Compound. — Moral Causes affecting the Physical Stamina of the Soldier, relating to Cowardice, Weakness of Will, and Nostalgia. — Malingering, its Causes and Degree of Prevalence. — The Forms of Disability feigned, namely: Affections of the Cerebro-Spinal System, of the Thoracic Organs, of the Digestive System, of the Genito-Urinary Apparatus, of the Extremities, and Constitutional or General Affections. — Detection and Treatment of the various Forms of feigned Disability. — Discharges on Surgeon's Certificate . . . 3

CHAPTER SECOND.

REMARKS ON VARIOUS CIRCUMSTANCES RELATING TO THE CAUSATION OF DISEASE, ESPECIALLY AMONG VOLUNTEER TROOPS, BASED ON PERSONAL OBSERVATIONS IN THE FIELD, DURING THE YEARS 1861–65.

The Aptitude of the American Mind. — The newly-appointed Medical Officer, his Early Embarrassments, and the little Instruction that he derives from those regularly in the Service. — The First Duty of the Medical Officer. — Bad Effects of the Volunteer Plan for Recruiting an Army. — Sketch of the Early History of an Ohio Regiment, as representing the History of New Regiments generally. — First Organization of Buell's Army, or "The Army of the Ohio," and Appointment of Division and Brigade Surgeons. — Increase of Sickness. — The Superiority of Tent Hospitals. — The Effect of Marching Orders upon the Health of the Troops. — The Size of Men best suited for Soldiers. — Line of March of Troops from Nashville. — Battle of Pittsburg Landing. — The Want of Coöperation between Commanding Officers and their Surgeons. — Account of the First General Hospital of this Army. — The Severe Services and Bad Nourishment of the Army before Corinth. — The Type of Disease that prevailed in the Army before Corinth. — The March of the Army of the Ohio, after its Evacuation of Corinth, and its improved Hygienic Condition. — The Reënforcement of the Army from the Calls of 1862; the Error of the Government; no Improvement in the *Personnel* over the Troops of 1861. — First Attempt at an Organization of the Medical Department, for the Field of Battle, in Wood's Division. — The Long Rest of the Army; the Time is spent in Recuperating, Organizing, and Reënforcing. — The March of the Army to Chattanooga. — Battle of Chickamauga. — Retreat to Chattanooga. — Siege of Chattanooga. — The Battles of Mission Ridge and Lookout Mountain. — The March to the Relief of Knoxville; remarkable Health coexisting with Destitution of all Kind of Supplies. — Still further Improvement in the Medical Department 42

CHAPTER THIRD.

ARMY ALIMENTATION IN RELATION TO THE CAUSATION AND PREVENTION OF DISEASE.

Public Opinion respecting the Wants of the Army prior to the Rebellion. — Experience of the British and French Armies in the Crimea. — Defects in the United States Army as regards the Equalization of the different Nutriments, and their Lack of Adaptability to the Vicissitudes of Climate and the Accidents of Campaigns.— Work of the Sanitary Commission. — Standard of Alimentation. — Classification of Foods into Nitrogenetic and Calorifacient. — Analysis of Blood. — Army Rations of different Nations. — Rations of the United States Army compared with those of the French, Russian, Turkish, East Indian, and British Armies. — Nutritive Value of Rations. — Nitrogenous Foods. — Experience of British Statisticians. — Experience at the Convalescent Camp in Virginia, and in the Military Prisons of the United States. — The Confederate Army Ration. — Experience of the 16th Army Corps in 1864–65; of the Frontier Head-quarters at Fort Smith, Arkansas, and at the Confederate Prison at Andersonville — Conclusions respecting Nitrogenous Diet. — Carbonaceous Foods. — Fresh Vegetables and Salt. — Notes on the Special Components of the Ration. — Beef, fresh or salt; Pork or Bacon; Bread, hard or soft; Pease and Beans; Coffee, Tea and Whisky. — Summary. — Professor Horsford's Plans to diminish the Weight and Bulk of the Army Ration. 64

CHAPTER FOURTH.

Testimony of Medical Officers respecting the Relations of Physical Endurance and the Power of resisting Disease to Age, Period of Service, Season, Climate, and Locality; Residence in City or Country prior to Enlistment; and the Influence of previous Habits of Life. — Remarks on the Physical Characteristics of Different Classes of Recruits and the Influence of Previous Habits, by Dr. S. B. Hunt — Remarks by Dr. Hunt on the Effects of Altitude. — Opinions and Facts Pertaining to Alimentation, the use of Tea and Coffee, and the Whisky Ration 95

CHAPTER FIFTH.

EFFECTS OF A MALARIOUS ATMOSPHERE AS REGARDS PHYSICAL ENDURANCE. — AGENCY OF MALARIAL POISONING UPON DISEASES AND THE RESULTS OF SURGERY. — RELATION OF MALARIA TO THE DIARRHŒAL AND PULMONARY MALADIES OF THE CAMP AND TO SUCCESS IN THE CONSERVATIVE TREATMENT OF WOUNDS.

Slow and Insidious Absorption of Malaria as contrasted with Sudden Poisoning. — Two Forms of Poison. — Gradual Absorption of Malaria, without Febrile Phenomena, due to the Poison not being Intense, to the Organism not being Susceptible, and to Hygienic Circumstances being unfavorable to its Speedy Absorption. — Effects of Malaria on Physical Endurance, without inducing Fever, shown by Lesions of Assimilation and by Lesions of Innervation. — Morbid Anatomy of Chronic Malarial Poisoning. — Symptoms denoting the Influence of a Malarious Atmosphere upon the Functions and Physical Endurance. — Danger from Intercurrent Diseases. — Tendency to Pneumonia, Diarrhœa, Phthisis, and General Dropsy. — Effects of Malaria manifested in Febrile Diseases, in Inflammations, in Intestinal Diseases, in Diseases of the Nervous System, and in Constitutional Affections other than Fevers. — Malarial Typhoid Fever. — Typhoid Pneumonia. — Development of Phthisis. — Relation of Malarial Poisoning to the Diarrhœal Maladies of the Camp. — Affections of the Nervous System connected with Malarial Poisoning. — Influence of Malaria on the Results of Surgery, as manifested in the Repair of Fractures and other Injuries; in Predisposing to Pyæmia, Hospital Gangrene, and Secondary Hemorrhage, and inducing a State confounded with Pyæmia (Pseudo-Pyæmia). — Case illustrative of Interference with Repair. — Case illustrative of Agency of Malaria in predisposing to Pyæmia. — Conclusions. — Prophylactic Employment of Quinia. — Essay by Prof. Van Buren. — Testimony of Medical Officers 118

CHAPTER SIXTH.

VACCINATION IN THE ARMY. — OBSERVATIONS ON THE NORMAL AND MORBID RESULTS OF VACCINATION AND REVACCINATION DURING THE WAR, AND ON SPURIOUS VACCINATION.

Vaccination of Volunteers delayed or neglected. — Revaccination generally neglected in Civil Life. — Much of the Vaccination in Civil Life not Effectual. — The Army Regulation. — Aid in Vaccinating the State Volunteers before they left for the Field. — Self-Vaccinations, Consequences of Marching, etc. — Efforts by Purveyors and the Medical Institutions in New York. — Amount of Small-Pox in the first Year of the War. — Results of Official Inquiry concerning Vaccination in New York, by Surgeon-General Vanderpoel. — Fifty Thousand Charges of fresh Virus supplied gratuitously by the New York Eastern Dispensary. — Analysis of Surgeon-General Vanderpoel's Returns. — Statistics of Vaccination; Ratio of the Protected to the Unprotected. — Experience in the Prussian Army; Benefits of Revaccination. — Importance of Genuine and thoroughly Protective Vaccination. — The Sanitary Commission urged and aided timely Vaccination, and insisted upon proper Precautionary Measures. — Amount of Virus supplied by the Sanitary Commission. — Spurious Vaccination. — Official Orders for Vaccination of the Troops of both Armies. — Early Appearance of Morbid Results of Vaccination. — Small-Pox and the Bad Results of Vaccination in St. Louis and the Mississippi Valley. — Scorbutic and Unhealthy Conditions. — Surgeon Ira Russell's Account of Cases at St. Louis. — Surgeon White's Cases and Conclusions. — Wide-spread Diffusion of the Inoculations. — Inquiry and Personal Inspection by a Committee of the Surgeons of St. Louis. — Prevalence of the Morbid Effects of Vaccination and of Spurious Vaccination. — Professor Hamilton's Observations after the Battle of Murfreesboro. — Testimony of Surgeons Hunt, Dwyer, Cook, Batman, Stevenson, Houston, Galloupe, Williams, and Grove. — Self-Vaccination of Soldiers from Foul Sores. — Experience among Prisoners at the North. — Experience in the Confederate Army. — Dr. Habersham's Report. — Dr. Ramsay's Report. — Dr. Crawford's Testimony. — Pathological History of Spurious and Impure Vaccination. — Jenner's Views; his Evidence before Parliament, and his *experimentum crucis*. — Sources of Impaired or Spurious Virus; Scurvy, Sero-Purulent Matter, Inoculation by Specific Infections, Deterioration of the Genuine Virus, and Destruction of the Virus by Heat. — Conclusions. — Vaccination to be proved by Revaccination at Enlistment. — Virus from Men in Camp and Hospitals not to be used. — The Results of Spurious Vaccination the same now as in Former Time. — Virus from Unhealthy Persons not to be used. — The Diseases which may be Inoculated. — The Syphilitic Poison may be Inoculated. — Vaccination to be performed when the Person to be vaccinated is Healthy. — History of Vaccination in our Armies confirms Jenner's Doctrines 137

SECTION SECOND.

CHAPTER FIRST.

THE COMPARATIVE MORTALITY IN ARMIES FROM WOUNDS AND DISEASE.

Error of Popular Opinion. — Purpose of the Writer. — Casualties of the English Forces in the Crimean War. — Mortality in the Crimea. — Effect of Sanitary Measures. — Comparative Mortality from Wounds and Disease. — Consolidated Table of the Losses of the English Army in the Crimean War. — Comparative Mortality among Enlisted Men and Officers. — Comparison of Enlisted Men and Officers as regards Casualties. — Mortality from Disease in the different Arms of the Service. — French Quota of the Allied Army. — Total Mortality during the War. — Comparative Mortality from Wounds and Disease. — Statistics of Scrive and Chenu. — Comparative Mortality among Enlisted Men and Officers. — Casualties of the United States Army in the War with Mexico. — Strength of the United States Army. — Total Mortality during

the War. — Consolidated Table of the Losses of the United States Army in the War with Mexico. — Comparative Mortality from Disease and Wounds. — Comparative Mortality among Enlisted Men and Officers. — Comparative Mortality in Different Branches of the Service. — Mortality in the Recent Rebellion. — Statement of the Casualties in the Armies of the United States, from the Commencement of the Rebellion to August, 1865. — Recapitulation of the losses from Wounds and Disease in the Regular and Volunteer Armies and among Colored Troops. — Comparative Mortality from Disease and Wounds. — Comparative Mortality among Enlisted Men and Officers. — Large Excess of Deaths from Disease among Colored Troops. — Mortality in the different Arms of the Service. — The Proportion per One Thousand of Mortality from Disease and Wounds. — Comparative Mortality among Troops from different States. — Proportional Analysis of the Table of Casualties by States. — Mortality in Kansas. — Comparison of Mortality among Regular, Volunteer, and Colored Troops. — Comparison of Losses from Wounds and Disease among Troops from different States. — Casualties among Medical Officers. — Casualties in the Rebel Army. — Losses in other Notable Campaigns; in the Sardinian Army in the Crimean War; in the French Army in Africa; in the English Army in Spain; in the Expedition to Walcheren. — Losses in the English Navy. — Losses in the Russian Army in Turkey. — Conclusions 169

CHAPTER SECOND.

CAMP FEVERS. — REMITTENT, TYPHOID, TYPHO-MALARIAL OR MALARIAL TYPHOID, COMMON CONTINUED, AND MOUNTAIN FEVER. REPLIES OF MEDICAL OFFICERS TO QUESTIONS CONCERNING CAMP FEVERS, — REMITTENT AND INTERMITTENT, TYPHOID, AND TYPHO-MALARIAL.

Conditions modifying the Symptomatology and Morbid Anatomy of the Fevers of the Army. — Remittent and Typhoid. — Dr. Woodward's Theory of Typho-Malarial Fever. — Classification of the Fevers of the Army into Periodical and Continued. — Subdivision of Periodical Fevers into Intermittent, Remittent, and Typho-Malarial (?). — Subdivision of Continued Fevers into Simple Continued, Typhoid, Malarial Typhoid, and Typhus. — Error of considering all these as Modifications of one Disease. — The Scorbutic Element in Camp Fevers. — Existence of Typho-Malarial Fever considered. — Comparison of Army Typhoid and Army Remittent Fever. — Alterations characteristic of Chronic Malarial Poisoning. — Etiology of Typhoid Fever. — Emanations from Excreta the chief determining Cause. — Facts showing Contagiousness of Typhoid Fever. — Simple Continued Fever. — Number of Cases in the First Year of the War. — Occurrence among Recruits and Young Soldiers. — Mountain Fever. — Dr. Ewing's and Dr. Logan's Account. — Malarial Origin of this Variety of Fever. — Remittent and Typhoid Forms of Mountain Fever. — Sources of the Malarial and Typhoid Poison. — Typhus Fever. — Conclusions.

Replies of Medical Officers. — Statistics of Fevers during the First Two Years of the Rebellion. — Replies relating to Intermittent and Remittent Fever. — Statistics of Periodical Fevers. — Extract from Communication by Surgeon H. W. Clark. — Communication from Surgeon Liddell. — Statements by Surgeons Miller, Jones, Windsor, Flagg, and Assistant-Surgeons Gennet and Abbott. — Extract from Letter by Surgeon Dibble. — Infrequency of Typhus Fever. — Frequency of Typhoid Fever. — Two "Walking Cases" of Typhoid Fever. — Proper Use of the Term Typho-Malarial Fever. — Surgeon Evert's Opinion. — Communication by Surgeon Harvey. — Cases reported by Medical Inspector F. H. Hamilton 193

CHAPTER THIRD.

CAMP MEASLES. TESTIMONY OF MEDICAL OFFICERS RESPECTING THE PREVALENCE, FATALITY, ETC., OF CAMP MEASLES.

Prevalence of Measles, and its Fatality. — Liability of Recruits to the Disease. — Dr. Salisbury's Theory of Fungi. — Observations of the Writer with respect to this Theory. — Circumstances rendering Recruits especially liable to the Disease. — The

Eruption in One Hundred Cases. — Desquamation in Camp Measles. — Delirium in Fatal Cases. — Symptoms and Affections pertaining to the Respiratory System. — Symptoms referable to the Heart. — Symptoms referable to the Mouth, Fauces, etc. — Symptoms referable to the Kidneys. — Sequelæ of Camp Measles, Typhoid State, Bronchitis, and Pneumonia.— Chronic Pneumonia and Diarrhœa. — Two Methods of Treatment. — A rational Method of Treatment proposed. — Testimony of Medical Officers. — Means of Protection against Losses by Death and Discharge from this Disease. — Testimony to Prevalence, Fatality, etc., from Surgeons Long, Gill, Anderson, Sanborn, Jones, Norton, Phillips, Leavitt, Wilbur, New, Windsor, Seal, Flagg, Whittaker, Bailhache, and Prof. Eve. — Communication by Surgeon Benjamin Woodward. — Communication by Surgeon Samuel L. Adams 218

CHAPTER FOURTH.

YELLOW FEVER ON THE ATLANTIC COAST AND AT THE SOUTH DURING THE WAR.

Predictions concerning Yellow Fever. — Assurances of Hygienic Protection.— The Capture of New Orleans did not open a Highway for Yellow Fever. — Sanitary Police in New Orleans. — The Troops in a Condition to take Yellow Fever. — Constant Exposure of New Orleans. — Quarantine. — Yellow Fever at Wilmington, N. C. — Commencement of the Epidemic. — Statistics of the Epidemic. — Arrival of the *Kate*. — Infected at Nassau, N. P. — Dr. Wragg's Report. — The Hygienic Condition of the City. — Facts relating to Origin. — Sporadic Cases. — Importation. — Remarkable Fatality. — Yellow Fever at Key West and the Dry Tortugas. — The Gunboat *Tahoma*, 1864. — Outbreak on the Tortugas. — Localizing and Personal Causes. — Key West and Nassau as *points d'appui* of Fever Infection. — The Epidemic at Hilton Head, S. C., in the Autumn of 1862. — The Ship *Delaware* as the Carrier. — The Manner of communicating the Infection. — A Series of Cases in Hospital. — Decline of the Disease. — Origin and Localizing Causes. — Two Distinct Outbreaks of the Epidemic. — Epidemic Causes. — General Mitchell and his Staff. — Fever at Beaufort traced to Hilton Head. — Diagram and Medical Topography of the Infected District at Hilton Head, 1862. — Yellow Fever at Newbern, N. C. — Number of Fatal Cases. — Heroism of the Physicians. — Beaufort and Morehead City. — The "Roll of Honor." — Was the Newbern Epidemic of Exotic Origin? — Conclusions.

Yellow Fever in the Gulf Ports. — Rigid Quarantine at New Orleans. — Liability to Exotic Infection Excluded. — The Question of Domestic Origin for the First Time susceptible of Solution. — One Class of River Craft prepared to generate Yellow Fever; but the City secure. — All the Gulf Ports and some Texian Towns Inland infected. — The Galveston Epidemic. — A District of the City escapes Yellow Fever by Exclusion from Intercourse with the Epidemic Quarter.— The Fever was conveyed Inland. — Experience in New Orleans in 1862–65. — New Orleans as Liable as any Gulf Port. — The Fever widely Epidemic in the Gulf Ports. — Exotic Germs and Localizing Causes of Past Epidemics. — The Exotic and the Domestic Factors controlled by Sanitary Measures. — River "Rams," etc., furnished the Artificial Causes. — Internal Sanitary Police of the City. — The Chances of Exotic Infection excluded. — Medical Topography of the Delta. — Temperature and Humidity, Cryptogamic and Infusorial Life and Decay. — Persistent Scourging by Yellow Fever before the War. — The City full of *Uncreolized* and most Susceptible Men. — Low Death-rate in 1864–65. — Death-rates and Epidemic Causes. — Sanitary Government of the City. — Yellow Fever in Iron Boats in 1863; not of Imported Origin. — New Orleans Quarantine Record of 1863–64. — Locality of Naval Hospital. — Record of the Naval Epidemic. — Foul Vessels long at Anchor; Twenty-five Boats become Infected. — The Boat-landing becomes Infected. — Hygienic Truths taught by this Record. — Conclusions.

Pathological Inquiries. — Therapeutical Experience 236

CHAPTER FIFTH.

THE ACUTE RHEUMATISM OF THE TROOPS IN NEW MEXICO. NOTE RESPECTING THE PREVALENCE OF RHEUMATISM.

Strength of Garrison at Fort Union, New Mexico. — Statistics. — Number of Cases of Rheumatism. — Relation of Climate to the Production of Acute Rheumatism. — Climate of Fort Union. — Humidity not a Cause of Acute Rheumatism. — Electrical Phenomena in New Mexico. — Agency of the so-called Rheumatic Diathesis, Hereditary and Acquired. — Acute Rheumatism a Substitution for Epidemic Erysipelas. — Special Characters of Rheumatic Disease of New Mexico. — The Cases characterized by Severity and the Number of Parts affected. — Bronchitis and Pneumonia occurring as Complications. — Mortality. — *Post-mortem* Examinations. — Points of Similarity between Erysipelas and Acute Rheumatism. — Conclusions. — Note respecting the Prevalence of Rheumatism 269

CHAPTER SIXTH.

SCURVY IN ITS MEDICAL ASPECT.

First Appearance of the Disease during the War. — Prevalence during the War. — Scurvy Incident to the present Army Ration. — Causation of Scurvy. — Scurvy in the Army attributable to Diet. — Dietetic Origin shown by History. — Discrepancies as regards Theories of Causation. — Scurvy dependent on Lack of Albuminoids and Salts. — Fresh Animal Blood in Scurvy. — Healthy Blood the Typical Food. — The Salts derived from Vegetable Food. — Causes of Prison-Scurvy. — Relative Value of Albuminoids and Salts. — Acids in Scurvy. — Symptoms and Pathology of Scurvy. — Essential Pathology. — General Debility the First Manifestation. — Symptoms in Advanced Cases. — Symptoms those of Exhaustion. — Ecchymotic Œdema. — Destructiveness of Tissue the Characteristic of Scurvy. — Morbid Characters of Scurvy in Pus. — Diarrhœa. — Characters of Inflammation. — The Pathological Conditions dependent on Depravation of the Blood. — Treatment to be based on the Pathology and Causation. — Total and Partial Starvation. — Saline Remedies. — Phosphate of Lime. — Remedies for Diarrhœa. — Object of Treatment to repair the Starvation. — A Complete Diet the most Reliable. — Reports by Drs. Charles A. Lee, Andrews, Frank H. Hamilton, Varian, Woodward, and McDonald 276

CHAPTER SEVENTH.

CAMP DIARRHŒA AND DYSENTERY. EXTRACTS FROM COMMUNICATIONS BY MEDICAL OFFICERS, RESPECTING CAMP DIARRHŒA AND DYSENTERY.

Frequency and Importance of these Diseases. — Their Prevalence in the United States Army. — Prevalence in the Confederate Prisons. — Symptomatology. — Pathology. — Anatomical Characters, and Intercurrent Affections. — Medical Geography in Relation to their Prevalence. — Forry's Geographical Divisions and Statistics. — Woodward's Statistics. — Comparison of Latter with Forry's Statistics. — Forry's Statistics, showing Relations to Intermittent Fever. — Woodward's Ditto. — Mortality in Different Regions. — Conclusion respecting the Agency of the Causes of Intermittent Fever. — Woodward on Effect of Latitude in General Hospitals. — Causes Independent of Latitude. — Altitude. — Prevalence in Low and Humid Localities. — Experience of British Army in the Establishment of Hill Stations in India. — New England Hospitals. — Special Causes. — Dietetic Causes. — Agency of Scurvy. — The Bivouac a Special Cause. — Predisposition from Previous Attacks. — Crowd-Poison, etc. — Causes at the Andersonville Prison. — Treatment. — Use of Purgatives and Opium. — Removal to the North. — Value of Drugs. — Dietetic Management. — Experience in Selma, Alabama. — Importance of Hygienic Measures. — Extracts from Communications by Medical Officers. — Intermittent Type of Diarrhœa. — Extracts from Communications by Dr. B. Howard, Surgeon B. Woodward, Surgeon Batwell, and Surgeon Ewing. — Conclusions respecting Malarial Influences. — Report by Dr.

Salisbury. — Surgeon B. Woodward's Report on Agency of Cryptogamia. — Defective Police of Camps. — Suggestions by Surgeon Gay. — Remarks by Surgeon B. Woodward. — Surgeon Benedict's Account of Diarrhœa at Fort Pickens. — Surgeon Batwell on Relations of Diarrhœa to the Nervous System. — Remarks by Surgeons Bailhache and Jewett. — Surgeon Dwyer on Agency of Hard Bread. — Diarrhœa caused by Fresh Mutton. — Report of Surgeon Stevenson. — Explanation of Apparent Discrepancies of Opinion 291

CHAPTER EIGHTH.

PNEUMONIA AS IT APPEARED AMONG THE COLORED TROOPS AT BENTON BARRACKS, MO., DURING THE WINTER OF 1864. NOTE RESPECTING THE PREVALENCE AND FATALITY OF PNEUMONIA AND OTHER INFLAMMATORY AFFECTIONS OF THE RESPIRATORY SYSTEM AMONG THE UNITED STATES TROOPS DURING THE WAR.

Number of Cases and of Deaths. — Division of the Disease into the Congestive Form, the Typhoid Form, and Pleuro-Pneumonia. — Congestive Variety most prevalent in January. — Severity of the Winter. — Congestive Form; its Symptoms and Physical Signs. — Chlorides in the Urine. — Typhoid Pneumonia; its Symptoms and Physical Signs. — Pleuro-Pneumonia; its Symptoms and Physical Signs. — The Disease attributable to Over-crowding and to Measles. — Number of Cases after Measles. — Differences found after Death in Cases following Measles. — Table 1, showing Number of Days in Hospital; the Affection of one or both Lungs; Stage of Disease at Time of Death; and Weight of Lungs in One Hundred Fatal Cases. — Table 2, showing the Dates of Deaths in One Hundred Cases. — Table 3, showing Duration of the Disease, Amount of Effusion, etc., in Fifty Fatal Cases of Pleuro-Pneumonia. — Table 4, showing Duration in Fifty Fatal Cases of Pneumonia, and Thirty-eight Cases of Measles. — Table 5, showing the Order in which the Lungs and General Lobes were attacked; the Stage of the Disease in each Lobe at the Time of Death; and the Weight of each Lung in Fifty Cases among Colored Troops at Wilson Hospital, Tennessee. — Table 6, showing Days in Hospital in Cases of Measles, and of Pneumonia ending in Recovery. — Treatment of Pneumonia. — Agents generally used. — Liability to Sudden Prostration. — Importance of the Carbonate of Ammonia. — Quinia as a Prophylactic. — Classes of Patients at Benton Barracks. — Liability of the Negro to Pulmonary Disease. — Efficacy of Treatment in Cases among Negroes. — Pleuritic Adhesions, found after Death, more frequent in Negroes. — Weight of Lung less in Negroes. — Note respecting the Prevalence and Fatality of Pneumonia, and other Inflammatory Affections of the Respiratory System 319

CHAPTER NINTH.

ON THE PREVALENCE AND FATALITY OF PNEUMONIA AND OF TYPHOID FEVER IN THE CONFEDERATE ARMY DURING THE WAR OF 1861–1865.

Importance of Pneumonia in view of its Prevalence and Fatality. — Table giving Mean Strength, the Total of Sick and Wounded, the Cases of Pneumonia, and the Percentage of Pneumonia in Mean Strength, etc., in the Confederate Army during Nineteen Months, 1862–63. — Analysis of this Table. — Cases most Numerous in the Winter and Spring Months. — Table illustrating the Prevalence of Pneumonia in the Armies serving in Different Sections of the Confederate States. — Cases in Virginia; in the Army of the West, etc. — Cases of, and Deaths from, Pneumonia, Typhoid Fever, and other Diseases in the General Hospitals of the Army of the Potomac, Northern Virginia, and other Hospitals, during Fifteen Months, in 1862–63. — Common Continued and Typhoid Fever identical. — Percentage of Deaths from Pneumonia. — Fatality from Pneumonia and Typhoid Fever. — Fatality from other Diseases. — Cases of, and Deaths from, Typhoid Fever, Pneumonia, and some other Diseases in the General Hospitals in and around Richmond during Seven Months in 1862–63. — Cases of, and Deaths from, Pneumonia, Typhoid Fever, and several other Diseases, in the General Hospitals in Virginia. — Cases of, and Deaths from, Pneumonia, and some other Diseases, in the General Hospital at Charlottesville, Va., during Twenty-

six Months, from July, 1861, to August, 1863. — Fatality in Hospitals at Savannah, of Pneumonia and Typhoid Fever. — Table showing the Numerical Relations of, Cases of, and Deaths from, Typhoid Fever and Pneumonia in the General Hospitals in Virginia and Georgia. — Progressive Diminution of the Prevalence of Typhoid Fever during the War. — Table illustrating the Numerical Relations of Pneumonia and Typhoid Fever in the Confederate Armies during Nineteen Months, 1862-63. — Cases and Deaths from all Causes, and Cases of, and Deaths from, Pneumonia and Typhoid Fever in the General Hospitals of Charlottesville and Staunton, Va. 335

CHAPTER TENTH.

OBSERVATION ON THE DISEASES OF THE HEART NOTICED AMONG SOLDIERS, PARTICULARLY THE ORGANIC DISEASES.

The Clinical Material for this Chapter. — Valvular Diseases. — Table of Valvular Diseases. — Cases of Valvular Disease following Rheumatism. — Cases of Valvular Diseases not preceded by Rheumatism. — Absence of Bright's Disease or any Diathetic Affection. — Cases of Valvular Disease attributed to Protracted and Violent Exertion. — Case of Insufficiency of the Pulmonary Valves. — Cases in which Valvular Disease did not prevent the Performance of Military Duty. — Infrequency of Diseases of the Pericardium. — Enlargement of the Heart independent of Endocarditis or Pericarditis. — Hypertrophy of Heart from persistent Functional Disorder and after Fevers. — Enlargement due to a Rheumatic Diathesis, or existing prior to Enlistment. — Cases of Hypertrophy without Valvular Lesions amenable to Treatment. — Treatment employed in these Cases. — Cases of Enlargement with Predominant Dilatation infrequent. — Of Irritable Heart. — Conclusions 360

CHAPTER ELEVENTH.

ON CEREBRO-SPINAL MENINGITIS.

Historical and Geographical Sketch. — Prevalence in America and during the War. — The Disease favored by Cold and Overcrowding. — Age and Constitution of those attacked. — Symptoms. — Premonitions. — Period of Invasion. — The Intellect. — Muscular Contraction. — Pain. — Decubitus. — Petechiæ. — Temperature. — Pulse, etc. — Phenomena of Vision. — Deafness. — Phenomena preceding Death. — General Summary of Symptoms. — Duration and Mortality. — *Post-mortem* Appearances. — Case reported by Surgeon Joseph Jones. — Note by the Compiler. — Commentary by Dr. Jones. — Commentary by the Compiler. — Dr. Webber's Division into Three Orders. — Surgeon Russell's Observations. — Dr. Upham's Observations. — Dr. Sanderson's Report of Autopsies. — Petechiæ. — Further Autopsies. — Treatment — Surgeon Russell's Report. — Dr. J. Baxter Upham's Account. — Dr. Webber's Views. — Dr. Sanderson's Report. — Comments by the Compiler. — Ætiology. — Climate. — Exposure. — Prisons and Barracks. — Epidemic Constitution. — Sex and Age. — Summary. — Is Cerebro-Spinal Meningitis Contagious? 383

CHAPTER TWELFTH.

ON THE DISEASES OF NERVES, RESULTING FROM INJURIES.

Purpose of this Chapter. — Previous Publications. — Primary Symptoms of Wounds or other Injuries of Nerve Trunks. — Case of Choreal Affection of Right Fore-arm and Shoulder after Amputation at the Wrist. — Classification of Modes in which Nerves are Injured. — Case of Injury by Contusion. — Crutch Palsy, and Palsy from other Modes of Pressure. — Case of Crutch Palsy. — Injury by Contusion. — Cicatricial Changes producing Nerve Injury. — Propagated Disease of Nerves. — Case. — Classification of Local Symptoms. — An Imaginary Case. — Changes in the Nutrition of Parts, the Nerves of which have been Injured. — Muscular Atropy. — Muscular Contractions. — Tonic Spasms. — Distinct Nutrient Nerve Fibres. — Certain Diseases of the Skin belong among the Nervous. — Case of Herpes. — Effect of Wounds on the

Nutrition of the Skin and its Appendages. — Glossy Skin. — Case of Intense Neuralgia, with Motor Palsy, etc. — Hypertrophy of Areolar Tissue of the Hand from Wound of Nerve. — Case. — Inflammation of Joints. — Effect on Secretions. — Lesions of Sensation. — Classification of these Lesions. — Hyperæsthesia. — Anæsthesia and Analgesia. — Delay in Transmission of Sensations and Volitions. — Slow Passage of Neural Impressions in Injuries of the Medulla Spinalis. — Retardation of Electrical Current. — Burning Pain. — Defects of Motion from Wounds of Nerves. — Different Ways in which Nerve Lesions affect Motion. — Paralysis. — Shortening of Opponent Muscles. — Spasm. — Prognosis of Wounds of Nerves. — Palsy of Nerves at a Distance from the Seat of Injury. — Case. — Treatment as regards Pain. — Case. — Treatment of Nutritive Changes, and of the Paralysis. — Blisters. — Active and Passive Motion. — Shampooing. — Hot and Cold Douches. — Electricity. — Electro-Muscular Contractility. — Electro-Muscular Sensibility. — The Interrupted Current and Electro-Galvanic Machines. — Direct Galvanism. — Electrization of the Skin. — Electrization of the Muscles. — Application of Electricity to Diagnosis and Prognosis. — Mode of Employing Electricity as a Therapeutical Agent. — Constitutional Treatment of Wounds of Nerves. — Illustrative Cases 412

SECTION THIRD.

CHAPTER FIRST.

GENERAL VIEW OF THE MEDICAL TOPOGRAPHY AND CLIMATE OF CAMP SUMPTER, ANDERSONVILLE, GA., AND OF THE COUNTRY IN THE IMMEDIATE VICINITY.

Character of Soil. — Elevation. — Geological Position. — Character of the Waters of Andersonville. — Waters of the Streams, Wells, and Springs within the Stockade (Confederate States Military Prison), and within the Military Prison Hospital. — Vegetation. — Animals. — Climate 483

CHAPTER SECOND.

DESCRIPTION OF THE CONFEDERATE STATES MILITARY PRISON AT ANDERSONVILLE.

Stockade. — Number of Prisoners confined in the Stockade during the Months of March, April, May, June, July, and August, 1864. — Area of the Stockade in Square Feet at Different Times. — Square Feet of Ground allotted to each Prisoner. — Physical Condition, Food, Clothing, Habits, Moral Condition, Diseases, and Deaths. — Scurvy, Diarrhœa, Dysentery, and Gangrene. — Condition of Sick within Stockade. — Morning Sick Reports. — Manner of Disposing of Dead. — Character of Food 501

CHAPTER THIRD.

CONFEDERATE MILITARY PRISON HOSPITAL AT ANDERSONVILLE, GA.

Physical and Moral Condition of Sick. — Defective Hygiene and Police of Hospital. — Accumulation of Filth. — Flies. — Mosquitoes. — Manner of Disposing of the Dead. — Defective Cooking Arrangements. — Improper Food for Sick. — Foul Air of Filthy Tents 519

CHAPTER FOURTH.

CONSOLIDATED REPORT OF SICK AND WOUNDED FEDERAL PRISONERS AT CAMP SUMPTER, ANDERSONVILLE, GA., MARCH TO AUGUST, 1864.

Number of Cases of Disease treated during Six Months, with Deaths. — Per Cent. of Deaths from all Causes, and from various Diseases, as Typhoid Fever, Scurvy, Diarrhœa, and Dysentery. — Inspection and Sanitary Reports on File in the Office of the Chief Surgeon 524

CHAPTER FIFTH.

CONSOLIDATED REPORT OF SICK AND WOUNDED CONFEDERATE SOLDIERS ACTING AS A GUARD TO THE FEDERAL PRISONERS AT CAMP SUMPTER.

Comparison between the Diseases of the Federal Prisoners and Confederate Soldiers performing Guard Duty. — Malarial and Typhoid Fevers more prevalent amongst the Confederate Troops. — Hospital Gangrene amongst the Confederate Troops . . 553

CHAPTER SIXTH.

DISEASES OF FEDERAL PRISONERS AT ANDERSONVILLE WHICH WERE REFERABLE TO CLIMATIC CHANGES, EXPOSURE, ETC.

Diseases of Federal Prisoners confined at Andersonville, which were referable chiefly to Climatic Changes and Influences. — Malarial Fevers; Quotidian, Tertian, and Quartan Intermittents; Remittent and Congestive Fevers. — Sun-Stroke. — Comparison of the Statistics of Malarial Fevers amongst the Federal Prisoners, with the Sick Reports of the Confederate Troops.

Diseases amongst the Federal Prisoners which were referable in a large measure to Exposure without Proper Clothing and Shelter from the Hot Sun, Rain, Dew, and Night Air. — Pneumonia, Pleurisy, Bronchitis, Catarrh, Acute and Chronic Rheumatism, Pericarditis. — Relations of Rheumatism to Scurvy 566

CHAPTER SEVENTH.

DISEASES DEPENDENT UPON THE ACTION OF SPECIFIC POISONS, AND SUPPOSED TO ARISE FROM CROWDING AND FOUL EXHALATIONS.

Typhus Fever. — Typhoid Fever. — Small Pox. — Measles 600

CHAPTER EIGHTH.

DISEASES OF THE FEDERAL PRISONERS DUE TO LONG CONFINEMENT, DIET, EXPOSURE, ETC.

Diseases of the Federal Prisoners due to Long Confinement, Sameness of Diet, Salt Meat, Absence of Fresh Vegetables, Milk, and Sugar. — Scurvy and its various Manifestations and Effects, Scorbutic Ulcers, Dropsy, Enlargement of Parotid Glands, etc.

Diseases Referable in a Measure to Long Confinement upon the same Diet, to Exposure without Proper Shelter, and to Crowding and Personal and General Filth.— Diarrhœa and Dysentery. — Hospital Gangrene. — Illustrative Pathological Observations. — General Conclusions 619

CHAPTER NINTH.

GENERAL CONCLUSIONS.

General Conclusions drawn from the Preceding Investigations upon the Diseases of the Federal Prisoners confined at Andersonville 642

SECTION FIRST.

CONTRIBUTIONS

RELATING TO THE

CAUSATION AND PREVENTION OF DISEASE.

THE contributions selected for *Section First* of this volume relate to topics belonging to General Pathology. These topics, for the most part, are etiological, having reference especially to the diverse causes incident to the camp and the field, tending to impair physical endurance, and diminish the power of resisting disease; and these causes are considered with special reference to their practical bearing on Prophylaxis, or the prevention of disease. Causes and preventive means are considered in this section, with some exceptions, in relation to disease in general; individual diseases are considered with reference to their causation and prevention, as well as under other aspects, in *Section Second*, which is devoted to Special Pathology. The relatively greater importance of the topics embraced in Section First entitles it to precedence in the order of arrangement. The several chapters of this section, embodying, as they do, the experience of distinguished members of the medical profession who served as medical officers during the war of the rebellion, will commend themselves to the attention of the reader, in view of the importance of the topics as regards the preservation of the life and health of the soldier, and thereby the efficiency of armies in active service.

SANITARY MEMOIRS OF THE WAR.

CHAPTER FIRST.

THE VARIOUS INFLUENCES AFFECTING THE PHYSICAL ENDURANCE, THE POWER OF RESISTING DISEASE, ETC., OF THE MEN COMPOSING THE VOLUNTEER ARMIES OF THE UNITED STATES.

By ROBERTS BARTHOLOW, A. M., M. D.,

PROFESSOR OF PHYSICS AND MEDICAL CHEMISTRY IN THE MEDICAL COLLEGE OF OHIO, ETC.; FORMERLY ASSISTANT-SURGEON U. S. ARMY.

Influences previous to Enlistment. — Qualifications for Military Service, relating to Race, Temperament, Occupation, Age, etc. — Causes affecting Physical Stamina subsequent to Enlistment, relating to Exposure, Diet, Overcrowding, and the Lack of Cleanliness. — The Mental and Moral Effects of Association. — Liability to specific Febrile Affections. — Causes affecting the Physical Stamina in Active Service, Climatic, Dietetic, Accidental, Specific, Moral, and Compound. — Moral Causes affecting the Physical Stamina of the Soldier, relating to Cowardice, Weakness of Will, and Nostalgia. — Malingering, its Causes and Degree of Prevalence. — The Forms of Disability feigned, namely: Affections of the Cerebro-Spinal System, of the Thoracic Organs, of the Digestive System, of the Genito-Urinary Apparatus, of the Extremities, and Constitutional or General Affections. — Detection and Treatment of the various Forms of feigned Disability. — Discharges on Surgeon's Certificate.

The various influences affecting the physical endurance of the men composing our volunteer armies, their power of resistance to disease, etc., may be comprehended in four groups, namely: —

1. The influences in operation previous to enlistment;

2. The causes affecting the physical stamina of the recruit subsequent to enlistment;

3. The causes affecting the physical stamina of the soldier in active service; and,

4. Moral causes, as malingering, desertion, nostalgia, etc., in operation during the whole period.

I.

Under the first head must be included an outline of the qualifications of a recruit for the military service: race, temperament, occupation, age, height, weight, capacity of thorax, muscular development, and a proper performance of the functions of animal and organic life.

Qualifications for military service.

Races composing our volunteer army.

The *races* composing our volunteer army consisted, chiefly, of American, Celtic, Teutonic, Negro, and the mixed Spanish-American of New Mexico. The term American applies, of course, to the composite race now inhabiting the continent, and not to the aborigines. It will be useful to contrast, in no invidious spirit, the aptitude for military service and the power of endurance respectively displayed by these several races. As regards these qualities, they stand to each other in the relation in which they are placed above — the American first and the Spanish-American last.

American mental characteristics.

The mental characteristics that fit the American for the military service consist of a spirit of enterprise and an intellectual hardihood which render him superior to fatigue; an easy bearing under defeat, and a buoyant self-confidence which misfortunes do not easily depress. The national vanity and love of popularity may have much to do in the formation and development of these military qualities. So acute an observer as Dr. Jackson [1] formed a very different opinion of the American character. "The people of North America are deficient in two qualities that are essential to the formation of military force, namely, the subordination which submits patiently to such forms of moulding and discipline as render the human race a machine, obedient to the will of a general to whatever point it may be applied; or, secondly, the ardent love of country, which, rising to enthusiasm, produces acts of individual heroism beyond the calculations of tacticians and superior to the arts of mere mechanism." Events have not justified the harsh criticism of Dr. Jackson.

American physical qualities.

The physical qualities which fit the American for military service consist, not so much in muscular development and height as in the toughness of his muscular fibre and the freedom of his tissue from interstitial fat, whereby active and prolonged movements are much facilitated. In active service he fails more frequently from defects in his digestive apparatus and from a phthisical tendency, than from a lack of power due to imperfect physical development.

Qualities of the Celtic races.

The Celtic races possess similar qualities, and in respect of merely physical development are not unequal to the American, but they have less tenacity of purpose and mental hardihood. As mercenary soldiers they did not exhibit the same zeal, energy, and power of endurance. They submitted with less patience than the Americans to the requirements of discipline,

[1] *Economy, Formation, and Discipline of Armies*, p. 230.

were frequently turbulent under hardships and given to complaints about the rations and fatigue duties. Irish laborers were especially notorious for their dislike to fatigue duties.

German element of the army.

The German element of the volunteer army did not equal the American or Celtic in the physical capacity for military service. There are certain defects of structure, common in a greater or less extent to all Germans, which impair their powers of endurance — a predominance of the lymphatic temperament; a patulence or unusual weakness of the abdominal rings; flatness of the feet, and a tendency to a varicose condition of the veins of the inferior extremities.

The German carries into the military service many of the mental and moral qualities for which he is most conspicuous in civil life, namely, thrift, fondness for good living, and a love of ease and enjoyment. The first inclines him to serve for hire and to make the most of his opportunities for emolument; the second produces discontent, and even unfits him for service when the rations are deficient; and the third renders him restive under hardships and exposure.

The physical qualities of the Negro.

The Negro possesses many of the physical qualities pertaining to the highest type of the soldier: sufficient height, a due correspondence between height and weight, ample thorax, and considerable power of endurance. His chief physical defects are small, ill-developed calves and bad feet, and a proneness to disease especially of the pulmonary organs. Having the faculty of imitation highly developed and being fond of the exterior show and parade of military life, he readily becomes an adept in the mechanical training of the soldier. The Negro soldier is, unquestionably, less enduring than the white soldier; less active, vigilant, and enterprising, and more given to malingering. The Mulatto is feebler than the Negro, invariably scrofulous, and more frequently the subject of pulmonary disease.

The mixed race of New Mexico.

The mixed race of New Mexico is inferior to the Negro. Of three regiments raised in New Mexico at the beginning of the war and examined by me, scarcely one fifth were fitted for service. The chief defects were, feebleness of constitution, the syphilitic cachexia, impaired vision, deformities of the hands and feet, and diseases of the urinary organs. They are cowardly, unreliable, and difficult to control, in consequence of a very mercurial temperament.

It is not easy to determine how far those special physical characteristics, denominated temperaments, influence the will, the moral

qualities, and the power of endurance. It is probably true that the light-haired, blue-eyed — the sanguine, are more susceptible to the influence of malaria, to diseases of the spleen, and to albuminoid degeneration of organs; the dark temperaments to diseases of the liver, to dysentery, and to pneumonia. The influence of temperament over the moral qualities will be considered more properly in the fourth group.

Influence of temperaments.

The influence of occupation upon the physical health is obvious enough. Those who pursue sedentary trades, who live much in-doors, or who are exposed in the course of their business and pursuits to crowd-poisoning, or to vitiated air from any cause, are by no means so well fitted for military service as those whose employments require them to spend much time in the open air, especially in the open air of the country. Hence farmers, lumbermen, and railroad men are better prepared to endure the hardships of a soldier's life than clerks, weavers, shoemakers, etc.

Influence of occupation.

Thirty years is undoubtedly the most suitable age for military service, for at this period the development is complete, the body is inured to climatic vicissitudes, and is, in most instances at least, more or less familiar with hardships, and the reason has acquired somewhat more control over the appetites and passions. The Enrollment Act fixed the minimum age at 20 years, and the maximum at 45 years. This wise regulation was frequently disregarded, except in the case of drafted men. It was not uncommon to find youths of 15 years and old men of 60 years in the ranks, but more frequently in the hospitals. In the English service the minimum age is 18; in the French and Prussian 20, and in the Austrian 19. As a majority of the most military nations have so decided after considerable experience, the age of 20 years must be regarded as the earliest suitable age for the military service.

Age suitable for military service.

The medium height, a weight of 160 pounds, 33 inches in the girth of the chest, and an expansive mobility of 3 inches, *cæteris paribus*, present the conditions as to physical health most favorable to military service. Symmetry is by no means so important as swelling muscles, well-marked bony prominences and well-developed joints — for these are the evidences of power and endurance. Great height is frequently objectionable, because gained at the expense of the development of the thorax. The rule is, that the girth of the chest at the level of the nipple should equal half the height, but in tall men this rule may be violated. Excessive weight or obesity is still more decidedly disqualifying than excessive height.

Other conditions most favorable to military service.

Perfection of the senses is essential. The organs of special sense should not only be free from disease, but they should have that ready appreciation of their appropriate stimuli, which is a proof of the healthy activity of the central nervous system. The functions of all the organs should be so well performed that the happy balance between waste and supply should be maintained.

Besides these physical requirements, there are certain mental states favorable, and certain others unfavorable, to the proper performance of military service. The soldier should possess a cheerful disposition, a calm temper, and that indifference to danger and fatigue which is more frequently the result of mental forces than physical strength.

Causes in previous life affecting stamina.

We assume that the recruit submitted to the usual inspection conforms to the standard as set forth in the preceding paragraphs. The question then occurs, What causes arising in his previous life and experiences may affect his physical stamina, independently of the new conditions to which he is subjected immediately on enlistment? These causes may include certain hereditary diseases, as insanity, epilepsy, scrofula, and tuberculosis; and such acquired cachexiæ as the chronic malarial poisoning, masturbation, chronic alcoholismus, and incipient disease of important organs. Although not recognizable on ordinary examination, these conditions may yet exist in sufficient degree to be readily excited by ordinary causes into well-defined morbid processes.

The operation of these occult causes of disease in recruits antecedent to enlistment is shown in the following statistics: In 15,500 discharges on surgeon's certificate, as examined by me at the War Department, there were 154 for mental infirmities, 341 for epilepsy, 411 for various cachexiæ, 44 for bad moral character, and 3593 for diseases of the chest. A large majority of these were either hereditary, or existed in modified form at the time of enlistment.

Many of the causes affecting the physical stamina of the recruit previous to enlistment might have been recognized by proper care and diligence in the examination. The neglect to examine men in the beginning of the war, and the lack of thoroughness in the examinations afterward, increased the number of men serving, but diminished the relative efficiency. The statistics bearing on this point are quite conclusive. Thus, in 15,500 discharges, there were 388 for disqualifications due to age, and 209 for natural feebleness of constitution, both of which are recognized without difficulty.

II.

Sudden transition of the recruit to an artificial state.

The recruit makes a sudden transition from a natural to an artificial state without any preparation for the change. It may be admitted as true, at least of a large majority of the people of this country, that the recruit has had sufficient food, and in proper variety; that he has been suitably clothed; that he has had undisturbed sleep as many hours as his health required; that he has had the necessary air-space in his daily avocations and during his sleep at night; and that he has been able to avoid the more trying vicissitudes of the weather. Those who have not enjoyed similar comforts are, it may be safely affirmed, usually unfitted for military service.

Life at the depot of recruits.

As soon after enlistment as possible, the recruit is hurried to the depot; he is supplied with army rations badly cooked and uncleanly served; he is drilled vigorously several hours each day; at night, furnished with one or two blankets and occasionally a little straw, he is thrust into a tent with a large number of others, or into crowded temporary quarters, where he is subjected to horribly impure air, frequently to cold and dampness, and always to excessive discomfort, or he is required to perform a tour of guard duty which interrupts his habit of nightly repose; but slender opportunities of washing and bathing are afforded him, and he is at all times exposed to the influence of the unwholesome air of badly-policed camps and quarters, and to the emanations from his comrades suffering under various contagious maladies.

Scarcely any depot of recruits was an exception to this description during the rebellion. Some of these evils of necessity grew out of the military service, and could not be eliminated from it; but many more were entirely preventable. To a military man, a recruit is a piece of mechanism, to be adapted to the needs of the military service; and the shortest method to accomplish this object is the best. Hence, a kneading and compressing process is followed. With the few recruits for the regular military establishment, this process may be pursued with less extensive injury; but mental, moral, and physical consequences ensue to the volunteers, which limit their efficiency in service, and often prove fatal to them at the outset. It will be useful to consider, in the first place, the physical consequences which ensued by reason of the improper hygienic management of recruits; for the mental and moral consequences largely depended on the physical.

The several drafts of men after the three months' service were

so issued that the recruiting and organization of troops occurred mainly in the fall, winter, and spring. The buildings at the camps of rendezvous in the various States were wholly inadequate, and hence, the recruits, as a rule, were placed in tents. Suitable provision, in these places, could not be made against vicissitudes of weather and dampness. Drainage, ventilation, and police of camps and quarters, were usually neglected. Guard duty at night, and exhausting drills, lessened the vital forces. Heated and fatigued by drill, the recruit was too much accustomed to throw himself upon the damp straw or blankets. Catarrhal and pulmonary affections were produced, the more promptly in the case of those recruits — a large number — who were not at all habituated to such experiences.

Exposure in tents, and its effects.

Dietetic causes were scarcely less important agencies in the production of disease than climatic. Large numbers of recruits being suddenly thrown together at the depots, little provision was made, or, indeed, could be made, for the suitable preparation of food. The recruits themselves were wholly ignorant of the culinary art; there was neither time nor opportunity to instruct them; cooks were not provided, and the utensils issued were most inadequate for the purpose. Moreover, the components of the ration were not adapted to the peculiar circumstances; they were sufficiently various and in sufficient quantity, but were not in a form available to recruits unaccustomed to the preparation of food. Hence, in the midst of abundance, suffering from hunger was not uncommon. The effort to have the cooking done by companies was hardly accomplished, even with troops in the field, by the end of the war; and this system was not practicable with recruits who had no company organization, or, if organized into temporary companies, had no homogeneity nor completeness of detail in respect to company management. It usually happened that a squad of three or four organized themselves into a mess, each contributing his rations to the common stock, and alternating in the duties of cooking. The results were not satisfactory. An American intrusted with cooking for the first time, thinks only of frying. Flour made into a paste with water was usually fried in the fat of the bacon, or made into loaves with baking powder, if the cook possessed so much skill or experience. Beef was invariably fried, and the beans and rice frequently also. Being unprovided with suitable receptacles for their stores, and unskilled in defining their daily quantitative allowances, they were frequently without food for a day or two

Dietetic causes of disease.

preceding the time for issue. Improvements were made, especially by constructing ovens and issuing baker's bread in lieu of flour, but the cooking by messes continued the rule throughout the war.

Eating badly-cooked food hastily, and without relish, resulted in indigestion, flatulence, and diarrhœa. Beans probably contributed, more than any single article, to the production of these intestinal troubles. They were almost always insufficiently cooked by recruits, to whom indeed they were not familiar as an article of human food, if we except the troops from New York and the New England States. It has frequently happened to me to observe an increase in the percentage of diarrhœa and dysentery on the day after the issue of bean soup. In a body of four hundred recruits, every man came on to the "sick report" with one of these disorders in the space of three months, and one fifth came more than once. Beans have been continued in the supplies of the commissariat upon a theory of their nutritive value, based upon a proximate analysis; on account of their portability, and because they do not readily undergo change. Whatever may be their value in these respects, there can be no doubt that they are hurtful to recruits, who do not have the necessary skill in preparing them, and who, by various causes, are rendered peculiarly susceptible to their irritant action upon the intestinal mucous surface.

The Napoleonic maxim — the soup makes the soldier — was not sufficiently attended to at our recruiting depots. Bean soup requires more artistic skill in its preparation than other plain soups, but was more frequently made. The distribution of the rations to individuals prevented the preparation of food on a large scale. The waste of this system rendered it more expensive to the government than ample provision for cooking would have been. Moreover, the destruction in health and life was hardly to be estimated in the pecuniary sense. If this view had governed the authorities, so great was the cost of a soldier that money would have been well expended which insured his preservation in health and efficiency.

These dietetic causes influencing the health of recruits would not be complete without some reference to the irregular sources of supply, available in the sutlers' shops and booths permitted in the camps. The chief profits of the sutler were derived from the sale of fruits and "fancy groceries" — to use a commercial phrase — which the recruit too eagerly purchased to enrich his meagre diet, or supply the loss of misused rations.

Overcrowding of tents and quarters was a fruitful source of

mischief. This was especially observable at night and during bad weather. The air of those places became quickly foul — loaded with organic emanations and with carbonic acid, and deprived of much of its oxygen. On entering the tents or quarters under these circumstances, there was immediately to be perceived a strong "animal odor," the more diffuse and powerful when the personal cleanliness of the men had been neglected. Headache, nervousness and tremors, a coated tongue and nausea, were frequently experienced by recruits subjected for a single day or night to the influence of such an atmosphere. Moreover, the increased action of the capillaries of the integument, the relaxation of the bronchial mucous membrane, and the diminished urinary secretion occurring under these circumstances, greatly favored the reception of morbific agents, and disposed to attacks of catarrh, bronchitis, and pneumonia, from slight causes. There can be no question that organic matter in a state of minute subdivision, derived from a number of persons crowded into a confined space, possesses considerable morbific power, especially in the production of intestinal diseases; for, absorbed into the blood, these particles are excreted mainly through the mucous surface of the alimentary canal.

Overcrowding of tents and quarters.

A lack of personal cleanliness was little less promotive of disease than the causes already enumerated. The water supply, at the inland depots especially, was never equal to the requirements; hence, if the recruit possessed the inclination, he had little opportunity to keep his person clean. Example and instruction were wanting as well as opportunity. Every thing about him being dirty and disagreeable, the necessity for cleanliness was by no means apparent. It was painful to see at all the depots the slovenly, slipshod appearance of the clothing and accoutrements of the recruits, their filthy skins, uncombed hair, and matted beards.

Lack of cleanliness.

The association of men in masses or herds, rapidly produces mental and moral degeneracy. In their lives being assimilated to that of animals, their minds conform to the same standard. This brings us to consider the influence of these conditions and experiences upon the mental and moral qualities of the recruit. The great change in his habits and modes of life, associated with so much that was disagreeable and repulsive, induced in the recruit, if not possessed of considerable fortitude and personal resources, a state of deep dejection, hypochondria, and nostalgia. This was especially to be observed in young men and

Moral effects of association.

married men of mature age. If there existed any hereditary tendency to insanity, this state of despondency, hypochondria, or nostalgia, powerfully contributed to its development; hence, mental disorders arising during the war occurred more frequently in recruits than in soldiers of more than a year's service.

The mental impressions of these first experiences of the military service, if not sufficient to induce insanity, lead directly to various mental and moral disorders. Malingering was suggested as a ready expedient for avoiding further service; desertion was considered if not attempted. The monotony of the life and the unaccustomed restraint, together with the hardships to which they were exposed, disposed recruits, when occasion offered, to run into excesses of drinking and venery. They became intoxicated and indulged in venereal excesses who were not accustomed to do so before enlistment: the forces repressed by military training thus broke bounds and ran riot.

The recruit is thus exposed to ordinary and extraordinary causes of disease.

The diseases arising from ordinary and extraordinary causes.

He is affected by diseases of those organs and systems most taxed under the conditions of his new life and experiences: diseases of the respiratory organs; eruptive diseases; intestinal diseases. By reason of overcrowding and other causes, typhoid fever may be developed, or if the depot be placed in a malarious district, malarious diseases may occur. The consideration of these may be excluded, because not characteristic of the special conditions under which the recruit is placed.

Catarrh, bronchitis, pneumonia, measles, mumps, diarrhœa, and dysentery, were the diseases which chiefly affected recruits at the depots during the war. It is easy to conceive that exposure to cold, to humidity, to sudden and extreme changes of temperature, — ordinary causes in the experience of recruits, — should produce catarrh, bronchitis, and pneumonia, or should favor the propagation of influenza, diphtheria, and the exanthemata. These forms of disease occur under similar conditions in civil life. Recruits were more subject to them than the same number of civilians of corresponding ages, because they were placed in circumstances more fully exposing them to the action of morbific agents.

The point of chief practical interest in this connection is, What agency had the new life and experiences of the recruit in producing or favoring the spread of the specific febrile affections (mumps, measles, influenza, etc.)? A variety of opinions have prevailed on this point. We may find a solution of the prob-

Liability to specific febrile diseases.

lem in the clinical history of measles, — the most wide-spread and fatal of these diseases, — for, since they all present strong analogies in their history, the study of one will serve to elucidate the rest.

Camp measles.

A popular and, to a certain extent, professional opinion existed during the war, which referred camp measles to a specific cause arising in the special conditions in which the recruit was placed. One observer (Dr. Salisbury[1]) proceeded so far, indeed, as to fix upon a variety of the penicillium, which he found upon damp straw used for bedding, as the cause. His views were accepted, probably without sufficient examination, by so distinguished an author and observer as Dr. Hammond.[2] On the other hand, they were wholly denied by Dr. Woodward.[3] It was generally believed that camp measles differed from ordinary measles in occurring several times in the same individual.

Some interesting statistics have been collected in elucidation of these questions.

Eight hundred cases were treated in two hospitals under my direction in a period of four months — January to April, 1864. The average mortality was 22 per 100. Of 100 cases set apart for special examination, 96 were recruits, and 28 of these were 18 years of age, and 68 from the ages of 17 to 20, inclusive. In one regiment, which came specially under my observation, every man contracted measles who had not had it in early life. This was the rule in all regiments exposed to the poison. This statement is supported by the fact, that in 100 cases 91 had not suffered at any period in life from measles, and only 9 supposed they had had this disease, but were not at all certain.

These facts in the clinical history of measles would seem to indicate that this disease was propagated by contagion, and that it occurred amongst young recruits because they had not hitherto been exposed to the specific poison, and that the epidemics were more severe amongst these subjects because they were placed in the most favorable condition for the development of the morbific matter. The skin, bronchial mucous membrane, and intestinal tract, whose several surfaces may be considered as organs performing offices in some respects vicarious of each other, were deranged in their normal relations, and rendered exceedingly susceptible to the action of poisons or common causes of disease.

It is thus evident how a large class of diseases arising from specific and ordinary causes were favored in their development by

[1] *American Journal of the Medical Sciences*, 1863.

[2] *Treatise on Hygiene.* [3] *Camp Diseases.*

conditions and experiences affecting the recruit. These conditions and experiences produced a morbid state, in which a feeble, contagious influence only was necessary to give rise to formidable epidemics of influenza, mumps, and eruptive fevers.

The operation of the dietetic causes already discussed, are apparent enough. Improper alimentation acted the more promptly in the production of intestinal disorders by reason of the derangement in the vicarious office of integument and mucous membrane alluded to in the last paragraph. It may be safely assumed as a fact, that few recruits passed through the first experiences of the military service without suffering from diarrhœa or dysentery. This is shown to be the case by the statistics of the first year of the war. Thus, in the armies of the interior region the proportion of these diseases was 994.77 per 1000 of mean strength.

III.

Causes affecting physical stamina in active service.

The influence of the various conditions and experiences affecting the recruit were not always manifested in the forms described in the preceding section. It was to be observed at every recruiting depot that many recruits *fell out of condition* who were not affected with a well-defined morbid process to which a specific nomenclature could be applied. Many of them suffered lesions, eventuating in permanent organic changes, which appeared after entering upon active service. Diseases of the lungs and kidneys, diarrhœa and dysentery, may be classed in this category.

The mortality, or the various degrees of disability, arising from camp measles, are not to be represented in the tables of immediate loss. Many cases of pulmonary tuberculosis and dysentery, which subsequently proved fatal or required discharge from the service, originated in camp measles at recruiting depots. Mumps is to be regarded from the same point of view. Whatever ill effects occur beyond the immediate sickness, are not developed at the time, but the seed is sown which ripens into a plentiful harvest. Various glandular affections and diseases of the testes, especially varicocele, may be traced back to an attack of mumps.

In this section, those causes of disease which result from actual service are to be discussed. They may be conveniently considered under the following heads, namely : —

Climatic ;	*Accidental ;*	*Dietetic ;*
Specific ;	*Moral ;*	*Compound.*

It is assumed that the soldier has passed through the chrysalis state

of recruit, unharmed by the causes of disease to which he was then subjected.

The *climatic causes* affecting the physical endurance of the soldier, were the first to which he was exposed during the rebellion. A vast majority of those who entered the military service were to a great degree unaccustomed to changes of climate. Men, indeed, possess an inherent indisposition to undergo these changes. This fact finds an expression in the well-known law of emigration, that movements of populations take place along the isothermal lines to which they are accustomed. This law is probably founded in a necessity of the human constitution, which requires for its highest development uniformity in the conditions surrounding it. An opinion has widely prevailed that our troops during the late rebellion experienced no ill effects from the changes of climate. This opinion has no foundation in fact. But whatever ill effects were experienced from this cause were not sufficient in extent to have occasioned very decisive results. Still, this influence of climate is rendered apparent enough by contrasting the mortality rates of troops operating in widely separated parallels of latitude. Thus whilst the average annual mortality of the United States army during eighteen years of peace service was 24 per 1000 of mean strength, during the Mexican war it rose to 103.8 per 1000. Contrast the mortality of the Mexican war with that of the first year of the rebellion — 103.8 : 67.6. The difference, amounting to 36.2 per 1000, was largely due to the influence of change of climate. This influence was also exhibited in the mortality rates of the armies operating in different sections of the country. Whilst the mortality of the army of the Potomac and the troops on the Atlantic coast was 33.40 per 1000 of mean strength, that of the armies operating in the interior — on the Mississippi and its tributaries — was 82.19 per 1000. In estimating these results it must be understood that the influence of climate was only one of numerous elements to be considered ; but it was, nevertheless, a substantive element.

Climatic causes.

The mortality rates and the percentage of sickness as influenced by season, illustrate the mode in which climate affects the physical endurance of men in active service. Whilst the maximum mortality of the armies of the interior region was attained in January, February, and March, the period of greatest sickness was in the months of August, September, and October. On the other hand, April, May, and June were the months of greatest mortality, and July and August of greatest sickness in the armies on the Atlantic coast.

Influence of seasons.

The particular forms in which these climatic causes expressed themselves were catarrh, bronchitis, pneumonia, diarrhœa, and dysentery.

Dietetic causes.

The dietetic causes affecting the physical endurance of men in active service were similar in character to those of recruits. So long as the supplies of the commissariat were regularly furnished, the effects were the same; but they were more evident in the former, because the cause was longer in action. In addition to this circumstance, soldiers in the field experienced various vicissitudes in the character and quality of their supplies. The amount of aliment furnished to the various armies was determined by the transportation available for bringing it forward, and by the so-called "military necessity." The armies operating in the interior region were more affected by deficiencies in commissariat supplies than those on the Atlantic coast. Thus, the army under General Buell was for many days subsisted on corn chiefly, and such precarious supplies as could be procured from an impoverished country. General Grant's army, in the campaign before the investment of Vicksburg, was reduced to similar dietetic expedients. The army encamped at Chattanooga, previous and for some time subsequent to the battles of Mission Ridge and Lookout Mountain, was restricted to little more than one fourth rations in consequence of deficient transportation. Irregularity and deficiency of supplies were, then, important dietetic causes, but they can hardly be considered the chief causes. For men exposed as our soldiers were to various morbific agencies, the diet was not sufficiently varied. Hard bread, pork, beans, and coffee, which were practically the elements of the diet, did not fulfill all the necessary conditions. Antiscorbutics came to be furnished after the first year of the war, but the chief antiscorbutic — the potato — was practically unavailable from the difficulty of transporting and preserving it. Cabbage, pickled, was also supplied; but however valuable as an antiscorbutic, it was indigestible and provocative of intestinal disorders.

Inexpert preparation of food, cooking by messes instead of companies, and the use of baking powders, may be classed as dietetic causes. The latter was by no means unimportant. Whenever flour was issued, and sutlers' supplies could be obtained, the men were accustomed to prepare bread with baking powder — a vile compound of flour and soda remarkable for hardness and indigestibility.

The unripe fruits obtained in the regions where the various commands operated also acted as a dietetic cause of disease.

In considering the *accidental causes*, we necessarily exclude traumatic lesions as not coming within the scope of this chapter. Various influences are to be discussed under this head, namely: all those conditions comprehended in the term, *bad hygiene;* exhausting marches, fatigue, scorbutus, etc.

Accidental causes.

Troops on the march, *cæteris paribus*, are more favorably situated as respects hygienic conditions than troops in camp. Fatigue and limited subsistence stores are frequently less injurious than the various influences of the camp. The injurious effects in camp are exhibited in proportion to the discipline of the troops. There is a direct ratio, usually, between the sickness and mortality of the camp and the degree of attention to police and sanitary regulations. The morbific influences of the camp, excluding malaria and scorbutus, are such as arise from deficient drainage, bad police, contaminated water-supply, and crowd-poisoning.

The march more favorable than the camp.

Dampness of the soil and humidity of the air affect the respiratory organs and the alimentary canal, producing catarrh, pneumonia, diarrhœa, and dysentery. The accumulation of the *débris* of camps, of offal and of sinks, produced that condition of the atmosphere in which fevers of the continued type occurred. The neglect to dig sinks, or to preserve in a proper condition those already constructed, proved injurious in numberless instances. The air of the camps was polluted not only by this cause but by the decomposing offal from the kitchens, which, thrown on to the ground, underwent decay with other vegetable organic matters in the soil. The water-supply was frequently contaminated in the same manner. When large bodies of troops were encamped on small streams the water quickly became infected, if not by the direct addition of camp filth and the contents of the sinks, indirectly through the surface drainage. The character of the water itself constituted in some instances a source of disease. Streams flowing through alluvial bottoms became saturated with organic matter of vegetable origin. The large percentage of lime which the water of many parts of the interior region contained, rendered it unsuitable for drinking purposes. The accidental impurities were more important in respect to the causation of disease, than the natural constituents of the potable waters.

Dampness of soil, humidity, and impure water.

The effects of crowd-poisoning were chiefly exhibited in the winter camps. After the first year of the war the camp and garrison equipage issued to the troops was never adequate to the necessities of the case. Huts were accordingly chiefly used.

Crowd-poisoning.

These were constructed of such materials as were available at the point selected for the camp. In many instances they were small huts or caves built of mud and covered with a portion of shelter tent large enough to permit three to live in them, giving each not more than fifty cubic feet of air-space, and frequently not more than twenty. Air was excluded as much as possible to permit the fire on the rude fire-place to warm the interior. Into these the men crowded during unpleasant weather and at night. The fœtid odor and suffocating vapors which were produced in these places appalled one not accustomed to them, and were injurious to all subjected to their influence. This deteriorated atmosphere affected the blood and was powerfully causative of fevers.

This description is not fanciful nor exaggerated. I draw the facts of the description from the winter camp of the army of the Cumberland at Chattanooga, where the soldiers were situated as favorably as any other troops as respects hygienic conditions.

Effects of sieges and long marches.

Severe and prolonged marching does not affect the health of troops so much as camp life. When the conditions of the camp are associated with exhausting fatigue duties, as in sieges, the health of men rapidly deteriorates. The carrying heavy equipments on long marches produced, especially in the young, deformity of the chest and hypertrophy of the heart. The pressure of the belt when the cartridge-box was filled, was injurious to the stomach and liver, and was no doubt a frequent cause of functional derangement of these organs.

Scorbutic taint.

A scorbutic taint was to be observed in troops who had served in the South for a considerable period; but unequivocal scorbutus rarely. The symptoms of this condition were not to be separated from others intermingled with it. But an impoverished state of the blood due to defective alimentation, undoubtedly existed to a large extent. It exhibited itself in various forms, but especially in increasing the fatality of diseases, and in impressing an adynamic character on those of mild and tractable form. As a distinct, substantive affection, it existed to the extent of 1338 in the first year, and 7395 in the second year of the war.

Specific causes of disease.

The *specific causes* of disease to which the soldier was subjected form a large and influential class. Chief amongst these was malaria. Beside the typical malarial diseases, the malarial element existed as a complication in a large number of diseases. It has been elsewhere shown the important *rôle* which this poison performed in army diseases.

The long-continued action of malaria, without inducing fever, is to be separated from the characteristic febrile movements resulting from the rapid imbibition of this poison. Malarial poisoning.

The general prevalence of malarial poisoning is exhibited in the fact that 262,807 cases of malarial fevers were admitted on the sick report during the years 1862–63. There are no data for estimating the degree in which the malarial element existed as a complication in other forms of disease. Taking those for a standard in which more or less malarial complication existed, — camp fever, dysentery, — we may obtain an insight into the great importance of this element without being able to express the influence numerically. Thus during the first two years of the war, 213,260 cases of the various forms of camp fever — typhoid, typho-malarial, and remittent — occurred. Again, the same influence is expressed in the number of cases of diarrhœa and dysentery, which for the first two years of the war reached the enormous number of 725,675 cases. The influence of season upon the degree of prevalence of these disorders tends to show rather more specifically the operation of a malarial element in their causation ; July, August, September, and October were the months of greatest prevalence of diarrhœa and dysentery.

Although the relation of malaria to various forms of army diseases cannot be expressed numerically, there are data for determining the relation in many cases. The influence of chronic malarial poisoning results in a series of well-defined anatomical changes which may be traced in the lesions with which they are associated. This is well seen in army diarrhœa. The changes induced by malaria in the glandular apparatus of the intestinal canal are closely connected with, if they do not precede, those belonging essentially to this disease. Again, this relation is exhibited in the morbid anatomy of the so-called typho-malarial fever — where the malarial element expresses itself in well-marked pathological changes which may be separated from those due exclusively to the typhoid disease.

The camp fever of the army was, essentially, typhoid ; it was modified by various accidental and specific causes. We have just alluded to one of the specific modifying causes — malaria ; the most important of the others was scorbutus. Typhoid fever prevailed under the same conditions in our armies as in our civil populations. Overcrowding, animal and vegetable decomposition, impure water, etc., were the conditions chiefly concerned in the army. Hence it was a disease of the winter camps rather than of summer campaigns. It was a specific disease arising from Camp, or typhoid fever.

a specific cause, in which a malarial or scorbutic element existed as an accidental constituent without being at all causative.

Measles, mumps, erysipelas, small-pox, diphtheria, etc., belong to this order. Of these, 78,809 occurred in the first two years of the war. Measles, the most important of these, we have already shown, is a disease of recruits and young soldiers chiefly.

Measles, mumps, erysipelas, etc.

The enthetic diseases, gonorrhœa, syphilis, etc., existed to the extent of 63,265 cases in the first two years of the war. These diseases prevailed chiefly amongst the garrisons of large towns.

Enthetic diseases.

The *moral causes* include nostalgia, malingering, etc., which are to be discussed in a separate section as causes in operation during the whole service of the soldier. They only require mention in this place.

Moral causes of disease.

Under the term *compound cause* it is intended to express that composite morbid state produced by climatic, dietetic, accidental, and some of the specific causes. In a study of the etiology, symptomatology, and even the morbid anatomy of army diseases, it was not possible in every case to separate one class of actions or causes from another. In this compound morbid state, scorbutus, or the scorbutic taint, so called, and malaria, played the most important parts. To the lowered vitality of the blood and softened solids of scorbutus were added the visceral and other changes due to malaria. A special cachexia was thereby developed, which not only favored the action of common causes of disease, but greatly influenced the mortality from all causes. Its influence was largely seen in the results of surgery in the war. The power of resistance to wounds and injuries was diminished in consequence of the lowered vitality induced by this cachexia. It prevented the reparative process, converting simple injuries into fatal ones ; it produced secondary hemorrhage, sloughing of tissues (pseudo-hospital gangrene), and septicæmia, and promoted the spread of hospital gangrene, pyæmia, and erysipelas.

Compound causes of disease.

The diseases and surgery of the war must be studied in the light of the conditions induced by this compound morbid state. Any statistics or deductions of experience must be valueless which do not express the influence of this state.

IV.

The moral causes affecting the physical stamina of the soldier include cowardice, weakness of will, nostalgia, and malingering.

The first two cannot be expressed numerically. There are no data for estimating their precise importance. Cowardice usually finds an expression in malingering, weakness of will, and nostalgia, but the immediate relation is not frequently demonstrable.

Moral causes affecting physical stamina.

In the first two years of the war, there were reported 2588 cases of nostalgia, and 13 deaths from this cause. These numbers scarcely express the full extent to which nostalgia influenced the sickness and mortality of the army. To the depressing influence of home-sickness must be attributed the fatal result in many cases which might otherwise have terminated favorably. By the same cause may we ascribe a predisposition to have been produced favoring the reception and development of various morbific agents. Again, it is difficult to define the precise action of nostalgia, and to separate the morbid phenomena produced by it from those of an analogous character, produced by wholly different causes. In my opinion, it more probably existed as a complicating element in various morbid states than as a substantive disease. Viewed in this light, the foregoing figures would very inadequately represent the importance of nostalgia as influencing the stamina of the soldier.

Nostalgia.

The term nostalgia is derived from two Greek words, signifying, in our vernacular, home-sickness.[1] The derivation of the word indicates the pathology. It is a mental disorder, and belongs to the class melancholia. Certain physical symptoms precede, accompany, or follow the development of the mental aberration: heat of head; increased rapidity of the circulation; constipation; gastro-intestinal disorders of various kinds; a low febrile state simulating typhoid. The mental despondency and the exaltation of the imaginative faculty increase with the decline in the physical strength. Weeping, sighing, groaning, and a constant yearning for home; hallucinations and sometimes maniacal delirium, are the particular forms in which the disorder of the brain expresses itself.

Does the mental state precede the development of the physical symptoms? Is this sufficient of itself to produce that train of gastro-intestinal disorders and febrile phenomena which characterize the progress of the case? My own experience leads me to the conclusion that derangement of the health, particularly of the primary assimilation, leads to the disorders of intellect, and that in those cases in which the affection of the mind precedes the physical

[1] νόστος, *return*; ἄλγός, *sadness*.

disorders, there is much reason to suspect a predisposition to mental derangement to have existed.

These questions are not without interest in view of the causes and degree of prevalence of nostalgia during the war.

The primal cause is, undoubtedly, absence from home in new and strange surroundings. Various authors have affected to discover a cause in the character of the new country. Thus it is said that the inhabitants of mountainous districts are more prone to homesickness than the denizen of the plain. The experience of the war hardly confirms this view of the influence of external nature. Both in the first and second year of the war, the number of reported cases were in a precise ratio to the number of troops employed. There was no difference, as far as the statistics show, between the troops on the Atlantic coast and those in the interior region as to the prevalence of nostalgia. Hence it may be assumed that the face of the country in which the troops operated had no influence in the production of this disease.

The cases which occurred under my observation were derived from two classes: young men of feeble will, highly developed imaginative faculties, and strong sexual desires; married men, for the first time absent from their families. The monotony of winter camps favored the development of the peculiar mental and physical effects of nostalgia, whilst active campaigning prevented their occurrence. Having too often no physical nor mental occupation, the minds of these unfortunates reverted homeward. They fell into reverie, and allowed their imaginations to run riot amid the images of home conjured up. Then followed melancholia, hallucinations, and physical phenomena due to disorder of the nervous system, such as borborygmi, constipation, indigestion, irregular action of the heart, disturbed sleep, etc. This interdependence of the morbid physical state upon the mental was rather exceptional. Some derangement of the health in the main, preceded the mental phenomena. According to my observation, deranged sexual functions were more frequently precedent to the mental changes than any other single physical condition. Masturbation and spermatorrhœa produced a mental state more favorable to nostalgia than any other cause. This relation may not be expressed numerically, but if the history of the 2588 cases could be arrived at, the intimacy of the relation existing would be surprising.

Only 13 deaths in 2588 cases! This result might well cause us to question the accuracy of the diagnosis. Of all diseases, nostalgia is undoubtedly the most fatal; none are less amenable to treat-

ment. A cure can only be wrought by sending the patient to his home. As this was not frequently possible during the war, it may be concluded that many cases reported as nostalgia were not really so, and that many fatal cases were reported under other names, probably as common continued fever. But this view is necessarily of limited scope. I have already remarked that, as a substantive disease, nostalgia was not common, but, as a complicating element in other diseases, very common.

A rational man in a good state of health may bear up pretty well under ordinary home-sickness, but when his reason is weakened by disease, and his imagination excited by the monotony of the sick-bed, then it is that he becomes a prey to the hallucinations of nostalgia. Consequently it was in the general hospitals that this disease was most frequently observed as a complication of other maladies, and not as a substantive disease. In these cases the precise importance of it in determining a given result could not be estimated. The melancholy and mental depression associated with it must have favored the progress and increased the severity of various diseases. Nostalgia may be considered also in the light of an element in that composite morbid state alluded to in the preceding section, united in many cases with malaria, scorbutus, the effects of crowd-poisoning, etc.

Feigned diseases.

The most important of the moral causes affecting the physical endurance of the soldier, are those which may be comprehended in the group — FEIGNED DISEASES. Our army furnished these cases on a stupendous scale. As this part of my subject will not be discussed elsewhere in these volumes, it is proper that it should be treated of here, at a length corresponding to its importance.

Forms of malingering.

To judge of the prevalence of malingering in our army, we must first understand the particular forms which the feigned maladies assumed. To study them intelligently we must arrange them in classes and orders.

The authors of the article on Feigned Diseases in the "Cyclopædia of Practical Medicine" [1] have proposed some useful distinctions between the several groups: —

1. Feigned, strictly so called, or those which are altogether fictitious;

2. Exaggerated diseases, or those which, existing in some degree or form, are pretended by the patient to exist in a greater degree or in a different form;

[1] Vol. ii. p. 123. Phil. ed.

3. Factitious diseases, or those which are wholly produced by the patient, or with his concurrence ;

4. Aggravated diseases, or those which, originating in the first instance without the patient's concurrence, are intentionally increased by artificial means.

These terms are based upon well-marked distinctions, and are so useful that we shall employ them in the same sense. It is obvious, however, that it would be impracticable to make them the basis of a classification. In the article in the Cyclopædia, no attempt is made to arrange feigned diseases in classes according to their affinities, but they are discussed simply in alphabetical order. In Gavin's prize essay,[1] a very artificial arrangement is adopted, founded upon the symptoms referable to the feelings of the patient, and to those cognizable by the senses or acquired information of the physician, and on the means of diagnosis. Mr. Marshall[2] treats of feigned and real disabilities together. Ballingall[3] treats of them according to the region of the body in which they occur. So also Dr. Cheyne[4] in his very admirable letter to Dr. Renny. The authors of the article on Malingering in the "American Journal of the Medical Sciences" for October, 1864, discuss the several forms of feigned diseases that came under their observation without any systematic arrangement.

To facilitate the consideration of the subject of malingering during the war, I shall treat of the several topics in connection with it in the following order : —

1. Causes of Malingering ;
2. Degree of Prevalence ;
3. Forms of Disability Assumed.
    - *a*. Of the Cerebro-Spinal System ;
    - *b*. Of the Thoracic Organs ;
    - *c*. Of the Digestive System ;
    - *d*. Of the Genito-Urinary Apparatus ;
    - *e*. Of the Extremities ;
    - *f*. Constitutional, or General.

Causes of malingering.

The causes of Malingering may be referred to either the mental and moral characteristics of the soldier, or to some accident of service. The first will, necessarily, include the influence of race, temperament, moral and intellectual training, etc.

[1] *On Feigned and Factitious Diseases*, p. 5.
[2] *On Enlisting and Discharging Soldiers.*
[3] *Outlines of Military Surgery.* Edinburgh, 1855.
[4] *Dublin Hospital Reports.* Dublin, 1827. Vol. iv.

There are no data for expressing numerically the influence of race, and hence we resort to the opinions based upon pretty extensive personal observations. As our army, during the late war, was constituted mainly of Americans, Germans, and Irish, the comparison is restricted to these three nationalities. Influence of race.

My own opinion is, decidedly, that the Germans were more given to malingering than the Americans and Irish. A larger proportion of them were mercenary soldiers attracted into the service by advance pay and bounty. They love ease, and the simple enjoyments to which they are accustomed at home, and have but little aptitude for military service. They do not have the physical endurance of Americans or Irish, and are not possessed of the same degree of mental resiliency. They were much given to feign chronic rheumatic disease, affections of the urinary passages, and diarrhœa.

The Irish soldiers in the English service, according to Marshall (*Op. cit.*), are much addicted to malingering, and the "poorer class of laborers" are the worst in this respect. It has seemed to me that the Irish were less given to malingering than the Americans, but this opinion is not supported by any statistical evidence. They have, as a class, great hardihood, fondness for adventure, buoyancy of spirits, and a natural aptitude for military life and training. A large number entered our service as purely mercenary soldiers, and hence were not indisposed to avail themselves of all the indulgences to be procured by sick men. The class of Irish laborers, especially, objected to fatigue duties, and would malinger to avoid them, when they would not think of doing so to avoid active and even dangerous military duty. "Sun-stroke" and pain in the back, were probably more frequently feigned than any other maladies by the Irish.

The Americans, being vastly in the majority in our army, furnished the largest number of feigned cases; but it is not true that they were in relative proportion the larger, except it may be by comparison with the Irish. The Americans were not to so large an extent mercenary soldiers. Indeed, a considerable percentage entered the service from motives of duty only. Nevertheless, advanced pay and bounty were not without influence upon large numbers who entered service neither in consequence of patriotic zeal nor fondness for military life. In the beginning of the war, the wide-spread enthusiasm forced many into the army who were every way disinclined and unfitted for it. At the same period dis-

charges on surgeon's certificate being given in most reckless profusion, all who were disposed to feign the most simple ailment found no difficulty in quitting the service. Many of this class enlisted again and again, to be discharged on some fictitious disease. When the professional "bounty-jumper" found his occupation too hazardous, he became a malingerer. The Americans who feigned disease consisted chiefly of married men separated from their families and homes for the first time. The particular forms which the feigned diseases of Americans assumed were affections of the respiratory organs, diarrhœa, dyspepsia, heart-disease, etc.

Influence of moral and intellectual training.

The influence of moral and intellectual training was strikingly exhibited. It was not common to see a well-educated man amongst the malingerers. There were, however, occasional cases. One of the most expert malingerers that came under my observation was a Michigan school-teacher. Generally, the men who feign disease belong to the lower orders, to the class of common laborers, and are ignorant and uneducated. In this view, I exclude, of course, the "bounty-jumpers" and malingerers by profession, who added to their evil tendencies the skill acquired by education. The disposition to malinger did not come of the associations of the camp, but was the natural direction of an originally bad character. As a general rule, it may be affirmed that men will feign disease in the army who are guilty of similar deceptions in civil pursuits.

Influence of temperament.

So far as temperament is an expression of innate moral and intellectual qualities, it influences the conduct of men. During the war, the practice of malingering seemed associated with the bilious and nervous temperaments, whilst the sanguine was comparatively exempt. "The typical malingerer has dark-brown or hazel eyes, dark hair and dark complexion; his face is stealthy, dogged, lowering; his eyes suspicious, furtive, restless; and his manner habitually constrained." [1]

If a man have the mental and moral characteristics for feigning, slight causes suffice to develop them in some practical direction.

Various causes.

A variety of other causes may be enumerated as producing malingering. A considerable number of men, not inherently vicious, but who were merely lazy and spiritless, feigned disease to avoid the fatigues and hardships of the service. Cowardice was a not uncommon cause. On the field of battle, a

[1] Bartholow, *Manual of Instructions for Enlisting and Discharging Soldiers*, p. 96. Philadelphia, 1863.

number escaped to the rear with feigned or factitious injuries. Personal difficulties with their comrades, punishments, capricious conduct of their officers influenced many; and pique, disappointment as to promotion influenced others. The most powerful of all causes affecting those not disposed to malinger in consequence of deficient moral sense, was the influence of wives and relations. To the reception of a piteous or complaining letter from home could often be traced the commencement of the deception. The readiness with which discharges were obtained during the first three years of the war, and the numerous successful instances of imposture contributed to the prevalence of malingering by suggesting the idea to those who had not previously conceived it, and by encouraging those whose timidity, rather than want of inclination, prevented engaging in a course of deception. Beside, such defects in military organization and such disregard of military law, as permitted or could not check the wholesale depletion of the ranks of the army by discharges on surgeon's certificate, disgusted those who would otherwise have been willing to bear for the sake of the cause all needful hardships.

Bad effect of general State hospitals.

The organization of general hospitals in the several States for the reception of the soldiers of the State was an ill-advised measure, which greatly contributed to the production of malingerers. Large numbers feigned disease to be sent to the hospital nearest their homes.

But from whatever cause the disposition to malinger arose, the success of the attempt depended much upon the skill and firmness of the regimental and medical officers, and upon the degree of discipline. When a malingerer once succeeded in passing beyond the control and observation of those who knew him, his subsequent operations were much less difficult. Unfortunately, the medical officers of the regiment and the enlisted men were frequently neighbors and associates before the war, and hence the same control could not be exercised as if they had been strangers to each other. In the regiment all cases of malingering should be confronted and disposed of.

Prevalence of malingering.

There are no statistics showing the extent to which feigning disease was carried in our army. This may be approximated to by an analysis of the discharges on surgeon's certificate. The data upon which my conclusions are based, were derived from an examination of fifteen thousand certificates on file in the Adjutant-General's Office, Washington, and from Circular No. 6, Surgeon-General's Office.

As a general rule, soldiers feign those diseases with which they are most familiar, whether by personal experience, or by observation. This is seen in the character of the disabilities feigned by the different nationalities: thus the Germans were given to chronic rheumatism; the Americans to diseases of the respiratory organs, diarrhœa, dyspepsia, heart-disease, etc.; and the Irish to "pain in the back," sun-stroke, chronic rheumatism, etc. The correlative fact is, that those diseases are feigned which are easily simulated and not readily detected. Comparing these two facts with the statistics of discharges on surgeon's certificate, an approximation sufficiently close for our purpose may be arrived at. In illustration of this, we may take rheumatism, consumption, debility, and epilepsy, for example. Thus, the discharges for rheumatism for the first year of the war were 3585; for consumption, 3161; for debility, 3139; and for epilepsy, 669. So numerous were the discharges for chronic rheumatism, that an order was issued by the War Department, at the close of 1862, forbidding any discharges for this cause. The discharges for "incipient phthisis" became so frequent, and exemptions under the Enrollment Act for this disease so numerous, that it was not permitted as a disqualification in the draft of 1864.

Infirmities concealed at enlistment.

In the first year of the war, there were a large number of discharges for infirmities which existed at the time of enlistment (concealed infirmities). Insanity, epilepsy, and hernia may be classed in this category. There were 246 cases of insanity, 669 of epilepsy, and 2300 of hernia discharged in the first year of the war, a vast majority of which existed at the time of enlistment, but were concealed. These concealed infirmities became much less frequent after the first year, and were replaced by feigned or factitious diseases, — rheumatism, heart-disease, incipient phthisis, deafness, defects of vision, etc., feigned; varicocele, hemorrhoids, old wounds and injuries, etc., exaggerated; and chronic diarrhœa, ophthalmia, etc., produced. The improvement in the art of feigning became very manifest as the war progressed. Whilst the discharges for heart-disease amounted to 30 per 1000 in 1862, in 1863 they reached the large proportion of 137 per 1000. The same increase was observed in respect to phthisis.

Malingering shown by sick reports.

The reports of sick, as well as of discharges, furnish some interesting statistical facts bearing on the question of malingering. In two years, 162,276 men came on to the sick report with rheumatism and neuralgia, being an average of 185

per 1000 of mean strength. In the second year of the war, there were reported 40,758 cases of constipation, 20,645 cases of headache, and 775 cases of deafness. There were also reported, the same year, 9977 cases of hernia, and 2585 cases of epilepsy, many of which, undoubtedly, should be considered as concealed infirmities. Whilst in the first year of the war 330 cases of paralysis came upon "sick report," in the second year they rose up to 1164. Again, whilst the cases of neuralgia, in the first year of the war, amounted to 7546, in the second year they reached 18,533, an increase considerably out of proportion to the increase in the numerical strength of the army.

Forms of disability assumed.

It has been already remarked, that soldiers feign those diseases with which they are most familiar, provided the simulation is easy and the detection difficult. The cases of feigned diseases proper were not nearly so numerous as the exaggerated ailments. Many who became acquainted with the ease and comforts of the hospital whilst suffering under some petty ailment, continued to complain after recovery to avoid a return to duty. The cases of factitious disease were infrequent.

Headache and neuralgia.

Of the Cerebro-Spinal System. — During the first two years of the war, there were reported 27,779 cases of headache. Many of these were malarial in character, no doubt, and many were due to indigestion; nevertheless, a large proportion were feigned or exaggerated, to escape some temporary unpleasant duty, or to procure admission into the general hospital. Neuralgia, and pain affecting the distribution of the fifth pair, were simulated as well as exaggerated. The 26,079 cases reported in two years contained many of this character. They were difficult of detection, because all the phenomena were purely subjective. No difficulty existed when the neuralgia produced objective signs. "When a man positively affirms that he suffers great pain in some portion of the body," says Dr. Woodward,[1] "it seems to the popular mind absurd for a surgeon to affirm that he does not." It was one of the most common experiences during the war, for the surgeon to meet cases of pretended pain without any evidences of suffering. That the majority of these cases came upon sick report merely for the purpose of escaping a temporary duty which was unpleasant, is shown by the statistics of discharges. Thus, of the 7134 cases of headache, and 7546 cases of neuralgia, occurring in the first year of the war, only 8 of the former and 39 of the latter were finally discharged. Excluding those who were prob-

[1] *Camp Diseases*, p. 326.

ably the subjects of malarial poisoning, and those who suffered from carious teeth, there must remain a considerable number who feigned or exaggerated this disability. But that they did not persist in feigning, is evident both by the statistics of discharge and by the observations of myself and others.

Vertigo.

I have met with numerous cases of vertigo which were referred to an attack of "sun-stroke" as the cause. These occurred chiefly among the Irish soldiers, who, as laborers, are more or less familiar with the phenomena accompanying an attack of *coup-de-soleil*. In the first year of the war there were reported 420 cases and 17 deaths from this cause, and 1199 cases and 57 deaths in the second year. The cases which came under my observation were more probably feigned than exaggerated. "In none of them were there any appreciable lesions or impairment of any of the functions or organs. All of them complained of strange sensations in the head, and vertigo. A singular expression was imparted to the countenance of two of them by wearing a handkerchief around the head; and a third wore green glasses."[1] Many cases of feigned sun-stroke originated in the temporary loss of consciousness produced by heat, fatigue, and anxiety, in which no lesion of the nervous centres occurs, but recovery ensues promptly. The dread of return to duty induced them to feign symptoms, alleged after-effects of the seizure.

Insanity.

Insanity was occasionally feigned in the beginning of the war. The number of discharges for this cause exceeded the number of cases reported. Thus the number on sick report was 227, and the number discharged 246. According to my own statistics, the discharges for this cause were for the first year 11 per 1000, and the second year 7 per 1000. The decrease is to be attributed to two causes — the elimination of the real cases, and the diminution of feigned cases. The regulations of the army forbid the discharge of insane soldiers, and require them to be sent to the government asylum; but this regulation was not observed with any degree of particularity until the last year of the war. But to the increasing observance of the regulation is to be attributed the cessation of feigned cases. Drs. Mitchell, Morehouse, and Keen are in error in asserting that no cases of feigned insanity occurred during the war. They overlooked my observations on this point. It is certainly true that the higher forms of insanity were not attempted by malingerers. I found in one instance a certificate of disability on which a man had been discharged for

[1] *Manual of Instructions for Enlisting and Discharging Soldiers*, p. 116.

inability to learn his military duties; his intellect and intelligence being, on all other points, sufficiently good! This was undoubtedly a case of malingering. Several of a similar character have been observed by me. Dementia, or imbecility, are the forms which the malingerers assumed, and they usually contented themselves with feigning loss of memory, inability to learn the manual, immobility of manner, and filthy personal habits. Drs. Mitchell, Morehouse, and Keen say, in reference to our soldiers, "any one who would feign insanity and submit to its restraints and associations to avoid work and obtain ease, must be, in reality, a monomaniac." Our malingerers, however, did not attempt the higher types of insanity. This would have been undergoing unnecessary trouble to accomplish their object, and might have subjected them to the risk of being sent to the asylum.

Paralysis.

Paralysis was a very common feigned disability, in its several forms of hemiplegia, paraplegia, and paralysis of a single limb or set of muscles. Quite a number of cases of paraplegia came under my observation. The usual history was, that they had suffered a blow upon the spine by a shell or by a fall, or that they had had lumbago, or that the paraplegia had followed exposure to cold and wet. The most usual form of feigned paralysis, however, was loss of power in one of the upper extremities. This occurs so rarely as a real condition, unless associated with obvious lesions, that a vast majority of these cases were feigned. Drs. Mitchell, Morehouse, and Keen have observed several cases,[1] and I have met with a number. In the first year of the war 330 cases of paralysis came upon sick report, and 252 were discharged from the service. In the second year 1164 cases were reported. A certain proportion of these were feigned, but as to the exact number we have no means of determining.

Epilepsy.

Epilepsy chiefly occurred as a concealed infirmity. In the statistics collected by me, I find that the discharges for epilepsy reached 22 per 1000. The discharges for this cause in the first year were 669, whilst 2585 cases came upon sick report. This extraordinary discrepancy — for in the beginning all cases were discharged — can only be accounted for on the theory that many of them were feigned and the imposture detected. Five cases came under my own personal observation. There was no difficulty in detecting the imposture in these cases. Messrs. Mitchell, Morehouse, and Keen are severe upon those authors who regard the assumed disease as easy of detection, and "speak of it

[1] *Am. Journ. Med. Sciences* (Op. cit.).

with a flippancy which shows conclusively that they have seen but little of the disease." This criticism is hardly just. In those feigned cases in which these very accurate gentlemen had much difficulty in making a diagnosis, it is not beyond the limits of possibility that they were deceived. The malingerers in our service were not sufficiently expert to produce so exact a portraiture as these gentlemen describe, and which confused *even* them. In my cases the epileptic paroxysm consisted in violent convulsive movements carried on with the most obvious effort of the will.

Deafness.

Deafness has been frequently feigned; it was also, in the beginning of the war, a concealed infirmity, and during the whole war, exaggerated. The statistics of discharges for this cause prove this. There were reported in the first year 273 cases and 260 discharges; in the second year, 775 cases came on to the sick report. In 10,991 discharges on surgeon's certificate examined by me, there were 169 for deafness. Notwithstanding the statement of Messrs. Mitchell, Morehouse, and Keen, there can be no doubt that this disability was frequently feigned or exaggerated. It is probably true that exaggerated cases were more numerous than the feigned. A diminution in the accuracy and delicacy of the organ of hearing is a not uncommon sequela of the eruptive fevers, without the occurrence of inflammation and its results, and may occur in typhoid fever. Such dullness of hearing was exaggerated into complete abolition of the faculty.

Defects of vision.

The defects of vision feigned belonged to the three classes: feigned, exaggerated, and factitious.

Ptosis was feigned several times in my experience. One flagrant case was seen by me in which a man had escaped duty four months, and finally reached the general hospital, in which a simple closure of the palpebræ was the only symptom. He was tenderly cared for and led by a comrade who had "*diarrhe!*" Ophthalmia tarsi was frequently exaggerated, and was probably also occasionally produced, or at least aggravated. The same remark is true of granular lids. Ten cases were observed by me in which I suspected the disability had been aggravated, but I was never able to determine the fact positively.

Myopia was a very common exaggerated ailment. This may not be demonstrated numerically, but every observant medical officer was cognizant of the fact. It was sometimes also a factitious disability, if such a term may be applied to the production of such merely objective signs of myopia, as holding objects close to the eyes and corrugation of the eyelids. As a small degree of myopia

did not constitute a case for exemption, those forced into the service under the Enrollment Act almost invariably exaggerated their infirmity, to procure a discharge. Several cases came under my observation in which myopia was concealed at the time of enlistment, and afterwards exaggerated. One of these, who had done no service, remained several months in a hospital under my charge, and whenever desired to give an account of his ailment, produced from his pocket a much worn bed-card, on which was inscribed — "Retinitis."

Total blindness was not frequently simulated. Such a condition would have been too inconvenient to suit the purposes of the malingerer. Partial loss of vision was the form of disability assumed. This was feigned outright, or predicated upon visible defects of the eye, as opacity of the cornea, pterygion, etc. In the first year of the war, there were discharged for diseases of the eye 529 cases, of which *Amaurosis* and *Ophthalmia* furnished nearly one half.

One case of exaggerated disability of the nose came under my observation — a small polypus — for which the soldier escaped duty for a long period, and was probably eventually discharged.

Dumbness has also been feigned. In one case, the man alleged that his dumbness was produced by the concussion of a shell. He carried a pencil and paper, ostentatiously producing it when questioned to write down his answers. Another, with a similar history, relied upon some guttural sounds and pantomime to make known his wants.

Dumbness.

Of the Thoracic Organs. — The discharges for aphonia in the first year of the war amounted to 42. In 15,500 discharges examined by me, there were 28 for this cause. It was a comparatively frequent feigned disability. In the cases seen by me, the patients professed to have lost the voice suddenly, and were unable to assign any satisfactory reason for the occurrence. When questioned, they replied in a whisper. A majority of those discharged were doubtless feigned.

Aphonia.

The discharges for diseases of the lungs and heart included a number of feigned, factitious, and exaggerated cases. A condition simulating "incipient phthisis" was both feigned and factitious. In the first year of the war, 5599 cases were admitted to the sick report, and 3161 were discharged on surgeon's certificate. A large number of these were classed as cases of incipient phthisis. No disease was more successfully simulated during the war. Many of these factitious cases pre-

Diseases of lungs and heart.

sented considerable difficulty in diagnosis, for it must be admitted that the physical signs of incipient phthisis are by no means conclusive. Cough kept up persistently by the voluntary efforts of the patient; the addition of blood from the mouth or nares to the expectoration; confinement in a hospital ward, and the deterioration in health consequent thereon; spermatorrhœa or masturbation may be united in any case to produce a set of symptoms, with difficulty distinguishable from those of the early stages of phthisis. A congested state of the throat, with nervous cough, indigestion, and emaciation, results from profuse tobacco chewing, and this state also may be confounded with incipient phthisis. These two classes of cases were exceedingly common.

In 10,446 discharges examined by me, there were 629 for heart-disease. In 1131 discharges during the months of January and February, 1863, there were 217 for the same cause. A large number of these were cases at the convalescent camp near Alexandria, Va. This extraordinary increase in the relative proportion of heart cases to other forms of disease is solely attributable to malingering. Functional derangement of the heart was produced by various causes, amongst which may be enumerated all of those agencies causative in factitious phthisis. The functional derangement produced by these causes was not to be distinguished from that produced by lowered vitality of the blood, resulting from a scorbutic taint, malaria, etc. The malingerers feigning heart-disease had, frequently, not been exposed to these causes of disability, and had enjoyed, for a more or less considerable period, the good diet and comforts of the general hospital.

Of the Digestive System. — The statistics of the first year of the war indicate a large number of concealed, feigned, and exaggerated cases. Thus, there were discharged for dyspepsia 69 cases. This is an unusual disease in the army, and rarely disabling. Amongst these 69 cases were some cases of the concealed, many more of the exaggerated, and probably a few of the feigned class. During the war, when the malingerers became more skillful, factitious dyspepsia was not uncommon. In two instances the power of vomiting at will was observed by me. Messrs. Mitchell, Morehouse, and Keen record another case. They were not common.

Dyspepsia.

Chronic diseases of the abdominal viscera, splenitis, hepatitis, diarrhœa, were frequently feigned. "The liver complaint" was a popular disease amongst malingerers. Diarrhœa was more frequently than either of those named a feigned or fac-

Liver complaint.

titious ailment. In two instances the factitious disease was explained by the discovery of "Wright's Indian Vegetable Pills," concealed about the persons of the invalids. In the first year of the war there were admitted to the sick report 215,214 cases of diarrhœa and dysentery. A number of these were feigned, but the exact number cannot be ascertained. The cases of diarrhœa, without any impairment of strength or nutrition, were numerous in the general hospitals.

5713 cases of piles were reported, and 215 discharges for this cause in the first year of the war. This disability was very commonly exaggerated. Some instances of feigning also came under my observation. In these cases the malingerers contented themselves with asserting that the piles were internal and bleeding. Piles.

Of Urinary and Genital Apparatus. — The feigned diseases of this system were both simulated and exaggerated. Amongst the former were hematuria, spermatorrhœa, incontinence of urine, gravel, "kidney disease," etc., and amongst the latter varicocele, spermatorrhœa, hydrocele, stricture of the urethra, etc. I have met with three cases of feigned hematuria, in which the deception consisted in mixing blood from the mouth with the urine. These malingerers complained of exquisite pain in micturition, and presented as evidence bloody urine. They were also loud in complaints about weakness of the back, which required them to go much bent. There was no harmony between the severe symptoms complained of and the general good health of these men. Hematuria.

Several cases of feigned spermatorrhœa have, from time to time, been under my observation. In one case hereditary tendency was alleged. Two classes of cases were observed during the war: those entirely feigned and factitious; those existing in slight degree exaggerated, either in consequence of the fears of the patient or to procure a discharge. Spermatorrhœa.

In the first year of the war 170 cases of incontinence of urine were reported; but in the second year the number rose up to 1280 cases. This extraordinary increase in numbers indicates a great increase in feigned cases. There were discharged the service in the first year 36 cases. These figures accord with my own observation; for incontinence of urine has seemed to me to be one of the most frequently feigned of the whole class. In the cases seen by me the malingerer made no pretense of being afflicted with any other trouble. When com- Incontinence of urine.

plicated with calculus, paralysis of the bladder, or disease of the spinal cord, there can be no difficulty in determining the reality of the alleged suffering or disability.

Gravel. Gravel also was frequently feigned. An officer attempted to pass off bits of plaster as small calculi which he had discharged from the bladder. The cases seen amongst soldiers were feigned outright. For stone and gravel 93 came on to the sick report in the first year, and 867 in the second, whilst only 8 were discharged for this cause in the first year. These figures indicate that this disability was frequently feigned.

Kidney disease. "Kidney disease" was a term much in use by malingerers to express a condition which seemed to them to authorize a discharge. Pain in the lumbar region which prevented them going upright; pain and difficulty in urination, and debility, were the symptoms expressed. Of the reality of some of these cases in which oxalate of lime, excess of urea, and excess of uric acid, were manifest, there can be no doubt. In such instances there were abundant evidences of lesions of primary and secondary assimilation, or of both. In the feigned cases these evidences were wanting.

Varicocele. There were 988 cases of varicocele reported in the first year of the war, and 3504 cases in the second year; and in the first year there were discharged 287 cases. In 10,991 discharges, I found 116 for varicocele. This disease was therefore very commonly exaggerated. A large proportion of the cases discharged were for inadequate reasons. Varicocele may exist to a considerable extent without impairing the physical efficiency. When both testes are affected, such serious mental and moral consequences may ensue as to require discharge; but few cases of this kind were to be observed in the large number who came on to the sick report. That a slight degree of enlargement of the veins was sufficient to procure exemption from duty, is evident enough on comparing the statistics of this disease for the first two years of the war.

Hydrocele and stricture. Hydrocele and stricture of the urethra may be classed amongst the exaggerated disabilities, but they were not met with frequently. A few instances of feigned stricture have been observed by me.

Of the Extremities.—As the integrity of the extremities is essential to the proper performance of military duties, feigned and exaggerated diseases, and injuries of these parts, presented a promising field for the exercise of the malingerer's art. Hence, the affections

of the extremities were feigned and exaggerated, and were also occasionally factitious.

Spurious anchylosis or contraction, the alleged result of rheumatic disease, was a very common feigned disability. The elbow, wrist, and knee were, in my experience, the joints usually selected for the deception. There were, during the war, some very remarkable instances of persistent feigning of immobility of a joint. In one case, a man carried his knee flexed upon his thigh nine months; in another, a man carried his fingers flexed for eighteen months for a simple wound of forearm, involving only the integument. Contractions, following gunshot injuries of soft parts, were very frequently exaggerated, and were also aggravated by the opposition of the patient to the means of cure. Many cases are involuntary, the patient nursing a wounded limb to prevent the pain of motion, and persisting in this treatment until contraction results; but many willfully resisted the efforts of the surgeon to bring the limb into use, thereby inducing such loss of function as to incapacitate for further military service. In addition to these, the cases of feigning in which no lesion existed were quite numerous. In such instances the patient professed to have lost motion, and when effort was made to ascertain the truth, simply resisted, by the exercise of his will, the attempt. The extent to which malingering was carried in this direction is conclusively shown in the statistics of discharge for anchylosis, of which there were 199 cases in the first year of the war.

Spurious anchylosis.

Lameness was assigned as a cause of discharge in 71 cases in 10,991 certificates of disability. During the war it was only necessary for a man to assume a cane or a crutch and to limp in order to procure admission to the hospital. From general hospital to convalescent camp, these cases were continually transferred, and, although repeatedly exposed, they could always procure sympathy and countenance in a new place. On the way to the front after having been caught feigning, and exposed, it was only necessary to assume the inevitable cane and to limp, to be admitted to some other malingerer's asylum. Old fractures and injuries which had occurred long anterior to admission into service, were frequently exaggerated. If the malingerer were so fortunate as to retain any evidence upon his person of former injury, as a cicatrix, or deformity of a bone, he was quite certain to parade it, to exaggerate his sufferings in consequence of it, and to demand a discharge for disability, having faithfully tried to serve his country, notwithstanding he was physically disqualified.

Lameness

In the same category may we class varicose veins. The number of these cases on sick report was enormous; in the first year 776, and in the second year 3344. At first the concealed cases were eliminated, the discharges in 10,991 certificates being 213 for varicose veins; but afterwards the exaggerated cases came forward to claim exemption from duty.

Varicose veins.

Another form of feigned disability of the extremities, very curious as to its cause and character, was swelling of an inferior extremity. This I observed in a number of cases, of which there were ten at one time in a hospital under my charge. Messrs. Mitchell, Morehouse, and Keen also observed one case. This swelling was alleged to have existed for a considerable time, and no explanation of the mode of its production was vouchsafed by those affected. "Careful search at unexpected times, even at midnight, never disclosed the slightest trace of a ligature or pressure upon the veins. The swelling seemed to be produced by keeping the leg habitually crossed upon the other, or, as the reporters of the case above mentioned suggest, by keeping "his leg resting on his crutch."

Swelling of an inferior extremity.

Constitutional or General. — In 28,640 discharges on surgeon's certificate for the first year of the war, there were 6724 for debility and rheumatism, or nearly one in four. These figures include a large number of feigned and exaggerated cases. Debility was a term applied to the low vital condition resulting from fever and from a variety of morbid states. But, to a considerable extent, it was also a factitious state, arising from all those abuses to which soldiers are addicted — indulgence in alcoholic drinks, masturbation, excessive tobacco chewing, etc.

Debility and rheumatism.

But debility was a less frequently feigned ailment than rheumatism. In the first year of the war 44,762 cases of rheumatic disease came upon sick report, and 3585 cases were discharged. In the second year the cases reached 81,435. So numerous were the cases and discharges for rheumatism that a general order was issued by the War Department forbidding any discharges for this cause. A large number of these cases consisted of lumbago, or were "back cases," as they were familiarly styled in the general hospitals. Every hospital had its quota of these cases. They referred their sufferings to exposure or to injury. To give color to the expressions of pain, they would flinch and cry out when the back was examined; they went about half bent, and they used, in the most ostentatious manner, crutches or a cane. When closely examined as to all the circumstances under which the injury or dis-

ability occurred, they were frequently betrayed into the most improbable and often ludicrous statements. The incongruity between the history, expressions of suffering, and general good condition of these back cases was often strongly marked.

Dr. Woodward [1] is disposed to refer many of these cases of lumbar pain and weakness to the existence of a scorbutic taint. He reiterates this statement in Circular No. 6 of 1865, p. 134: "The scorbutic taint manifested itself very generally in the form of rheumatic pains in the back and limbs, associated with the scorbutic, clay-like appearance of the skin, sometimes even with sponginess of the gums, much more rarely with petechiæ, scorbutic discolorations about the flexures of the knees," etc. The back cases so commonly seen in our general hospitals do not answer to this description. Such evident marks of disease could hardly be mistaken by any intelligent medical officer for malingering.

Contractions of muscles and immobility of joints, the alleged result of rheumatism, were exceedingly common. These cases were to be seen in the general hospitals, limping in the most painful way and complaining piteously, whilst enjoying the most robust health. Such cases could not be confounded with pains attendant upon scorbutus.

Contractions of muscles.

The feigned diseases described in this section are the principal forms that occurred in our service during the late war. I have discussed those which have fallen under my own observation, and have purposely excluded all references to malingering as it occurs in foreign armies.

No reference was made to the diagnosis and treatment of the various forms of feigning. Some general remarks on these subjects will not be inappropriate.

Diagnosis and treatment of feigning.

The cases of successful imposture were not frequent. Surgeons usually recognized them, or at least suspected them for good reasons. Numbers were discharged who succeeded simply by virtue of obstinate perseverance, the surgeon being the first to give in. The duties which the surgeon was required to perform in relation to malingering were very unpleasant. To detect and expose imposture was unpopular, and also exposed the surgeon to misconception and abuse. The citizen soldiers who feigned disease relied on the services and sacrifices of their faithful comrades to secure them immunity from exposure and punishment. They traded on the blood of the fallen. Notwithstanding the difficulties in the way, the surgeons, as a general rule, strove faithfully to maintain the discipline of the army, by discountenancing imposture.

[1] *Camp Diseases* (Op. cit.).

In the diagnosis of malingering the medical officers relied upon the indications afforded by the incongruities of the patient, upon systematic surveillance, upon strategy, and upon the use of anæsthetics. Patients who feigned disease, except in exceptional cases of expertness, rarely told a consistent story as to the causes, progress, duration, and symptoms of their malady. The state of good health in many of them was in striking opposition to their expressions of pain and suffering. Subjected to surveillance in the general hospital, all but the most expert malingerers were usually easily caught in some acts inconsistent with their professions of disease. The address of the surgeon himself, in cases of amaurosis, paralysis, and lameness, was often quite sufficient of itself to expose a malingerer. The most important means for the detection of feigning is the inhalation of ether. This was largely resorted to during the war, and proved to be adapted to a very wide circle of feigned cases.

To detect imposture, to separate real from simulated cases, required a competent knowledge of disease under all its varied aspects. Whenever a malingerer succeeded, the surgeon had either been wearied or deceived.

Complaints of harshness and severity of medical officers.

During the war the newspapers teemed with complaints of the harshness and severity of medical officers. These were, usually, written by malingerers themselves, but they none the less excited the indignation of the public. These accusations were almost invariably unjust. If the medical officers failed in the performance of any of their duties, the failure was due rather to defects of training than to inhumanity or prejudice. As a class, they were the best friends of the soldiers during the war. Their labors and sacrifices were all directed to improve the health, and cure the diseases and injuries of the soldiers. Yet it was a sad fact, that the regimental surgeons who were engaged in these humane offices were less popular than those whose duty made them agents for destruction of health and life.

Granting of certificates of disability on insufficient grounds.

Discharges on Surgeon's Certificate. — Soldiers were discharged on the certificate of the surgeon setting forth their inability to perform military duty. In the first years of the war certificates were often granted for insufficient causes. General Order 212 of 1863 defined the disabilities for which soldiers could be discharged, and the irregularities which previously existed were thereby corrected. No certificates were sufficient until they had received the approval of the medical directors of corps, army, and department. Early in the war regimental and district

commanders often exercised the authority to discharge, and many men were thus dismissed without the least regard to the requirements of law. The most serious abuse existing in this respect was the disposition of the certificate of disability, which was frequently given to the soldier discharged instead of being forwarded to the adjutant-general. Hence the statistics of discharges on surgeon's certificate for the first two years of the war do not accurately represent the whole number of discharges.

Notwithstanding the pension laws and the army regulations based upon them require that the degree of disability shall be stated numerically, this was constantly disregarded in the first two years of the war. And throughout the whole war there was no uniformity in the views of medical officers in respect to the degree in which any particular disease or injury incapacitated a man for earning his subsistence by manual labor. In the French military service, precise rules govern those empowered to discharge for disability. Similar regulations should be introduced into our service. Uniformity in expressing the degree of disability for any particular disease, and especially injury, would insure justice to the soldier, and protect the interests of the government.

CHAPTER SECOND.

REMARKS ON VARIOUS CIRCUMSTANCES RELATING TO THE CAUSATION OF DISEASE, ESPECIALLY AMONG VOLUNTEER TROOPS, BASED ON PERSONAL OBSERVATIONS IN THE FIELD, DURING THE YEARS 1861–65.

By A. J. PHELPS, M. D.,

SURGEON UNITED STATES VOLUNTEERS.

The Aptitude of the American Mind. — The newly-appointed Medical Officer, his Early Embarrassments, and the little Instruction that he derives from those regularly in the Service. — The First Duty of the Medical Officer. — Bad Effects of the Volunteer Plan for Recruiting an Army. — Sketch of the Early History of an Ohio Regiment, as representing the History of New Regiments generally. — First Organization of Büell's Army, or "The Army of the Ohio," and Appointment of Division and Brigade Surgeons. — Increase of Sickness. — The Superiority of Tent Hospitals. — The Effect of Marching Orders upon the Health of the Troops. — The Size of Men best suited for Soldiers. — Line of March of Troops from Nashville. — Battle of Pittsburg Landing. — The Want of Coöperation between Commanding Officers and their Surgeons. — Account of the First General Hospital of this Army. — The Severe Services and Bad Nourishment of the Army before Corinth. — The Type of Disease that prevailed in the Army before Corinth. — The March of the Army of the Ohio, after its Evacuation of Corinth, and its improved Hygienic Condition. — The Reënforcement of the Army from the Calls of 1862; the Error of the Government; no Improvement in the *Personnel* over the Troops of 1861. — First Attempt at an Organization of the Medical Department, for the Field of Battle, in Wood's Division. — The long Rest of the Army; the Time is spent in Recuperating, Organizing, and Reënforcing. — The March of the Army to Chattanooga. — Battle of Chickamauga. — Retreat to Chattanooga. — Siege of Chattanooga. — The Battles of Mission Ridge and Lookout Mountain. — The March to the Relief of Knoxville; remarkable Health coexisting with Destitution of all Kind of Supplies. — Still further Improvement in the Medical Department.[1]

Aptitude of the American mind.

The promptitude with which our country, in the year 1861, bounded from the attitude and pursuits of a long reign of peace into the condition of active and vigorous war, struck the world with astonishment. In a day, the current of its

[1] It is proper to state that a considerable portion of the paper by Dr. Phelps related to topics belonging so exclusively to surgery, that insertion in this volume would have been inappropriate. That portion was transferred to the editor of the surgical volume. The following are the topics to which the portion thus transferred related: "The battle of Perrysville," "Order issued for the government of medical officers on the battle-field previous to the battle of Stone River," "Train of reserve medical supplies to be left on hand for a battle," "Battle of Stone River," "Recovery of the wounded; experience in favor of tent hospitals," "Best practical method of the time proposed for conducting the medical department under all the contingencies of a battle," "Condition of the wounded recovered from the enemy," "The obstacles in the way of the cure of our wounded," "Plan proposed for treating the badly wounded by means of a general field depot near the battle-field." "Army of the Potomac; Grant's campaign against Richmond." — Editor.

whole energies was diverted into preparations for war! All classes were affected alike; all trades and professions yielded with equal enthusiasm to the call for troops. Since then, millions of soldiers (2,759,049) have joined the army, fought many of the bloodiest battles of history, and, with the loss of a vast number of lives by disease and wounds, the object of the war has been accomplished, and a large proportion of those who remained have disappeared in the by-ways of peaceful pursuits! And this army was accompanied by thousands of medical officers, called from civil life to treat millions of cases of disease and wounds.

Early embarrassments of the newly appointed medical officer.

This vast amount of labor and responsibility devolved at once upon the medical profession; and the newly appointed medical officer was ushered without preparation into positions of weighty responsibility. He had to learn his duty, and to practice it at the same time; and he soon discovered that he had but little written authority to consult, and that experience must be his teacher. It cannot be said of the corps of regular surgeons, who had been educated in the service, that they were to a much greater degree qualified for the emergency. Their services had generally been performed at small frontier posts, where the routine of duty was so limited as to tend by long habit to disqualify for the greatly enlarged and practical effort that was now required; and, while we naturally looked to them as directors and instructors, we were disappointed to find that they had no instructions to give other than those which were to be found in the Army Regulations. These "Regulations" embraced but little more than directions how to procure medical supplies, by requisition, and to prescribe the forms for certain reports; and howsoever well they might have answered the requirements of the army in time of peace, they were totally inadequate now with an army of hundreds of thousands in active service. The new medical officer, therefore, was thrown from the first upon his own resources; and whatever of excellence characterized the medical department of the army at the close of the war, was the result of the aptitude of the American mind to adapt itself to any emergency that calls forth its action.

First duty of the medical officer. Bad effects of the volunteer plan for recruiting.

The first duty of the medical officer was the examination of recruits. The plan of voluntary enlistment, relied upon by our government for raising its army, brought to the recruiting office all sorts of men who were anxious and determined to go into the service. The surgeon was influenced in the examination by the prevailing impression that for

the volunteer service it was not necessary to be as severe as if examining for the regular army. This was a great error to commence with, and aside from the bad effects for the government, it proved fatal to thousands of patriotic, but feeble and unhealthy men, who might now have been living and pursuing useful occupations. Feeble boys, toothless old men, consumptives, asthmatics, one-eyed, one-armed men, men with different length of legs, club-footed and ruptured, and, in short, men with every variety of disability, and whose systems were replete with the elements of incipient disease, were accepted as recruits, and started to the field only to become a tax upon the government, and to encumber the movements of its armies. It has been said by an eminent officer, whose services have been constantly in the field (Major General Thos. J. Wood), writing on military organization, "that statistics derived from the observations of the closest observers, lineal and medical officers, disclose the startling fact that, as a rule, throughout the entire war, not more than thirty-five per cent. of the muster-roll strength of the armies of the Union appeared on the battle-field bearing muskets!" Many causes operated to produce this discrepancy, but none so potent as the loose manner of recruiting that prevailed; and it is surprising that after all the embarrassments to the service that resulted from this cause, effective measures were not taken sooner to correct the evil. But various influences continued to operate throughout the war inimical to the thorough inspection of the recruit. Governors of States, in their great anxiety to fill their quotas promptly, grew intent upon measures that would be most sure to bring forth numbers, unmindful of the fact that, not numbers alone, but healthful vigorous men, give strength to an army. Even as late as the fall of 1864, in the last levy under the Conscription Act, the looseness of recruiting existed to such an extent that the Secretary of War deemed it necessary to publish Circular No. 67, of date August, 1864, requiring a re-examination, by experienced medical officers, of all men, at the several States' rendezvous, before being sent to the field; ordering all to be discharged, according to the provisions of the regulations, who were found to be unfit for active field service. I was President of the Board of Examiners for Ohio, where we reëxamined about 8000 men, and discharged 266. The ratio of men rejected by the Board was much greater during the first period of our examinations, but grew less as it became known to the recruiting and mustering officers and boards of enrollment throughout the State, that their recruits would be reëxamined at the general rendezvous before

being forwarded to the field. By citing these facts no reflection is intended upon the honesty and skill with which the great majority of these officers performed their duties; yet among the discharged recruits were found every variety of physical disqualification; and some of them exhibited the most culpable carelessness, or the most stupid fraud upon the part of the recruiting officers. And the facts are highly significant as showing how necessary for the good of the service are the most stringent recruiting regulations, to insure sufficient caution on the part of officers in the performance of this most important duty.

Early history of an Ohio regiment, as representing the history of new regiments generally.

The 33d regiment of Ohio Volunteers commenced its organization in the summer of 1861, and started into active service as a minimum regiment about the middle of the ensuing October. It was recruited generally from the rural districts of Southern Ohio, and was composed of medium-sized men, the nervous temperament predominating. The medical examination of the men consisted of but little more than opening and shutting the hands, bending the elbows and knees, and rotating the shoulder-joint, with a casual glance at the teeth and eyes, and a question as to age and previous general health. They were then, with few exceptions, mustered in to the service. The only regular officer in the regiment was the Colonel (Brig.-Gen. J. W. Sill, killed at Stone River). It was rendezvoused near Portsmouth, upon the Ohio River, in a miasmatic locality. The camp was supplied with water freely impregnated with various salts, and was located, not for the salubriousness of the region, but for geographical convenience. Intermittent fever and diarrhœa made their appearance to a considerable extent in the regiment before leaving camp, and the men generally were not in a good hygienic condition, on account of the malarious poisoning. Its first service was in Eastern Kentucky, under General Nelson, and it was accompanied by the 2d, 21st, and 59th regiments Ohio Volunteers, and several detachments of Kentucky troops. The campaign was a severe one, on account of rainy weather and hard marches through a mountainous region. Thirty or thirty-five of the brigade were wounded in a skirmish, and a large number of all the regiments fell sick with diarrhœa and measles. During this short campaign, each regiment conducted its medical affairs independently. We had sufficient medical stores for years, but few of other necessaries for our sick. We lacked hospital tents, ambu-

lances, etc. On our return, by way of the Big Sandy and the Ohio rivers, we were ordered to Louisville, Ky., and were encamped in a low marshy place, that was known long afterward as "Mud Camp." We remained here only a short time, and were ordered to Bacon Creek, in supporting distance of the troops at Mumfordville, on Green River, where we remained until the 10th of February, 1862.

Organization of the "Army of the Ohio," and appointment of division and brigade surgeons.

In the mean time Buell had come into command, and began the regular organization of this army into brigades and divisions, and surgeons were assigned to staff duty at brigade and division head-quarters.

Increase of sickness.

At the same time sickness continued on the increase. Large numbers were attacked with measles, mumps, small-pox, asthenic diarrhœa, camp fever, etc. In my own regiment, I had nearly three hundred cases of measles alone, and, on account of all forms of disease, it was reduced to a mere camp-guard. The sick reports in the Surgeon-General's Office, from Bacon Creek, Camp Nevin, and Green River, and from the numerous and overcrowded hospitals at Louisville, testify to the ravage of disease at this time, and to its exhausting effects upon the army. According to my observation among the regiments composing our (Mitchell's) Division, those that had served during the first three months of the war did not suffer to the same extent from sickness as those that were recruited in the late summer and fall months; and from this fact I deduce the opinion that all new levies of troops should be made in the spring-time of the year.

Superiority of tent hospitals.

We soon discovered, from the large per cent. of mortality that attended the cases sent to general hospital, that they would have recovered better in camp; and accordingly, we secured all the tents that we could, and sent no more sick away, unless compelled to do so for want of room. I have never since seen cause to change my decided preference for canvas for hospital purposes.

Effect of marching orders on the health of the troops.

When the order came for marching upon Nashville, a striking improvement in the health of the troops took place. The signal for breaking camp seemed like electricity to revive into activity energy long dormant, and I take it as a fact

illustrating the beneficial effect of ideas and new mental impressions upon health. That the long repose of a large army in camp is unfavorable to its health, notwithstanding the best hygienic regulations, is a fact too frequently observed throughout the war to require argument.

Size of men best suited for service.

Another circumstance occurred about this time which bears upon the size of men who can best endure the vicissitudes of army life. It occurred with the 10th regiment Wisconsin Volunteers. When this regiment joined us on the march to Bacon Creek, it was full to the maximum, with generally very tall and athletic men. It was a splendid looking regiment, and maintained its size quite well while we remained in camp, but the march that proved a stimulant to the health of my own regiment had the opposite effect upon it; its largest men fell out of ranks by platoons, and I believe that it never did recover its proportionate strength, as compared with other regiments where the size of the men was not above medium.

Line of March of Troops from Nashville.

When the main army left Nashville and moved on to Pittsburg Landing, our division marched on Huntsville. In the mean time I was commissioned into the general staff, and received orders to report to General Halleck, in the field, before Corinth; but not until after I had, under the direction of the division medical director, opened the Huntsville General Hospital.

Battle of Pittsburg Landing.

The battle of Pittsburg Landing, or Shiloh, will be recorded in the history of this war as one of its most terrible scenes. I saw nothing of this battle save the scarred trees, the shallow graves, and numerous little mounds bursted with the bloating carcases of slightly buried horses. As I rode from the river to the front over the field, I smelled the dull, heavy odors of the old camp and of the march. The sun was hot, and the paludal water, which was the sole dependence of the troops, rested in puddles or shallow ditches, equally common to beast and man, and I felt that disease and death must be holding high carnival in such an atmosphere and place as that. This I found to be true. We heard much of the battle that had been fought, and as we reflected upon the tales told us of the suffering and slow relief on the battle-field, we thought surely "some one had blundered!" A grave

fault existed somewhere; and although I knew that the medical department of the army did not at that time hold the high place in the consideration of the commanding generals that it should have done, yet I am of the belief that the chief medical officers present did not comprehend the full extent of the preparation required for a large battle, so as to have properly prepared for it. There had been no organization of the medical department, especially for the field of battle; and the natural result is what is shown to have occurred, namely, confusion amongst the medical officers, slow relief to the wounded, unjustifiable operations, and a lack of supplies. The news of the battle went to the North, and the boats that brought supplies carried off the wounded. No attempt was made to treat the severely wounded men near the field, where rest could be maintained, which is so essential to the cure of such cases; but all were sent North, and the sufferer had not the alternative of choosing between transportation North and death, and remaining upon the field with a reasonable chance of recovery, even though it were under the rudest shelter that the bedding found would have afforded.

Want of co-operation between commanding officers and their surgeons.

As I have intimated above, during the first two years of the war, there did not exist that harmony between the generals commanding and their staff medical officers necessary to the efficiency of our department. Whether it was because medical officers unwisely coupled to the proper claims of their department authority that did not belong to it, and thereby themselves provoked an opposition deleterious to its interests; or whether it was owing to an arbitrary disposition with officers commanding to regulate every staff department according to their own ideas of what was necessary, the fact was, there existed a want of harmony, if not open antagonism. In justice to the generals upon whose staff I have served, I must say that it was my good fortune never to find any difficulty in obtaining their hearty coöperation in carrying out any measures that I deemed important to the health, comfort, and proper care of the soldier.

First general field hospital of this army.

Profiting by the dear-bought experience of Shiloh, and in anticipation of a severe battle at Corinth, orders were given, about the time that I arrived there, to establish large field hospitals in the rear of each of the armies. It was not designed to send to the rear any wounded whose lives or limbs would

have been seriously endangered by the transportation. The hospital for Buell's army, which was placed under the charge of Surgeon A. P. Meglert, U. S. V., and myself, was intended to accommodate 2500 patients. Elaborate drawings of this hospital, and a description of its construction and administration, were afterwards forwarded to the Surgeon-General of the army. The plan was in general terms as follows: It consisted of sections, each section complete in its own administration, with one senior medical officer, two assistants, and the necessary attendants, and made to contain about one hundred and twenty-five patients. Each section consisted of four wards, arranged two on either side of an avenue, or space, in which were located the quarters of its medical officers and attendants. These sections were repeated in a line with each other. The kitchens and very narrow and deep latrines were located on one flank, while on the other were located the quarters of the chief medical officers, purveyor, commissary, and the guards. In the absence of hospital tents, the wards were made of tarpaulins, stretched over a frame-work consisting of corner-posts and studs driven into the ground, and plates and rafters. The tarpaulins formed the roof, and old tent-flies were used for curtains to the sides. I like this form of shelter much better for the summer than the regular hospital tent. A good substitute for the tarpaulin in this kind of tents, especially when it is necessary to economize canvas, is to use hospital tent-flies for the purpose. They can be arranged by tacking the side border of a fly upon the ridge-pole of the frame-work; then drawing it tight over the plate, and fastening the other side-border, by means of its cords, to stakes driven firmly into the ground; then tack another fly upon the opposite side in a similar manner, and so on with four more flies, and you will have a large and commodious tent, cool in the summer and easily ventilated.

But the enemy retreated from Corinth without a battle, and when our armies moved on, these large field-hospitals were filled with sick and such men as were too feeble to march. No better opportunity could have been afforded than this for a study of the diseases prevalent in the army at that time. It will be remembered by all who served in the trenches before Corinth, that during the whole time they were constantly on duty, either digging in the trenches or watching on the picket-line, and that their rations consisted of but little more than salt pork and hard bread, or flour, with no means of preparing it. They will remember how grateful they felt for

Severe service and bad management of the army before Corinth.

any little article of fruit or vegetable food that the Sanitary Commission were enabled to supply. How could one wonder, then, at the spectral appearance of this army as it marched off!

Type of disease in the army before Corinth.

The following "Observations on Camp Disease in the Field, near Corinth, Miss.," made at the time by myself, and published in the "American Medical Monthly," will give a fair idea of the type of disease that prevailed there: —

"In our hospital alone there were registered seventeen hundred patients. All of these cases presented the same type of disease, variously expressed by the terms 'Dysentery,' 'Diarrhœa,' 'Febris Typhoides,' 'Scorbutus,' and 'Debilitas.' Subsequent observation of these cases demonstrated the uncertain character of this classification, and that the disease derived its name from the most prominent symptoms present, rather than from ascertained pathological conditions. It could not easily have been otherwise, as all surgeons will testify who have found the same person, in the course of a few weeks, upon their register, under treatment for dysentery, diarrhœa, and febris typhoides; the same attack acquiring a new name, in accordance with the development of new symptoms, or the absence of others. In fact, these diseases exhibited such a diversity in their behavior, seldom running a regular course, but alternating one with the other, and exhibiting so many symptoms in common, that the nomenclature was necessarily confused.

"The case was termed 'dysentery' or 'diarrhœa,' in accordance with the presence or absence of tormina, tenesmus, and bloody evacuations. But there was seldom an amount of local pain and constitutional disturbance in the cases exhibiting bloody evacuations sufficient to indicate the presence of active inflammation; and ulcerations in the colon, and bloody dejections, frequently occurred, unattended by tormina and tenesmus, and seemed to be more the result of a hæmorrhagic diathesis than of any perceptible organic change. In all the autopsies made, the large intestine was free from ulcerations, but the mucous membrane of the ileum invariably exhibited a softened condition, and was easily removed with the back of the scalpel. This condition also existed in the colon occasionally. In no case were there discovered well-defined ulcerations. In a few instances the mucous coat was found absent in patches, but the appearances denoted an abrasion rather than the result of an ulcerative process.

"In cases of *fever*, the fever present was decidedly of the adynamic type, and was usually registered as 'febris typhoides.' But this fever differed essentially from the true typhoid or enteric fever in several particulars. There was no tympanites, no rose-colored eruption, and no affection of the Peyerian and solitary glands of the ileum. The visceral complications were trifling. In no case was any disposition to a disorganization of the parenchymatous organs observed. There was a great tendency to serous effusion, especially in the pericardium. The brain appeared healthy. Death seemed to result from asthenia. Parotid abscesses were frequently developed in the course of the fever. They usually appeared in a late stage; but when they appeared earlier in the fever, the system failed rapidly, and death ensued in a majority of cases, though not in all. When life was prolonged, the entire gland suppurated, leaving the whole parotid region cavernous.

"'*Scorbutus*' was applied to cases in which more of the distinctive marks of scurvy were present, such as spongy gums, large and flabby tongue, feeble pulse, dusky complexion, and petechiæ. This disease very seldom appeared in its worst and most characteristic forms.

"'*Debilitas*,' as used, was a very general term. Sometimes it indicated convalescence; sometimes it was applied to the merely adynamic condition of the system that resulted from the continued operation of the depressing influence of the past severe winter and spring campaign. In these cases there was no fever, and but little, if any, diarrhœa, but simply a 'weakness,' attended with emaciation and a loathing of the army ration. Occasionally, cases terminated fatally very suddenly where no cause *post mortem* could be discovered, save fibrinous coagula in the cavity of the heart.

"These coagula were observed in 33 per cent. of the autopsies made, and in nearly all the cases of sudden death. They were firm, unmixed with red blood corpuscles, and weighed from one and a half to seven drachms. They were found oftener in the right ventricle; usually, however, in both ventricles; generally attached to the chordæ tendineæ, but sometimes entirely loose. The largest coagulum discovered was in the case of a patient who was admitted on the 28th day of May, 1862, with 'febris typhoides.' At the end of twelve days his symptoms of fever were entirely relieved, and he bid fair for a speedy recovery. He remained in this condition, without apparent disease, nourished and stimulated with care, until death came like a gentle sleep on the 22d day of June. The

heart was found in all cases pale and flabby, and the blood was very fluid. The gall-bladder was usually found full of dark-colored bile. In several instances it was very much distended; but there were no icteroid symptoms before death, nor any apparent deficiency of bile in the evacuations from the bowels.

"Several instances of intussusception were discovered; in one of which there were six invaginations of the intestine, ranging from one inch to four inches in extent. Yet the fœces had been passed regularly, without any symptoms of obstruction.

"The deductions from the foregoing observations are, that the causes of all these affections were in the totality of their effects essentially debilitating, and, in the main, may be enumerated: as the long-continued exposure to cold and wet during the winter and spring, the hot sun and cold nights of the later months, excessive labor and loss of rest, deficiency of food and bad water; that, possessing so many elements of similarity, these affections owed their variety to some accidental circumstance in the constitution of the individual; and that no certain classification of these could have been made having for its basis the presence or absence of pathological lesions that could be determined before death. It would seem that the combined operations of all these causes generated a general morbid condition, or dyscrasia, which constituted the true disease; and that the pathological phenomena that resulted therefrom were but secondary effects, and that these effects or 'diseases' compensated each other when attacking different individuals, and alternated very often in the course of the same case. Our main reliance in treatment was in rest and nutrition."

Along with the sick above referred to, we received a hundred cases of severe wounds, amputations, etc. Erysipelas appeared in almost every case to a greater or less extent, but gangrene in none.

March of the army of the Ohio after the evacuation of Corinth, and its improved hygienic condition.

As I have already remarked, the army that moved out of the trenches in pursuit of Beauregard was but the spectre of an army. The men and officers looked sallow and thin, and considered themselves fortunate if they only had "a little diarrhœa."

After pursuing Beauregard for a short distance into Mississippi, the army of the Ohio (Buell's army) took up its march eastward to Middle Tennessee, and continued marching almost without intermission for nearly five months; traversing Northern Mississippi and Alabama up into the mountains bounding Middle Tennessee on

the west; thence northward through Kentucky to Louisville; thence returning in pursuit of Bragg, fighting the battle of Perryville, on the way back to Nashville, where we finally went into camp and indulged in a short rest before fighting the battle of Stone River. The health of the army began to improve the moment it got into the region of pure water, vegetables, and fruits. Rations of green corn did more for the cure of the obstinate diarrhœa that then prevailed than any or all the theraupeutical measures that had been tried!

When the army arrived at Louisville it was reënforced by recruits who came forth in answer to the calls of July, 1862. The *personnel* of this enlistment was scarcely any improvement over the former one. New organizations were formed, and were officered by inexperienced men. The government surely committed a great error at this time in not filling up the old regiments before creating new ones. The new recruit would then have been subjected to the inspection of regimental officers already experienced, and would have soon acquired the habits of personal care and comfort that association with drilled and disciplined soldiers alone can teach. But as it was, in a short time these new regiments were reduced in strength below those that were then serving out their second year. On the march from Louisville large numbers fell from the ranks. They had not the encouragement and friendly aid of the old soldier at their side to teach them the folly of carrying a heavy knapsack, or to carry their gun for a while, and to relieve them of fatigue duty on going into camp at night; but, exhausted and sick, they fell out of line, overloaded the ambulances, and over-peopled every town through which we passed.

Reënforcement of the army from the calls of 1862; no improvement in the *personnel* over the troops of 1861.

But to return to the field hospital at Corinth. After the sick and wounded left behind by the army had been sent North, we were ordered by Surgeon Murray, U. S. A. Medical Director, to bring the tents, etc., to Huntsville, with the view of establishing a similar hospital there, but this intention was not fully carried into effect on account of the retreat of the army into Kentucky.

In the mean time I was assigned to duty as medical director of the 6th (Wood's) Division.

During our march northward we were in constant expectation of an engagement with the enemy, who marched in a parallel line close to our own, and with the same objective

First attempt at an organization of the

medical department for the field of battle in Wood's Division.

point or points in view. At this time (Sept. 10, 1862) I made the first attempt that was made, to my knowledge, toward an efficient organization of the medical department for the field of battle. I do not know what may have been done in other divisions of the army, and am not disposed to take any especial credit for exclusive originality in the conception, as it appears from Circular No. 4, Surgeon-General's Office, of date March 25th, 1863, that a circular was published by the medical director of the army of the Potomac on this subject the 30th of the following October. The plan that I inaugurated was as follows: I directed that when a battle was imminent the chief surgeon of each brigade of my division should report to me immediately for special orders, and to assist in the selection of a site for the division hospital. They were directed to have one regimental medical officer to accompany each regiment upon the field, for giving temporary aid, and to see that the wounded were removed promptly. The remainder of the medical officers were to be held in readiness to rendezvous with their hospital wagons at the point designated for the division hospital. The brigade surgeons were to constitute an operating board, without whose sanction no important operation was to be performed. We had no regular ambulance organization.

The long rest of the army. The time spent in recuperating, organizing, and reënforcing.

The season was unfavorable to military movements, and no great danger was felt that the enemy would attack us. The minds of the troops were therefore at rest from the constant expectation of orders to march, or apprehensions of an attack. During this period the army was largely reënforced by the return of men to duty from general hospitals, and by new enlistments; and on the other hand great numbers of physically disabled men were discharged from the service who had rested as a dead weight on all of its movements.

The first real and successful attempt toward a thorough organization of the medical department of the entire army commenced here under the directions of Surgeon G. Perin, U. S. A. Many practical observations had been made by those medical officers who had labored in the field for a period of eighteen months or two years in all the capacities of regimental surgeon, surgeon-in-charge of field hospitals, and medical director; — in the camp, on the march, and in battle; and the new medical director of the department wisely availed himself of the experience and suggestions of his subordinates, and took them into his counsel. Under his care and direction the army grew in strength like a convalescent, from day to day.

If either of the grand armies was further advanced in the completeness of their medical organization than ours was at this time, we would claim in qualification that no other army had done an equal amount of hard and continued service. No other army had less time and opportunity than ours to inaugurate and carry out reforms. We had long since ceased to look to our common senior for instructions, and any thing of excellence that existed in our administration sprung from our own unaided efforts. We struggled without enlightenment from the chief of our bureau, and against the prejudices of a commanding general who felt that every soldier detailed from the ranks for the care of the sick and disabled was a permanent loss to his effective force, and that the medical department should be self-sustaining — that the sick should take care of the sick! Without wishing to dispute his high position among scientific military generals, the commander of the army of the Ohio exhibited in his conduct a great deficiency of sympathy for the sick and disabled soldier, and treated the efforts of the medical department to improve itself with an amount of indifference that showed that he merely tolerated its existence as an unpleasant necessity.

A different condition of things commenced when General Rosencrans took command of the army. He and his medical director harmonized in friendship and benevolence of feeling, so that every practicable measure recommended to improve the efficiency of the medical department, and to raise the standard of qualification of its officers, met with his hearty coöperation. Soon after the battle of Stone River an Army Board of Medical Examiners was appointed for the examination of medical officers reported incompetent, of assistant surgeons for promotion, and of private physicians applying for contract. I regret to have it to say that we had some medical officers who were found to be grossly incompetent. The effect of these examinations was very apparent in the improvement of the efficiency of the medical staff.

The hygienic condition of the army was greatly improved here by a change in the method of cooking, which was *enforced by orders*, namely, by companies. Heretofore the cooking had been done by squads or messes, notwithstanding the oft-repeated recommendation of medical directors in favor of cooking by companies. To insure a good quality of soup for the soldier an order containing a set of most excellent soup receipts was issued on the recommendation of the medical director of the department: —

GENERAL ORDER No. 76.

HEAD-QUARTERS DEPT. OF THE CUMBERLAND,
Murfreesboro, Tenn., April 10th, 1863.

Soup-order.

To preserve as far as possible the health of the troops of this Army, the following regulations, in regard to diet, are prescribed: —

I. When in camp, cooking will be done by companies, instead of squads.

II. Soup, made according to the following recipes, will be served to the men as follows: —

1st. Beef soup, when fresh beef can be procured, twice a week.

2d. Soup made from beans or pease, twice a week, or oftener, if desired by the men.

RECIPE FOR BEEF SOUP.

Beef and Vegetable Soup for fifty men.

Ingredients. —	Beef (cut in pieces of 4 or 5 lbs. each)	35 lbs.
	Dessicated Vegetables . . .	3 "
	Rice	4 "
	Flour, sugar, and salt, each . .	$\frac{3}{4}$ "
	Pepper	$\frac{1}{2}$ oz.
	Water	8 galls.

Directions. — Soak the dessicated vegetables from reveille until after breakfast. Immediately after breakfast, put all the ingredients into kettles at once, except the flour; set them over the fire, and when beginning to boil diminish the heat, and simmer gently until 11 o'clock; then add to the soup the flour, which has been first mixed with enough water to form a thin batter; mix well together and boil until noon. Sufficient hot water may be added, from time to time, to replace that lost by boiling. The soup should be stirred occasionally, to prevent burning or sticking to the sides of the kettle.

Note. — To make good beef soup, it must be borne in mind that the ingredients are put into cold water, and the heat gradually applied until nearly the boiling point; then simmer for several hours. By brisk boiling the exterior of the meat is hardened, and its juices will not be mixed with the water, but retained. The meat will also be tough and unpalatable. The dessicated vegetables should be well separated when put in water to soak.

RECIPE FOR BEAN SOUP.

Bean Soup for fifty men.

Ingredients. — Beans . . . . . 4 qts.
Bacon or Pork . . . . . 15 lbs.
Onions . . . . . no. 3
Pepper . . . . . ½ oz.
Water . . . . . 8 galls.

Directions. — Soak the beans over night; at reveille in the morning, put them into vessels, carefully cleaned, and boil steadily until done; then mash them with a spoon, or masher made for the purpose, and strain through a colander if practicable.

Immediately after breakfast, put the bacon (or pork), cut in pieces of from three to five pounds each, into another kettle with water, and boil for an hour; pour off the water, add the bacon to the soup, with onions (chopped fine) and pepper, and boil until noon. Remove the bacon and cut into smaller pieces, suitable for serving with the soup.

Note. — In the preparation of this soup, soft or rain water should be used, when practicable; and if a less quantity than that directed be put into the vessel, or if it become necessary, from long boiling, to add more, it should be boiling and not cold water. The bacon, after parboiling, can be placed near the fire if the beans are not sufficiently soft to mash well. The reason for directing that the bacon be added after the beans are done is, that grease of any kind hardens them.

When pease are issued in lieu of beans, they should be treated in the same manner.

III. All commanding officers are charged to see that these orders are strictly enforced, and that there may be no negligence on the part of company cooks. Company officers will inspect the cooking every day, to see that it is properly done.

IV. The especial attention of the officers of the Inspector-General's Department will be given to this matter, and they are directed to report the execution or neglect of these orders, by every regiment in the Department, in their semi-monthly Inspection Reports.

V. The senior medical officer on duty with each regiment will make a written report, on Monday of each week, to the Medical Director of the Department, through the intermediate medical officers, stating the number of times soup has been served to the men during the week, the kind, and the quality of the cooking.

The importance of wholesome food cannot be over-estimated, and the General Commanding enjoins upon the commanding officer of every regiment the necessity of enforcing these orders. Improper and badly cooked food, eaten at unseasonable hours, is the cause of much of the sickness which thins our ranks and fills our hospitals.

By command of
MAJOR-GENERAL ROSECRANS,
C. GODDARD, *A. A. G.*

Scurvy.

There appeared but very few cases of *scurvy* here, applying this name to cases in which were present the diagnostic symptoms usually given for it; yet a dyscrasia evidently existed with the troops, as many cases of death occurred, some of them sudden, in which a similar *post-mortem* condition was discovered to that described as having existed at Corinth. For the period of many months the men had received no fresh vegetables regularly through the commissariat; though the necessity and importance of the issue had been very frequently reported to the head-quarters of the army. Relief finally came, not through the commissary, but through the agency of the Sanitary Commission, to whom General Rosecrans gave unlimited orders for transportation for this purpose. It seemed that the U. S. Sanitary Commission could succeed in furnishing potatoes, etc., where the commissary could not. This has been accounted for by the fact that the government let contracts for their supply in such large amounts, that no one dared to undertake to fill them properly, whilst the Sanitary Commission purchased in lots of any size, and forwarded them to the field immediately.

Cerebro-spinal Meningitis.

A few cases of *Cerebro-Spinal Meningitis* occurred here, though it did not prevail as an epidemic. I cannot give the treatment of these cases, or the success, as I became an invalid myself about this time, for a period of two or three weeks, with an attack presenting some of the prominent symptoms of that disease.

Camp police.

Camp police was a subject that received special attention during the army's long rest here. As a principle, habits of order, and cleanliness in the regimental encampment, extended their influence to the soldier in the care of his person and accoutrements, and greatly contributed to his health and happiness. Our camps became models of neatness and order, and received the most flattering encomiums from the U. S. Army medical inspectors who visited us. The latrines and kitchen sinks were constructed very

generally upon the same plan; by digging pits, corresponding in size to the purpose, being larger for the former, and smaller for the latter; then covering them over with platforms made of clapboards, excepting a place small enough merely to give a sure support to a half-barrel or cracker box, in the top of which was made a hole for the convenience, as the case might be, of a seat, or of pouring in slops. Any day the most fastidious person might have gone through the encampment of the 21st Army Corps without perceiving an unpleasant odor. These measures of personal and camp police, including the improved method of cooking, had a remarkably good effect upon the health of the soldiers, which was demonstrated by their subsequent endurance of fatigue and wounds.

The subject of an *ambulance organization* also engaged our attention here. Up to this time no regular ambulance system existed in this army. Regiments were unequally supplied with ambulances, and as regimental quartermasters were responsible for them, their use was by no means restricted to legitimate purposes, and were not usually kept in serviceable condition. For instance, in a report made by myself on the subject, Dec. 7th, 1862, out of one hundred and one (101) ambulances reported in my corps, only thirty-nine (39) were reported as serviceable; and it was with this number that we transported our wounded from the battle-field! The division quartermasters reported that they had made frequent demands for ambulances ever since the army left Louisville, the preceding August, but failed to get any. On recommendation of the Medical Director, an "Ambulance Order" was issued, March 6th, 1863, which, in the hands of the medical directors proved very efficient during the long march to Chattanooga, and in the battles of Chickamauga, Lookout Mountain, and Mission Ridge. Ambulance organization.

Thus was the army of the Cumberland, on the 20th of June, when it broke camp, to commence the summer march of 1863, that led to the battle-field of Chickamauga. The 14th Corps had a short engagement with the enemy before reaching Tullahoma, but my own corps being a few miles distant, I knew nothing of this engagement that would be of interest in this history. March of the army to Chattanooga.

During the march to Chattanooga there was nothing occurred worth recording beyond the incidents common to a continuous march of weeks, and the occasional rests that intervened. The hygienic condition continued good; all the conditions were favorable. The season summer; the country mountainous and abound-

ing in springs and running streams of pure water; the marches easy; and supplies of blackberries, peaches, and green corn in abundance. But few fell sick on the way. Chattanooga was evacuated on our approach. We here found a large number of pavilions that had been used by the rebels for hospitals, which we immediately prepared for our own use. They were well arranged for the purpose, but were not nearly as elaborate in all their appointments as our own general hospitals. One striking feature of their general arrangement was, having a large receiving hospital near by the principal railroad depot, where the sick and disabled could be received at all hours, and not have to suffer ambulance transportation before being fed and dressed.

Siege of Chattanooga.

Our army remained in Chattanooga, in this state of siege, for a period of five weeks. Owing to the fall rains the roads soon became almost impassable. The troops were regularly on half rations, and sometimes failed to get any for a day at a time. Sometimes, in lieu of rations, they were favored, over the horses, with a few small ears of corn, which they parched and ate with a relish.

Soon all the forest trees within the works, and as far beyond as it was safe to venture, were felled and used for firewood; and when this supply was exhausted, the stumps thereof disappeared for the same purpose; and when these failed, the roots and rootlets of the trees were dug from the ground, and husbanded with care. There had been no issue of clothing made since in the summer. The men had left their knapsacks and overcoats at Murfreesboro, according to orders, and now were protected only by their threadbare and tattered summer clothes; none had overcoats, and but a portion had blankets.

The transportation of the army had become fearfully reduced. For want of forage many of the officers were compelled to turn their horses out to roam at large, and perhaps die, or else see them starved to death at the picket-stake. Thousands of mules died from starvation. The road to Bridgeport was corduroyed with their carcasses. In every mud-hole they might have been seen struggling with feeble and fast-waning strength in fruitless efforts to extricate themselves. Whole wagons became worthless under their ravenous attack. They died in such numbers in the encampment that the living scarcely sufficed to drag their dead away. All the ambulance-horses that could be spared, and almost all the artillery-horses, were sent away to the rear. Finally the situation demanded, as the only hope of our army, that we should fight

again. And although no very apparent increase of sickness had been produced by the destitution of food and clothing, yet it may be readily conceived with what forebodings for our wounded we contemplated the necessity for another battle. We knew that their hygienic state must be unfavorable to recovery from wounds, and the means at our control were almost totally inadequate for their proper care and subsistence. When the enemy evacuated the place, they cleared the hospitals of every thing that could be of use to us, even to household utensils. Not a bunk was left in the buildings used for hospitals. Truly, "we were compelled to make brick without straw." A part of the pavilions that the enemy had used for hospitals came within the range of the guns, when our defensive lines around the city were established, and were destroyed by fire; and for hospital purposes we were driven to the necessity of using hotels, churches, and deep and badly ventilated warehouses, the walls of which had become so many square yards of *fomites*, in consequence of the poisonous emanations from the large number of Confederate sick and wounded who were treated here. For bedsteads, we manufactured bunks from fencing-boards and the sidings of old frame houses, which were carefully removed that the nails might be saved for special purposes. A few bales of cotton furnished us material for mattresses, and for cooking purposes we gathered odd pieces of cooking utensils and broken ranges which, at any other time, would have been considered worthless, but which to us now were invaluable.

Battles of Mission Ridge and Lookout Mountain.

The battles of Lookout Mountain and Mission Ridge were fought on Nov. 23d, 24th, and 25th, 1863, and opened up the old line of communications to Bridgeport. Our forebodings for the sufferers in these battles were too well verified. Under the best nursing and treatment that we were enabled to give them, the mortality was very considerable. Nature seemed to arouse all her energies in one effort to cure; but hospital gangrene and its congeners blighted with their poisonous venom her laudable efforts, and again we were compelled to stand by and see case after case that had excited our most lively interest falter in the reparative processes and perish. We lived in constant fear and trembling for our most promising cases; not until the last particle of pus had ceased, and the cuticular epithelium had interposed itself as a final protection, pronouncing the amputation or wound healed, did we rest secure in our triumph with nature's remedial forces. Too often, at night, we left our "good fellow" with promises that he should soon go home to his friends, and in

the morning met the nurse with the deportment so ominous of evil tidings, and with the report that our patient "had had a chill;" and, on inspection, found, instead of laudable pus, a sanious discharge upon the dressings, with perhaps gas bubbles issuing from the wound, and granulations of a hue of greenish gray. Our patient would then be singularly unconscious of any danger, taking his quinine as if he had only a chill, and, loth to see inevitable death in the case, for a few hours, or a day perhaps, we, too, hoped it would prove "only a chill." But it was well for him that, as he must die, his death came from a simultaneous poisoning of his system with his wound, rather than from the slow exhaustion of gangrene and repeated secondary hemorrhages.

The behavior of all classes of wounds was very much modified by the character of the buildings or shelter in which they were treated. It was best in tents, next in pavilions or modern buildings, and least well in the brick buildings. A row of deep warehouses was used for our purposes, a part of which were constructed of brick, and a part of wood, and it was observed by all who went from ward to ward that there was a decided improvement in the appearance of the patients in the wooden over those in the brick portion of the buildings.

March to the relief of Knoxville. Remarkable health notwithstanding destitution of all kinds of supplies.

Immediately after the battle of Mission Ridge, two divisions of the 4th Corps marched to the relief of Knoxville, and remained in that vicinity until the army was concentrated for the spring campaign. It is a fact worthy of note that although these two divisions were compelled to subsist on the very shortest rations, and were still almost naked in the midst of winter, and without tents, yet their health was unprecedented, many of the regiments not reporting a single case of sickness on their monthly reports of sick and wounded; while the remaining division that was in camp near Chattanooga, which was much more liberally supplied, was constantly reporting quite a large sick list, and the appearance of scorbutic indications. Short rations alone do not cause bad health so much as a more abundant ration less carefully prepared, and, usually, the more abundant the ration, the less carefully it is prepared for food.

Further improvement in the medical department.

The long rest that ensued after the battle of Mission Ridge was spent in still further improving the efficiency of the medical department, by reducing its transportation and consolidating its forces. The transportation allowed to a regiment for medical purposes was one serviceable pack-mule for the purpose of carrying a medicine pannier. Regimental hospitals

were abolished, and a system of brigade hospitals was established, equipped in accordance with the following allowance, namely: one wall tent, one common tent, and hospital tents in the proportion of one for every 350 men present; camp kettles, etc., as many as are absolutely necessary; and one medicine wagon and two army wagons for transporting medical stores and camp and garrison equipage for the brigade hospital — all of which were to be under the direction and charge of the brigade surgeon. A field supply-table was determined upon, and published for the guidance of medical officers in a circular dated "Head-quarters, Department of the Cumberland, January 1st, 1864," specifying the allowance for a brigade. This obviated the necessity of continuing the trains of corps reserve supplies which had proved so advantageous in previous campaigns.

The ambulance corps was more thoroughly organized, in accordance with General Orders No. 2, Head-quarters, Department of the Cumberland, January 2d, 1864.

CHAPTER THIRD.

ARMY ALIMENTATION IN RELATION TO THE CAUSATION AND PREVENTION OF DISEASE.

BY SANFORD B. HUNT, M. D.,

LATE SURGEON AND BREVET LIEUT.-COL. U. S. VOLUNTEERS; FORMERLY PROFESSOR OF ANATOMY IN THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF BUFFALO.

Public Opinion respecting the Wants of the Army prior to the Rebellion. — Experience of the British and French Armies in the Crimea. — Defects in the United States Army as regards the Equalization of the different Nutriments, and their Lack of Adaptability to the Vicissitudes of Climate and the Accidents of Campaigns. — Work of the Sanitary Commission. — Standard of Alimentation. — Classification of Foods into Nitrogenetic and Calorifacient. — Analysis of Blood. — Army Rations of different Nations. — Rations of the United States Army compared with those of the French, Russian, Turkish, East Indian, and British Armies. — Nutritive Value of Rations. — Nitrogenous Foods. — Experience of British Statisticians. — Experience at the Convalescent Camp in Virginia, and in the Military Prisons of the United States. — The Confederate Army Ration. — Experience of the 16th Army Corps in 1864–65; of the Frontier Head-quarters at Fort Smith, Arkansas, and at the Confederate Prison at Andersonville. — Conclusions respecting Nitrogenous Diet. — Carbonaceous Foods. — Fresh Vegetables and Salt. — Notes on the Special Components of the Ration. — Beef, fresh or salt; Pork or Bacon; Bread, hard or soft; Pease and Beans; Coffee, Tea, and Whisky. — Summary. — Professor Horsford's Plans to diminish the Weight and Bulk of the Army Ration.[1]

Public opinion respecting the wants of the army prior to the Rebellion.

PRIOR to the Great Rebellion the public mind had rested in quiet satisfaction as to the physical wants of its small regular army. The few who had opportunities for observation saw only a well-fed, well-dressed, and well-"set-up" looking man in uniform, who had no complaints to make; and, therefore, they ran easily to the conclusion that gov-

[1] The endurance and health of the soldier are obviously affected, favorably or unfavorably, to a greater or less extent, by alimentation; inadequate nutritious supplies must, of course, lessen his ability to sustain the hardships of army life, and impair the power of resisting disease. The regulation of army rations, so as to secure to each soldier a proper relative proportion of the different alimentary principles, avoiding, on the one hand, deficiency, and on the other hand, excess, and the preparation of food with regard alike to wholesomeness, convenience, and economy, are objects of the greatest importance with a view to promote the largest amount of efficiency, and to afford the fullest protection against morbific causes other than those which are directly or exclusively dietetic. Army alimentation, therefore, belongs properly among the topics embraced in section first of this volume; and, in consideration of its importance, a distinct chapter is devoted to it. The next chapter contains testimony of medical officers respecting certain points connected with alimentation. Dietetic causes, standing in direct relation to the production of certain individual diseases, especially scurvy, diarrhœa, and dysentery, will enter into the consideration of these diseases in section second of this volume. — EDITOR.

ernment took ample care of its soldiers, and, of course, would do so in the then impending crisis. Even in the Mexican War, when the element of undisciplined volunteers, under inexperienced officers, had been largely introduced, the distance of the field of operations was so great, and their results so satisfactory to our pride, that little attention was drawn to the disastrous mortality from diseases of assimilation that attended those brilliant campaigns.

Experience of British and French armies in the Crimea.

Fortunately for the American people, this self-contented apathy was broken by the revelations of the sufferings of the British and French armies in the Crimea. The results of parliamentary investigations and of newspaper reports revealed the fact, that, after an experience of many centuries of foreign wars and wars of invasion, the British commissariat was totally inefficient. The science of the alimentation of armies had been neglected to an extent that involved all the errors of a diet which, when abundant, was unsuited to the wants of the system; and which was so often deficient as to produce actual starvation. The publicity so sensibly given to these important truths seems to have been the direct cause of the inquiries made into the constitution of the United States army ration at the outset of the rebellion, and the considerable reform, by enlargement and increase of flexibility, made by Congress in the summer of 1861.

Faulty alimentation in the armies of the United States.

But notwithstanding this, and without having been subjected to such calamities as attended the Crimean War, the armies of the United States doubtless endured much that might have been avoided. The ration was sufficient (judiciously issued) in weight of nutriment, except in the more pressing exigencies of hard marches and distant bases of supply; yet it cannot be denied that a fault existed, which we may expect to find, —

1st. In the arrangement or equalization of the different nutriments; or,

2d. In their lack of adaptability to vicissitudes of climate or the accidents of campaigns.

The proof of the existence of the fault asserted needs little argument. It is found in the great mortality from diseases of assimilation which began with the war and increased in fatality up to its close; and in the evil results which attended gunshot injuries and operative surgery from the impoverished condition of the blood of the sufferers. Thousands of such men were borne from the field, apparently hardy and strong, who within a few days developed some cachexia, seriously complicating the otherwise simple nature of their injuries. In the establishment of the present ration, only

tradition was consulted. So far as is now known, it was arranged by men without pretense to skill as experts, and without any exhaustive study of the laws of alimentation.

Occasional interruptions of supply.

In the discussion of the food of armies it is not our intention to base our argument on those occasional interruptions of supply which sometimes subjected our troops to the evil of short rations. They were the almost unavoidable incidents of a sudden and gigantic war, conducted by inexperienced officers, and of the magnitude of which only a few foresaw enough to urge the needed preparations. These misfortunes, as they occurred in camp, in hospital, or on battle-fields, it was the work of the Sanitary Commission to relieve. In all wars this supplementary labor will be necessary. Some agency must exist in alliance with, but independent of, the government, which, with an easy book-keeping and a broad charity, can be present with help in emergencies and remedy the deficiencies of the government and the improvidence of the soldiers themselves.

The ration and its employment a fruitful source of disease.

On the other hand, we have been led to the conviction that, throwing out of view these occasional disturbances of supply, and making the broadest allowance for all other causes of disease in the army, one, and the most fruitful, of its sources is to be found in the ration and its unscientific employment. We reach this conclusion from the almost uniform observation of army surgeons, — that veteranship conferred no immunity from diseases of assimilation; that chronic diarrhœa and scurvy increased with the term of service; that the longer a soldier had been subjected to the ration (as he got it), the more liable was he to develop some form of cachexia when wounded. Thus, hospital gangrene was hardly known during the first few months of the war, but steadily increased in frequency of occurrence up to its close.

Importance of the laws of alimentation.

To insure a proper comprehension of this subject in the public mind, it is necessary to revert briefly to some of the more obvious of the laws of alimentation; to endeavor to establish some standard of diet, which, in average circumstances, shall be sufficient to maintain the body in health; to note the variations in that diet which may be required by way of adapting it to the peculiar life of the soldier; and, finally, in the suggestion of any changes, to see that they possess the requisites of sufficient cheapness and ease of transportation. Without the latter essential the best of rations would be unavailable. It must be in some form that can accompany the march of a column, without overburdening the train or the haversack.

A STANDARD OF ALIMENTATION.

The average weight of seventeen hundred soldiers of the army of the Potomac was 147½ pounds. The average weight of seven hundred and five French mounted chasseurs was 142½ pounds. The average weight of twenty-seven thousand eight hundred and fifty-three recruits to the British army at home, in 1860, was 128 pounds; and the average weight of twelve thousand one hundred and ninety-one British recruits for 1861 was 131 pounds. These recruits were all over twenty-one years of age. Thus, the average French weight was 5½ pounds less than the American, and the average English weight was about 18 pounds less than the American; a fact brought out by investigations made under the direction of the Sanitary Commission. It is an emphatic contradiction of the prevalent idea that the physical manhood of the Americans has deteriorated from the European standard.

Average weight of soldiers in different armies.

Physiologists have fixed upon one hundred and forty pounds as the average weight of the human male. Supposing that to be the weight of a person in perfect health, the diet he needs is one that will keep him at that weight by equalizing the receipts and disbursements, the food and the waste of the system. The gain acquired by the assimilation of food, should exactly counterbalance the loss by exertion. Yet there is a further consideration. In what material, in muscle, in fat, or in bone, shall this one hundred and forty pounds of original capital be invested? A soldier's diet must be adapted to a soldier's needs and vicissitudes, to his capacity for enduring heat and cold, to long marches and heavy burdens. He demands an athletism not called for in the ordinary walks of civil life. The diet, therefore, most favorable for the counting-room or the shop, is not that required in the field.

Average weight of the human male.

Physiological experiment has arrived at a close approximation to the average diurnal gain and loss in the man of one hundred and forty pounds weight. The daily gain is stated as follows: —

Average diurnal loss and gain in weight.

Water . . .	lbs. 4.109	Inorganic gain	lbs. 6.301
Oxygen	" 2.192		
Dry vegetable food . .	" 1.687	Organic gain .	lbs. 2.250
" animal " . .	" .563		
Total daily gain			lbs. 8.551

The total daily loss, in a healthy body, will be exactly equal to the gain. The rapidity of this interchange is an important element in the argument. It may be augmented by severe exercise or decreased by idleness; and there are articles of diet that may compensate for a short allowance of food by restraining the waste of the system. This waste, however, may be largely increased without impairing the health, provided the food is equalized to it. The waste is from interstitial death of organic atoms in the system; and that atomic death depends largely on the activity of exercise — the wear and tear to which the system is subjected. And if we have other new-born organic atoms ready to fill the places of those destroyed, the weight of the body will remain unchanged.

In the above table we may at once dispense with three fourths of the weight of the *ingesta* named, as not in any army ration. Water and oxygen are provided by another Commissary; but it should not be forgotten that they are nevertheless foods, and that the official act or neglect that deprives the soldier of any part of his six and three tenths pounds of water and oxygen, robs him of so much actual food to which he is entitled. Beyond that, it remains only to consider what we have called the "organic gain"; the actual food, vegetable and animal, assumed to be necessary to the maintenance of the body, under usual conditions, in a stationary condition of serviceability.

CLASSIFICATION OF FOODS.

Foods either nitrogenetic or calorifacient.

The division of foods into vegetable and animal is unsatisfactory, insomuch as it does not specify, except very roughly, the chemical or physiological office of either class. Rejecting that division, we find another in the physiological office of food, which is either nitrogenetic or calorifacient, — flesh-forming or heat-producing. To this it is objected that it is not yet proven that the production of animal heat is a process of combustion; yet it is so plain that animal heat is maintained by some kind of chemical process carried out under physiological control; so plain that the class of nitrogenetics cannot produce heat except at a great waste; so plain that the so-called calorifacients cannot, under any circumstances, become converted into plastic compounds, that the objection loses all practical force. We know that the nitrogenetics are the only source of muscular flesh. We know, also, that the calorifacients contain the elements of animal heat; and whether those elements are actually burned, or in some other manner applied to the same pur-

pose, is a question which is never practically employed in our studies of alimentation.

All foods may be expressed in one chemical triad, namely, Albuminoids, Starch and its products, and Fats. Of these, the first are nitrogenetic, flesh-forming. Starches and fats are calorifacient, — heat-producing, — and do not contain the elements of muscle. They cannot, therefore, perform the office of albuminoids; but albuminoids may, and doubtless do, in the process of their excretion from the system, become calorifacient. Thus we reach at once the safe conclusion that nitrogenetic food may imperfectly perform all the offices required; that a man will avoid starvation much longer on albuminoids alone, than he will on starches or fats only.

Albuminoids, starch, and fats.

Allied to foods — in the better sense of the word, actual foods — are the various salts of lime, soda, potash, iron, magnesia, and phosphorus, which are all essential to the proper assimilation of food. In all good diet-scales they are, with the exception of common salt, found provided by Nature in sufficient quantities, and beyond that they do not need to be sought after. As artificial substitutes for food, the cerebral stimulants, alcohol, coffee, and tea, may be mentioned. And as all foods find their final expression in the constitution of healthy blood, we here introduce Le Canu's analysis of that fluid.

Salts of lime, soda, etc.

ANALYSIS OF HEALTHY BLOOD.

	First Analysis.	Second Analysis.
Water	780.145	786.590
Fibrin	2.100	3.565
Albumen	65.690	69.415
Coloring matter	133.000	119.626
Crystallizable fatty matter	2.430	4.300
Oily matter	1.310	2.270
Extractive matter soluble in water and alcohol	1.790	1.920
Albumen combined with soda	1.265	2.010
Chloruret of sodium and potassium and alkaline phosphates, sulphates, and sub-carbonates	8.370	7.304
Sub-carbonate of lime and magnesia, phosphates of lime, magnesia, and iron, and peroxide of iron	2.100	1.414
Loss	2.400	2.586
	1000.000	1000.000

To this proximate analysis we here append the ultimate analysis

of Prof. Playfair, of the blood and flesh of the ox, showing their almost absolute identity.

ANALYSIS OF THE BLOOD AND FLESH OF THE OX.

	Ox Blood.	Beef Muscle.
Carbon	51.95	51.83
Hydrogen	7.17	7.57
Nitrogen	15.07	15.01
Oxygen	21.39	21.37
Ashes	4.42	4.23
	100	100

Albuminoid compounds.

The albuminoid compounds differ from the other classes of food in one essential. They contain nitrogen, and without nitrogen there can be no muscular flesh; and, so far as muscular vigor is concerned, the nutritive value of any food is in a direct ratio with the amount of nitrogen it contains. The importance of the albuminoid element is well expressed, in the table of Le Canu, in the large amounts of albumen found in fibrin and blood; and, in the table of Playfair, in the amount of nitrogen found in flesh. The part performed by the carbo-hydrates (starches), and hydro-carbons (fats), is less conspicuous. The rapid assimilation of these elements, and their equally rapid destruction after assimilation, keep their volume, at any one time, circulating in the blood, small; while the amount chemically consumed is large. *Per contra*, albuminoids are slow in assimilation, and slow in submitting to the destructive processes. They have more permanence in the system, and find their outlet from the economy through the channel of the blood; while the calorifacients, after destruction, are mainly gotten rid of by exhalation from the lungs in the form of carbonic acid gas.

Proportion of carbon and hydrogen to nitrogen in food elements.

The food elements containing carbon and hydrogen stand to those containing nitrogen in a proportion variously stated, at from one part of nitrogenous to three, five, or even seven parts of non-nitrogenous. Beneké, from a study of the diet-scales of the principal schools, prisons, and hospitals of London, "derives the conclusion that nitrogenized should be to non-nitrogenized food as one is to five." Frerichs puts his estimate in ounces: nitrogenous 2.17 oz. to non-nitrogenous food 15.54 oz.; or, as one is to seven. Prof. Christison, the distinguished Edinburgh savant, says in his "Observations on a Report by Sir John McNeill, relative to the Diet of Soldiers,"[1]

[1] Vide *Report of Crimean Commissioners*, Appendix xxxii.

"Soldiers in the field will be the more efficient the nearer they are brought to the athletic constitution. But as the demand for protracted, unusual exertion occurs only at intervals, the highly nutritive athletic diet is not absolutely necessary. On the whole, from experience in the case of other bodies of men somewhat similarly circumstanced, twenty-eight ounces of real nutriment, of which seven are nitrogenous or reparative, will probably prove the most suitable. Any material reduction below twenty-eight ounces will certainly not answer; and under unusual exertion, kept up for days continuously, as in forced marches or forced siege labor, the quantity should for the time be greater, if possible."

Christison's estimate of amount of nutriment required for the soldier.

It is eminently desirable that a real and definite understanding of the term "nitrogenous" should be reached. All the ordinary foods, sugar excepted, are to some extent nitrogenous, but the percentage of nitrogen in them varies from one half of one per cent. to fifteen per cent. We shall attain, in the course of this chapter, a more exact understanding, though hardly a better phraseology in reference to the plastic elements. In the mean time, we pass from this imperfect approximation to a typical diet, to the model which Nature furnishes in the food she provides for the embryo and the infant. The unborn chick finds within the egg all the elements of growth at a time when, secluded in its shell, it has neither exercise nor respiration to cause waste, and when it derives its animal heat from the incubation of the mother hen. These elements are albumen and fats, with the necessary salts, the phosphates of lime, even, being cunningly provided by the phosphorus of the yolk and the lime of the shell.

Sense of the term nitrogenous. Nutritive elements in the egg.

In the food provided for the infant, we have all the conditions. The child exercises, respires, maintains its own animal heat, and performs all the functions of growth and waste, with the maternal milk for its only diet. The conditions of life in the infant vary from those in the adult in only one essential. The great business of the infant is flesh-making. It has not only to maintain its animal heat and existing status, but it must constantly accumulate and hoard material for its growth. Hence we should anticipate a provision by nature for this want. And when the adult becomes an infant — when he, too, by reason of sickness must maintain the old and build up the new fabric of health and strength — we should carefully adapt his diet to his doubled necessities. In the case of the infant, we accordingly find the analysis of milk presenting the following elements: —

Elements in milk.

Water	.873
Caseine	.048
Sugar	.044
Butter	.030
Phosphate of lime	.002.30
Other salts	.002.70
	1.000

Here, reduced to dryness, we find the proportion of nitrogenous food as one to one-and-a-half of non-nitrogenous. As the child progresses toward manhood, as growth is completed, and the process of construction of tissue is at last limited to the daily waste, the proportion of nitrogenous food diminishes until it approximates to some one of the several ratios given by Christison, Beneké, and Frerichs — which, we hope to show. The old man reverses the gradation and seeks for fats and starches. This ratio, however, can never be considered as a fixed quantity. It varies with the daily life of the individual, with his labor, his hours of ease, his sleep, his climate, and his clothing. As we change our skies we change our appetites. The dainty boy of careful nurture, who detested fats at home, is a devourer of raw bacon after a few weeks of exposure in a campaign; and the vegetarian of the cities becomes almost purely carnivorous when "roughing it" on the great plains of the West.

Army rations of several different nations.

It is necessary then to recognize nitrogen as the plastic, and carbon as the heat-producing element; to state the proximate and ultimate analysis of different foods in actual weights, and to rest their nutritive value on their approximation to, or departure from, a certain standard diet which is accessible, and which is derived from the experience of vast numbers of men, in all climates, and subjected to all vicissitudes, as well as from the deductions of chemical and physiological science. To this end we will take up the army rations of several different nations, and the dietaries of a number of prisons and alms-houses; stating in the first place of what they consist, and then reducing them to their ultimate elements. We shall thus avoid the inaccurate classification we have alluded to.

In the analysis of these rations they will be considered as net weights, excluding the water, and, ultimately, the *débris* naturally combined with them. Before such an analysis, sundry explanations are necessary, and subsequent to it should follow a discussion of the arguments for and against any particular article of food, without much reference to its chemical constituents.

NOTES ON THE DIFFERENT RATIONS.

United States army ration.

The United States army ration is, to a certain extent, rendered adaptable to all circumstances. Prior to the rebellion, salt meat only was included in the commissariat supply-table. Practically, however, the use of salt beef and pork was avoided in most instances, and fresh meat substituted through the operations of the "company fund." A fixed daily value was placed upon the ration. The value of any portion drawn, but saved by economy, was commuted in money and expended in any other food that might be cheaper, more available, or more healthful. These expenditures were usually made with good judgment and under favorable circumstances, so that a varied and healthful diet was often attained under the old army ration. During the summer of 1861, an act of Congress enlarged and improved the ration.

RATIONS OF DIFFERENT ARMIES REDUCED TO OUNCES AVOIRDUPOIS.

Articles.	U. S. A.	French.	Russian.	Turkish.	E. India Co.	British.
Fresh Beef, *or*	20 oz.	8.47 oz.	16 oz.	13.5 oz.	16 oz.	The former British Ration consisted of 1 lb. of Beef and 1 lb. of Bread, the remainder to be purchased by the men. The Crimean War resulted in a reform, for which see Sir A. M. Tulloch's Dietary, in this chapter.
Pork, Bacon, Hams, *or*	12 "	10.6 "	16 "		16 "	
Mutton, *or*				9 "		
Cavourma [preserved mutton]				4.5 "		
Soft Bread, *or*	22 "	26.44 "	16 "	33.80 "	16 "	
Army Biscuit, *or*	16 "	23 "		22.53 "		
Corn Meal	20 "					
Pease *or* Beans	2.40 "	2.11 "		.78 "		
Rice *or*	1.60 "	2.11 "		5.66 "	4 "	
Hominy	1.60 "					
Fresh Potatoes	4.80 "					
Desiccated Potatoes	1.50 "					
Fresh Vegetables				.73 "	8 "	
Desiccated Vegetables	1. "					
Barley			4 "			
Sour Cabbage			4 "			
Horse Radish			3.86 grs.			
Sugar	1.50 "	.74 "		.56 "	2.50 "	
Molasses	.08 gills					
Butter				.91 "		
Oil				.11 "		
Salt	.60 oz.	.56 "	1.80 "	.73 "	1 "	
Pepper	.04 "					
Vinegar	.32 gills					
Coffee	1.28 oz.	.56 "				
Tea	.24 "				.71 "	
Kwass [fermented drink]			1 $\frac{1}{10}$ qrts.			
Wine		.1$\frac{3}{4}$ gills				
Brandy		.$\frac{7}{16}$ "				

"*Section* 13. — And be it enacted further that the army ration shall be increased as follows: namely, — 22 oz. of bread or flour, or 1 lb. of hard bread; fresh beef shall be issued as often as the commanding officer of any regiment or detachment shall require it, in place of salt

meat, etc. . . . . When beans, pease, rice, hominy, or potatoes, cannot be issued, an equivalent in value shall be issued in some other proper food. Desiccated potatoes or desiccated vegetables, at the rate per one hundred rations, of one hundred and fifty ounces of the former, or one hundred ounces of the latter, may be substituted for pease, beans, rice, hominy, or fresh potatoes," etc.

With the increased value of the ration a return to the system of company servings would virtually render the ration discretionary, and, especially in garrisons, enable the men to provide a great variety of foods.

French ration.

The French ration presents the most meagre proportion of nitrogen of any. It is hardly sufficient to the maintenance of the athletic condition.

Russian ration.

The Russian ration is deficient in carbonaceous food, a noteworthy omission in view of the cold climate to which a large portion of that army is subjected. This is doubtless made up considerably by the "Kwass" — as all fermented drinks are rich in starches and sugars.

Turkish ration.

The Turkish ration is that of the "contingent" serving in the Crimean War. It is excessive in its quantities, but well distributed. It is extravagantly good.

East India ration.

The East India ration is neatly distributed. Fresh vegetables are a large element in it, which are necessarily excluded from our analysis. At the most permanent stations in India, garrison gardens are maintained.

British army ration.

The British army ration is derived from the dietary of Sir A. M. Tulloch. Prior to the Crimean War the ration was a part of the soldier's pay. This was fixed at 1*s.* 1*d.* *per diem*, less 4½*d.* charged him for one pound of bread and pound of beef daily from the commissariat. He was expected to purchase any other articles from his remaining pay. Under that system the officers lost control of the food of the men; an evil to which was added the greater evil of campaigns in which the soldier could find no place to expend his money. His reliance then was on the camp-followers who keep "canteens" and sutler to the men. Such a reliance is obviously insufficient, especially in long marches through thinly settled country. It was to reform this evil that Sir A. M. Tulloch proposed the ration under consideration; and as it is the only thoroughly studied ration ever devised for armies, the offspring of long practical experience and careful physiological research, we give it *in extenso:* —

From the Report of the Crimean Commission, App. XXX.

SCHEME OF DIETARY FOR SOLDIERS, PREPARED BY COL. SIR A. M. TULLOCH, K. C. B.

BREAKFAST.

Bread	8 oz.
Coffee	⅔ "
Sugar	1 "
Milk	1 gill

SUPPER.

Bread	8 oz.
Tea	¼ "
Sugar	1 "
Milk	1 gill

DINNERS.

No. 1.

Irish Stew	Mutton	12 oz.
	Potatoes	16 "
	Onions	½ "
Suet Pudding	Flour	3 "
	Suet	1 "
	Sugar	1 "

No. 2.

Salt Beef or Pork		12 oz.
Pea Soup	Peas	⅓ pint
	Onions	½ oz.
Calcannon	Potatoes	8 "
	Greens	8 "
Bread		5⅓ "

No. 3.

Mutton, baked		12 oz.
Potatoes		16 "
Yorkshire Pudding	Flour	5 "
	Suet	½ "

No. 4.

Beef, boiled		12 oz.
Soup	Vegetables	8 "
	Rice or Barley	2 "
Potatoes		16 "
Bread		5⅓ "

No. 5.

Beef, baked		12 oz.
Potatoes		16 "
Plum Pudding	Flour	2½ "
	Raisins	1 "
	Suet	1 "
	Sugar	1 "

No. 6.

Mutton, boiled		12 oz.
Soup	Vegetables	8 "
	Rice or Barley	2 "
Potatoes		16 "
Bread		5⅓ "

No. 7.

Beef, stewed	12 oz.
Vegetables	8 "
Potatoes	16 "
Bread	5⅓ "
Cheese	2 "

In his comments on this dietary, Prof. Christison of Edinburgh says: — Christison's comments.

"These several diets approach on the whole nearly in total real nutriment to the allowance for the British navy, which contains 28½ oz. of daily nutriment on an average, and which has been found very suitable. The diet of the first and seventh days alone are materially less. It would require an addition of four ounces of meat and four ounces of

bread to make them equal to the navy allowances." . . . . "The relative proportions of the carboniferous to the nitrogenous nutriment of the seven diets approaches nearly to that which scientific analysis has shown to be very exactly the proportion in the dietaries hitherto examined, which have been practically found satisfactory, namely, the ratio of three to one."

In the use of the terms "carboniferous" and "nitrogenous" nutriment, Dr. Christison means actual weights of carbonaceous and protein compounds, — the water and the indigestible cellular tissues which most forms of food contain, having been rejected as non-nutrients. He asserts that "the nutritive value of any dietary may be tested with care and certainty by reference to its chemical composition. In order, then, to test more thoroughly the nutritive values of the different rations enumerated, we have prepared the following table, in which a new subdivision has been added in the division of carbonaceous foods into starches and fats, and from which, finally, we have reduced the absolute weights of carbon and nitrogen. We have also given the weight of component salts, phosphates, lime, soda, etc., usually existent in foods: —

NUTRITIVE VALUE OF RATIONS. — [Water Free.]

Nationalities.	Carbo-Hydrates. (Starches.)	Hydro-Carbons. (Fats.)	Total Carbonaceous Food.	Nitrogenous Food.	Total Solid Nutriment.	Absolute Carbon in the Rations oz. avoirdupois.	Absolute Nitrogen in the Rations in grains avoir.	Component Salts in $\frac{1}{100}$ of an oz.
	oz.	oz.	oz.	oz.	oz.	oz.	grs.	oz. $\frac{1}{100}$
U. S. Army, Beef Ration .	16.839	4.205	21.024	5.440	26.484	13.707	367	1.155
" " " Pork " .	16.839	11.518	28.357	2.440	30.797	17.787	164	
British Army [Tulloch's] .	17.518	3.292	20.810	5.760	26.570	13.458	388	0.950
French Army	15.168	2.428	17.596	3.859	21.455	10.711	260	0.711
Turkish Contingent, Crimea	21.154	5.817	27.051	5.033	32.084	16.682	339	0.987
Russian Army	10.632	3.572	14.204	4.240	18.444	9.809	286	0.908
British in India	10.640	3.312	13.952	3.720	17.672	9.330	276	0.830

Notes.—As pork is substituted for beef in the U. S. army ration, two calculations were necessary. The pork ration furnishes less nitrogen than the quantity understood to be starvation point.

In the British ration, Tulloch's third (or Tuesday's) dietary was taken as a fair standard.

In the French, Turkish, and East India rations the fresh vegetables were not computed, for want of data.

In the Russian ration the nutritive value of $1\frac{1}{10}$ quarts of "Kwass," an unknown fermented drink, is omitted.

In all the rations, tea and coffee are omitted for want of sufficient data.

A glance at the preceding table will show that the United States army ration has *accidentally* approximated itself to a standard approaching that which has been experimentally found correct. Yet it should be remembered that the amount of nitrogen given in the table is on the supposition that twenty ounces of beef are issued daily. We have already shown that the caprice of a commanding officer, the ignorance of a surgeon, or the accidents of the service may, at any time, reduce the nitrogenous food to a point which will occasion starvation of the muscular system. It is indeed notorious that muscular attenuation frequently occurred among men who rarely suffered hunger, and who, perhaps, considered themselves well fed. And when this attenuation, or starvation, reached the most important of muscles, the heart, it produced a train of symptoms known as "functional disease of the heart," characterized by very rapid pulse, short breath, general debility; and recovery was always slow. Many thousands of soldiers were discharged the service for this disorder prior to the organization of the Veteran Reserve or Invalid Corps. It was not clearly understood to be a disease of assimilation, to be cured only by food, although the inefficacy of medicines was plain to all.

Effects of a deficiency of nitrogenous food in the United States Army.

It is a matter of the utmost importance to decide upon the relative proportions and the actual quantities of each of the component parts of food, which are necessary to support the athletic constitution. Christison argues that nitrogenous substances should be to non-nitrogenous as one to three; Beneké, as one to five; Frerichs, as one to seven; while Prof. John Stanton Gould found the dietaries of eight hard-labor prisons in the Northern States to average daily 2.846 ounces of nitrogenous food, and that *the men improved in flesh under that quantity;* while in seven alms-houses the amount of nitrogenous food daily was only 1.77 oz. The "Sixth Report of the Medical Officer of the Privy Council" [London, 1863], in forwarding Dr. Edward Smith's Report on the food of the lowest-fed classes of England, offers a scientific estimate, "necessarily imperfect" but "approximate and provisional," of what "quantity of food might on an average just suffice to avert starvation diseases." He says: —

Dietaries of prisons and alms-houses. Effects of deficient alimentation.

"Its purport was, that in order to avert starvation diseases, an average woman's daily food ought to contain at least 3.900 grains of carbon with 180 grains of nitrogen; and an average man's daily food at least 4.300 grains of carbon with 200 grains of nitrogen; *i. e.*, for the woman about

the same quantity of the nutritive elements as is contained in two pounds of good wheaten bread, and for the man about a ninth part more. Taking the mean of the two allowances, male and female, the estimated weekly need of an average adult would be for at least 28,600 grains of carbon and 1330 grains of nitrogen. It will be observed that in only one of the examined classes of in-door operatives did the average nitrogen supply just exceed, while in another it nearly reached, the estimated standard of bare sufficiency, and that in two classes there was defect — in one a very large defect — of both nitrogen and carbon. Moreover, as regards the examined families of the agricultural population, it appeared that more than a fifth were with less than the estimated sufficiency of carbonaceous food; that more than one third were with less than the estimated sufficiency of nitrogenous food; and that in three counties insufficiency of nitrogenous food was the average local diet."

The consequence of this semi-starvation of British laborers is stated in the report to be a reduction to brutishness, to extreme selfishness, and loss of the natural affections; the latter disgracefully exhibited in the intentional starvation of infants by parents who could not support them. Among soldiers, short rations produce analogous effects in loss of the feeling of comradeship, in refusal to submit to discipline, and in a tendency to marauding among the people of the country.

Error of substituting carbonaceous for nitrogenous food.

It will be seen that if the experience of British statisticians has led them to the conclusion that 200 grains daily of nitrogen is barely sufficient to avert starvation diseases, then the 367 grains of our army ration in its best form cannot be too much to maintain the athletic constitution, and that the constant substitutions of carbonaceous food for nitrogenous, which are authorized by the law, and which are practically carried out in nearly all American commissariats, are serious errors, impairing the health of the soldier and constituting the cause of the painfully frequent diseases of assimilation which have so greatly weakened the efficiency of our armies. Perhaps nowhere have practical experiments been made on so large and reliable a scale as in the armies of the United States, and in the prisons and organized camps attached to them. In the absence of exact knowledge of the amount of nitrogen required, we can wisely resort to our experience in the effects of known dietaries. If under a certain diet the men increased in flesh and strength, the quantity of nitrogen was sufficient. If they lost, then *vice versa*. To some of the more extended of these great experiments we shall now refer.

Experience at Convalescent Camp, Va.

1. At Convalescent Camp, Va., the men received were nearly all from hospitals *en route* to their commands. Those not yet fit for duty were retained to undergo a further reparative or seasoning process. From August 17, 1862, to February 26, 1865, 224,381 men passed through the camp. It was not until about February 1, 1863, that the camp was in proper condition to judge of its results. From that time up to its disbanding, about 150,000 soldiers had a longer or shorter residence at this place, the average population being perhaps about 4000. These men were subjected to the following conditions: They were all in imperfect health. They were housed in well-warmed and ventilated barracks; had free range of extensive and pleasant grounds; were detailed for light fatigue duty a part of the time, giving them exercise enough for appetite; and were disciplined to a scrupulous cleanliness. Under these favorable circumstances it was found that the men did not consume the ration, and that large camp-savings resulted. The food was all cooked under one supervision, the men eating it in the four great dining-rooms provided. Each man ate as much or as little as his appetite required, some doubtless eating more than the full ration. Yet in the month of June it was found that nearly two fifths of the ration had been saved, the saving being mostly in fats and starches. Somewhat less than the full ration of nitrogen was consumed, though, taking into account the excellence of the cookery, it may be assumed that the quantity of *digestible* nitrogen was equal to the full ration. Subsequently the system of savings was abandoned, or rather the savings were converted into extra allowances of vegetables; but the experiment was tried long enough to show that under these very favorable circumstances, the quantity of carbon was largely in excess of the wants of the soldier, and that less than four fifths of the entire ration was sufficient to repair previous losses by disease and recreate the athletic constitution. It should be noted that during the twenty-six months existence of the New Convalescent Camp no epidemic of any sort occurred in its limits. It was the boast of its officers that no zymotic disease ever originated there. It could not have been a deficient diet that produced these results, and an experiment so large and long continued is of equal weight with any chemical analysis of excreta. And from such an experience we may approximate to the necessary standard for active field service.

2. In the Military Prisons of the United States the ration for Confederate prisoners of war was established, in general terms,

at two thirds of the army ration. In the animal food, fat pork and bacon were largely substituted for fresh beef, so that we state a fair average when we assume that these prisoners received 200 grains of nitrogen *per diem*. Under this order several hundred thousands were fed for periods of prison residence of from a few weeks to many months in the great prison camps at St. Louis, Rock Island, Chicago, Johnson's Island, Camp Chase, Elmira, Annapolis, Point Lookout, and elsewhere. In all these places the prisoners had shelter and warmth and no duty except their own policing. They had a fat, oily, but not athletic look; yet their condition was such that the Confederate Commissioner of Exchange, Robert Ould, spoke of them as "splendid material" which he was receiving in barter for the starved victims of Andersonville. In our opinion they were only fat and not athletic, but they were in a position to be made speedily efficient by more nitrogen and moderate exercise.

Diet in the United States military prisons.

3. The Confederate army ration was subject to so many vicissitudes and was so irregular that no just estimate of the quantity of nitrogen it contained can be formed, beyond the broad fact that it was insufficient. Its effects, finally, on the constitution of the men are thus spoken of by Dr. Joseph Jones, a Confederate surgeon of fine acquirements, after allowing liberally for all the food in excess of the ration which the soldier may have procured by a careless system of foraging, or by donations from home. In speaking of diseases allied with faulty assimilation and surgical accidents that we all attribute to impoverished blood, Dr. Jones says: —

Confederate army ration. Account by Dr. Joseph Jones.

"The great fact, however, was observed at the General Hospital at Charlottesville, Va., and in numerous other hospitals throughout the Southern Confederacy, while well-marked symptoms of scurvy were not often observed among the wounded, and while the men from the battle-field presented a strong and healthy appearance; at the same time secondary hemorrhage and hospital gangrene progressively increased during the progress of the war, and the former complication of gunshot wounds became fearfully prevalent. The great increase of secondary hemorrhage appeared to be referable to the prolonged use of salt meats and the consequent scorbutic condition of the blood, although the active symptoms of scurvy were not manifested. The increase of hospital gangrene may, in a measure at least, have been connected with physical and chemical changes of the blood and organs dependent on imperfect nutrition."

"Whilst at Danville, Va., in 1862, Dr. Cabell treated a large number

of cases of chronic diarrhœa and dysentery, and a number terminated fatally. With men sent to private quarters, and abandoned simply to the kind attention of friends, with little or no treatment beyond domestic remedies and good nutritious diet, the results were most happy, and many recovered, who, it is thought, would have died if left in hospital. Dr. Cabell expressed the belief that almost every case, which had not extensive ulcerations of the mucous membrane, would be cured by a change of diet."

Experience of 16th Army Corps.

4. The 16th Army Corps, having been employed as a flying column, was subjected in 1864–65 to great hardships. The Red River campaign in the spring was followed by the Tupelo raid. Later in the season the corps crossed the Mississippi and made a campaign of great severity in Arkansas and Missouri, in pursuit of Gen. Price's invasion, returning *via* St. Louis and Cairo to Nashville, Tenn., in time to participate in the decisive battle under Major-General Thomas. Thence it was ordered to Eastport, Miss.; next to New Orleans, and thence *via* Fish River to the siege of Mobile. That completed, the corps marched to Montgomery, Ala., and its First Division was finally encamped at Selma, Ala., about May 1st, 1865. Long and exhausting campaigns, sieges, and battles, mostly on the hard bread and bacon ration, had reduced the vitality of its gallant veterans. Scurvy and chronic diarrhœa became alarmingly prevalent. The Surgeon-in-Chief of the division directed all cases of "assimilative disease" to be sent early to the division hospital. There, under the superintendence of Surgeon Murta, 8th Wisconsin Volunteers, a large ward had been prepared for the dietetic treatment of diseases of assimilation. In cleanliness and ventilation it was nearly perfect. The diet gave great prominence to albuminoids and fresh vegetables — very little to drugs, which were almost discarded. Eggs, custards, chickens, beef, mutton, onions, lettuce, greens, potatoes, fruits, and wines of the hock variety, were freely employed. Fats also were allowed, but the starches were almost excluded. The results obtained were most gratifying, excelling in success any that the writer has witnessed elsewhere. It was a triumph of nitrogenous diet.

Experience of the army of the Frontier at Fort Smith, Ark.

5. The army of the Frontier, head-quarters at Fort Smith, Ark., during the year 1864, averaged only about one half rations issued from the commissariat. This one half was eked out by foraging and the peculiarly enterprising habits of the men, so that there was little disease upon the surface. Yet in cases of wounds and surgical operations, the scor-

butic taint was always manifest, and a most unfavorable percentage of results followed.

Confederate prison at Andersonville.

6. The Confederate prison at Andersonville, Ga., exhibits its records elsewhere in this volume. It is only necessary to call attention to the phenomena of inanition as they are there portrayed. They prove what for the credit of human nature should not have been proven in the 19th century — that starvation and an insufficient diet are synonymous terms, and that a lingering death is the common end of each.

Conclusions respecting nitrogenous diet.

So far, then, as we are able to reach definite results from these statements, and from the experience of other armies than our own, we may conclude that the amount of nitrogen estimated by Prof. Christison is not excessive. It is assumed that 200 grains of nitrogen *per diem* is sufficient to avert starvation, and the history of Federal prisons confirms the assumption. And we consider it proven that from 350 to 400 grains is enough to support a high standard of athletism. It should be recollected that armies are not always "marching along;" that the occasions of great fatigue are just those when there is least transportation for food and least time to cook properly. Such periods of extravagant waste of tissue are fortunately brief, as a general thing. The verdict of observers is that in the attempt to alleviate their hardships all efforts should be directed to increasing the supply of nitrogen. The marching ration should be beef rather than pork, and in this country it is hardly ever impossible to procure cattle, either by driving them along on the hoof with the column or by foraging. No non-combatant theory should ever prevent a commanding officer from feeding his troops by foraging when necessary; of course under judicious restrictions. And when he is able to issue the ration allowance of beef, or to substitute for it lean pork or mutton, he is not likely to find diseases of assimilation arising among his soldiers. In 1864, the 54th U. S. C. I. spent about three weeks upon the prairies in the Cherokee Nation, north of Fort Gibson. They were exposed to several snow-storms, destitute of tents or other shelter, and were almost without rations, except beef, which was abundant in the herds of wild cattle in those regions. Yet the command returned in perfect health, so bountiful had been their supply of nitrogen. During the previous summer the 11th U. S. C. I. had been camped several weeks on the prairie, subsisting entirely on hard bread, bacon, and small stores. Scurvy became very prevalent, but was speedily gotten rid of by changing the meat ration to beef, and ordering the neu-

tral salts of potash to be given to the men. The effect was marked and unmistakable.

While it seems plain that the full [beef] ration contains enough of nitrogen, it is to be regretted that our soldiers rarely obtained that quantity, owing to the unscientific manner in which fats and starches were substituted for albuminoids, as if they were equivalents in nutritive value; forgetting that a ton of butter will not replace an ounce of muscle, and that in plastic nutrition one hundred and thirty pounds of rice are as good only as seventeen pounds of beef. Says Lehmann: —

"When, however, we seek to ascertain the most favorable mixture of the nutritive elements, we must not think that this will remain one and the same for all conditions; the proportions of the nutritive elements must, on the contrary, change according to the state in which the organism to be nourished is; its necessities will as little always demand the same proportions of this mixture, as the necessity for food remains constant in regard to the absolute quantity."

CARBONACEOUS FOODS.

Quantity in different rations.

The quantity of carbonaceous food varies from twenty-seven ounces in the Turkish ration to twenty-one ounces in the United States ration, and so on a gradually decreasing scale to the nine ounces, stated by British authorities to be barely sufficient to avert starvation diseases. The proportions are noticeably the same as those stated in the discussion of nitrogenous food, and it is interesting to find that experiences so widely separated reach at last results so nearly identical. The quantity of absolute carbon in the American and British rations is about thirteen and a half ounces in each. This quantity is found in the entire ration, as even the muscular meats, which we speak of as "nitrogenous," contain 53 per cent. of carbon.

Normal proportion of fat and starch or its products.

It is desirable that we should, if possible, arrive at some idea of the normal proportions of the two components of carbonaceous food; *i. e.*, how much should be fat and how much starch or its products. Sugar and starch are convertible terms, the latter undergoing a transformation into the former in the process of digestion. In those manufactories where starch is converted into sugar as a commercial enterprise, a bushel of Indian-corn is considered equal to twenty-five pounds of starch, and one pound of starch will make one pound of sugar. And the same is true in the digestive laboratory. But one pound of sugar will not make one pound of fat, and hence arises a differ-

ence in the relative value of fats and starches as foods. In their final conversion into carbonic acid gas, fat consumes nearly two and a half times as much oxygen as starch does, and is, therefore, in just that ratio, more valuable as a fuel.

Metamorphoses of sugar.

We do not consider it settled that sugar is burned as sugar in the system to maintain the animal heat; nor that, on the other hand, it is always converted into fat before undergoing combustion. In fact, it is not yet positively known that the animal heat is maintained by a process identical with combustion. For the purposes of this chapter it is only necessary to know that carbonaceous food is, in some manner, destroyed in the system in the maintenance of animal heat; that the portion assimilated and not immediately destroyed is transformed into fat, thus furnishing a storehouse of fuel, which, whenever the outside supply of carbon fails, is in its turn destroyed for its original purpose as the source of heat.

Proper relative proportion of fat and starches.

Hence it would seem, at first glance, that it would be well to centre all our carbonaceous foods in fat, and thus spare the digestive system the labor and fatigue of transforming the lower to the higher form of carbon. Unluckily for this notion, the function of digestion has been organized by nature with all the machinery necessary for these several duties. This machinery must work or become lazy and rusty, and when it becomes so, it is a positive evil, engendering disease. And, further, the machinery assigned to the work of absorbing fat — digesting it — is not large, nor active enough to supply the system with all the carbon it needs. Hence, both a division of labor, and several forms of material designed for the same result, become necessary; and out of that grows the demand for a varied diet, in which all three elements of this trinity — starch, sugar, and fat — shall be present. The data are insufficient by which to estimate the proper proportion between fats and starches in our food (sugars being considered as perfected starches); but if we take the relative size of the intestinal absorbents that take up fat, and those that take up starch, as a criterion, we might assume that the proportion should be as one of fat to five or six of starch. And as a matter of fact, our table shows this to be about the proportion in the adult. In the infant it is higher, being as 30 parts of butter to 44 of sugar.

Quantity of carbon required, as shown by dietaries.

The absolute quantity of carbon required for the athletic constitution is only to be ascertained, like that of nitrogen, by reasoning from dietaries, the success or unsuccess of which has been proven. Prof. Liebig states the average

daily consumption of carbon by the body-guard of the Grand Duke of Hesse-Darmstadt at 13.9 ounces, which would require for its conversion into carbonic acid gas 37 ounces of oxygen. Draper states the average ingestion of oxygen at about 35 ounces daily. The "Report of the Medical Officer of the Privy Council" (London, 1863), estimates 9 ounces of carbon per diem as the quantity just sufficient to avert starvation diseases. Nearly all army rations largely exceed these quantities, though it may be that they do so in the ignorant attempt to compensate for the deficiency of nitrogen. It is certain, however, that the soldier needs more carbon than the civilian. We have seen how little carbon is required for the chick, whose animal heat is maintained by the incubation of the mother-hen; and the human animal repeats the same conditions when he lives in-doors and in heated rooms, and surrounds himself at night with non-conducting bedding. So the soldier, sleeping on the ground and rapidly radiating the heat of his system, in all ways exposed to constant loss of caloric, calls for more carbon, and soon acquires a fondness for fats and fat-producing foods. Again, even this demand may be increased by active exercise, and every extra exertion must be repaired by extra quantity of food.

Amount of carbon in United States army ration.

Waste of starches.

The 21 ounces of carbonaceous food in the U. S. army ration contain 13.707 ounces of absolute carbon. Physiologists have fixed upon 35 ounces of oxygen as the amount daily ingested, a part of which is consumed in excreting the nitrogenous products. Hence it seems fair to assume that the quantity of starches and fats is ample, though the latter might be judiciously increased in periods of cold and exposure. The waste of starches, so notorious in our army, does not arise from an excess of carbon in the ration as we have calculated it, on the basis of the beef issue; but from the fact that instead of the beef, pork or bacon were issued much or most of the time, swelling the quantity of carbon for the day to 21 ounces (absolute carbon), which would require a respiratory capacity to take in 56 ounces of oxygen in twenty-four hours. The absurdity is manifest; 40 ounces of oxygen must be nearly the limit of Esquimaux capacity. It is assuredly the final limit in our temperate climate.

Having thus shown the source of the notorious and extravagant waste which attended the full (pork or bacon) ration in all commands during the late war, we shall endeavor to specify, in considering special foods, the changes that can profitably be made with benefit to the soldier and economy to the government.

FRESH VEGETABLES AND SALTS.

Provision for vegetables in United States army ration.

The only fresh vegetables provided in the army ration are potatoes at the rate of three pounds per week per man. The Act of 1861, however, provides that "when beans, pease, rice, hominy, or potatoes cannot be issued, an equivalent in value shall be issued in some other proper food." From this source only can fresh vegetables be procured, except when the organization is sufficiently thorough to provide a company fund. Rations not consumed by a company are designated as "company savings," and the commissary may re-purchase them from the company, paying over to the company council of administration their cost value. These savings constitute, with distributions from post-funds, a company fund "to be disbursed by the captain for the benefit of the enlisted men of the company, pursuant to the resolves of the company council, consisting of all the officers present." Company funds, however, may be applied to other than food purposes, as, for instance, libraries.

It will be seen at once that in the case of great armies it is simply impossible for the commissary to issue an equivalent in value of other proper food for pease, beans, rice, etc., not on hand for issue. The demand so far exceeds the local supply as to act as a prohibition. Nor are company funds easily available in a campaign. The result is that fresh vegetables are very rarely issued to the men, an evil that might, to a valuable extent, be avoided by making the equivalent in lieu of starches optional. If instead of saying "when pease, beans, etc., *cannot* be issued," the law were to say, that when "they *may* not be issued, an equivalent in value shall be issued in some other proper food," the power would then rest in the hands of the medical officers to adapt the diet to the circumstances, and secure at frequent intervals a change from starches to fresh vegetables. At present, the order of a general commanding an army is the lowest authority for the purchase of fresh vegetables.

Importance of fresh vegetables.

The importance of this form of food is universally conceded, if not scientifically understood. We recognize in our natural craving for the succulent vegetables a proof of their necessity, and when deprived of them, we find that the blood undergoes changes producing diseases of assimilation. Yet it is plain that the great value of fresh vegetables does not lie in their carbon or nitrogen. They contain nearly 90 per cent. of water, and are therefore bulky and expensive in transportation, and altogether

unavailable as foods in the sense which we have employed in the previous treatment of this subject. What then is their value?

Sense of the term starvation.

Starvation is a comparative phrase. We can starve muscle by withholding nitrogen. We can starve the fats of the body and destroy the animal heat by withholding carbon. So, too, we can starve the brain by withholding phosphorus, and starve the blood by failing to supply it with those salts of lime, potash, soda, iron, and magnesia, which are essential to its healthy condition. Just how these salts exert their power is not known; but we do know that when they are withheld the blood globule becomes pale and irregular in form, and starvation diseases are developed. Without these, nitrogen no longer builds up the muscle, and carbon fails to maintain the animal heat.

Salts of the blood derived from vegetables.

These salts of the blood constitute about one per cent. of its weight. One of them, chloride of sodium, or common salt, is provided in the ration at the rate of six tenths of an ounce daily to each soldier. This provides the muriatic acid necessary for the gastric juice, but no formal provision is made for the other and almost equally important salts of lime, potash, iron, etc. The source of these salts is twofold. They are found, first, in the water we drink, which is almost always impregnated with mineral substances; and, second, in what may be considered as their natural source, the fruits and succulent vegetables. To these sources there is another to be added in the case of common salt, which is craved in excess of the natural supply by both the human animal and the brute. But the only reliable source of our phosphorus and potash is in the vegetable foods.

Desiccated vegetables.

It is possible that the dietetic value of fresh vegetables rests largely upon this fact — as if the luscious fruits were Nature's sugar-plum to tempt the grown-up boy of humanity to take his daily dose of salts. Evidently were these salts isolated, instead of being pleasantly combined with the malic, citric, and tartaric acids, they would be too unpalatable. However this may be, the loss of health incident upon a deprivation of some elements — which we suggest to be salts — in fresh vegetables, has led to the effort to supply them in a desiccated form. Paragraph 1191, Revised Regulations, 1863, orders that — "Desiccated compressed potatoes, or desiccated compressed mixed vegetables, at the rate of one ounce and a half of the former, and one ounce of the latter, to the ration, may be *substituted* for beans, pease, rice, hominy, or fresh potatoes." This regulation exhibits again the unscientific features which have crept into our traditional ration. The one

ounce of desiccated vegetables can in no manner be made a *substitute* for the $8\frac{8}{10}$ ounces of starches named, nor would the starches supplement the salts in the vegetables.

The use of desiccated vegetables has been to some extent a failure. To prevent their decomposition it was necessary to make their desiccation very thorough; so thorough that only very careful and intelligent cookery could make them soft and palatable. And as an antiseptic they contained an undue amount of pepper, which is unsuited to the simple tastes of the soldier. Their absolute value, however, as a substitute for fresh vegetables, cannot be disputed, and we by no means despair of seeing the experiment entirely successful. Recent achievements in the preserving of fruits, patés, oysters, etc., seem to assure us that this special difficulty may be overcome at an early day.

NOTES ON SPECIAL COMPONENTS OF THE RATION.

Beef, Fresh or Salt. — In the ration existing previous to 1861, only *salt* beef was mentioned, of which 16 ounces was the daily allowance, except when pork was issued in lieu. It was optional, however, with the commanding officer to substitute fresh beef two or three times a week, and when it could be purchased for less than six and a quarter cents a pound it might be issued five times a week. In the substitution one and a quarter pounds of fresh beef was considered equivalent to one pound of salt meat. This was one of the errors of tradition. Christison says: —

Christison on salt meat.

"If soldiers could be supplied with what people in civil life know as salt meat, there would be less difficulty; but military authorities ought to discharge their minds of this very natural comparison. The salt meat for soldiers in the field has always been highly salted, in order to keep for two years or more in every climate. Now, my persuasion is that, apart from the tendency of the protracted use of such food to favor the development of disease, its nutritive value has been very much overrated. This may appear evident from the fact stated in the Report, that of a body of men, fed even on rations by no means liberal, few continued to eat a pound of salt meat daily for any length of time. And the science of the question has been sufficiently looked into for an explanation; because meat highly salted must be so thoroughly steeped in cold water to remove the salt, before it is eatable in large quantity, that much of its most nutritive constituents must be washed out of it, namely, its albumen and sapid extracts called osmazome."

Yet in the U. S. army ration a pound of salt beef with its albumen and osmazome (we may add also its phosphates and potash) washed out, is considered an equivalent to a pound and a quarter of fresh beef with all its juices present! Allowance of about one sixth should be made for the fact that salt beef has no bone, but in the present state of the art of preserving meats that of high-salting is somewhat obsolete. "Salt horse" is something very different from the corned beef of civil life, and fortunately it has never been largely used in the army.

"Salt horse."

Pork or Bacon. — In the U. S. army ration, pork and bacon are almost exclusively fat, and are to be ranked only as carbonaceous food. They cannot, philosophically, be substituted for beef. In the absence of butter, lard, and suet, the pork comes in as a most agreeable adjuvant to cooking, and its rich supply of carbon has vindicated its value in all armies. A third or half ration of pork, *added to and not substituted for* the beef ration, would at once facilitate the cookery of both, and would supply nearly all the carbon and nitrogen needed. The extra cost of this issue might readily be compensated by lessening the unwieldy allowance of starches.

Pork and bacon not substitutes for beef.

Bread, Hard and Soft. — When hard bread only is issued, as in the marching ration, sixteen ounces is the daily allowance. It is practically a pound of flour, and is about equivalent to twenty-two ounces of soft bread. When flour is issued the ration is twenty-two ounces, or quite enough to make thirty ounces of soft bread. It is an issue in excess. A company of 100 men draw 10 days rations of flour, namely, 1375 pounds. This flour should make, on the average, 1833 pounds of soft bread; and as only 22 ounces of bread are issued, the result is a saving of 458 pounds of flour, which may be re-sold to the commissary and converted into any other food. Many commands maintained this saving at all times except when actually on the march. The sole object of the flour ration is to enable such a fund to be created.

Flour ration.

The objection has been made to hard bread that it is with difficulty comminuted by the teeth, and that it is liable to undergo the process of fermentation in the intestines, producing yeast and a free development of carbonic acid gas. The flatulence thus created, at the cost of the destruction of the nutritive value of the bread, is alleged as one of the most prolific causes of chronic diarrhœa. There is an element of truth in this notion. We conceive the real fact to be, that a system enfeebled by exposure and deprivation of nitrogenous and fresh vegetable food soon

Objection to hard bread.

becomes incapable of properly digesting starches; that under these conditions fermentation and distillation of the starch is substituted for its normal change into dextrine, and finally diarrhœa is thus produced. Experience has shown the propriety of withholding starches in chronic diarrhœa. But a healthy system, otherwise well nourished, will have no difficulty in digesting starches, whether in the form of hard or soft bread.

Pease and Beans. — Of the two, the latter is the most nutritious, containing nearly one per cent. more of nitrogen. The starch of both pease and beans is digested with difficulty unless very well cooked. It is liable to fermentation and consequent flatulence, a fault which forbids their use when the tendency to diarrhœa is strong. For active, healthy men, both pease and beans are a very nutritious and available food.

Pease and beans injurious if there be tendency to diarrhœa.

Beverages, Coffee and Tea. — Coffee is the great consoler of the soldier. As a cerebral stimulant it promotes cheerfulness and play of the mind. Medicinally, it checks the effects of malaria, and in commands in permanent camp was often served at reveille as a preliminary to the morning drill before breakfast-call. Physiologically, it possesses the power of "staying the stomach," *i. e.*, of so checking the waste of the system as to enable it temporarily to endure privation of food. In quantity it is ample, but all commands will use all they obtain. *Tea* is to a certain extent the same in its essence and effects, but is less decided in flavor and in results. It is, consequently, rarely used except in hospitals, where its astringent qualities add to its other merits.

Coffee as a cerebral stimulant preferable to tea.

Whisky is not a regular issue, but is given under circumstances of great fatigue and exposure. The concurrent voice of army surgeons would limit it to that use only. It is not needed on ordinary occasions, nor as a preliminary to great exertion. When, *after* great fatigue, the period of rest arrives, it is a grateful solace to the system, promoting sleep and maintaining warmth. It undoubtedly possesses the qualities of an actual food [carbonaceous] and of checking the natural waste of the system.

Whisky useful after great fatigue.

SUMMARY.

It will be seen from the preceding pages that the U. S. army ration is badly distributed. Its errors may be briefly summed as follows: —

Errors of the United States army ration.

1. In making fat pork or bacon a substitute for fresh beef, and thereby reducing the nitrogen of the ration below starvation point.

2. In making salt beef a substitute for fresh beef. It is not an equivalent.

3. In making compressed vegetables a substitute for eight times their weight of starches.

4. In an excessive quantity of carbonaceous foods and a deficiency of the saline elements.

5. While the variety of carbonaceous foods may not be too great they are unduly cumulated. A system of rotation should be substituted.

To remedy these evils it would be necessary to make pork and bacon a supplementary instead of a substitute ration. The beef ration, varied when possible by mutton or fresh pork, being issued every day or nearly every day, the pork ration could be reduced one half or two thirds, to four or six ounces per diem. If we are correct in assuming that 13.707 ounces of absolute carbon is an average and 16 ounces an extreme limit of the wants of the soldier, then the carbonaceous components of the ration may safely be improved by a reduction in the starches and the substitution for them of a small amount of fats; or, better still, by a system of rotation in which while the daily amount of carbon will be the same the foods will be varied and therefore more appetizing. A ration made up of twenty ounces beef, four ounces pork, sixteen ounces flour, one half pound potatoes, and two and a half ounces of beans, with eight ounces of fresh vegetables, would contain 15.169 ounces of actual carbon, about 390 grains of nitrogen, and 11.55 ounces of component salts, exclusive of common salt and coffee. It would thus supply *all* the wants of the system, instead of irregularly supplying sometimes one and sometimes another element, with no regard to which was most needed.

How the evils are to be remedied.

Section 13 of the Act of Congress approved August 3, 1861, directs that "After the present insurrection shall cease, the ration shall be as provided by law and regulations on the first day of July, 1861"; that is, the old ration is reëstablished. As we think we have shown that the old, as well as the present, ration is essentially unphilosophical, and that it is only endurable through the modifying influences of post and company funds, it seems that it would be better to take the present time for a careful revision of the commissariat. The formula we have proposed, with its accompanying small stores, is a much richer ration than that of the old army; but we believe not more expensive, when we consider the cost of transportation and the losses of salt meats and starches from the effects of climate. And in order to secure greater

variety, we would propose that the commissary should have power, under the orders of his immediate commanding officer, to substitute an occasional allowance of fruits and fresh vegetables, equal in money value to some other portion of the ration to be withheld. This would give adaptability and enable us to conform to circumstances under restrictions sufficient to prevent increased cost.

The economical argument should not be omitted. It was estimated in 1862 that it cost at that time about $1000 to put a soldier in the field. A piece of property of such value, especially when that value is to be annihilated in three years or sooner, is worthy of good care in a money point of view. The modifications we have proposed do not, we believe, increase the expense of maintaining the soldier. We propose to let the most essential part of our ration transport itself, inasmuch as beef on the hoof can almost always keep up with an ordinary march. It cannot in case of raids; but all raids are designed to subsist, as far as possible, on the invaded country, and in the United States beef can always be captured, if not purchased. We propose also to reduce the amount of carbonaceous food transported.

Suppose a column of 20,000 men starting on a twenty days' march with the full army-ration of salt meat, flour, beans, sugar, rice, coffee, vinegar, candles, soap, salt, pepper, potatoes, and molasses. It would weigh 1,204,000 pounds, and require 602 wagons, carrying a ton each, to "roll it out" the first day.

Suppose the same column to be moving on what we consider a more nutritious and every way better marching-ration, as follows: Beef on the hoof, one third rations of pork, full rations of all the other articles named in the paragraph above, with the addition of 37,500 pounds of desiccated vegetables. It would weigh only 836,500 pounds, and require only 418 wagons, thus reducing the wagon train one third. If the usual order to take three days' rations in the haversack were issued, the odds would be still larger in favor of the latter ration.

Professor Horsford's efforts to diminish the weight and bulk of the army ration.

This paper would be more incomplete than it confessedly is did it omit to make mention of the able and well-directed, though not quite successful effort of Prof. E. N. Horsford, late Rumford Professor in Harvard University, to diminish the weight and bulk of the army ration, and secure economy in its administration. Prof. Horsford exhibits very clearly the loss of the nitrogenous element and phosphates in the ordinary superfine wheat flour issued to troops. Immediately within the

bran or surface of the grain of wheat lies a shell of gluten, "the reservoir of vegetable fibrine and albumen, and of the phosphates." Much of this is bolted away with the bran, the middlings, and the shorts, in the effort to make a white flour, and it is not unfair to estimate that the plastic value of the grain is thus reduced one half.

To meet this evil, Prof. Horsford proposes two plans: First — To throw the supply of gluten entirely, or nearly so, on the meat ration, and to furnish phosphates artificially by the use of "self-raising flour" — an invention of Prof. Horsford's, in which bicarbonate of soda and pulverulent acid phosphate of lime are intimately intermingled with the flour. Such a flour requires only to be mixed with water to insure the combination of the phosphoric acid with the alkaline soda, releasing the carbonic acid of the latter, and thus giving the necessary "lightness," while the resulting salts, phosphates of lime and soda, are left in the bread to replace the loss created by the process of bolting. Second — Prof. Horsford proposes to secure the gluten and phosphatic salts by the simple process of roasting the wheat before grinding it, and putting it up unbolted. For a marching ration, this has the merits of a condensed nutritive value, the expulsion of the water from the starch, and its easy preservation. Of its appetizing qualities it can only be said that it is not disagreeable. We have witnessed its use in the West in the form of parched corn, but it was usually held as a resource against probable starvation, and was never eaten when any other form of bread could be procured. In armies temporarily compelled to subsist upon it, it was usually accepted without undue complaint.

Two plans proposed.

In the supply of nitrogenous food, Prof. Horsford accepts beef as the standard, and shows conclusively that if meat can be properly desiccated and canned in its native pastures in Illinois, and still remain a palatable, nutritious food, it would save a vast proportion of the cost of transportation, the shrinkage *en route*, and the diseased condition of the meat produced by hunger, thirst, and overcrowding. It would, moreover, be valuable like all other condensations in the decreased amount of transportation on the march.

As to the latter element, we have already expressed our belief that an infantry column can usually take its beef along on the hoof, or can purchase if among friends, or forage if among enemies, to an extent sufficient to keep up the supply. Even in cavalry raids, — which Prof. Horsford instances as incapable of doing this, — we have found, as a practical experience, that it can usually be done.

It cannot be denied, however, that whenever beef can be furnished the army as Prof. Horsford proposes, a vast economy will result. Prof. Horsford estimates it at over $10,000,000 per annum in an army of 100,000 men. As a practical fact, we have as yet little experience. Prof. Horsford's sausaged meat met with a strong prejudice from the soldiers, and has not been adopted except experimentally. But there can be little doubt that such a process is destined to perfection, and that it is within the resources of science to furnish a ration of preserved meats which shall be sweet, nutritious, healthful, and far more economical than our present methods of supply. It is to be hoped that the distinguished scientist who has done so much already will continue his efforts and bring the concentrated marching ration to perfection.

CHAPTER FOURTH.

TESTIMONY OF MEDICAL OFFICERS RESPECTING THE RELATIONS OF PHYSICAL ENDURANCE AND THE POWER OF RESISTING DISEASE TO AGE, PERIOD OF SERVICE, SEASON, CLIMATE, AND LOCALITY; RESIDENCE IN CITY OR COUNTRY PRIOR TO ENLISTMENT; AND THE INFLUENCE OF PREVIOUS HABITS OF LIFE. — REMARKS ON THE PHYSICAL CHARACTERISTICS OF DIFFERENT CLASSES OF RECRUITS AND THE INFLUENCE OF PREVIOUS HABITS, BY DR. S. B. HUNT. — REMARKS BY DR. HUNT ON THE EFFECTS OF ALTITUDE. — OPINIONS AND FACTS PERTAINING TO ALIMENTATION, THE USE OF TEA AND COFFEE, AND THE WHISKY RATION.

In order to obtain, as far as practicable, information concerning topics embraced in this section, the Medical Committee of the United States Sanitary Commission addressed to a large number of medical officers, who served in different sections of the country during the rebellion, a Circular including questions relating to various influences affecting the physical endurance of troops and the power of resisting disease. A number of medical officers have responded to these questions, and it is the purpose of this chapter to give a digest of the information thus obtained.

AGE.

To the question concerning the period of life, during which were manifested the highest amount of physical endurance and the greatest power of resisting disease, explicit replies have been received from a large number of medical officers. The testimony of the great majority fixes the minimum at or above twenty years of age. Of the correspondents of the Commission, a few fix the minimum at an earlier age, but no one under eighteen years. Surgeon B. F. Stevenson, 22d Infantry, Kentucky Volunteers, writes that —

"Some boys bore the vicissitudes of camp-life better than the majority of men; but this does not prove that the same boys as men, would not have been able to undergo a much greater amount of fatigue." Testimony of Dr. Stevenson.

Several state as the minimum twenty-five and thirty years of age. The testimony is almost as uniform with respect to the maximum, only one fixing it above forty years. The maximum given by different officers, ranges below forty to thirty years. Surgeon C. E. Denig, 28th Ohio Volunteers, furnishes the following statement: —

"Taking from the hospital register 100 names, the ages ranging from 17 to 50 years, 25⅔ was the average age of the sick. Of this number 80 were under, and 20 over, thirty years."

Testimony of Surgeon Denig.

The following is communicated by Surgeon E. Batwell, 14th Infantry, Michigan Volunteers: —

"From a list of 500 cases in the hospital of the second division, 14th Army Corps, during February and March, while the army was marching through the Carolinas, it would seem that the period during which soldiers have the greatest immunity from disease, is between twenty-five and thirty years. Of these 500 cases, 62 were between twenty-five and thirty years, 158 were between eighteen and twenty-five years, and 280 were between thirty and forty-five years. These figures have reference to those only who were sick. As regards those who were wounded, the statistics show a different result, namely: 43 were between twenty-five and thirty years, and 274 were between eighteen and twenty-five years."

Testimony of Surgeon Batwell.

Surgeon Edward C. Bidwell, Massachusetts Volunteers, states that —

"Growing boys of eighteen or nineteen years endured the vicissitudes of camp-life better than men of thirty-five or forty years, and indeed as well as those of any age. Even in hard marches, as small a proportion of this class fell out as of those of more mature age."

Testimony of Surgeon Bidwell.

PERIOD OF SERVICE.

With respect to the relation of the period of service to the power of endurance, and of resisting disease, the testimony, without exception, is in behalf of the superiority of veteran troops. The answers in full of eleven medical officers are subjoined.

1. "Veterans have shown a greater power of endurance and been less subject to scorbutic and ataxic diseases. All ages and classes endured well the vicissitudes of camp-life, and usually became of stronger physical conformation, provided they took the ordinary hygienic precautions. An exception is to be made of those who suffered from the depressing influence of home-sickness. This malady, which was quite common in the early history of regiments, prevailed most extensively among those who were quite young and who had volunteered for service with scarcely an idea of what a soldier's life was to be."[1]

Testimony of Surgeon Galloupe.

2. "Soldiers of two years' experience, in sound health, can perform 50 per cent. more service than new troops. The longer the march the more the former proved superior to the latter in physical endurance. New troops in active service seem to have a vague

Testimony of Surgeon Jewett.

[1] Surgeon J. F. Galloupe, 17th Infantry, Mass. Vols.

fear that some disaster will befall them, and they do not march with that spirit, readiness, and *abandon*, which characterize old troops." [1]

3. "Veterans have endured exposure much better than new recruits." [2] Testimony of Surgeon Dwyer.

4. "Veterans, as compared with soldiers of less than two years of service, are remarkably exempt from sickness or disability during active campaigning or rapid marches, owing, as I think, to the fact that they have learned how to take care of themselves. In the course of two years the weak and debilitated have been taken from the ranks by death, discharge, and detail, leaving only the strong and healthy to contend with the vicissitudes of the soldier's life." [3] Testimony of Surgeon Bailhache.

5. "One veteran of two years' service is worth three raw recruits for immediate active service. One year of active campaigning, however, is nearly as good as two years." [4] Testimony of Acting Assistant-Surgeon Powers.

6. "Veterans did better than soldiers of less than two years' service." [5] Testimony of Surgeon Denig.

7. "After one year of active campaigning the soldier's capacity to endure fatigue is at its maximum; he has learned how to take care of himself, and his energies are still fresh for the endurance of hardships. At the end of three years of active campaigning, he is generally either worn out or heartily tired of the service; in either case he is practically unfit for active field service." [6] Testimony of Surgeon Manfred.

8. "The percentage is largely in favor of the veteran, not more from the habit of exposure and schooled resistance of his organs, than from the fact that he takes better care of his person, with the facilities which are available; he is more provident of necessaries, he does not burden himself with any thing superfluous, and by the systematic avoidance of unnecessary exertion he performs his labor with much less fatigue and exhaustion than the novice." [7] Testimony of Surgeon Everts.

9. "The soldier requires twelve months' training to learn how to take care of himself. Disease, death, and discharges, generally within the first twelve months after the organization of a regiment, weed out the sickly plants which escape the closest scrutiny of the examining surgeon. It follows that the veteran is, *pari passu*, the better soldier." [8] Testimony of Surgeon Stevenson.

10. "The question respecting the influence of the period of service turns on the point whether the veteran has been on active duty or engaged in 'masterly inactivity in the rear.' Careful Testimony of Surgeon Batwell.

[1] Surgeon C. C. Jewett, 20th Infantry, Mass. Vols.
[2] Surgeon R. A. Dwyer, 175th Infantry, Ohio Vols.
[3] Surgeon P. H. Bailhache, 14th Cavalry, Illinois Vols.
[4] Acting Assistant-Surgeon Cyrus Powers, Stanton Hospital.
[5] Surgeon Chas. E. Denig.
[6] Surgeon Henry Manfred, 22d Infantry, Ky. Vols.
[7] Surgeon O. Everts, Indiana Vols.
[8] Surgeon B. F. Stevenson.

investigation and inquiry of the regimental surgeons with whom I have been thrown, satisfy me that green recruits stand the service better than old soldiers who have not been exposed to the hardships of camp-life, when both are called on to undergo severe field duty." [1]

Testimony of Surgeon Woodward.

11. "Veterans are not as subject to disease, and withstand hardships far better than those less than two years in the service. It requires from one to two years to accustom men to a military life." [2]

Facts communicated by Surgeon Denig.

As showing the acquirement, during service, of greater physical endurance and power of resisting disease, the following facts, communicated by Surgeon Chas. E. Denig, in reply to the question concerning the influence of seasons, localities, etc., may be here quoted: —

"By reference to the Monthly Report of the sick for a period of twenty-four months, there does not appear to be any remarkable increase or decrease of sickness occasioned by the influence of the seasons, locality, or altitude; but by comparing one twelve months with another, considerable difference will be seen —

		Sick.	Aggregate average of command.
1862.	June, July, August	220	905
"	Sept., Oct., Nov.	207	670
1863.	Dec., Jan., Feb.	268	675
"	March, April, May	270	650
"	June, July, August	143	634
"	Sept., Oct., Nov.	69	675
1864.	Dec., Jan., Feb.	96	625
"	March, April, May	109	650
		1,382	

"Total number of sick from June, 1862, to June, 1863, 980. Average aggregate of command, 725. Total number of sick from June, 1863, to June, 1864, 402. Average aggregate of command, 646. Difference in sickness, 578. Difference in average aggregate strength of command, 78.

"The regiment during the twelve months from June, 1862, to June, 1863, was campaigning on Flat Top, Sewell Mountain, Princeton, Brownstown, Gauley Bridge, and Charlestown, West Va., while from June, 1863, to June, 1864, it was at Buckhannon, Antietam, South Mountain, Clarksburg, Weston, Shenandoah Valley, and Beverly, West Va. To account for this difference in sickness, I cannot ascribe it to any influence of seasons, locality, altitude, or latitude, or to severe and hard marching, — for that the regiment had during 1863 and 1864, — but rather to inurement and adaptation for physical endurance, acquired by a year or more experience in the service."

[1] Surgeon E. Batwell. [2] Surgeon Benjamin Woodward, 22d Infantry, Illinois Vols.

SEASON, CLIMATE, AND LOCALITY.

Under this head are embraced those influences which are independent of malaria or any special causes (endemic or epidemic) of disease. Irrespective of these causes, which will be considered subsequently, the following statements respecting the relation of endurance and health to season, climate, and locality, have been elicited by the Circular: —

1. "The power of physical endurance is greatly lessened by the warm season at the South, especially in low, level, or swampy localities. Sudden transitions of latitude, in whatever direction, made temporarily, have the same effect." [1] Testimony of Surgeon Galloupe.

2. "The health and physical endurance of the soldier are best during moderately cold weather; he is better able to withstand the fatigues of rapid marches, etc., in the mountains of East Tennessee and Northwestern Georgia, than in the low grounds of Mississippi and Louisiana." [2] Testimony of Surgeon Bailhache.

3. "I have observed that soldiers are unable to undergo as much fatigue, or to perform as much duty in the hot summer as in other months." [3] Testimony of Surgeon Dwyer.

4. "In my observation, confined (with one exception) to Eastern Virginia, from the Potomac to the James River, it would be difficult to estimate the influences pertaining to 'seasons, localities, altitude,' etc., disconnected from other associated influences. The transfer of the army from the Potomac to the James in 1862, involved a transition from a school of instruction to actual service, — from winter-quarters to active campaigning, — so that the influences of season and climate cannot be separated from those of diet, labor, exposure, and the moral impressions incident to battle and duties 'at the front,' and these influences are very great. Soldiers will endure more and resist disease better, in the latitude of Virginia, late in the season than in early spring or midsummer. They bore better marching toward the north than toward the south, although under more discouraging circumstances in a military point of view. A humid condition of the atmosphere succeeding a dry period, during a march, was always beneficial — relieving the ambulance train." [4] Testimony of Surgeon Everts.

5. "The summer season I found most congenial to the soldier, alike in the latitude of Kentucky, and further south. In the summer season troops in field service can always secure, to some extent, green and succulent vegetables, and the crowding of tents, with the consequent bad ventilation, is avoided. My regiment was not at any time subjected to any very sudden transition from a high to a low latitude, or *vice versa*. When sent south in November, 1862, progress Testimony of Surgeon Stevenson.

[1] Surgeon J. F. Galloupe.
[2] Surgeon P. H. Bailhache.
[3] Surgeon R. A. Dwyer, 175th Infantry, Ohio Vols.
[4] Surgeon O. Everts.

was made slowly. One most pernicious practice was pursued in the quartermaster's department everywhere, so far as my observation extended. I allude to overcrowding steamboats with men, horses, wagons, and all the material of war, to such an extent that comfortable positions for rest and sleep often could not be obtained. I will cite an instance: — In Gen. Sherman's campaign against Vicksburg, in December, 1862, the 22d Kentucky Infantry, the 54th Indiana Infantry, and a Wisconsin battery (Capt. Foster's), were all shipped on one boat (the *Crescent City*). More than fifteen hundred men, with all their camp equipage, horses, mules, etc., were huddled on this boat, where they remained more than two weeks. The boat became extremely filthy, and a low form of fever, complicated with erysipelas, prevailed in both regiments. Each regiment was engaged in the assault on Chickasaw Bluff, and each suffered severely in killed and wounded on that occasion; but the confinement on that boat led to a greater number of deaths in these regiments than the shot and shell of the enemy in the assault."[1]

RESIDENCE IN CITY OR COUNTRY PRIOR TO ENLISTMENT, AND THE INFLUENCE OF PREVIOUS HABITS OF LIFE.

Several of the correspondents of the Commission testify to the superiority in endurance, and the power of resisting disease, of men from cities, as compared with those from the country. Surgeon Bailhache writes that —

Testimony of Surgeon Bailhache.

"The vicissitudes of camp-life are best sustained by those who have lived in cities and large towns; farmers or countrymen are particularly liable to break down."

Dr. H. Manfred states, —

"The companies of my regiment which were recruited from cities, bore the vicissitudes and hardships incident to a soldier's life, much better than the stalwart men brought up on farms."

Surgeon B. F. Stevenson says, —

Testimony of Surgeon Stevenson.

"Men raised in towns and cities, as I always thought, without reference to fatigue, bore best the vicissitudes of the camp. They are more cosmopolitan in habit, thought, and feeling, and they were much less subject to home-sickness."

Surgeon A. W. Heise, Illinois Volunteers, makes the following statement: —

Testimony of Surgeon Heise.

"The lower classes from large cities surpassed all others in power of endurance, and of adaptation to the vicissitudes of camp-life. Even those of sedentary occupations from the cities were better able to bear these vicissitudes than laboring men, of rude health, from agricultural districts."

[1] Surgeon B. F. Stevenson.

Surgeon A. L. Clark, Illinois Volunteers, states that —

"Young men of previous irregular habits coming from cities or towns endured the hardships of service better than farmers who apparently had a better physical organization." Testimony of Surgeon Clark.

Professor Paul F. Eve, Confederate Surgeon, gives similar testimony, as regards the soldiers of the Southern armies, in the following language: —

"To the question, 'What classes of men best endured the vicissitudes of camp-life?' I reply that, greatly to the surprise of all, townsmen contrasted favorably with countrymen. But one opinion exists on this point, though contrary to general belief. The volunteers from cities and towns, the mechanics, clerks, store-keepers, professional men, etc., bore exposure in the field better than farmers, day-laborers, or even woodsmen. The difference may be attributed to these facts: Townsmen have generally passed through the usual infantile diseases which are so prevalent in camp; they are somewhat accustomed to irregularities in living; they were better provided for the service, and they knew more of the ways of the world. I think it may with truth be stated in support of this position that, at the organization of the army, one town regiment was more efficient than two or even three from the country. In one company from Nashville there were seven youths under seventeen years of age, six of whom passed through the war and are now in excellent health. It was noticed everywhere that the more intelligent the recruit or soldier, the better he fared in the field and bore the vicissitudes of camp-life." Testimony of Professor Paul F. Eve.

REMARKS BY SURGEON S. B. HUNT ON THE PHYSICAL CHARACTERISTICS OF DIFFERENT CLASSES OF VOLUNTEERS, AND THE INFLUENCE OF PREVIOUS HABITS OF LIFE.

Among the conditions that affect the efficiency of the recruit, previous education and habit have an important bearing. In the busy recruiting season following the Peninsular campaign, every motive of pride, patriotism, and pelf combined to urge young and old into the field. On the call made July 2, 1862, for 300,000 volunteers, 419,627 were actually mustered into service. So far from effort to secure recruits being necessary, it required absolute firmness and integrity on the part of the examining surgeon to reject the unworthy. I have seen tears shed by young men rejected on account of varicocele and slight hernia, and have been offered bribes as an inducement to accept them. All arguments were offered, and a too-ready yielding to them on the part of examiners very much embarrassed the service for a year succeeding. Activity of recruiting in 1862.

Reëxamination of recruits at Binghampton, N. Y.

On the 9th of August, 1862, I reported at Binghampton, N. Y., as surgeon of the 109th N. Y. V., then far advanced in its organization. A partial reëxamination of those already accepted, and of several hundred more who offered (two regiments of 1000 men each were raised), resulted in my rejecting about 26 per cent. of all candidates. As only a few days were occupied in this work, it was done hurriedly, in this wise: The men reported by companies and often had 120 men to the company. They were marched into a large hall, and sometimes a part, sometimes the whole of the company directed to strip to nudity at once. Commencing at the head of the line, each man was rapidly examined. First, his head was felt for scalp-wounds, and the countenance scanned for any epileptic look. Hearing was tested by questions asked in a low voice; sight by visual examination and by questions as to objects at a distance. The mouth and teeth were then inspected, a general look given to the physique, front and rear, the genital organs examined for hernia or varicocele, the fundament for hemorrhoids, and the candidate was then tested gymnastically. He was told to strike first the palms and then the backs of his hands together perpendicularly over the head; and then to place the palm of the hand on the corresponding shoulder, keeping the elbow flat against the side. He was also directed to strike his heel sharply against the nates. Respiration and circulation were then examined, and a more careful look given to fingers and toes. Such an examination occupied hardly more than one minute per man, but as no time was lost in waiting for individuals to undress a great deal of business could be done with tolerable care.

Farmers and laborers from the country as material for the army.

The material was mostly of young farmers and laborers, of fine physique, elegantly rounded forms, and soft and supple skins. No better class ever offered themselves to an examining surgeon, yet as I have mentioned, only 74 per cent. were found fit for enlistment. The fault in this body of men became evident immediately. They had been tenderly nurtured in homes of comfort. To lose a meal or sit down to a poor one was a hardship few had experienced. Up at an early hour, the duties of the farm-yard had busied them for an hour before the substantial breakfast of the New York farmer. If the weather were fair they "plowed a-field;" if rainy, lounged about the house, the neighboring "store," or worked at repairs under shelter, until, the three regular meals completed, they went to their feather-beds at nine o'clock in the evening to dreamless and

healthy sleep. It is fair to say that many of them had rarely lost a night's rest, or suffered a wetting from rain, in the even tenor of their monotonous and gentle lives.

Such is not the best material for ready conversion into soldiers. The city youth, who has "run with the machine," dissipated whole nights at frequent intervals without rest the next day, and who in the chances of life learns to laugh at the little miseries of the day, is far better adapted to endure the hardships of the first campaign, and maintain through all the spirit of the laughing philosopher. On the other hand the quiet farmer's son no sooner finds himself packed in an A tent with too numerous companions, and compelled to cook his own food, than he longs for the feather-beds and the flesh-pots of the old homestead.

Young men from the city more readily converted into soldiers.

Physically, too, he is *for the time* the inferior. His muscles have more development than training. All his life a lounger, indulging in the American luxury of one chair for his person and another for his heels, never assuming the absolutely erect position except momentarily, always resting himself by frequent changes of attitude, it is really a severe trial for his nervous system to "stand at attention." This shows itself in frequent syncope at dress parade. Standing erect, facing the declining sun, it is a very common thing for the rural recruit to find his head reeling until he astonishes the adjutant by falling prostrate and insensible. Again, he cannot bear hard exercise in the morning. I have known about ten per cent. of a company faint or break down at a drill on an empty stomach directly after reveille.

Yet the essentials of a splendid soldiery are all here. Morally, they require a more gentle and friendly treatment from their officers, and greater familiarity may be permitted between the higher and lower ranks. This will not be abused if judiciously employed, and the necessity for it is found in the importance of sustaining the spirits of the men, who are very likely subjects for nostalgia. If they can feel that their patriotism is appreciated, that they are esteemed and valued by their officers, they are too intelligent, and as a class too honorable, to abuse the freedom of intercourse to which they are admitted.

Management of men recruited from the country.

Physically, all depends upon their early handling. During the period of seasoning we should watch them carefully, and it is the surgeon's duty to interpose authoritative advice as to the hours of drill and duty. Recollecting that these men are still "soft" in tissue, it is the height of imprudence to crush them with long

drills in heavy marching order. Some commands in the army of the Potomac literally "broke the hearts" of their men by laborious brigade drills with full knapsacks. Of course in the production of the athletic condition, to which the soldier must come at last if he is to have any military value, these drills must necessarily be employed. But all should be done gradually, so as to steadily inure the man to his work, day by day hardening his muscle and developing his powers of endurance. In a few months, or even weeks, of wise gymnastic training, all the quiet growth of his early years becomes a source of reliable strength, fitting him for hardships and exposures. As to personal bravery he has no superior, when once he learns to sink his own intelligent individuality in the general mass of thought and action. He is, more than any other soldier, brave from principle and patriotism, meets wounds cheerfully, and dies with a clear-headed appreciation of what he is dying for. Such soldiers are inestimable, and the early faults they exhibit are easy of correction, in fact they are only a modification of excellence. In the particular body of recruits whom I have taken as my text, the subsequent history confirmed my opinions. The difficulties I have named presented themselves in due succession. I was fortunate in having intelligent and humane field officers, with whom I could consult, and who were willing to take my previous experience for at least as much as it was worth. We had been hardly a week in camp in Maryland before the measles attacked us, and we had nearly one hundred cases, closely followed by over one hundred cases of a simple continued fever of very mild character. Yet at the end of a year the regiment had lost by death from disease only five men out of 1020, and a very few more by discharge. Ever after I heard of it as a hardy, healthy, and very efficient regiment in the field.

Superior marching qualities of western soldiers.

I think the superior marching qualities of western soldiers, as compared with the untrained eastern soldier, were due to previous habits of life, the greater recklessness — or, to use a more descriptive phrase, Bohemianism — of the western troops. They were more accustomed to roughing it, to indulging in the sports of the chase, and to vicissitudes of life which are rarely encountered in the thickly-settled and orderly East. This rendered them more available for immediate action, but in the end they manifested no superiority over that indomitable pertinacity which marked the army of the Potomac, alike in success or defeat.

REMARKS BY SURGEON HUNT ON THE EFFECTS OF ALTITUDE.

No meteorological law is better understood than that with increasing altitudes we find a lower temperature and a wider variation between the temperature and the dew-point. That is, we have a cooler and drier atmosphere, conditions always favorable to health, inasmuch as they forbid the development of the various ferments that constitute malaria, and have in themselves a specific tonic effect upon the human system. Mere altitude, however, may fail to produce these results, owing to the geographical conformation of the land; as, for instance, a low, sheltered, mountain valley, unventilated and with an imperfect exposure to the sun, may have a high dew-point and be eminently malarial. All the conditions that create disease in alluvial districts may thus be sometimes found among rocky hills.

Relation of temperature and the dew-point to altitude, affected by geographical conformation.

On the other hand, it happens that prairies may sometimes combine all the essentials of health, even at a comparatively low altitude. Such is the fact in that slightly elevated plateau of prairie extending from the Rio Grande northwardly to the Canadian line, embracing much of Texas, the Indian Territory, Kansas, Nebraska, and Iowa, and which, growing broader as we go northward, extends westward to the foot of the Rocky Mountains or to the verge of the great American desert. This plateau is in some portion known as the "Great Plains," yet the savannas of the Indian Territory and the prairies of Texas are essentially parts of the same system, and governed by the same laws. It has an air inspiringly pure and bracing. Even in periods of great heat, there is none of that nervous exhaustion which attends a hot and humid atmosphere, and sun-stroke is an accident rarely known. The latter is said never to occur except in unventilated and thickly-timbered river bottoms. Physical energy, a restless tendency to nomadic life, and a keen appetite for adventure, are the characters impressed upon the people by the brisk air they breathe, which has all the properties of the purest mountain air, except its rarity. It is a more condensed atmosphere, but equally dry and oxygenated.

Health on the "Great Plains."

Yet this great natural sanitarium is comparatively low, as one may reason when he recollects that its rivers flow sluggishly, and for vast distances have no waterfalls. In periods of freshets, steamers may navigate the Arkansas to Fort Gibson, or the Missouri to a point nearly to the Rocky Mountains. The general level

of the prairies of Texas, above the sea, is about 500 feet only, and so gradual is that slope that it is passed unconsciously, the traveller supposing himself on an interminable plain. Toward the north and the foot-hills of the west it rolls in grand yet gentle undulations, its hills segregated and rarely assuming the form of ranges, and when they do, lying north and south so as to oppose no obstacle to the steady flow of the return-trade-wind, which is there almost due southerly in its course — a steadfast breath from Paradise flowing through happy hunting-grounds. Few men of Atlantic origin have any conception of the marvelous beauty of the eastern border of the great plains, or of the wonderful salubrity of their climate. The traveller from some slight eminence sees before him one vast undulating ocean of grass waving in the wind like ripening barley, until its rollings are lost in the soft, yellow haze of the horizon. At intervals a belt of timber marks a water-course, and here and there are strangely-shaped hills of varied formation, flat topped and geometrical, sometimes crowned with equally symmetrical turrets, and having a striking resemblance to the monitor class of ships. Fat herds of cattle graze contentedly and people the solitudes, the quail hops along the trail before you like a dove in the streets of a town, the turkey-hen fussily hovers her brood out of harm's way, or the prairie-chicken starts up with vigorous wing; while over all bends a sky of deepest purity, so clear that at night the stars swing out like lamps, as if set upon the inner surface of the dome and not buried in the measureless distances beyond.

A few records of marches will illustrate the effect of this climate upon the efficiency of troops. In September of 1864, Colonel James M. Williams, of the 1st Kansas Colored Infantry, was lying upon the Salisoe River — a stream about thirty-six miles east of Fort Gibson, in the Cherokee Nation. At noon he received orders to make a forced march on Gibson. The route crosses one of the rocky and mountainous ranges just east of the inter-continental plateau, and was so rough and stony that, on reaching Fort Gibson at about 9 A. M. the next day, a large proportion of the troops — all negroes — had blistered their feet or worn out their shoes. A surgeon's examination, however, only excused eleven men out of the 1200 present, and at 7 P. M. the march was renewed, pushed on through the night upon the open prairie, with short halts, until at noon the next day the entire command, without a single straggler, went into line of battle on Pryor's Creek — a distance of forty-two miles marched in just seventeen hours; or, taking the entire march from the Salisoe, of

Records of marches showing effect of this climate on the efficiency of troops.

seventy-eight miles marched in something less than forty-eight hours. At sick-call the next morning only four men presented themselves, and nowhere in the command were there the usual evidences of a forced march through night and day. All felt exhilarated, and the contrast with marches in humid districts was very prominent.

Later in the same season the 54th U. S. Colored Infantry, Lieutenant-Colonel Fair commanding, repeated this march on a more leisurely but extended scale. They passed some four weeks of November and December upon the plains between Fort Gibson and Fort Scott, without tents for officers or men, experiencing several snow-storms and much severe, cold weather; yet they returned not only without deaths from disease, but remarkably free from pulmonic or rheumatic complaints.

Another march, in part through malarial and in part through prairie regions, affords a striking illustration of climatic influences. Early in July, 1865, Major-General Wesley Merritt left Shreveport, La., for San Antonio, Texas, with a full division of cavalry. The division had been some weeks in the oppressively hot and humid valley of the Red River, and its health was already shaken. From the Red River to the Brazos is a timbered country, pine barrens or post oak, alternating with rich alluvial bottoms. The country is quite hilly, yet everywhere malarial. The roads were narrow and extremely hot and breathless. A regiment (18th New York Cavalry) preceded the column to provide forage depots. On the march from Shreveport to Marshall, Texas, — a distance of only sixty miles, — it lost by sun-stroke, congestive chill, or other zymotic causes, eight men. Subsequently, by more prudent marching and avoiding the midday heats, the mortality ceased. The main column was marched with great prudence from the outset; but cases of fever constantly occurred, and were packed along in the ambulances. The command may be said to have been very sickly on reaching the Brazos.

Arrived there, the route led out upon the open prairie, over which swept continuously the strong southerly wind, blowing night and day. The heat was intense, the thermometer ranging very high, but withal there was no languor. The sick in the ambulances recovered, few new cases occurred, and the command reached San Antonio on the 1st of August in remarkable health, which was well maintained thereafter. Here we came off the highlands, which were sickly, down on to the lowland prairie, which *per contra* was as healthful as any part of the world, and that in a temperature averaging 90° for each twenty-four hours.

The causes that determine this local climate must be looked for in its physical geography. The region of which we are speaking lies somewhat to the western border of the "normal south-west wind," or rain-bearing wind. This moisture-laden air-current gives its greatest precipitation in the region of the Mississippi Valley. As we pass to the westward we are still in the same air-current, governed, as in the valley, by the diurnal motion of the earth, and flowing steadily northward; but it is not so moisture-laden, inasmuch as its major portion has passed over but a little of the Gulf of Mexico, and has absorbed but little water. And as we go westward we find the annual precipitation decreasing until it reaches its minimum in the arid wastes of the Great Central Desert. It is in the interval between the humid valley of the Mississippi and its immediate tributaries, and the sand deserts that skirt the Rocky Mountains, that we find this happy combination of a warm climate and an invigorating air — of almost tropical heats with delightful breezes.

ALIMENTATION, AND THE USE OF COFFEE AND TEA.

Army alimentation has already been considered in a chapter devoted to that subject (Chap. iii.). It will claim further consideration as connected with the causation and management of certain diseases, especially scurvy. A thrilling account of the effects of innutrition dependent on deficiency of alimentation, as exemplified in the Andersonville prison, will appear in a subsequent section. In this chapter, under the head of alimentation, will be quoted remarks by some of the correspondents of the Commission, in reply to the following questions contained in the Circular: "What effects have followed deficiency in quality or quantity of rations?" "At what times and to what extent was there such deficiency?" "Have you observed any special advantage from food and beverage partaken warm after fatigue?" The small amount of testimony to a deficiency of rations is significant of the abundance of alimentary supplies; and to the liberality of the commissariat, as well as to the efficiency of the coöperative efforts of the Sanitary Commission, there is no lack of direct testimony.

Surgeon Samuel W. Abbott, of Mass., who served two and a half years as assistant-surgeon in the navy, and afterward as assistant-surgeon and surgeon in the army of the Potomac, writes, respecting rations, as follows: —

Remarks of Surgeon Abbott.

"Those of the navy, especially in squadrons within a few days' sail of northern ports, were better and more varied during the war than those of the army. I have observed, while in the navy,

scarcely any ill effects from deficiency either in quality or quantity. I know that the 'preserved roast meat,' in large cans, was a miserable article, often unfit to eat, and productive of diarrhœa. While in the army near Petersburg, during the winter months of 1864–65, there was a great deficiency of fresh vegetables. The weekly sick report of the various regiments in my brigade, showed a lamentable want of potatoes and onions. Only one or two rations of potatoes were received for three or four months. I did not, however, at that time, notice ill effects. Two or three cases of scurvy occurred in my regiment, of about 400 men, and but a few cases in the whole brigade. I have no doubt that the effect on the health of the soldiers, during the ensuing season, would have been very injurious had there been an active campaign in the summer. Deficiency in quantity was of rare occurrence. It was only once complained of during the winter of 1864–65 in my command. Soft bread, onions, cabbages, and potatoes, when issued, were eagerly partaken of by the men. They would often throw away fresh beef, but almost never 'hard tack.' The latter would be just as good after a week's marching as at first. I think the hard bread of both arms of the service is the most useful, available, and nutritious part of the ration for men in active service. Several rations of desiccated mixed vegetables were issued during the winter, which, when boiled and made into soup, were very palatable.

"One source of disease among soldiers in active service, is in the fact that every man cooks for himself. Now, all soldiers are not good cooks. Hence, a great amount of neglect, waste of food, and filthy habits of cooking. I could not but notice the difference between soldiers and seamen in this respect, and in many instances it could not be avoided. One of the most common utensils used in the army was the frying-pan, which was very convenient, but often very dirty, being frequently laid aside with the accumulated filth and grease of several weeks. In my own regiment and brigade, I made special inspections of this article, and recommended, as far as possible, the substitution of gridirons made of old telegraph wire, easily obtained along the deserted railroads leading from Petersburg. When in winter-quarters several companies had cook-houses, from which good soups were frequently furnished to the men. But picket and other detached duty interfered much with such arrangements. In the naval service, on the contrary, every ship has one man, often a professional cook, who prepares the food for all the crew, divided into messes, each provided with separate mess-chest and utensils. Among the varied commutations of the naval ration, tomatoes in cans formed an excellent part; they were almost invariably in good condition. Bean or pea soup, as served in most men of war, was a very nutritious and palatable article, as the officer of the deck could often testify at 'seven bells' in the forenoon watch. Flour was commonly boiled in the form of 'duff.' Fresh beef was sup-

plied to the South Atlantic Squadron every three weeks. It was eagerly eaten by the men, but frequently productive of diarrhœa on account of the sudden change from salt food, and also on account of the unusual quantity eaten.

"In regard to warm and cold food and beverages, I have not made any special observation, but I should think the former had a better effect on body and mind. I have never known men to take their coffee cold. I have found the most available nutriment after battle to be coffee, condensed milk, hard tack, and extract of beef, carried in the medical wagons and ambulances. The extract of beef furnished an excellent soup when made with such vegetables as could be obtained by foraging in the vicinity. Frequently hot coffee, boiled farina, and milk punch, as furnished by the Sanitary and the Christian Commission, have been most acceptable; and I shall never forget the gratitude manifested by our men when these articles were so kindly furnished by the agents of the Sanitary Commission, at the battle of Hatcher's Run, in February, 1865."

Surgeon B. F. Stevenson bears testimony to the evils of over-feeding and the comparative immunity from sickness, under temporary dietetic restrictions, in the following quotation: —

"Deficiency in the quantity of the rations I never witnessed. On the contrary, I have observed but too frequently the injurious result of over-feeding in the army. The regular daily ration issued in the army of the United States contains much more nutrient material than one man ought ever to consume in a single day. On the retreat from Cumberland Gap, in September and October, 1862, the troops were on shorter allowance than at any previous or subsequent period of my connection with the army; and notwithstanding the depressing effect of a retreat, surrounded and harassed by an exultant and confident enemy, I should select this period as exhibiting a smaller daily sick-list in my regiment, than any period of equal duration whilst I was in the service. The commutation of the regular ration which I would suggest, is the substitution of canned and dried fruits or vegetables, and also green vegetables, when these can be procured, together with a large increase of the sugar ration. Of salt meats, I think beef can be dispensed with better than pork.

Testimony of Surgeon Stevenson respecting over-feeding and effect of temporary dietetic restrictions.

"Food and beverages taken warm after a hard march, or after exposure to cold on picket duty, I always found more invigorating than when taken cold. After a hard march I have often found a cup of strong, warm coffee or tea reinspire soldiers with a determination to press on and accomplish a given work which they had almost despaired to accomplish."

Warm food and beverages.

Testimony analogous to the preceding is given by Surgeon E. Batwell, as follows: —

"It has never been my fortune to see ill effects from deficiency of rations. During the time that the garrison at Nashville was closely besieged, and were on quarter rations, having to collect the rations at the point of the bayonet, a condition of good health existed among the men not equaled before or afterward; the hospitals had only old chronic cases. Again at Chattanooga, after the battle of Chickamauga, when the immense army of Rosecrans depended for supplies on the almost impassable road over Waldron Ridge, when the mules and horses died from starvation, and when it was not uncommon to see our noble, uncomplaining soldiers pick up and parch for their own use the kernels of corn scattered by the mules, one would have supposed that sickness would prevail; but the reports of the divisions, corps, and regiments showed the reverse. We do not regard short rations as necessary for the health of the soldier, but we do say that the army of the Southwest was never in such a high condition of health as when the full ration was not furnished. At Camp Big Springs, where there was a lavish distribution of the full army ration, the Sanitary Commission filling up with delicacies and luxuries every chink that might be left, one might imagine that the 'palmy days' of soldiery would furnish a small sick-list. Yet I venture to say that a larger number of men were prostrated by disease, under these circumstances, than before or afterward. Testimony of Surgeon Batwell.

"No one who has experienced the refreshing effect of a cup of good, hot coffee, at 'noon-halt,' can doubt its beneficial result. It supplies a want that nothing else fills. Every one must have observed on a march the amount of water drank by the men. Some, however, seldom drink from breakfast to dinner-time, and that too when marching under a broiling sun. At dinner-time they get their cup of coffee, and drink it with that relish which no one but a soldier can fully understand; whereas, they who rush to every well or spring are too full to enjoy their meal, and they are those who 'drop out' in the afternoon march, while their companions (who are not water-logged) come into camp with an elastic step, so characteristic of 'Sherman's boys.' Beef soup, made from the extract, and thickened with grated hard-tack or farina, was the most available nutriment on the field." Refreshing effect of coffee.

Surgeon Samuel A. Green, 24th Massachusetts Volunteers, writes respecting the want of a proper system of cooking, as follows: —

"In regard to alimentation, I have always found the ration remarkably generous in quantity and good in quality. Never was an army so bountifully supplied with every article of food that loyal hearts could wish, and yet something was wanting. The great difficulty has always been, a want of proper preparation of the food. While the cooks did their best, many were inexperienced in their duties, and ignorant of some of the first principles of their art. They were Remarks by Surgeon Green.

detailed from the ranks, and it was not to be expected that they could do better. To be a good cook requires a certain kind of knowledge to be acquired by education, otherwise the food will be improperly prepared. At times the nutrient elements will be wasted, and then again, the food will be so altered as to be positively hurtful, if the cook does not understand his business. It is true that the cooks have to work as they best can under great disadvantages; that on a march they have but an iron pail or two in the way of utensils. It is not so much with them that I find fault, as with the system which tolerates them. In garrison or in winter-quarters, the same want of method is seen. Desiccated vegetables were generally furnished troops stationed in a place with any likelihood of permanence. With these a very excellent soup might be made on 'fresh-meat days,' and yet this was rarely done. Instead of this the soluble part of the meat was lost in the water, and the water thrown away. This waste was seen in every thing in the cook's department. Some allowance is to be made for the American taste. Soups are, to a certain extent, in opposition to the genius of the American people. It is not so with the French, who understand these things better. A French soldier would make a good dinner of this very soup, if he had bread and a little red wine, whereas an American would not look at it, but must have the meat. I do not mean that the diet of the two countries should be the same, but I do think that we might take a hint from the French. With our more invigorating climate, we need solid animal food more than European nations. We consider meat a necessity rather than a luxury. If this be true in civil life, it holds good *à fortiori* in the army.

"The life of a soldier is peculiar. It is one of extremes. Never in civil life is there such a demand for mere force or muscular power, followed immediately by the opposite extreme. To-day it is storming a breastwork, or charging a battery, and to-morrow doing nothing. It is this life which wears and tears the soldier, and the waste must be supplied in order to keep him whole. This is to be done by a careful attention to his food. The great want of the army is food prepared more scientifically than at present."

Surgeon Edwin C. Bidwell thus bears testimony to the utility of coffee and of warm food and beverages: —

Testimony of Surgeon Bidwell respecting coffee and warm food and beverages.

"I have had but little experience with troops upon short rations, none, in fact, except for very brief periods, too brief to give rise to any lasting ill effects. In cases of fatigue, either with or without a sufficient diet, I have always found hot coffee a very valuable restorative. So strongly impressed was I, as respects the value of this article in the field, from my own experience, as well as observation of its effects on others, that I was accustomed to call coffee the 'staff of life.' I am sure that warm food and drinks have an especial advantage after fatigue."

Assistant-Surgeon John Whittaker, Ohio Volunteers, communicates the following statement respecting the use of tea: —

"Previous to, and during the investment of, Atlanta, the duty was so hard that a great many of the men broke down. From constant and rapid marching, often at night, prolonged labor in erecting defenses, living in trenches, the constant mental strain from exposure to balls and shell for weeks at a time, together with poor diet, great numbers came on the sick-list; many of these not appearing to suffer from any particular disease, but simply 'worn out.' In these cases tea was found to be a valuable restorative. With rest and plenty of good tea they generally recovered rapidly."

Statement of Surgeon Whittaker respecting tea.

Surgeon Charles Southworth, 18th Michigan Volunteers, says, with regard to the use of coffee: —

"I would recommend the use of coffee instead of whisky. I believe coffee, used freely by the soldier on picket, during a march, on the battle-field, or when engaged in any fatiguing duty, is not only a prophylactic but a healthful stimulant, such as is required by the nervous system under these circumstances."

Testimony of Surgeon Southworth respecting coffee.

THE WHISKY RATION.

The use of whisky is to be here considered with reference only to the effect of an alcoholic stimulant on endurance and the power of resisting disease, not as a therapeutic agent. Does alcohol enable the soldier to bear better the exposure, exertions, and fatigues to which he is liable in the field, and does it exert an influence as a prophylactic? The statements of medical officers from whom reports have been received, do not all agree respecting the answer to this question. The great majority, however, are of opinion that the issuing of a whisky ration, as a rule, is injurious instead of being useful; but some hold to the belief that spirit may be given with advantage on occasions when the physical powers are unusually taxed, and that some feeble persons may do better with than without it. There are certain moral considerations connected with the issuing of a whisky ration which cannot be easily disconnected from the purely physiological and etiological aspects of the topic. Here, as under the other heads which this chapter embraces, the testimony of those who have responded to the Circular will be submitted. In addition to opinions, the reports of some of the correspondents of the Commission contain facts of importance as bearing on this topic. To the following series of extracts the names of the writers, respectively, are appended: —

1. "While I admit that whisky is occasionally beneficial in sustaining the physical strength of some on hard marches, after fatiguing exertion, exposure to cold, or while camping on marshy ground, I have not found its regular free use advisable. The evil moral influence which the common use of it exerts over an army or regiment far overbalances any good effect even of its occasional proper use. Some who never drank spirits before acquire the habit of drinking or a taste for liquor from its being issued as a ration. I made trial of its use, as a ration, at one time for several weeks, by order of the medical director, and I can truly say that remittent fever, intermittent fever, diarrhœa, and dysentery, were not in the least prevented, nor was the physical strength of the men perceptibly sustained." [1]

Surgeon Denig's opinion.

2. "In regard to the 'whisky ration,' I have doubts concerning its benefits. Perhaps my doubts are based on moral rather than physiological grounds. Many soldiers were intemperate in civil life, but away from temptation the craving for liquor is not felt. Doling it out at irregular intervals as a ration keeps up the appetite in these men, creates an appetite in others, and it is questionable in my mind whether it does any good. Whisky should be confined to the hospital, where it can be used freely at times with much benefit, if given with discretion." [2]

Opinion of Surgeon Green.

3. "The impressions left upon my mind by observation respecting the whisky ration, are that it does not promote the ability of the soldier to endure physical exertion, and that it diminishes the ability to resist disease. It would be difficult to show this by figures — statistics — derived from morning reports, etc., (which every army surgeon knows to be often nearly worthless, if not deceptive,) because it is difficult to determine the value of any single influence among the many influences tending to increase or decrease the sick-report. I found the whisky ration in vogue and very popular when I joined the army of the Potomac in the Chickahominy Swamp early in June, 1862. It was given as a prophylactic against malaria. Quinine, which was at first ordered with it, did not come into general use. But so far from the malarious manifestations being prevented, they were on the increase among the troops; and so strongly was I led to suspect that the operation of malaria was aided by the whisky that I induced the Colonel commanding my regiment to destroy it instead of giving it to the men. This was done, until some three weeks afterward a general conviction led to the suspension of the whisky ration, or to its being issued only by special order after 'fatigue duty.' There was no increase of fever certainly after the whisky was withdrawn, notwithstanding the advance of the season to a period more productive of malaria, and an increased amount of the physical exertion of the army in defending its position and changing its base." [3]

Opinion of Surgeon Everts.

[1] Surgeon Charles E. Denig. [2] Surgeon S. A. Green. [3] Surgeon O. Everts.

4. "When the army of Rosecrans lay about Nashville, I had a fair chance of testing the effect of the indiscriminate use of whisky among troops, and of proving satisfactorily to my own mind that it is productive of evil. Four regiments were similarly situated around Fort Hegley, using the same water, similar rations, and in every way living as nearly alike as possible, except that two of the regiments had whisky freely distributed. In the latter regiments if a man felt cold he got 'a horn' to warm him; if he felt hot or feverish he got the same to make him 'throw off the fever;' and so things went on. Consequently the surgeons of these regiments were lauded to the sky, while those of the other commands were abused both by officers and men. The monthly report of sick, however, showed a condition of affairs very prejudicial to the use of whisky. Each of the regiments in which it was so profusely used had a larger number of sick than both the two other regiments. Again, at Camp Big Springs, near Corinth, Miss., two Michigan regiments lay side by side, endured the same exposure, and had an equal number of men when they reached Pittsburg Landing. In one of these regiments whisky was used freely by both officers and men, and in the other regiment the contrary practice was inculcated and carried out. Sickness and death prevailed among both regiments, but at the end of June, 1862, there were less than two hundred for duty in the former regiment, whereas in the latter over five hundred men appeared on the morning report as fit for duty. I have thus endeavored to set forth statistically the grounds for my not favoring the 'whisky ration.'" [1] Statements by Surgeon Batwell.

5. "Men accustomed to the use of whisky have proved less able to endure prolonged hardship, and have recovered with more difficulty when sick or wounded. In emergencies, however, when it has been desirable to obtain a great amount of service in a short time, the use of stimulants has seemed to answer a good purpose." [2] Testimony of Surgeon Galloupe.

6. "My opinion, based upon observation, is that the whisky ration, as used in the army, is always an injury, and that the sick list is increased by it. I do not say that were it properly used under certain circumstances and with proper restrictions, it might not be beneficial, but, as it has been used under my observation, it has proved injurious. I think that all alcoholic stimulants should be prohibited except as a medicine, and supplied only through the medical department, the medical officers being held strictly responsible for their proper use." [3] Surgeon Wright's opinion.

7. "My experience regarding the influence of the whisky ration upon the physical endurance and health of soldiers is very limited, but, from what little I have seen, I would much prefer the issue of good vegetables, such as potatoes, onions, etc." [4] Testimony of Surgeon Bailhache.

8. "Whisky, as a ration, I deem pernicious. Under certain circum-

[1] Surgeon E. Batwell.
[2] Surgeon J. F. Galloupe.
[3] Surgeon John Wright, 107th Illinois Vols.
[4] Surgeon D. H. Bailhache.

stances, whisky is allowable as a remedy, but a regular issue of it as a ration to troops is, in my judgment, not in accordance with physiological or hygienic principles. Its prolonged use impairs the digestive functions and reduces the power of physical endurance. I have always found that habitual dram-drinkers were deficient in physical and moral stamina, and I know of nothing connected with the army that should render the daily use of whisky less pernicious than in civil life." [1]

Surgeon Stevenson's opinion.

9. "My opinion is that the capacity for physical endurance was seriously impaired by the use of alcoholic stimulants in advance. Besides, some men will always get other men's rations, or, at least, more whisky than is good for themselves, and thus become unfit for duty. After a little experience, I came to dread the issuing of the whisky ration, especially in the morning, and I never advised nor permitted it, if I could prevent it, except *after* great physical exertion or exposure, and in fatigue actually present, not prospective." [2]

Surgeon Bidwell's opinion.

10. "The habitual issue of the whisky ration is useless, mischievous, and demoralizing. Occasionally, during severe fatigue duty or great exposure, it is salutary." [3]

Acting Assistant-Surgeon Powers' opinion.

11. "I would subject the issuing of the whisky ration in all cases to the discretion of the medical officer. The use of alcoholic stimulants is injurious except when given at night after great fatigue." [4]

Surgeon Hand's opinion.

12. "Whisky in the army is a great nuisance except for the use of the sick. I never saw any but the sick benefited by it." [5]

Surgeon Houston's opinion.

13. "I have seen whisky given after unusual fatigue or exposure, and to the constitutionally feeble after ordinary duties, with great advantage, which was so apparent to men principled against all stimulus, that, after repeated attacks of cachectic or febrile diseases, they concluded to avail themselves of the whisky ration, which they did with satisfactory results." [6]

Testimony of Surgeon Jewett.

14. "I have observed that it is advisable to issue the whisky ration, as it increases endurance and promotes health." [7]

Testimony of Surgeon Keith.

15. "The ration of whisky, when regularly served, doubtless proved beneficial. It acted as an adjuvant to the digestive functions. The men would eat better, work better, and. if they did not indulge to excess, they endured sickness better for it." [8]

Testimony of Surgeon Flagg.

16. "The whisky ration is so universally denounced by medical and the best of military officers, both of the volunteer and the regular service, that it is scarcely necessary to mention any

Statements by Surgeon Andrews.

[1] Surgeon B. F. Stevenson.
[2] Surgeon Edwin C. Bidwell.
[3] Act. Asst.-Surgeon C. Powers, Stanton Hospital.
[4] Surgeon Hand, 8th Cavalry, Illinois Vols.
[5] Surgeon W. M. Houston, Ohio Vols.
[6] Surgeon C. C. Jewett.
[7] Surgeon Price Keith.
[8] Surgeon Samuel Flagg, Mass. Vols.

names in this connection. Suffice it to say, that whilst many discountenance *in toto* the use of the article either in camp, on the march, or in hospital, the majority of the surgeons with whom I have conversed prefer to have a moderate supply always at hand and subject to their order. It is undoubtedly valuable as an adjunct to the armament of the medical officer in many cases, and sometimes indispensable; yet the doubt has often been expressed by the most thoughtful, whether, on the whole, it has not been productive of more evil than good even in the hospital. For men after exhausting marches, or severe duty of any kind, it would be undoubtedly often very useful, were it not that we have in coffee or tea — especially the former — a better 'renewer of life,' and entirely free from the objections which are so great against all kinds of alcoholic stimulants." [1]

17. "From my own observation, I judge the effect of alcoholic stimulus on soldiers to be pernicious; it causes a temporary increase of vital force, which is followed by a greater depression and increased liability to disease." [2] Surgeon Heise's opinion.

18. "Although a 'temperance man,' I have always used whisky liberally with my men, — using a barrel in my regiment during a march. My testimony is unequivocally in favor of its judicious use — say an ounce twice daily to the most weary on a march." [3] Testimony of Surgeon Sanborn.

19. "In bad weather, or when exhausting duties were required, I have observed the very best effects from a toggle of whisky; but I have seen nothing to convince me that the daily administration of the whisky ration would be desirable." [4] Surgeon Adams's opinion.

20. "In every instance under my observation the whisky ration has done more harm than good." [5] Testimony of Surgeon Gill.

The reader will note that, of the foregoing opinions furnished by twenty correspondents of the Commission, all but two, Nos. 14 and 15, are adverse to the whisky ration save during or after unusual exposure or exertions. A comparison of these opinions shows some discrepancy as regards the importance of alcoholic stimulants under the circumstances just stated; but, exclusive of the two medical officers referred to, the testimony is uniformly against their use otherwise than under judicious medical direction. Summary.

[1] Surgeon G. L. Andrews.
[2] Surgeon A. W. Heise.
[3] Surgeon J. E. Sanborn, 27th Iowa Vols.
[4] Surgeon Samuel L. Adams.
[5] Surgeon H. Z. Gill, Penn. Vols.

CHAPTER FIFTH.

EFFECTS OF A MALARIOUS ATMOSPHERE AS REGARDS PHYSICAL ENDURANCE. — AGENCY OF MALARIAL POISONING UPON DISEASES AND THE RESULTS OF SURGERY. — RELATION OF MALARIA TO THE DIARRHŒAL AND PULMONARY MALADIES OF THE CAMP AND TO SUCCESS IN THE CONSERVATIVE TREATMENT OF WOUNDS.

By ROBERTS BARTHOLOW, M. D., Etc.

TESTIMONY OF MEDICAL OFFICERS RESPECTING THE PROPHYLACTIC EMPLOYMENT OF QUINIA.

Slow and Insidious Absorption of Malaria as contrasted with Sudden Poisoning. — Two Forms of Poison. — Gradual absorption of Malaria, without Febrile Phenomena, due to the Poison not being Intense, to the Organism not being Susceptible, and to Hygienic Circumstances being unfavorable to its Speedy Absorption. — Effects of Malaria on Physical Endurance, without inducing Fever, shown by Lesions of Assimilation and by Lesions of Innervation. — Morbid Anatomy of Chronic Malarial Poisoning. — Symptoms denoting the Influence of a Malarious Atmosphere upon the Functions and Physical Endurance. — Danger from Intercurrent Diseases. — Tendency to Pneumonia, Diarrhœa, Phthisis, and General Dropsy. — Effects of Malaria manifested in Febrile Diseases, in Inflammations, in Intestinal Diseases, in Diseases of the Nervous System, and in Constitutional Affections other than Fevers. — Malarial Typhoid Fever. — Typhoid Pneumonia. — Development of Phthisis. — Relation of Malarial Poisoning to the Diarrhœal Maladies of the Camp. — Affections of the Nervous System connected with Malarial Poisoning. — Influence of Malaria on the Results of Surgery, as manifested in the Repair of Fractures and other Injuries; in Predisposing to Pyæmia, Hospital Gangrene, and Secondary Hemorrhage, and inducing a State confounded with Pyæmia (Pseudo-Pyæmia). — Case Illustrative of Interference with Repair. — Case Illustrative of Agency of Malaria in predisposing to Pyæmia.[1] — Conclusions. — Prophylactic Employment of Quinia. — Essay by Prof. Van Buren. — Testimony of Medical Officers.

The slow and insidious absorption of malaria contrasted with sudden poisoning.

The influence of malaria absorbed slowly and insidiously differs in some important respects from the sudden poisoning of the blood by large quantities. The first exhibits itself mainly in subjective phenomena, the second chiefly in objective phenomena. Indeed, it is worthy of consideration, whether or not the poison producing the two series of effects does not consist of two cognate but independent poisons.

[1] The agency of malarial poisoning upon the results of surgery and success in the conservative treatment of wounds, will be considered in the surgical volume, but the consideration of this topic is here appropriate, in so far as facts may tend to elucidate the influence of malaria on physical endurance and the resistance to disease. The effects which malaria produces without producing fever are alone to be considered in this section of the medical volume; the consideration of fevers attributable to malaria belongs to section second, which is devoted to special pathology. A considerable number of the correspondents of the Sanitary Commission bear testimony to the influence of malaria upon physical endurance and the resistance of disease, corroborating the views which are more fully set forth by Dr. Bar-

In regions where malaria is greatly rife, intermittent and remittent fevers are the common and obvious forms, varying greatly in severity, yet conforming to the type, but there are also various anomalous affections which may or may not be periodical. The distinction between these two forms of poison, or, if it may be preferred, two varieties in its mode of manifestation, is further shown in the action of the antidote quinia, which is much more efficacious in the regular than in the anomalous forms of malarious diseases. The question of the probably essential differences between these two forms can hardly be considered in the present state of our knowledge, much less definitely settled. There are, however, abundant reasons for believing that the gradual and long-continued absorption of malaria produces a series of phenomena clearly separable from those produced by the sudden saturation of the blood by the poison.

Every one accustomed to observe soldiers in our army must have seen those who, exposed to malaria, never suffered from the typical malarious diseases, or, in other words, never experienced any febrile movement induced by malaria, but whose whole organism manifested clearly enough the long-continued action of the poison. A similar condition of the interior and exterior organs of the body may be induced by attacks of intermittent malarious fever, the poison acting continuously in the interim without febrile phenomena.

Action of malaria irrespective of fever.

The gradual changes in glandular organs, in the blood, in the nervous centres, are those which are chiefly comprehended in questions 6 and 14,[1] but they must be studied from both points of view.

It will be proper then to consider, in the first place, the effects of a malarious atmosphere upon the physical endurance of men without the production of fever, and, in the second place, the agency of malarial poisoning upon the diseases and the results of surgery in the war, which includes both the gradual absorption of malaria without febrile phenomena, the anomalous, and the regular forms of malarious diseases.

tholow. This general statement is deemed sufficient without quoting the individual opinions which have been received. Dr. Bartholow's contribution was made in answer to the following inquiries contained in the Circular issued by the Medical Committee of the Sanitary Commission: "Have you observed any facts that show in what manner and to what degree a malarious atmosphere affects the physical endurance of men without inducing fever?" "What evidences have you observed of the agency of malarial poisoning upon diseases and the results of surgery in the war?" "Please to state facts respecting the relation of malaria to the diarrhœal and pulmonary maladies of the camp, and to success in the conservative treatment of wounds."—EDITOR.

[1] These numbers refer to questions contained in the Circular issued by the Medical Committee of the Sanitary Commission.

I.

IN WHAT MANNER AND TO WHAT DEGREE A MALARIOUS ATMOSPHERE AFFECTS THE PHYSICAL ENDURANCE OF MEN WITHOUT INDUCING FEVER.

Basis of the writer's observations.

This inquiry is involved in more or less difficulty, because it is not always possible to separate the influences of change in the mode and conditions of life, and the effects of constitutional vices, from the influences of malaria. Cases involving other agencies than malaria have been excluded from these observations, which are based upon experiences with troops, and upon forty autopsies made at Chattanooga and Nashville, chiefly the former.

The gradual absorption of malaria, without the production of febrile phenomena, may occur under three conditions: —

Conditions under which the gradual absorption of malaria occurs.

The poison not intense;

The organism not susceptible;

Malaria abundant, but hygienic circumstances unfavorable to its speedy absorption.

Variations in the intensity of the poison.

To variations in the intensity of the poison may be ascribed the effects which I have attributed to slow imbibition, or to differences in its essential nature. The intensity of the poison varies with the locality and with special telluric influences; but it is also greatly affected by population. A small party in a malarious district will suffer more than an army, a small army more than a large one, an isolated farm-house more than a village, a village more than a city. This variation in the intensity of the poison is exhibited in the great changes of type which malarious diseases undergo where the populations increase: intermittents and remittents gradually disappear; they are supplanted by a new form — the so-called typho-malarial fever, in which the typhoid disease is complicated with a malarial element; and, finally, typhoid fever, pure and unmixed, occupies the whole ground. Such a transformation has occurred in our large armies serving in malarious districts — typho-malarial fever prevailing, rather than periodical fever. This substitution, it must be remarked, is not altogether dependent upon change in the hygienic conditions incident to large collections of people, but much is due to antagonism of poisons, to the dilution of the malaria, to a wider surface to be acted on; and hence in individual cases it is less potent.

The manifestations of the poison when introduced into the organism would therefore seem to be due, not to a process of zymo-

sis or power of self-multiplication, but rather to the continual additions to the blood from the great storehouse of the malarious atmosphere.

Susceptibility to malarious poisoning varies greatly, of which our army is a striking example. All are not attacked with periodical fever when the cause is in full operation. This difference in susceptibility is due most probably to constitutional peculiarities. Some men, although saturated, as the *post-mortem* appearances sufficiently indicate, experience none of the febrile phenomena characteristic of periodical fever. This insusceptibility is again most instructively shown in those who have experienced these febrile phenomena for the first time since their discharge after four years' service, of which a number of examples have come under my observation recently. But these cases of insusceptibility to the poison are not cases of immunity, for all the facts go to show that there is a gradual accumulation of the morbific matter, and slow but serious alterations in the constitution of organs.

Variations in the susceptibility to malarious poisoning.

The third condition, however, is most powerful in favoring the slow absorption of the poison: malaria abundant, but its development into more active morbid effects hindered by improved hygiene. The hygienic improvements consist in the careful selection and drainage of camp sites, the use of prophylactics, as quinine, coffee, etc., suitable regulation of the hours of labor and drill, and sufficiency in quantity, variety, and excellence of the food. Vigorous health and attention to these hygienic rules are opposed to the reception of malaria, and, especially, are opposed to that molecular change in the solids and fluids which is necessary to the development of the periodic febrile state; but they are not effective in preventing the slow absorption of the poison, nor in preventing the secondary changes induced thereby.

Hygienic circumstances unfavorable to the speedy absorption of malaria.

The effects of malaria upon the physical endurance without inducing fever may be comprehended in two groups: —

Effects of malaria on endurance comprehended in two groups.

Lesions of assimilation;

Lesions of innervation.

The primary lesion, which is in the blood, is unknown; we can determine the agency of malaria only by its effects upon organs. These are sufficiently characteristic.

Lesions of Assimilation. — Under this head will be considered, objectively, the lesions of both primary and secondary assimilation.

Loss of, or capricious appetite; constipation alternating with moderate diarrhœa; leanness; loss of power; muscular fatigue; cardiac palpitations; bronzing of the integument; excessive excretion of the urates; unusual formation of the oxalate of lime; phosphatic deposits, etc.

Effects of these lesions.

Lesions of Innervation. — These are, also, considered objectively.

Moroseness, despondency, irritability; dullness of intellect; headache and neuralgic pains in the peripheral distribution of the fifth-pair; pains in the lumbar regions, in the calves of the legs, and in the soles of the feet; insomnia; paralysis, etc.

Effects of these lesions.

A man suffering from chronic malarial poisoning manifested by the foregoing signs and symptoms is peculiarly liable to attacks of intercurrent diseases, of which pneumonia is most frequent. Diseases are fatal under these circumstances, which ordinarily would prove quite amenable to treatment. Hepatic, splenic, and intestinal lesions are, however, the common affections attendant upon this state. They bear the same relation, indeed, to chronic malarial poisoning, that deposit, thickening, and ulceration of Peyer's patches do, to typhoid fever.

Liability to intercurrent diseases.

I will now proceed to describe the lesions of assimilation and of innervation, subjectively considered.

Morbid Anatomy of Chronic Malarial Poisoning. — The integument is bronzed, especially, in the regions of the face, neck, sub-axilla, arm, forearm, and outer side of thigh. This change consists in a pigmentary deposit resembling that of Addison's disease, and is to be distinguished from icterus, or the icteroid hue, which is probably from altered hæmatine.

Bronzing of integument.

Leanness does not amount to emaciation; the fat has largely disappeared, but the muscles retain their fullness. The muscular tissue is generally of reddish-brown color, tears more easily than in its healthy state, but its specific gravity is not lowered. The blood is fluid, but fibrinous coagula full of white corpuscles are found in the cavities of the heart and in the great vessels.

Lesions of nutrition and of the blood.

The chief and most characteristic changes are, however, to be found in the liver, spleen, kidneys, the lymphatic glands, and the intestinal glandular apparatus.

Changes in the liver, spleen, kidneys, lymphatic glands and glands of intestines.

The liver is large, of a pale reddish-slate or fawn-color, and its relative and absolute gravity are increased. It is firm to the touch and divides firmly; the faces of the divided parts are smooth and the edges sharp; the acini are small and indistinct,

Appearances of the liver.

and the interlobular substance is increased in thickness and development. This increase of the interlobular substance is either by development of its own substance, or, as is more probable, by the addition of new material, albuminous in character. This encroaches upon the vessels, or deposits take place in the walls of the vessels, lessening their calibre and diminishing the supply of blood to the lobules; hence the hepatic cells become pale and shrink, and fatty transformation finally occurs. This fatty metamorphosis I observed but in a single instance; the liver was small and very flaccid. The secretion of bile does not cease; the gall-bladder is well distended, but the character of the bile is changed; it is usually dark brown and tarry in consistence.

Corresponding changes occur in the kidneys. They are enlarged, their relative and absolute gravity being increased. They divide firmly. The cortical substance is whitish or fawn, and the cones of Malpighi are congested, purplish, and the papillæ red. The tubules are seen to be crowded with epithelial cells, and their walls are thickened. From the papillæ may be expressed a milky urine, which is loaded with the *débris* of cells. The change appears to consist primarily in the interstitial deposit of molecular albumen (albuminoid degeneration). Changes, not very definite nor uniform, occur in the supra-renal capsules; the most constant alteration seemed to consist in the relative increase of the cortical substance; but frequently they were not at all changed.

Appearance of the kidneys.

The spleen is also somewhat enlarged; its trabeculæ more distinct and tougher; the splenic pulp brick-red, firm and fleshy; the Malpighian bodies, much enlarged, are plainly seen in great numbers throughout the pulp.

Appearances of the spleen.

Very characteristic alterations are found in the intestinal canal. They vary in degree with the stage at which they are examined, but they are always capable of being demonstrated. At the earliest period the intestines are pale and transparent; the solitary glands are slightly enlarged, elevated and filled with a granular matter, albuminous and fatty; the follicles of Lieberkühn come into view by reason of a deposit of pigment in their epithelium, and are thickly strewn at the sites of the oval patches of Peyer; the villi are pale, their cells shrunken, and the basement membrane transparent (waxy). In the large intestines, a pigment deposit, greenish in color, takes place about the orifices of the tubular glands; the flask-shaped solitary glands enlarge, and their contents accumulate. *Pari passu* with these changes, the veins of the sub-mucous coat become more prominent.

Appearances in the intestinal canal.

Appearances in the lymphatic system.

The changes in the lymphatic system are found in greatest perfection in the mesentery. Its color is yellowish or fawn, and the glands are enlarged and prominent. Exteriorly the individual glands are red or purplish; interiorly they contain a central whitish, fawn-colored, or yellowish spot of variable size, sometimes solid and resisting, but frequently granular and cheesy.

Appearances in the nervous centres.

The alterations in the nervous centres are not easily followed. The brain is generally firm, pale, and resists decomposition remarkably. The specific gravity has appeared to me to be increased, although not considerably.

We are now prepared to study, as a whole, the influence of a malarious atmosphere upon the functions and the physical endurance of men.

Symptoms denoting effects on the functions and on endurance.

The alterations are very gradual, and as the *post-mortem* observations show, characteristic and important. The effects of these alterations are slowly developed, and hence the first departure from the standard of physical endurance is hardly observable. There is a gradual loss of power; fatigue comes from slight exertion, with hurried breathing and distressing palpitations; the senses are dull, the taste perverted; there are headache and neuralgic pains in the distribution of the fifth pair; the muscles, particularly of the back and calves, ache after moderate exercise; occasionally paralysis, more or less complete, of inferior extremities and altered sensibility, commonly occurring with indurated enlargement, smooth, shining and pitting slightly under firm pressure; the appetite is diminished or capricious; constipation occurs, and the stools are black or brownish, with alternations of diarrhœa which rarely consists of more than four successive stools; the urinary secretion is first increased, but soon diminished; there is an increased elimination of the urates, of the phosphates, and frequently of the oxalate of lime, and the urine is loaded with epithelium and the *débris* of cells; the bladder is irritable, and micturition frequent; the skin is harsh, dry, bronzed in various situations, and the hair has a dull, deadened appearance.

The effects attributed to general debility.

The man presenting these signs and symptoms is evidently *out of health and incapable of performing his duties;* but the specific lesions producing the morbid state are not always, not even frequently, recognized. The man is said to be laboring under "general debility," under which term he is transferred to the general hospital. Convalescence, from various acute diseases, is frequently classed in the same category, but a large

number of cases of general debility, the origin of which cannot be referred to an acute attack or to a specific disease of any description, are undoubtedly instances of chronic malarial poisoning.

The chief source of danger in this condition is the strong tendency to attacks of intercurrent diseases, of which pneumonia, camp diarrhœa, and pleuritis, are the chief. Camp diarrhœa should probably be considered as the natural termination, rather than an intercurrent disease. Pneumonia is the most frequent intercurrent disease.

Danger from intercurrent diseases.

Camp diarrhœa, phthisis, and more rarely ascites, general dropsy and uræmic poisoning, are the natural terminations of chronic malarial poisoning.

II.

THE AGENCY OF MALARIAL POISONING UPON DISEASES, AND THE RESULTS OF SURGERY IN THE WAR, AND ITS RELATION TO THE DIARRHŒAL AND PULMONARY MALADIES OF THE CAMP, AND TO SUCCESS IN THE CONSERVATIVE TREATMENT OF WOUNDS.

We have here to consider not only the gradual absorption of malaria, but the effects of distinct disturbance of the organism resulting from the imbibition of large quantities of the poison. These two classes of effects agree in this — that they both produce a degeneration of organs, closely assimilated to, if not identical with, the so-called *albuminoid or amyloid degeneration*.

Degeneration of organs analogous to, if not identical with, the albuminoid or amyloid, produced by malaria.

A number of factors enter into the agencies affecting the diseases and surgery of the war, each of which has its specific action, and is with difficulty separable from the others. Thus the scorbutic taint, diatheses, diet, habits of life, temperature, are factors as well as malaria. Although they cannot always be separated in the symptoms which they produce, it is nevertheless the fact that, generally, the influence of malaria is distinctive and can be clearly traced.

Agencies, in addition to malaria, affecting diseases and the surgery of war.

CLASSIFICATION OF DISEASES SHOWING THE EFFECTS OF MALARIA.

The effects of malaria may be traced in

The Febrile Diseases . . .	(Malarial Typhoid);
The Inflammatory Diseases . .	(Pneumonia, Pleuritis, etc.);
The Intestinal Diseases . . .	(Camp Diarrhœa, etc.);
The Constitutional Diseases .	(Phthisis, Hepatic, Splenic, and Mesenteric Diseases);
The Nervous Diseases . .	(Pain, Paralysis, etc.);
and in Surgical Diseases and Injuries .	(Pyæmia, Hospital Gangrene, Repair of Fractures and other injuries).

Modifications of typhoid fever, caused by malaria.

The modifications impressed upon typhoid fever by malaria, are so well recognized that a name has been invented to express the relation — typho-malarial fever. This term is faulty, in that it makes the malarial element the chief; the true relation might be better expressed by *malarial typhoid*. I have already adverted to the fact that as populations increase in malarious districts, typhoid supplants the intermittent and remittent fevers. During the transition period a mixed fever prevails; it is a typhoid fever with a malarial complication. To the signs, symptoms, and morbid anatomy of typhoid, are added the periodicity, the exacerbations, and the glandular implications of malarious disease. This is a common form of disease, often difficult to manage, lengthy in duration, and frequently fatal.

Malarial typhoid differs from unmixed typhoid in the character of the delirium which is more frequently wild than low-muttering, in having remissions and periodical exacerbations, in the bronzing or jaundiced hue of the integument, and in the frequency of a dysenteric and pneumonic complication. Many of the cases of so-called typhoid pneumonia, are nothing more than the malarial pneumonia of typhoid fever.

Peculiarities of pneumonia, caused by malarial poisoning.

The great danger of an intercurrent pneumonia in the progress of the degenerations caused by malaria, has already been alluded to. It is a common and fatal disease. Large portions of one or both lungs are usually involved. In autopsy No. 31, the pulmonary and costal pleura were adherent by recent lymph throughout their whole extent, the whole right lung was involved, passing to gray hepatization at the apex, and the left was deeply congested though still crepitant. The diagnosis in this case was entered by the ward surgeon, typhoid pneumonia; but the organs instead of being in the typhoid state were in the condition I have described as due to the long-continued action of malaria. In autopsies 9, 11, 12, 16, 20, 21, 26, 32, — deaths from pneumonia, — similar appearances were observed; the malarial element was strongly marked; the pneumonia being an accident merely in the onward progress of the malarial poisoning. In autopsy 35, the intercurrent disease was pleuritis; the right lung was collapsed, and the cavity occupied by 88 ounces of serum, and soft, yellowish exudation.

Agency of malaria in the development of phthisis.

Phthisis, as I have already remarked, is one of the natural modes of termination of malarial poisoning. In the large number of discharges throughout the war for "incipient phthisis," not due to hereditary tendency, nor feigned or factitious,

a considerable percentage had their origin in chronic malarial poisoning. The state of impaired nutrition which follows upon the albuminoid degeneration of organs, is particularly favorable to the deposition of ordinary tubercle; but the more usual relation of tuberculosis to the malarial state is the deposition of molecular albumen in the lung tissue — a lesion correspondent to that which has already taken place in other organs; but never, so far as my observation extends, anterior to the change in other organs. And this deposition is wholly independent of hereditary tendency. The subsequent changes which the deposit undergoes belong to the history of tubercle. It is probable that, whilst in many cases the albuminoid deposit takes on the characters of ordinary tubercle, or becomes the seat of calcareous degeneration, in other cases the albumen softens, and is metamorphosed and reabsorbed. Every hospital surgeon has observed in malarious subjects, presenting the rational signs of phthisis and the physical signs of deposit and consolidation, the rapid clearing up of the pulmonary tissue and the restoration to health, under favorable hygienic conditions.

Relation of malaria to diarrhœal maladies.

The relation of malarial poisoning to the diarrhœal maladies of the camp is capable of exact demonstration. The changes in the intestinal tract which I have described are easily excited into the morbid processes characteristic of camp diarrhœa. Chronic dysentery is a disease of tropical and malarious regions, and it is questionable, indeed, whether it ever exists in the same form as found in our army under any other climatic or etiological conditions. The initial change consists in the impression made by the malarial blood on the glandular apparatus of the intestinal tract.

Morbid appearances in the intestines.

The first point of departure from the healthy state is thickening, elevation, and prominence of the solitary glands, due to deposit or accumulation of secretion within their interior. The small intestine, which, in the early stages, is very transparent when held up between the eye and the light, will be seen studded with these glands from one to three lines in diameter. In the large intestine the same glands are enlarged, but are not so readily seen. Throughout the whole tract, but particularly in the ileum and cœcum the tubular glands are visible by reason of a pigment deposit in their epithelium. The villi are pale and their cells shrunken before the stage of hyperæmia comes on. The stage of congestion or hyperæmia succeeds this transparency of intestinal wall, and before it is fully developed the vessels are plainly visible through the mucous coat, arranged in a regular arborescent manner

throughout the submucous coat. In some cases the hyperæmia is considerable, the vessels are very full, and the mucous membrane becomes a deep port-wine color. This congestion corresponds to the stage of commencing ulceration. The ulcers in their incipient stage are established by the softening of the epithelium about the orifices of the tubular glands.

The progression in the morbid processes is well shown in autopsies 7, 9, 11, 12, 31, and 32, all of them deaths from intercurrent pneumonia. Beside the firmness of texture, the fawn color, and the increase of the interlobular substance of the liver, the brick-red color and fleshy consistence of the spleen, the pale, whitish, light yellowish, or fawn color of the cortical substance, and the congestion of the cones of the kidneys, there were "prominence of the solitary glands," "exceeding transparency" of the upper part of the small intestines, and "port-wine injection" of the lower part of the ileum, and "tubular glands visible" by their dark orifices in small and in large intestines.

The next step consists in slight thickening of the oval patches of Peyer; softening of the epithelial layer, the villi becoming cloudy, granular, and matting together; and the follicles of Lieberkühn appear as black points thickly strewn amongst the thickened glands. These patches become so soft that they may be detached by a stream of water directed against them, leaving the submucous layer exposed. The solitary glands ulcerate, their contents are discharged, and the excavations remain the centres of gradually widening spheres of ulceration. Similar changes occur in the large intestines. Ulcerations commence around the orifices of the tubular glands; the solitary glands become filled with a white granular matter (albuminous?) and burst, leaving an excavation or ulcer. Coincident with these changes, the submucous coat, largely supplied, as we have seen, with vessels, undergoes an extraordinary development, particularly in the large intestine, and for a time opposes the progress of the ulceration through the intestinal coats. The so-called exudation on the surface of the mucous membrane appears to me to be nothing more than a multiplication or proliferation of the epithelial layer.

The subsequent progress of the ulcerations belongs to the history of chronic dysentery.

Nervous affections dependent on malarial poisoning.

A class of cases yet remain to be discussed, whose connection with malarial poisoning is not so clear and definite as the preceding — certain affections of the nervous system. Pain, paralysis, hyperæsthesia, and anæsthesia, may all

accompany, and be dependent upon, chronic malarial poisoning. Hemicrania, tic-douloureux, pleurodynia, sciatica, irritable bladder, more or less definitely periodical, are often of malarial origin. Paralysis of the fore-arm, resembling lead-palsy, and loss of power in the inferior extremities, with abnormal sensations, have, in some instances, seemed to be also attendants upon malarial poisoning.

THE INFLUENCE OF MALARIA UPON THE RESULTS OF SURGERY IN THE WAR.

This part of the inquiry is involved in the same difficulty as the preceding, in that it is not always possible to separate the actions of various other morbific agents from the action of malaria. Scorbutus and crowd-poisoning have also been active, as well as malaria, in effecting changes in the organism, and hence the surgery of the war has been influenced by a morbid state compounded of these three conditions.

Scorbutus and crowd-poisoning associated with malaria.

Whilst improper alimentation has proved an exciting cause of diarrhœal and dysenteric complications, the food of the soldier has rarely been so deficient in the true proportions of the proximate and other principles as to produce scorbutus; nevertheless, a scorbutic taint, or dyscrasia, has existed in some instances, as in the case of the troops on the Chickahominy, on the South Carolina coast, and on the Lower Mississippi.

The influence of crowd-poisoning has been exerted everywhere, but the effect of this, as a cause of disease, has probably been overestimated; at all events, whatever influence it exerts has not been separated from the emanations of wounds and disease.

The most important agency in the compound morbid state induced by these poisons is unquestionably malaria.

Malaria the most important agent, anterior to wounds.

This opinion, however, is confined to the period anterior to the reception of a wound or injury, and, of course, anterior to the crowding of wounded and sick in hospitals. Then, new causes come into operation. It is proper, therefore, to study the action of malaria, in individual cases of wound or injury, in which scorbutus, crowd-poisoning, the organic emanations from wounded and sick, and the gaseous poisons developed by decomposing animal substances, could not enter to vitiate the results. The following conclusions are based upon instances of this kind that have come under my observation.

The results of surgery in the war have been influenced by malaria in respect to the following: —

In repair of fractures and other injuries;

In predisposing to pyæmia, hospital gangrene, and secondary hemorrhage;

In producing a morbid state confounded with pyæmia (pseudo-pyæmia).

Interference with repair of fractures and other injuries.

The altered state of the primary and secondary assimilation and of innervation, dependent upon chronic malarial poisoning, necessarily interferes with the process of repair. The blood contains an excess of fibrin and white corpuscles; the connective tissue is pale and lacking in nutritive energy, and the nervous force is weak and irregular. Hence the tendency to the production of degenerate forms, to suppuration, to decomposition of exudates, rather than to the production and organization of plastic material. The following case illustrates in an admirable manner this influence of malaria.

Illustrative case.

Captain J. B. W—— had served from the beginning of the war; was engaged at Shiloh, in the Vicksburg campaign, and in all the subsequent movements of the "Army of the Tennessee." During this period his general health was perfect, except a slight attack of intermittent fever, which lasted three days. He received, in one of the battles near Atlanta, July 22, 1864, a gunshot fracture of right femur at the junction of the middle with the lower third. He was immediately transferred to his home on East Walnut Hills, near Cincinnati, where he arrived on the 1st day of August.

The surgeon who examined the wound on the field removed a number of fragments, and adapted to the limb a modification of Hodgen's splint. After his arrival home, sand-bags and a weight were applied.

A profuse discharge of sanious pus continued for weeks. No attempt at union was discoverable after a period of more than six weeks. His strength meanwhile declined, and some bronzing of the integument of the face and upper extremities was evident; his appetite diminished, and there was a tendency to diarrhœa. Under these unfavorable circumstances, a violent chill occurred, followed by intense febrile excitement and profuse sweating. A chill occurred on the second day of a decided character; there were irregular chills during the day and night, and the fever, although it abated somewhat in the interim, did not intermit. The same phenomena continued. The discharge from the wound ceased, and its edges became dry and glazed. He had attacks of vomiting; his appetite failed, and his mind wandered.

There seemed to be no doubt that systemic infection or pyæmia

had occurred; but having observed many cases of this character due to malaria, the irregularity of the paroxysms being caused by the local morbid process, I hoped this case would prove to be one of remittent fever. Under this theory of the case, I prescribed quinia in large doses, and the result was most satisfactory. Recovery from the febrile state ensued promptly, the bronzing disappeared, and the fracture united.

I give the history of this case thus minutely, because I shall have occasion to refer to it further on. The important point to be considered in this connection is the *extraordinary rapidity with which union of the bone took place after the subsidence of the remittent attack*. It occurred in a few days, and *because* the malaria expended in producing the febrile movement could no longer interfere with the reparative process. Had not this fortunate critical event occurred, the course of this case would have been the course of thousands of similar ones: gradual wasting and emaciation; profuse suppuration and abscesses dissecting up the muscles of the thigh; closure of the femoral vein with a fibrinous coagulum and its subsequent degeneration; metastatic abscesses and death.

The action of malaria in predisposing to pyæmia, hospital gangrene, and secondary hemorrhage, is evident from what has preceded. In respect to gangrene and hemorrhage, the agency of malaria can hardly be separated from scorbutus and crowd-poisoning; but in pyæmia its agency is distinctive and peculiar. To appreciate this fact it is necessary to define with some precision the different morbid states comprehended under the term pyæmia. This term includes an acute disease, a chronic disease, and a metastatic disease. The successive symptoms of the first succeed each other with great rapidity; the chills are violent; the temperature is high; and the purulent depots are formed with extraordinary promptitude. In this acute form the blood is early poisoned; it deposits a peccant matter which rapidly proceeds to suppuration, but time is not afforded for the production of those transformations in the fibrinous clots of the veins, to which Virchow and his followers ascribe all the secondary changes. The peccant matter thus deposited in the interstices of organs is probably albumen in a molecular state, modified by the poison by virtue of a catalytic action. The tendency to this acute form of pyæmia is probably increased by overcrowding of wounded and by humidity; but it frequently occurs wholly irrespective of these conditions.

Acute pyæmia.

In the second or chronic form, the changes are very slow, and

may extend over several weeks or months. The veins are occluded, and are invariably found in the condition upon which so much stress has recently been laid, namely, the contained clot is found broken down into a puriform mass. This condition of the veins of the part explains the slow development of the pyæmic state. The poison can enter the organism only through the lymphatic system.

Chronic pyæmia.

In the third form, which is intermediate in duration between the first and the second, the formation of the purulent depots is chiefly, if not wholly, mechanical; clots are separated from the veins of the affected part and are deposited in the first set of capillaries, when the suppuration follows the ordinary laws. This is probably the only curable form of pyæmia. If the so-called *emboli* are not numerous, and if there exist no decided dyscrasia, the suppuration may be confined to a small area and may not prove fatal. Obviously, this form of pyæmia will prove more destructive if the vital powers have been lowered by malarial poisoning, by the scorbutic taint, or by other agencies.

Metastatic pyæmia.

There are many striking analogies between the morbid anatomy and the symptoms of acute and chronic malarial poisoning, and acute and chronic pyæmia. The essential difference in the two relates to the purulent depots of pyæmia. I have ascribed the formation of these depots in the acute form to the liquefaction of the albuminoid matter by a catalytic process. In the chronic pyæmia the deposits occur in situations different from the acute, through the agency of, and in connection with, the lymphatic system. The patient is in so much the more favorable condition for the production and subsequent transformation of these deposits, if his organs have undergone the changes of malarial poisoning.

The following case illustrates the agency of malaria in predisposing to pyæmia:

Case illustrative of the agency of malaria in predisposing to pyæmia.

Col. —— Mihlotzi, —— Illinois Volunteers, was wounded in a skirmish at Buzzard's Roost, near Chattanooga, through the fleshy part of the arm, the ball lodging in the side. In a few hours after being wounded he was removed to the officers' hospital at Chattanooga, and was placed as the only occupant in a large airy apartment containing two large windows, two doors, and a fireplace. He had no scorbutic symptoms, was well nourished, was in excellent health, and had not been subjected to crowd-poisoning, nor to the organic emanations nor gaseous poisons arising from collections of wounded. Yet he died in forty-eight hours after the first chill. Malarial poisoning

was the only evident cause of the constitutional state favorable to the development of pyæmia — for he had suffered from time to time from attacks of intermittent fever. The wound was a simple flesh wound, and the ball was extracted from the parietes of the abdomen, not having penetrated to the viscera.

Hospital gangrene and secondary hemorrhage occur under very much the same conditions as pyæmia.

Hospital gangrene and secondary hemorrhage.

The hospital gangrene, so-called in our army, has existed under two conditions:

Hospital gangrene, a contagious malady propagated as other contagious maladies; at first local, but followed by constitutional symptoms;

Hospital gangrene, a sloughing condition of wounds due to constitutional causes, and wholly independent of the preceding.

It is in the last only that the morbid state or dyscrasia, compounded of malarial poisoning, scorbutus, and crowd-poisoning, is the origin of the local trouble. The former may be much aggravated by these constitutional causes, but may exist under the most favorable hygienic conditions. The latter will be much more destructive if there is superadded to the local morbid process the specific poison of the former.

The agency of this compound morbid state, and especially of malaria, in the production of gangrene and secondary hemorrhage was well exhibited in eleven hundred (nearly) wounded from the assault on Fort Wagner, received in M'Dougall General Hospital, Fort Schuyler, N. Y. Nearly every wound had the sloughing character, and hospital gangrene, so-called, was developed in about eighty cases. These patients had served in the malarious atmosphere of the coast of South Carolina; they had suffered from prolonged heat and great fatigue, and a scorbutic taint was presumed to exist. The malarial cachexia was the chief, for they presented in perfection the objective signs of that state, whilst the other morbific states were much less distinctly or not at all evident.

An attack of intermittent or remittent fever in the progress of a gunshot wound or injury is with difficulty diagnosticated from pyæmia. There can be no doubt that the two are frequently confounded, and that patients die who might be saved by a vigorous early use of the antidote.

Diferential diagnosis of intermittent or remittent fever and pyæmia.

The case of Captain W—— proves this. The cessation of the discharge and the glazed appearance of the wound; the irregularity of the chills and febrile exacerbations; and the profuse sweats, all indicate pyæmia. If all these phenomena are associ-

ated with the peculiar bronzing of the integument characteristic of chronic malarial poisoning, the difficulty of making a correct diagnosis is much increased, for such an appearance of the integument is also characteristic of pyæmia. It is not safe nor proper to rely upon the irregularity of the paroxysms as evidence that the febrile attack is one of pyæmia, for, as we have seen, this irregularity is also attendant upon a remittent fever in a case of gunshot wound. It is probable that the process of suppuration modifies the objective phenomena of the malarious fever.

Frequency of periodical fever in traumatic cases.

It has seemed to me that these cases of periodical fever, occurring as accidents in traumatic cases, have been more numerous than is generally supposed. Several have occurred under my observation in hospitals, but these are excluded in this inquiry for the reasons I have already indicated. The instances of supposed recovery from pyæmia, under the use of some favorite or fashionable remedy, have seemed to me to be cases of malarious fever, an accidental complication, and not the result of the local lesion.

CONCLUSIONS.

1. Malaria affects the physical endurance of men without inducing fever, by a gradual change in the constitution of organs — the albuminoid degeneration. This acts first by impairing the primary and secondary assimilation, and thus inducing loss of power or "general debility"; and second, by predisposing to the occurrence of various intercurrent diseases.

2. Upon the alterations characteristic of chronic malarial poisoning are largely dependent the diarrhœal and pulmonary maladies of the camp; so much so, indeed, that these diseases may be considered as natural modes of termination of the long-continued action of malaria.

3. The degeneration of organs induced by malaria affects the results of surgery in the war by preventing the repair of fractures and other injuries, and by predisposing to pyæmia and hospital gangrene.

PROPHYLACTIC EMPLOYMENT OF QUINIA.

Essay by Professor Van Buren.

The attention of medical officers of the army was called, early in the war, to the employment of quinia as a prophylactic against malarious diseases, by an essay from the pen of Professor Wm. H. Van Buren, which was published and widely circulated by the Sanitary Commission. In this essay, Prof. Van

Buren, in addition to his own extensive experience, adduces testimony by physicians of this country, and the evidence afforded by the British Army and Naval Medical Reports, of the efficacy of quinia, in small or moderate doses, in preventing fevers and other diseases into the causation of which malaria enters.[1] It is well known that, during the war, quinia was extensively employed as a prophylactic. Of its inefficacy no testimony has been received by the Commission. Several correspondents have testified to its efficacy, and the statements of some of these are subjoined.

Surgeon Isaac F. Galloupe writes as follows: —

Surgeon Galloupe's testimony.

"In my opinion almost complete immunity from malarial fever may be secured by the use of quinia. During my three years' service, all of which were spent in malarial districts, I never had a symptom of periodical fever, whereas all the other officers of my regiment, and nearly all with whom I became acquainted who were similarly exposed, had the disease, and one captain died of pernicious intermittent. As long as these officers followed my example they enjoyed immunity as well as myself, but in a short time they became careless and neglected the use of quinia. My practice was to take a dose of quinia at night. When not overworked, well quartered, and otherwise favorably situated, a dose of three grains is sufficient; but the dose must be increased according to circumstances. On a march, with no shelter at night, when exposed to the rays of the sun in extremely hot weather, or in rainy weather, ten grains may be necessary, and under unusual hardships two or three doses should be taken in the twenty-four hours."

Surgeon S. B. Thrall communicates the following facts: —

Surgeon Thrall's testimony.

"During August, September, and October, in 1863, at Vicksburg and vicinity, a grain of the sulphate of quinia, with two grains of cinchona, and an ounce of whisky, was given to every man in the regiment, soon after reveille, every morning. The men came up by companies, with an officer, and the 'bitters' were swallowed on the spot, each man taking his dose and no more. It was given by the hospital steward under my direction. During the time stated and the entire autumn we had three fourths less sick than any other regiment in the brigade, or division, and indeed, in the army corps. The difference in favor of our regiment was so marked as to cause an investigation, ordered from the head-quarters of the corps, and made by Lieutenant-Colonel Summers, medical inspector. I attributed the difference chiefly to the above stated prescription, and to the method of its administration. I am not aware that so efficient a method was resorted to in any other regiment."

[1] Vide *Military Medical and Surgical Essays*, prepared for the United States Sanitary Commission, edited by Wm. A. Hammond, M. D., Surgeon-General U. S. Army, etc.

Surgeon F. H. Milligan offers the following testimony: —

Surgeon Milligan's testimony.

"Quinine, with whisky, in five-grain doses, administered at sick-call, under my observation, has done much to prevent malarial diseases."

Prof. Paul F. Eve says, —

Professor Eve's testimony.

"I can testify to the efficacy of quinia in preventing intermittent fever, without being able now to do more than make this general statement. The quinia was given in from one to three-grain doses, repeated every four or six hours."

The following statement is made by Surgeon C. C. Jewett: —

Statement by Surgeon Jewett.

"The employment of quinia as a prophylactic is of unquestionable utility. I have given it, with great satisfaction, to every variety of subject, as far as the vigor of the system is concerned, and in highly malarious districts. In no instance has my confidence in its protective efficacy been impaired by the result. My usual mode was to give it in solution, a drachm, containing two and a half grains of the salt, being a dose, which was to be taken three times daily. 'Going to surgeon's call, and getting the strong solution,' became so much a matter of routine in the 16th Massachusetts regiment as to be a stereotyped joke with the men. The only cases of intermittent fever occurred among those who neglected to avail themselves of the prescribed prophylactic. On various occasions, being on my guard as respects malarious influences by unmistakable symptoms when soldiers were at work at certain picket stations or camps, I believe disease has been prevented by a rigidly enforced administration of quinia."

Surgeon Samuel W. Abbott says, —

Surgeon Abbott's testimony.

"I have used the sulphate of quinia successfully as a prophylactic through the summer and fall months, giving it often with the powder of capsicum in doses of two or three grains of the former, with two grains of the latter, twice or thrice daily."

Surgeon Wm. S. Willes gives the following statement: —

Statement by Surgeon Willes.

"From the use of quinine, as a prophylactic, I think I have seen decided good results. In the early part of the autumn of 1864 we were in Prince George County, Va., encamped near a large mill pond, the dam of which had been destroyed a short time before, and the pond was at the time dry. Here we had a large number of cases of intermittent and remittent fever. A prophylactic was used consisting of four or five grains of quinine, with about two ounces of whisky. This was given daily, and the cases of fever were markedly diminished."

Surgeon H. Z. Gill's testimony is as follows: —

Surgeon Gill's testimony.

"Quinine is valuable as a prophylactic, as well as a curative, agent. It seems to act more decidedly when combined with a stimulant, such as capsicum or whisky."

CHAPTER SIXTH.

VACCINATION IN THE ARMY. — OBSERVATIONS ON THE NORMAL AND MORBID RESULTS OF VACCINATION AND REVACCINATION DURING THE WAR, AND ON SPURIOUS VACCINATION.

By ELISHA HARRIS, M. D.

MEMBER OF THE UNITED STATES SANITARY COMMISSION, REGISTRAR OF VITAL STATISTICS AND CORRESPONDING SECRETARY OF THE NEW YORK METROPOLITAN BOARD OF HEALTH, ETC.

Vaccination of Volunteers delayed or neglected. — Revaccination generally neglected in Civil Life. — Much of the Vaccination in Civil Life not Effectual. — The Army Regulation. — Aid in Vaccinating the State Volunteers before they left for the Field. — Self-Vaccinations, Consequences of Marching, etc. — Efforts by Purveyors and the Medical Institutions in New York. — Amount of Small-Pox in the first Year of the War. — Results of Official Inquiry concerning Vaccination in New York, by Surgeon-General Vanderpoel. — Fifty Thousand Charges of fresh Virus supplied gratuitously by the New York Eastern Dispensary. — Analysis of Surgeon-General Vanderpoel's Returns. — Statistics of Vaccination; Ratio of the Protected to the Unprotected. — Experience in the Prussian Army; Benefits of Revaccination. — Importance of Genuine and thoroughly Protective Vaccination. — The Sanitary Commission urged and aided timely Vaccination, and insisted upon proper Precautionary Measures. — Amount of Virus supplied by the Sanitary Commission. — Spurious Vaccination. — Official Orders for Vaccination of the Troops of both Armies. — Early Appearance of Morbid Results of Vaccination. — Small-Pox and the Bad Results of Vaccination in St. Louis and the Mississippi Valley. — Scorbutic and Unhealthy Conditions. — Surgeon Ira Russell's Account of Cases at St. Louis. — Surgeon White's Cases and Conclusions. — Wide-spread Diffusion of the Inoculations. — Inquiry and Personal Inspection by a Committee of the Surgeons of St. Louis. — Prevalence of the Morbid Effects of Vaccination and of Spurious Vaccination. — Professor Hamilton's Observations after the Battle of Murfreesboro. — Testimony of Surgeons Hunt, Dwyer, Cook, Batman, Stevenson, Houston, Galloupe, Williams, and Grove. — Self-Vaccination of Soldiers from Foul Sores. — Experience among Prisoners at the North. — Experience in the Confederate Army. — Dr. Habersham's Report. — Dr. Ramsay's Report. — Dr. Crawford's Testimony. — Pathological History of Spurious and Impure Vaccination. — Jenner's Views; his Evidence before Parliament, and his *experimentum crucis*. — Sources of Impaired or Spurious Virus; Scurvy, Sero-Purulent Matter, Inoculation by Specific Infections, Deterioration of the Genuine Virus, and Destruction of the Virus by Heat. — Conclusions. — Vaccination to be proved by Revaccination at Enlistment. — Virus from Men in Camp and Hospitals not to be used. — The Results of Spurious Vaccination the same now as in Former Time. — Virus from Unhealthy Persons not to be used. — The Diseases which may be Inoculated. — The Syphilitic Poison may be Inoculated. — Vaccination to be performed when the Person to be vaccinated is Healthy. — History of Vaccination in our Armies confirms Jenner's Doctrines.

In each campaign and under each successive levy during the war, great numbers of volunteers hurried to the field, or were gathered in crowded rendezvous or transports, without being protected against small-pox. In none of the States had there existed,

for many years previously, any adequate regulations for encouraging or enforcing vaccination, and in but few States did the local military authorities succeed in vaccinating their volunteers previous to departure for the field.

Vaccination of volunteers delayed or neglected

Revaccination was never generally advocated, nor has its importance been appreciated by our American physicians, though experience in our national army in times of peace had proved its importance, and careful observations in civil life have abundantly confirmed the conclusions which have been reached in England, France, and Prussia, in regard to this duty. The fact must also be mentioned that the good rules laid down by the immortal Jenner, in regard to the essential conditions to genuineness and full efficacy of vaccination, have for many years been grossly neglected by the medical profession. Hence it turned out during the late war, both in the national and the insurgent armies, that vast numbers of men who supposed themselves protected from small-pox, really had never received a genuine vaccination, while a still greater number of men had never been vaccinated at all.

Revaccination generally neglected in civil life.

Much of the vaccination in civil life not effectual.

The Army Regulations always required that every soldier should be vaccinated,[1] but that good rule was not effectually applied to the volunteer forces. The causes of its omission, or for delay of the duty until the volunteer recruits reached the lines of the army, or some distant or central rendezvous, were such that, in many instances, it became the duty of the Governor or the Surgeon-General in each State to offer such aid as they could to secure the early vaccination of recruits in the State, and to encourage the surgeons of regiments to keep up the work of vaccination after reaching the field, until every man should be effectually protected. It likewise became a duty of the U. S. Sanitary Commission to encourage and aid such efforts of the regimental surgeons.

The Army Regulation.

Aid in vaccinating the State volunteers before they left for the field.

In the military rendezvous, in the encampments, and in the successive campaigns, and along all the great thoroughfares of armies, there were frequent outbursts of small-pox, and so anxious were the soldiers to procure the coveted boon of protection from the contagion, that they not unfrequently anticipated the work of their medical officers by vaccinating themselves, from arm to arm, or by means of dissolved, and, sometimes, decaying crusts. But the Medical Bureau made very great efforts to supply pure lymph and fresh crusts to the medical officers; and

Self-vaccinations, consequences of marching, etc.

[1] See *Revised Regulations for the Army of the United States*, Article XLIV., Section 1263.

the Purveyor-General in New York kept up as large a stock of good virus as the public dispensaries and private practitioners could supply. Yet, in the remote lines of the army there were occasions when an adequate supply of fresh virus could not be obtained as soon as wanted, or there were some occasions when none but deteriorated crusts, or dubious sores which came from inoculation by them, could, for weeks, be obtained.

Efforts by purveyor and the medical institutions in New York.

These few statements concerning the adverse conditions that attended the efforts to protect the armies against small-pox, properly precede the observations now to be recorded regarding the normal and the morbid results of vaccination of the volunteers during the war.

In the first two years of the war there were 4132 cases of variola and varioloid officially reported to the Medical Bureau from the regiments in the national forces; and, in addition to these, there were nearly or quite as many more cases of the disease that were not returned to the Bureau in the lists of hospital admissions; that is, the outbreaks of small-pox in hospitals did not, during that period, enter into the bureau records of the contagion, except in certain fatal cases; again, there were many cases of the disease, fatal and otherwise, among recruits at the temporary depots for the volunteers in the several States, which at that period of the war never were officially returned. The total number of deaths from small-pox in the army in the first two years was 1544. Nearly a million of enlisted men were called into the military service during those two years. It is plain, therefore, from the great number of men exposed, that, considering the vast number of outbreaks and the widely distributed operation of the contagion, there was a creditable degree of vigilance and effort on the part of the medical officers to arrest the progress of infection when it confronted them in camp.

Amount of small-pox in the first year of the war.

It is important that we should notice in this place facts that will show what percentage of the volunteers were actually susceptible to small-pox and to the vaccine virus. In the absence of a final analysis of the returns that have been made to the Medical Bureau relating to this point, perhaps the most trustworthy data now available are those which we find in the first Annual Report of Dr. S. Oakley Vanderpoel, Surgeon-General of the State of New York, in January, 1862. We quote that excellent officer's observations on this subject, both with confidence and pleasure, for he made great efforts to procure ample

Results of official inquiry concerning vaccination in New York, by Surgeon-General Vanderpoel.

supplies of fresh and genuine virus, and to inculcate the duty of vaccination immediately upon the enlistment of men. During the first eight months of the war he supplied, by aid of the Eastern Dispensary of New York, upwards of fifty thousand charges of fresh and genuine vaccine lymph. The official returns to the State records, concerning the vaccination, could not be complete, but it is presumed that upon so large a scale the few returns that were made would represent with tolerable correctness the general results.

Fifty thousand charges of fresh virus supplied gratuitously by Eastern Dispensary.

The total number of complete official returns made by surgeons upon vaccinations performed under General Vanderpoel's order of May 12th 1861, in the first six and a half months of the war, was 9248

Total number of the vaccinated who exhibited some evidences of previous vaccination 7586

Number out of the 9248 that were proved susceptible to the virus 2403

Number susceptible in the 7586 who exhibited evidence of previous vaccination 1551

Thus it appears that 26 per cent. (25.9 per cent.) of the entire number of recruits vaccinated and revaccinated were susceptible to the virus; while 20 per cent. of the class of men that presented evidences or scars of former vaccination proved to be susceptible to the full operation of the virus.

Analysis of General Vanderpoel's returns.

The same returns show, in regard to the ages of the successfully revaccinated persons, that the resusceptibility seems to have been nearly as completely established in the period between 18 or 25 years as in the later periods of military ages.

In regard to the classes of the population upon whom these returns of vaccination are based, it is believed they fairly represent the highest average that could be found in the armies, North or South, as regards the proportion of the men who were fully protected by early and genuine vaccination. And were we to compare these few statistics, and the conclusions above given, with similar experience in vaccination and revaccination in the European armies, we would find that these observations of the New York surgeons are in harmony with observations abroad, especially as regards the renascent susceptibility of a certain proportion of any great number of adults who were vaccinated in childhood.[1] In the

[1] Readers who desire to consult good authorities on this subject are referred to *Papers on the History and Practice of Vaccination*, by John Simon; the *Report on Small-Pox and Vaccination*, by the Epidemiological Society of England; and Prof. Heim's *Report on Vaccination*.

Prussian army, where every soldier is revaccinated, there were upwards of a million revaccinations in a period of twenty years, prior to 1855, and during all that period only four cases of variolous disease occurred in the men who had been successfully revaccinated or perfectly vaccinated, and only two cases, on an average, occurred each year in all the Prussian army during the same period of twenty years. But, we are informed, previous to the adoption of the practice of thorough revaccination in that army, and while its soldiers enjoyed all the benefits of infantine vaccination, — which has been compulsorily and very thoroughly performed in that country the past fifty years, — the deaths by small-pox averaged about one hundred annually. And in the armies of Bavaria and Wurtemburg there has been a similar experience of the greatly increased protection by revaccination. Unfortunately, in the American armies, revaccination has not been enforced. But wherever, in the late war, the regiments were effectually vaccinated under military orders, or by voluntary efforts of the surgeons all the men submitting to the same process regardless of previous vaccinations, such soldiers successfully resisted the variolous contagion, however much they were exposed to it. In the course of such thorough vaccinations, we have known a completely pock-marked man exhibit a normal susceptibility to vaccinia; while, on the other hand, deaths from small-pox were reported in soldiers who had acquired the marks of that contagion in childhood. Thus has been shown the importance of offering to every person the prophylactic virus of vaccinia, and of repeating that offer to every one who is past the period of adolescence, regardless of the marks of previous vaccination, or even of small-pox itself. This view of the utility of the more thorough application of the vaccine virus and of revaccination has been very convincingly set forth by Messrs. Marson, Ceely, and John Simon, of England, and by numerous continental observers; and, unless we wholly misinterpret the experience of our American armies in regard to the causes that led to the constantly repeated outbreaks of small-pox and the extensive and calamitous prevalence of foul ulcerations and spurious results of ill-timed attempts at vaccination, the vital importance of a strict adherence to the Jennerian principles, in all that pertains to the proper application of the prophylactic virus of kine-pock, has been abundantly illustrated in both great armies in the late war.

Statistics of vaccination; ratio of protected to unprotected.

Experience in the Prussian army. — Benefits of revaccination.

Importance of genuine and thoroughly protective vaccination.

The United States Sanitary Commission was very early im-

pressed with the importance of adequate regulations and means to prevent the spread of small-pox in the army. In July 1861 its medical officers reported the necessity for immediate improvements in the means and the methods of care and transportation of soldiers sick with the disease; and at the same time the Commissioners began to supplement the supply of fresh vaccine virus to military surgeons. The quantity of vaccine lymph, of genuine quality, thus supplied by the Sanitary Commission during the war was equal to about 300,000 points or vaccine charges. But one of the most essential aids rendered by the Commission in promoting timely and proper vaccination in the army was effected by the publication of a monograph on the subject, which was specially prepared to meet the exigencies of the occasion, by Professors Alfred Stillé and Francis Gurney Smith of Philadelphia.[1]

Sanitary Commission urged and aided timely vaccination, and insisted upon proper precautionary measures.

Amount of virus supplied by the Sanitary Commission.

SPURIOUS VACCINATION.

In the autumn of 1863 small-pox began to be unusually prevalent at many points throughout nearly the entire extent of the army lines. The troops in the Mississippi Valley suffered most. And, since the close of the war, we learn that at the same time, and earlier, the Confederate troops, as well as the civil population in the Southern States, were scourged with that contagion even more severely than the loyal troops of our Northern States.

Orders for general vaccination were promulgated throughout the armies; extra supplies of dried lymph, in one form or another, were laid in store and forwarded to the military depots and encampments; and during the autumn of 1863 and winter of 1864, there were more persons vaccinated in the United States, than ever before in the same length of time.[2]

Official orders for vaccination of the troops in both armies.

During the summer and autumn of 1863, soon after the battle of Gettysburg, the fact was reported that Federal prisoners in Libby Prison, at Richmond, had, in some instances, been inoculated by syphilis or foul matter by vaccination. And immediately

[1] *Vaccination in Armies:* Document E, Medical and Hygienic Monographs, published by U. S. Sanitary Commission.

[2] In the autumn of 1862, and subsequently, the Surgeon-General of the Confederate army ordered the general vaccination of all soldiers in the southern forces. He appointed Superintendents of Vaccination, who, interpreting the orders literally, undertook, in many instances, to revaccinate or apply the virus primarily to every man. The execution of those orders was a difficult task in the face of the blockade and the widely scattered population. Shut up to their necessities, the southern surgeons resorted to such virus as they could obtain from the vaccinated soldiers, who too often were not in a suitable hygienic condition to furnish vaccinia of normal prophylactic endowments.

after the war, the writer ascertained, while visiting that city, that as early as January and February, 1863, the Confederate medical officers had been vexed by the frequent occurrence of obstinate inflammation and sores upon recently vaccinated arms. As the evil rapidly increased during the winter of 1863–64, and subsequently in almost all divisions of the southern troops, it would be unwarrantable for us to entertain any suspicion of intentional fault on the part of the physicians who vaccinated the inmates of rebel prisons. During the subsequent year, at Camp Douglass and Rock Island, Illinois, similar results followed the vaccinations of southern prisoners in Federal prisons.

Early appearance of morbid results of vaccination.

In the month of December, 1863, in the presence of small-pox, at St. Louis, Mo., and at several points where small-pox had gained foothold in the vicinity of great bodies of soldiers in the Mississippi Valley, vast numbers of men were speedily vaccinated. Difficulty in procuring adequate supplies of fresh vaccine lymph from infants and healthy persons, through medical purveyors and otherwise, led to the general practice of vaccinating from arm to arm among the soldiers in camps and hospitals; and throughout the West and Southwest, most of the vaccine lymph and crusts were derived from the soldiers themselves.

Small-pox, and the prevalence of bad results of vaccination in St. Louis and the Mississippi Valley.

The unhygienic condition and prevailing scorbutic cachexia, from which the army in that region was then suffering, we will have occasion to notice hereafter. Let us first examine the history of the vaccinations and abnormal results at the period here mentioned. A great number of distinct records of the abnormal and spurious phenomena, ensuing upon vaccinations, could be adduced in this place, but for the sake of brevity and the importance of a few perfect examples, let the following illustrative instances suffice.

Scorbutic and unhealthy conditions.

The Experience at St. Louis, Mo. — During the autumn of 1863, in the encampments and barracks near St. Louis, it was observed that erysipelatous inflammation, frequently followed the operation of the vaccinator. For example, Dr. Ruge, the surgeon of a colored regiment, numbering eight hundred men, vaccinated all of them with virus obtained from the medical purveyor. A large proportion of those soldiers thereupon became the victims of phagedenic ulcerations, and in the course of a few weeks the small-pox contagion was introduced, and spread among those men regardless of their sores from the vaccinator,

An instructive series of morbid phenomena at St. Louis.

thereby proving that they had been vaccinated with a spurious and probably a dangerously deteriorated virus. About the same time the 9th Iowa Cavalry, a freshly recruited and very vigorous body of men, arrived at Benton Barracks, near St. Louis, with many of the command yet unvaccinated. The surgeon of the regiment had already procured lymph from New York, and was proceeding with his vaccinations, when appeared erysipelas, troublesome inflammation in the arm, and glandular swellings. And from these sore arms men frequently vaccinated themselves. Large phagedenic ulcerations speedily ensued. Small-pox spread in the regiment regardless of the vaccinations, and only those who had previously been vaccinated, and could exhibit good vaccine scars, escaped the variolous contagion.[1] Dr. Wasson, the regimental surgeon, has stated that several deaths occurred among his men, as a direct result of the foul inoculation thus introduced.

Disability and fatal results produced.

In some of the colored regiments there were similar and even worse results. Surgeon Ruge reported that out of eight hundred negro soldiers vaccinated by him in a certain regiment, about one hundred of them resulted in phagedenic ulcers, and that small-pox made a fatal sweep through his regiment subsequently. Such events created deep anxiety in the minds of medical officers. Fresh virus was procured from New York and elsewhere, and a new and genuine stock of it was created by the aid of healthy colored children in St. Louis.

About the middle of December, 1863, there commenced, in the General Hospital at Benton Barracks, such a series of events in vaccination, and in the morbid results from it, as seemed, at last, to determine the true causes of the accidents that had, for the time, baffled the medical officers, particularly in regard to a class of obstinate sores that was generally accredited to syphilitic inoculation by contaminated vaccine matter. The history of these cases is recited as follows by Surgeon Russell, who became chief medical officer at Benton Barracks, immediately after this class of sores began to be prevalent there. We quote Dr. Russell's words: —

Surgeon Ira Russell's account of the St. Louis cases.

"About the middle of December, 1863, the patients in General Hospital at Benton Barracks, were vaccinated in the following manner: The surgeon in charge directed Dr. Klüber, the acting assistant-surgeon in charge of Ward E, to vaccinate the patients of his ward from the arm of a patient who appeared to have at that time — the eighth day from his vaccination — a

[1] *Notes on Spurious Vaccination*, contributed by Surgeon Ira Russell, U. S. Vols. Also, *Remarks on Impure Vaccination*, by Dr. Hammer, in *Transactions of St. Louis Medical Society*, 1865.

genuine vaccine vesicle. The duty was performed as ordered, and the vesicle was excessively drained. The next day the same man was ordered into another ward for similar service, with his then irritated arm, and all the occupants of that ward received a charge in their arms of what was presumed to be vaccine lymph. The succeeding or third day, the same man was taken into another ward, and lent his inflamed and now purulent vaccine sore to the patients there. This was the tenth day after his own vaccination. In successive days he was still kept moving through the remaining wards for the same unfortunate service to his comrades.

No bad results followed the vaccination in the patients who received the first charges of virus the first day in Ward E, and, as subsequent inquiries proved, there was no abnormal result produced in any arm except in the men who received inoculation from the purulent matter which the constantly teased vesicle and sore supplied, after fifty or more arms had been vaccinated. The greater part of all who were vaccinated after the first day, or the eighth of the stock vesicle, suffered much from local inflammation, obstinate ulcerations, and lymphatic inflammations and swellings. Suppuration frequently ensued in the axillary region, and in some instances there were severe constitutional symptoms resembling those of pyæmia. Ecthymatous eruptions appeared upon the vaccinated arm and elsewhere, and when that class of pustules degenerated into open sores, the edges were ragged, and the ulcerations were exceedingly obstinate. These characteristics led several of the surgeons, who had the care of that class of patients, to conclude that the morbid phenomena were attributable to syphilitic inoculation."

We have been informed by Dr. Russell, who observed these obstinate sores, and we have ascertained from other witnesses, that early in the winter (1863–64) immediately following the events just recited, small-pox spread through the wards of the barracks' hospital; and that while it wholly spared all the inmates of Ward E, where the first day's work of vaccination was performed, the other patients — even those with arms worst scarred and ulcerated by their recent inoculation — took the variolous contagion and were transferred to the small-pox hospital. The following cases, quoted from the records of Surgeon White and Surgeon Russell correctly illustrate the history of these vexatious results of faulty vaccination. And we must here premise that Surgeon White was a firm believer in the hypothesis of a syphilitic origin of the abnormal sores: —

Surgeon White's cases and conclusions.

I. Richard Lambeth, private in company G, Thirtieth Illinois Infantry, aged 18 years, native of Iowa, was vaccinated in Ward

D, December, 1863. The point of vaccination on the arm was much inflamed, though a sore formed. But one week after vaccination he showed symptoms of variola, and was removed to the small-pox hospital, where he went through the disease safely. Permanent marks of the disease remained. The vaccinated points became seriously inflamed and ulcerated soon after small-pox had finished its course. They healed over during the early part of the spring of 1864, but about the first of May they opened again, and did not heal for some time. The treatment, from January to the 10th of April, 1864, was iodide of potassium, in doses of ten to twenty grains twice or thrice daily. Dr. Russell reports that there was sub-sternal tenderness during the entire period, and that the ulcerations on the arm were circular, the size of a dime, edges raised and centre depressed.

II. Sergeant Tiffany, company H, Ninth Minnesota regiment, was vaccinated December 25th, 1863, in Benton Barracks' hospital, from the arm of a female nurse, a very respectable lady, who had been vaccinated from one of the patients vaccinated by Dr. Klüber after the pustule from which he took the virus had become irritated and inflamed. This lady had a bad pustule which healed with considerable difficulty. About the middle of January the sergeant was examined by Surgeon L. B. Smith, who reports that the point vaccinated was then much inflamed, and about an inch below this point there was an abscess; several weeks after another abscess appeared, which was punctured and poultices applied; it readily healed.

The following cases are taken from notes furnished by Dr. White. All these cases can be traced to the man from whom Dr. Klüber and others vaccinated the patients in the several wards of the barracks' hospital. Many of them were vaccinated from Sergeant Tiffany, whose vaccination can be traced to the same source.

III. Berry was vaccinated from Sergeant Tiffany, and from him G. K. Ives, private of company H, 9th Minnesota Infantry Volunteers, aged 26 years; nativity, State of New York; complexion light; eyes blue; constitution robust; health always good; parents living. Admitted January 23d, 1864. Vaccinated January 6th, 1864. Sore circular, about the size of an American quarter, depressed centre, edges slightly raised. Glands of the axilla commenced swelling about eight weeks after vaccination; became very large; and continued about two weeks without suppurating. Throat became sore about one week after; being nine weeks after vaccination. Says he never had syphilis. Treatment same as in previous cases.

IV. Corporal of company H, Ninth Minnesota Infantry, aged 24 years; of a very robust constitution; dark complexion; hazel eyes; always healthy; without any scrofulous or syphilitic taint. Vaccinated at one point by drummer Stanley Reese, of same company, from his own arm, about the 13th day of January, 1864, at Schofield Barracks.

The vaccination became an open sore about ten days after, and remained open and indolent to April 1st, 1864; edges circular and raised, centre depressed. Treatment commenced about the 25th of January by Acting Assistant-Surgeon Ames, of the Seventh Minnesota Infantry. Pills of blue mass and opium, twice daily, were administered, and a solution of iodide of potassium given thrice daily, containing about five grains to the dose, until March 17th, 1864, when he was admitted into this hospital by order of Surgeon F. G. Porter, Medical Director of the district. He has been, from his admission to April 4th, 1864, treated as follows: Citrine ointment topically; a solution of iodide of potassium, ten grains thrice daily, internally; and a wash of the chlorate of potassa as a gargle for the soreness of the throat, of which he complained. Afterwards an expectorant was ordered on account of bronchial irritation and a troublesome cough.

V. A private, company H, Ninth Minnesota Infantry, aged 23 years; complexion light; eyes blue; nativity, Sweden. Admitted March 23d, 1864. Vaccinated from Ives's arm (III.) The glands of the axilla were swollen, a part of the time hard and painful; afterwards soft, but did not suppurate. Treated topically with tincture of iodine to axillary glands, and citrine ointment to vaccination sore.

VI. O. Barber, private, company H, Ninth Minnesota Infantry Volunteers, aged 22 years; nativity, New York; complexion dark; constitution robust; health good; mother died of consumption, father of dropsy. Admitted March 25th, 1864. Vaccinated January 1st, 1864, in two places; sores round, edges raised, centres depressed and cup-shaped. No swelling in axilla.

VII. Private, company H, Ninth Minnesota Infantry Volunteers, aged 19 years; nativity, Sweden: has been in America eleven years; complexion dark; eyes blue; constitution robust; health always good; parents living. Vaccinated January 15th, 1864. Admitted March 23d, 1864. Was vaccinated from the arm of Hammersberg, who was vaccinated from the arm of Barber, and the latter from the arm of Sergeant Tiffany; all of the same company. The glands of the axilla began to swell in about two weeks;

scalp tender. Vaccination sore not healed (March 31st, 1864), but rapidly improving; circular in form, and about one inch in diameter.

VIII. Corporal company H, Ninth Minnesota Infantry Volunteers, aged 24 years; of a very robust constitution; dark complexion; hazel eyes; always healthy, without any scrofulous or syphilitic taint. Vaccinated at one point by drummer Stanley Reese, of the same company, from his own arm, about the 15th day of January, 1864, at Schofield Barracks.

The vaccination became an open sore about ten days after, and remained open and indolent to April 1st, 1864; edges circular and raised, centre depressed. Treatment commenced about the 25th day of January by Assistant-Surgeon Ames, of the Seventh Minnesota. Pills of blue mass and opium, twice daily, were administered, and a solution of iodide of potassium given thrice daily, containing about five grains to the dose, until March 17th, 1864, when he was admitted into this hospital by order of Surgeon F. G. Porter, Medical Director of the district. He has been from his admission to April 4th, 1864, treated as follows: Citrine ointment topically; a solution of iodide of potassium, ten grains thrice daily, internally; and a wash of the chlorate of potassa as a gargle for a soreness of the throat, of which he complained.

Dr. Russell states that the cases here described are fair samples of hundreds of others that occurred under his observation during the last years of the war. He writes: "I have seen them in raw recruits, in men in new and in old regiments, in field and in quarters, in hospitals, and among 'contrabands' and refugees."

Wide-spread diffusion of the inoculations.

Dr. Hammer, a physician in St. Louis, and most of the members of the Medical Society of that city, saw the cases that occurred in Benton Barracks and in the various hospitals in the city. A committee of distinguished medical men was appointed to investigate the nature of the so-called syphilitic vaccinations among the soldiers there. Dr. Hammer, the chairman, reports that they stripped and carefully examined over two hundred men with the foul ulcers, and that "in all there existed sores spreading and indurated; but none had any symptoms of secondary syphilis. The sores existed in two forms, abscesses and eczema. . . . The committee concluded, from the examination, that this condition of the patients was produced principally by two causes — irregular and improper vaccination, and exercise. Many of the soldiers vaccinated themselves, employing for the purpose rusty pins, irregular incisions,

Inquiry and personal inspections by a committee of St. Louis surgeons.

Conclusions reached by the Committee.

etc. While the vaccination was progressing, they went to drill, exercising the arms. Eighty to one hundred negro soldiers in one regiment, under Surgeon Ruge, were affected in this way. . . . The treatment in these cases was simply to cut the undershirts and use lead water locally." [1]

The influence of scurvy and of erysipelas investigated by committee.

The class of cases last referred to by Dr. Hammer consisted of vigorous men in barracks; but the great majority of the patients in the General Hospital, previously described by Surgeon Russell and Surgeon White, were men already suffering from the dyscrasia of scurvy and malarial anæmia. Again, there existed in the 1st Iowa Cavalry regiment, and in the men who were inoculated with virus from the bad sores in that command, a kind of ulcerative poison that propagated its kind wherever applied. Opinion was divided upon the question whether it was a syphilitic ulceration, or a simple ulceration induced by an enthetic morbid poison resulting from vaccine crusts in a state of decay.[2]

[1] *Remarks on Accidents of Vaccination*, by Dr. Hammer, before the St. Louis Medical Society, June, 1865.

[2] Surgeon Sanford B. Hunt, U. S. Vols., and late Medical Director in the Army in the Southwest, has contributed the following important summary of evidence bearing upon this subject, and illustrating the true etiology of spurious vaccination: —

"Perhaps nowhere were the facts so closely and clearly aggregated as in the 'Northern Department' (of the Ohio). In March, 1864, that Department having just been organized, and consisting of the States of Ohio, Indiana, Michigan, and Illinois, the attention of the Medical Director, Surgeon Charles S. Tripler, U. S. A., was called to the prevalence of small-pox. The returns of his office show that in the various camps and prisons for insurgents in that Department, cases of variola and varioloid occurred as follows: —

	Variola.	Varioloid.	Deaths.
March	446	68	166
April	214	94	113
May	35	37	19
Total	695	199	298

"Thus one third of all cases attacked perished — a mortality unusual, and only to be referred to causes of an unusual nature, such as confinement to prisons and physical debility when attacked. Orders were at once issued to 'vaccinate and revaccinate' until all should be protected, and to report results. The reports received in reply can be briefly tabulated: —

Vaccinated Successfully.	Vaccinated Unsuccessfully.	Revaccinated Successfully.	Revaccinated Unsuccessfully.	Result not Stated.	Total cases of Vaccination.
1558	132	752	8025	4453	16,102

"A reference to the table of variola — to its reduction from 446 cases in March to 35 cases in May — will show the thorough success which attended this wholesale vaccination. The epidemic was *choked off*, absolutely abolished, by this energetic use of the protecting agency, and that in the presence of very unusual numbers of persons actually exposed. In the crowded barracks of a great prison, like the Rock Island Prison-barracks, containing 12,000 insurgent prisoners, the extent of the contagion must have been almost indefinite. But other facts, to be subsequently narrated in relation to this particular camp, prove that vaccination played a comparatively subordinate part, and that other means, especially seclusion, were vastly important in checking the spread of the epidemic. Small-pox is not contagious in its early stages. If the patient be secluded at the earliest period when the disease can be recognized by the scientific eye, another and an unprotected person can sleep in the same bedding with very little danger. We have seen this tested on a large scale.

"But so far our statistics show only another of the repeated conquests of vaccination. It has, however, another value. The vaccine crusts used were those procured in the usual manner from the

In forty-five cases which the writer examined in the 20th *Corps d'Armée* in which recovery from the sores resulting from vaccination in the summer of 1864 had occurred with cicatrization, no pathognomonic sign of the syphilitic taint was present, or had at any time existed, so far as the records and recollections of the medical officers are able to show, yet most of these sores had been treated as being of syphilitic origin, — iodide of potassium, combined with the bitter tonics, and a generous antiscorbutic diet, being the agencies employed for rescuing these patients from their cachectic condition.

PREVALENCE OF THE MORBID EFFECTS OF VACCINATION AND OF SPURIOUS VACCINATION.

Army of the Potomac comparatively exempt.

No circumstance connected with the records of spurious and morbid results of vaccination in the armies of the late war is more instructive than that of the extent and the distribution of localities in which this class of accidents occurred. In the army of the Potomac we saw comparatively little of this evil, though occasionally there was a series of obstinate sores from deteriorated lymph and from virus taken from injured and puriform vaccine vesicles. But that class of the causes of spurious and abnormal vaccinations never seemed to perpetuate itself. The

medical purveyors, just as good and just as bad as those which in the popular opinion were impregnated with syphilis. No information exists to prove that in the 16,102 cases in which it was employed any harm resulted. In the system of vaccination adopted it was used again and again on the same person. Thus we find it reported that 1558 primary vaccinations were successful, 'took well,' and run the regular course of the true pustule. 132 primary vaccinations were unsuccessful, and these were all revaccinated. Of successful revaccinations there were only 752, while of unsuccessful revaccinations there were 8075. It was assumed, and is probably scientifically correct, that when vaccinia runs its regular course the system was liable to variola; and, *per contra*, that when the system refuses to mature vaccinia, it will also refuse to receive variola. If this is correct theory, about 9 per cent. of people who have been at some time vaccinated are still exposed to the poison of variola, and the only safety lies in occasional revaccinations, designed to test the question whether the system is or is not open to variola.

"We come now to the developments as to spurious vaccination which resulted from this investigation. Small-pox was alarmingly rife at Rock Island Prison-barracks. The same orders sent to other camps and depots were sent to Surgeon John H. Grove, U. S. Vols., in charge at Rock Island. In reply, Surgeon Grove wrote that among the rebel prisoners there confined there was such a dread of spurious vaccinia, that to comply with the order he should be compelled to resort to force; and further, that this dread was justified by the very distressing results that had already obtained among them. He asked to be relieved from the order; and both he and his prisoners — although in the face of a great number of cases of variola daily occurring — preferred to take their chances without further protection. He further stated his belief that, with certain new hospital accommodations just constructed, he should be able to accomplish the suppression of the disease by seclusion, and that it would not extend much, if any, further — an expectation which was very speedily realized.

"It was determined, then, to leave this matter entirely to the discretion of Surgeon Grove, and consequently the vaccination was not enforced at Rock Island. He was instructed, however, to make an extended report on spurious vaccination. His report showed 1580 cases of bad ulcers among the rebel prisoners, directly traceable to vaccination, made from crusts procured as usual from the medical purveyors. Of these 1580 only 668 had at that time healed. Among the prisoners were also 846, not included in the above, who presented the scar peculiar to this ulcer, and who had acquired it from vaccination by rebel surgeons. So that in all we have 2426 cases of bad result, packed into one camp of prisoners, and passing under one observer."

medical purveyors furnished new supplies of healthy virus from the northern cities, and thereby prevented the repropagation of the enthetic poison of the morbid sores. In the West and Southwest, as already mentioned, the morbid phenomena attending vaccination were noticed early, and were perpetuated by repeated inoculation in successive series of men as they demanded vaccination. The foul sores resulting from such inoculation began to require official attention in the autumn of 1862, in the armies west of the Alleghanies, and, during the subsequent year after the campaigns for the season were nearly ended, this class of morbid results became wide-spread, and caused a great amount of disability. In the army under General Rosecrans there was much suffering from this kind of sores. Professor F. H. Hamilton, the medical inspector of that army, states that he found among the troops in Tennessee sores which were very obstinate, and, to a great extent, coexisting with the scorbutic dyscrasia; and that distinguished officer remarked that he was prepared to admit that in certain of the cases seen by him the results might have been due to the impurity of the virus employed.

Prevalence in the Southwest.

Army of the Cumberland.

Professor Hamilton's observations after the battle of Murfreesboro, Tennessee.

After the battle of Chickamauga many of the regiments were vaccinated, and, in most instances, with disastrous consequences. For example: the 154th New York Volunteers, when at Bridgeport, on the Tennessee River, in October, 1863, was vaccinated with virus — in crusts — obtained directly from the Medical Department at Washington, and, as we are informed by Dr. Day, the surgeon-in-chief of the brigade, the vesicles resulting from the vaccinations appeared to be normal, but before the crust was matured, or after it fell, they degenerated into foul sores, the axillary glands swelled and occasionally suppurated, and the patients became cachectic. In several well-attested instances this class of sores exhibited syphilitic characteristics; possibly, in some instances, they were the results of contaminated virus.[1]

Experience in Tennessee and Northern Alabama after the battle of Chickamauga.

[1] The following testimony, which we have obtained directly from surgeons in the field and in hospitals, bears directly upon the question of syphilitic contamination of the virus employed in vaccination in the army. Its weight is strongly in the negative.

Surgeon R. A. Dwyer, 175th Ohio Volunteer Infantry, says: —

"I never saw a case of vaccination that was syphilitic. I observed a great many that were of an erysipelatous character. There was severe constitutional disturbance. I vaccinated over one hundred and fifty in the second battalion, 2d Ohio Heavy Artillery, in 1864, with vaccine matter that I obtained from the Medical Purveyor in Louisville, Ky., and it was followed by such severe effects that I procured fresh virus from a respectable physician in Louisville (Dr. Hewitt), and it was followed by as severe effects as the other. There were not a half-dozen cases that run a natural course. . . . A good many had abscesses in the axilla, but in no case was there any syphilitic eruption on the surface.

Dr. Kendall, surgeon-in-chief of another brigade, states that while at Stevenson, Alabama, he saw cases of these ulcerations among citizens who had obtained their virus from Confederate sur-

I observed a great many citizens to be affected similarly. I think it was an atmospheric state that caused the irregularity. In the 175th O. V. I., in 1865, I vaccinated one hundred, and no irregularity occurred."

Surgeon G. M. Cook, 101st Ohio Volunteer Infantry, reports: —

"To a small extent, but through the whole period of three years, spurious vaccination gave rise to very grave difficulties among the troops of the 1st brigade, 1st division, 4th Army Corps, while at Ooltewah, Tenn., April, 1864, as well as to a number of citizens who were also vaccinated by surgeons of our troops. Many of these cases were unfit for duty during most of the campaign; having deep, chancroid ulcers, not confined to the place where matter was introduced, but with additional sores breaking out months later with all the virulence of the first sore, many times attended with constitutional disturbances, though not specifically of a syphilitic character, as was often mooted."

Surgeon B. F. Stevenson, 22d Kentucky Volunteers, says: —

"I think I have not observed any well-defined instances of the inoculation of syphilitic disease from vaccination. The cases alluded to were cases where, after vaccination, the arm operated on became much tumefied from the hand to the shoulder, and, in a few instances, involved the axillary glands. The swelling of the arm seemed to be confined to the cellular tissue entirely, and occasioned but little pain and no ulceration, except in one instance. The integument presented a greasy appearance, and communicated to the touch a doughy feeling and pitted on pressure. I observed no permanent untoward result from these cases, and have reached the conclusion that the tumefaction was caused by a strumous diathesis in all the suffering cases; aggravated, perhaps, by some impurity of the fluids; or a tendency to phlegmonous inflammation, to which soldiers are at all times very liable."

Surgeon Batman reports several men "vaccinated from matter procured from a young lady from Nashville, where she had been vaccinated from a child residing there. *In all*, ulcers of a phagedenic character made their appearance, of so obstinate a form, that in some instances twelve months elapsed before they could be induced to heal."

Surgeon Wm. M. Houston, 122d Ohio Volunteer Infantry, says: —

"While confined in Libby Prison in 1863, several of our officers had very obstinate ulcers after vaccination. The virus was furnished by one of our own medical officers, from his own arm. When I first saw the sore from which the virus was taken it had an unhealthy appearance, was large, irritable, and had irregular edges. In consequence of insufficient diet, and the impure air of the prison, the health of the prisoners was impaired, and obstinate ulcers resulted frequently from slight injuries."

Surgeon G. F. Galloupe, 17th Massachusetts Infantry, reports having vaccinated about four thousand soldiers, and witnessed the operation on several thousand negroes. Nearly seven thousand were vaccinated in one day. No case of spurious vaccination came to his notice.

Surgeon G. H. Williams, of an Ohio regiment, has seen no cases of syphilitic or other diseases caused by matter furnished by the purveyors, but has seen hundreds from other sources among the rebel prisoners who had vaccinated themselves, and among our own men who had been in rebel prisons. They were all syphilitic and yielded readily to syphilitic treatment.

Surgeon S. B. Hunt remarks, upon this evidence, that "this pest did not prevail in the army of the Potomac, though vaccination from the same sources as the vaccinia used at the West was largely employed. Nearly all western localities suffered, an important exception, however, existing at Keokuk, Iowa, where Surgeon S. B. Thrall, 13th Iowa Infantry, reports having vaccinated several thousand soldiers and saw no bad results in any instance. We have shown that in over 16,000 cases, accurately recorded in the Northern Department, vaccination was harmless and effective.

"The great sources of vaccine virus for the army medical department were as pure as those from whence practitioners in civil life derive their supply. The medical dispensaries in northern cities were the chief sources. Their stock of virus was wholly from infants. Another source of supply was from an intelligent physician in Massachusetts, who produces the vaccine directly from the cow. This gentleman, Dr. Cutter, furnished perhaps five per cent. of all that was used by the government. His crusts had the typical form, with the one peculiarity of having frequently a long cow's hair transfixing them. In his

geons. Dr. Hobbs, another brigade surgeon, states that when his command moved forward from Lavergne, Tenn., there were five hundred men suffering from these foul ulcers, and that the adjutant of the 33d Indiana Volunteers, who was absent on sick leave with such a vaccine sore, took small-pox and died. Dr. Brock, of the 66th Ohio, states that fifty men in his regiment, when at Bridgeport, Tenn., were disabled for the war by such sores. He had his virus directly from the medical purveyor. At Purdy, Tenn., and at various places in Northern Georgia, there were instances in which the men of our army obtained virus from citizens or captured men, and with needles, or by other rude methods, inserted the matter in their own arms, because of the extensive prevalence of small-pox in the southern towns. The results were disastrous, as the writer can attest from his personal examination of the cicatrices in nearly one hundred of the men thus vaccinated, who recovered sufficiently to make the grand march in General Sherman's army in 1864–65.

Sources of the virus.

Self-vaccination of soldiers from foul sores.

Among the Confederate prisoners at Rock Island, on the Mississippi, — a most healthy region of Northern Illinois, — 2426 of this class of obstinate sores ensued upon the vaccination of the men. At Camp Morton, Indiana, Camp Chase, Ohio, at Andersonville, Ga., at Salisbury, N. C., at Libby Prison, in Virginia, and among our prisoners in Texas, the same kind of accidents resulted from the honest attempts of medical officers to give protection against the small-pox contagion to which the soldiers and prisoners were exposed.

Experience among prisoners at the North.

case the crusts bore his name. In those derived from the dispensaries the name of the child, the dispensary, and the date when procured, were inscribed on the envelope which inclosed the crust.

"But however honest these sources, the previous question — Did they produce corrupt forms of disease? — still remains. Surgeon Grove reports upon the unlucky vaccinations made at Rock Island — which finally became so evident that he could not conscientiously renew them, — that the bad results were confined to prisoners; that the same crusts were used for United States troops employed as guard, and for insurgent troops in the prison; that with our own soldiers no bad effects followed, the vaccinia seeming to be genuine. But within the poison and on the arms of men impregnated with scurvy, suffering from miasm, or impoverished by chronic diarrhœa, the ulcers followed with a miserable certainty. In other words, he got 'spurious vaccination.' And in his recommendations he insisted with a commendable urgency, not on purer vaccinia, but on better diet and a more careful attention to the sanitary needs of the prisoners. He especially excepts one case outside, that of a feeble, chlorotic lady, the wife of an officer, who had a very troublesome ulcer from a crust that did no one else any harm. From Camp Morton, at Indianapolis, a similar typical case was reported. One crust vaccinated a surgeon, a steward, two feeble but convalescent soldiers, and we think one other person. The two soldiers went on to Arkansas to rejoin their regiment, had bad ulcers, and reports of their cases were sent back for investigation. The inquiry proved that the same crust had been pure vaccinia with two or three persons, and had produced chronic ulcers in two others; the latter known to be debilitated."

EXPERIENCE IN THE CONFEDERATE ARMY.

In the autumn of 1862 the medical department at Richmond issued orders for the general vaccination of the armies under its care. By direction of Dr. Carrington, the Medical Director, a division of the Chimborazo Hospital in Richmond was designated for the reception and treatment of "a peculiar eruptive disease, supposed to be the consequence of vaccination." The medical officer of that division of the hospital, Dr. Habersham, reports the following facts: —

"In compliance with an order issued by Surgeon-General Moore, in the month of November, 1862, general vaccination was practiced upon all soldiers as soon as they were admitted into this division; and in order to insure the full protective influence of vaccination (not anticipating any evil consequences therefrom), the order was strictly obeyed, and all the patients, even those having recent scars upon them, were revaccinated. A few days after the insertion of the virus, and in many cases, within twenty-four hours, the seat of puncture became very much inflamed with a deep inflammatory blush around, which gradually implicated, in the severe cases, nearly the whole of the affected limbs. A pustule rapidly formed, instead of a vesicle, which very soon discharged an ichorous fluid. This fluid was in the course of forty-eight hours converted into a dark mahogany-colored irregularly shaped scab, prominent and firmly attached at its base. A deep-red areola of several lines in diameter, measuring from the edge of the scab, was then developed, which in turn seemed to exude an ichorous serum. This was soon converted into a scabby surrounding in juxtaposition to the first, and presenting the appearance of a single scab. This process continued for several days, and there was often formed a scab one inch or two and a half in diameter. *Pari passu* with the increase of this scab, the erysipelatous blush on the limb diminished, and when the blush had disappeared, this scab ceased to enlarge. As this inflammatory process subsided, the discharge lost its serous character, and seemed to be converted into pus, which exuded from under the scab, loosening its firm attachment at its base, thus rendering it liable to be removed prematurely by the patient in his sleep, or even by the friction of his clothing. When this occurred, a foul, bleeding, irregularly shaped phagedenic ulcer was revealed, with everted edges, and presenting the appearance of a syphilitic phagedenic ulcer involving the subcutaneous areolar tissue, exposing, in many cases, the muscular tissue below. The process of destruction of parts did not end here, for the ulcer continued to increase, and from the loosened edges an ichorous discharge continued to pour out from under the skin, which seemed to destroy the edges of the ulcer, thus increasing its dimensions. Wherever the ichorous pus from this

Dr. Habersham's report, Richmond, Va., Nov. 1863.

The morbid appearances as seen at Richmond.

ulcer touched the sound skin, another pustule of a similar character was formed, in some cases reaching the size of the primary sore. This, however, was seldom the case, but a smaller ulcer generally resulted, which often healed and cicatrized before the first. The inoculating property of the pus.

"The axillary glands when the arm was affected, and the inguinal glands when the leg was the seat of the disease, sometimes became inflamed and discharged pus, presenting the microscopic characters of healthy pus. This enlargement of glands, however, did not occur in a sufficient number of cases to make it a natural sequence of the disease. Attending the early stages of the formation of the ulcer, before pus was discharged, there was always more or less pyrexia, with furred tongue and loss of appetite. These symptoms disappeared as soon as ulceration was established. In these highly aggravated cases successive crops of pustules made their appearance on the affected limb, after developing themselves also upon the lower limbs of the affected side, but seldom crossing the mesian line, and never developing themselves upon the trunk or head.

"The less malignant form of the disease resembled the first in character, but not in degree. For a few days after the insertion of the virus, merely a small inflamed spot was discerned, which seemed to be more the result of the injury done to the skin by the prick of the lancet than any inflammatory action resulting from a specific cause. About the fifth or sixth day a minute pustule was discovered upon a scarcely larger inflamed base. This pustule with the areola was not as great, and there was no deep inflammatory blush upon the arm, but merely a diffused redness of several inches in diameter. The same process, however, took place, on exudation of serum from the areola, which in turn became a crust, and which increased in size gradually, but never reached the diameter of the more malignant type; and when it was detached by the process of ulceration, which occurred at an earlier period, the revealed ulcer was neither as deep nor as malignant in its appearance. The edges were not everted, and there was no discharge of pus from under the edges of the ulcer; it only presented the appearance of an ordinary ulcer, showing no tendency to increase, and but little to heal. Pyrexia very seldom attended this form, nor was the appetite impaired.

"The third and mildest form of the disease made its appearance as a small pimple in from two to ten days after the introduction of the virus, which gradually formed a pustule; a dark-brown scab succeeded in from three to four days, which remained attached sometimes as long as two weeks, and when it became detached a livid or brown spot was revealed, the size of which was equal to the scab. This scar, however, was very sensitive to the touch, and liable to bleed from the least friction of clothing; and when this occurred it would exude serum or blood, and another scab would surely form. If the system became suddenly depressed from any cause, it would almost always assume the ulcerative process

and become a sloughing ulcer, which only healed with the general improvement of the system.

"As thus described, this disease has prevailed in the army of Virginia, both in field and hospital. The surgeons of the army of the Southwest report its prevalence there during the year (1863). It was developed in the early part of the year in a cavalry regiment, in the mountains of Virginia, the colonel commanding suffering severely from the disease. In every case it has been traced to the introduction of vaccine virus into the system. How far an epidemic cause may have exerted its influence in its early development it is impossible even to surmise; we know, however, that it originated in Virginia at a time when our army was upon very short rations, and that many of the soldiers sent from the field at that time presented a decidedly scorbutic appearance; many had been reduced and were broken down by exposure to the inclemency of a cold winter and the depressing influences of low diet, want of clothing, and many other prolific causes of disease calculated to deprive the blood of its healthy constituents, particularly of its fatty matters. Hence this may have produced a predisposition. In verification of this fact I will state, that when it was found how frequently the disease in consideration supervened upon vaccination in this hospital in broken-down and depressed constitutions, it was deemed prudent to postpone the introduction of the virus until the patients were restored to a healthy condition by improved diet and medical treatment. At the first appearance of the evil consequences of vaccination, I was inclined, with other surgeons, to believe that the virus was impure, and because of this suspicion, I threw away the matter we then had, and obtained a vaccine scab from Dr. Knox, a practitioner on Church Hill, who assured me he had used it in several cases with a perfect result.

The extensive prevalence of these sores in Virginia, and throughout the South.

Obscurities and probabilities.

"The introduction of this virus into the arms of some ten patients, resulted in the development of the disease in question in three of them, while in the remainder it produced apparently a true vesicle. From this fact, and the immunity which healthy-looking men enjoyed, I was led to believe that the predisposing cause existed in a vitiated and impoverished condition of the blood, and so reported in my first report, and that the introduction of pure virus into the system was the exciting cause of a latent disease."

The morbid results here described by Dr. Habersham, in the soldiers about Richmond, were early observed in the northern men confined in the Libby Prison in that city, and, under the same suspicions as filled the minds of southern prisoners confined at Rock Island, Illinois, and Camp Douglas, the surgeons were falsely accused. It would appear, from evidence we have obtained in the Southern States since the war, that Dr. Moore, the Surgeon-Gen-

eral of the insurgent army, took prompt measures to arrest and control the evil and to discover its causes. To Dr. James Bolton, a learned and philanthropic physician in Richmond, and to Professor Joseph Jones, and Professor Paul F. Eve, of Nashville, we are indebted for very minute and important records of the history and pathology of the abnormal results of vaccination in the Southern States during the war. These records, extending over a hundred pages, were kindly furnished to the U. S. Sanitary Commission immediately after the war closed, and as they are found to be entirely in harmony with what was observed in the Federal armies in the West and Southwest, we need only to present a few points to illustrate the extent which the evil reached in the soldiers and the civil population of the South.

Students of this subject in the South.

So threatening was the small-pox contagion, on the one hand, and the incurable sores resulting from vaccination, on the other, that Dr. Moore imported fresh vaccine lymph from Europe, and at the same time commissioned Dr. Bolton and others to undertake the most careful repropagation of virus from healthy infants wherever they could be found upon plantations. Proceeding from one plantation to another, and, on the day week, returning to take the fresh and genuine lymph, Dr. Bolton obtained virus which, for a time, yielded results that promised to extirpate small-pox and the foul ulcers. He ascertained that in the first thirteen hundred persons, mostly adults, who were vaccinated with that virus, only one failed to receive its normal operation and full protection. The Medical Department also gave instructions and orders for the propagation of virus by retrovaccination.

Means adopted South for propagation of genuine virus.

Dr. Ramsay, Medical Director at Knoxville, Tenn., reports that many cases of spurious vaccination having occurred at that post, a civil physician of high repute was employed to obtain a supply of valuable vaccine virus from healthy infants, in that city and its environs. Notwithstanding the greatest care was taken, the virus thus obtained produced no effect in some instances, and in others it was followed by erysipelas and by other cutaneous eruptions. Dr. Ramsay reports : —

Experience in Eastern Tennessee.

" Unpleasant abnormal exhibits were recently observed to succeed the insertion of real or presumed vaccine virus. These exhibits are not alone erysipelatous, but are in many instances a nondescript furfuraceous condition of the skin, — presenting in flakes, from the size of meal particles to that of a fish-scale, and a much larger number of instances of rupia, — sores of irregular shape and size, penetrating deep in the tissues, and thickening black scabs occurring at points remote from, as

well as at, the point at which the real or presumed vaccine virus had been inserted. In many cases of the erysipelatous exhibits, sloughing of the tissues occurred to an enormous extent, even to the destruction of the part for use. . . . . These exhibits have been observed in every State of the Confederacy, in every department from the Potomac to the Mississippi. They have been observed to follow the insertion of virus which, when inserted into other persons, was followed progressively by pimple, vesicle, cellular pustule drying, small in diameter, with dark-brown or deep mahogany tint, semi-opaque color, the whole completed in from sixteen to twenty-one days, and regarded by me as regular vaccine diseases. . . . . These abnormal exhibits do not depend on, or proceed from, any quality essentially pertaining to the virus which was used, but result from an epidemical cause, the impress of which is made efficient or active by the operation with a virus — the old doctrine of predisposing and exciting causes.

"When the army of Northern Virginia lay at Fredericksburg, after the first battle at that place, a large number of cases of spurious vaccination occurred among the soldiers. These appeared to be abnormal sequelæ of true vaccinations. Large numbers were sent to hospital, and many remained in a disabled condition for several weeks, the ulcers showing no disposition to heal. The army was ordered to move northward, and most of the men quitted their beds and joined the ranks. *All these cases got well on the march.*"

The sores cured by the march, and not by medicine.

At Danville, in East Tennessee, at Knoxville, at Greenville, in Northern Alabama and Georgia, the morbid results following vaccination, in the insurgent army and among the civil population, exceeded any similar evils that were experienced in the Federal army and in the Northern States. Extended inquiry among medical officers of both armies, warrants the writer in stating, that while soldiers and inhabitants of the insurgent States experienced the evils of spurious and impure vaccination, chiefly in those regions, and those persons that were suffering from scurvy and the effects of want and sickness, there was, at the same time, from difficulties in procuring fresh and genuine virus, a far greater amount of deteriorated and impure virus in use at the South than at the North.

Reasons for more of this evil South than North.

Great effort was made by Surgeon-General Moore, and the most intelligent of his medical directors, to procure fresh virus by retro-vaccination in the cow, and by the agency just mentioned by Dr. Bolton; but retrovaccination proved a failure, the stock of fresh lymph from the children upon the plantations was insufficient to meet the enormous demands of the army, and even that pure stock quickly degenerated, and, in many instances, lost its normal

endowments, which were superseded by the poisonous enthetic properties of foul ulcers and decaying animal matter. There is undeniable evidence of the fact that under the circumstances prevailing at the South during the last two years of the war, the accidental inoculation of syphilitic poison from initial sores of a syphilitic character at the point of, and in substitution for, the vaccination sore, occurred more frequently South than North. It is likewise true that privates and non-medical officers at the South were very much given to the habit of vaccinating and being vaccinated without medical supervision, and this was a most fruitful source of ill-judged, badly-performed, and spurious vaccination. Says Dr. S. P. Crawford, a southern surgeon who saw and studied spurious vaccination in the hospitals and the vicinity of Greenville, Tenn., where small-pox became epidemic, —

. . . . "There was great alarm both among the citizens and soldiers. . . . . Neither the citizen nor the soldier was satisfied of his immunity from danger, unless he could make a '*sore*' of some sort upon his arm. Consequently vaccination was perseveringly sought from the ugliest and foulest looking ulcers. . . . . If a '*sore*' was not produced by the matter from one arm, another was sought. . . . This spurious vaccination yielded no protection whatever from variola. I have seen more than a dozen cases of variola occur where there were large ulcers from this spurious virus, the patients thinking they were protected from the disease by such '*sores.*' The spurious matter would take effect in all sorts of constitutions."

Dr. Crawford's testimony.

This surgeon, whose language we have just quoted, had charge of a hospital containing three hundred and fifty medical and surgical patients at Greenville, at the time here referred to, and he states that he carefully vaccinated all the men, and that "the matter took well upon all who had not been vaccinated, and imperfectly in some of the others." Patients with small-pox continued to be frequently admitted to his wards. In no case was the contagion communicated to the men who had recently been successfully vaccinated, and, although every man of the three hundred and fifty in hospital was exposed to the contagion, only six of them were afflicted by it, and that in the form of varioloid. These six had not been revaccinated.

Test of the protective power of genuine vaccinia.

The important fact is stated by many of the southern surgeons, that much of the virus used was taken from revaccinated men that had no genuine operation of vaccinia, but only a "sore" that had been produced in the manner described in the foregoing paragraphs. Thus it frequently occurred that virus was

Delusion concerning the "*sores.*"

employed which not only was void of any attribute of vaccinia, but that had the quality of a morbid poison, though the pustule may not have presented an unhealthy appearance. Throughout the Southern States, the fact seems to have been noticed that the most excessive and wide-spread prevalence of the spurious and morbid results of vaccination, coexisted with scurvy and epidemic erysipelas. The contemporaneous prevalence of small-pox, usually very malignant in character, was another fact worthy of special remark. Surgeon Crawford, of Greenville, Tenn., states that the small-pox epidemic which coexisted with the morbid and destructive phenomena of vaccination, was so fatal that forty out of ninety of the variolous patients perished. The fact should likewise be noticed that the medical officers of the Southern army were disposed to divide enthetic and infectious causes of the vaccine sore about equally between the specific viruses of syphilis and erysipelas. Among the most skillful of observers at the South, we find Professor Joseph Jones and Professor Eve taking a middle ground, and adducing very conclusive evidence to prove that while the erysipelatous diathesis and specific virus, the syphilitic taint and ulcer, and the morbid poison of foul ulcers, each played their part in distinct, and sometimes in related, series of cases of spurious vaccination, the leading fact in the etiological history of the majority of instances was this, namely, — that a scorbutic dyscrasia constituted the most essential part of the record of causes.

Coexisting with scurvy.

With epidemic small-pox.

With infectious animal poison.

With syphilis.

PATHOLOGICAL HISTORY OF SPURIOUS AND IMPURE VACCINATION.

Whoever has studied the writings of Jenner, cannot fail to have been impressed by the evidences he adduces to the fact that the propagation and successive reproduction of the genuine vaccine vesicle in the human family depend upon very strict and intelligent adherence to the principles or laws that govern the perfect development and effect of the virus of vaccinia in the persons who are successively vaccinated, and in turn transmit the lymph. The immortal discoverer of those principles seems to have succeeded perfectly in his attempt to enunciate the laws or propositions that should aid medical men in all places to apply the prophylactic with entire success. This was the high aim of Jenner's thirty years of patient research, experiment, and toil. And now, in a later generation, after a long forgetfulness of nearly all that relates to the science of vaccination, it certainly is not strange that there should have been such an experience of spurious and morbid results of vaccination as we have here described.

Jenner's views.

In his evidence given before a Committee of the House of Commons, in the year 1802, Dr. Jenner stated that "In the course of the investigation upon this subject, which, like all others of a complex and difficult nature, I found that some of those *who seemed to have undergone the cow-pox*, nevertheless, on inoculation with the small-pox, felt its influence just the same as if no disease had been communicated to them by the cow. . . . . This for a while damped, but did not extinguish, my ardor. . . . . I surmounted a great obstacle, and was led to form a distinction between the two diseases; one of which only I have denominated the *true* and the other the *spurious* cow-pox; the latter not possessing any specific power over the constitution."

Jenner's evidence before Parliament.

Thus did Jenner describe a spurious but enthetic sore that was sometimes transmitted directly from the common pustule of the cow's udder, or from person to person. It possessed no attribute of vaccinia; it might be simple, or it might be malignant and troublesome. But there was discovered another obstacle to uniform success in vaccination, even when virus of an unmistakable quality, taken directly from the cow, was employed upon the infant arm when too far past the eighth day of the vesicle, or after many weeks' keeping. With philosophical discrimination he says: —

"I discovered that the virus of cow-pox was liable to undergo progressive *changes*, and that when it was applied to the human skin in *a degenerated state*, it would produce the ulcerative effects in as great a degree as when it was not decomposed, and *sometimes* far greater; but, having lost *its specific properties*, it was incapable of producing that change upon the human frame which is requisite to render it unsusceptible of the variolous contagion; so that it became evident that a person might milk a cow one day, and having caught the disease (the true vaccinia), be forever secure; while another person, milking the same cow the next day, might feel the influence of the virus in such a way as to produce a sore or sores, and in consequence of this might experience an indisposition to a considerable extent; yet, the specific quality being lost, the constitution would receive no peculiar impression." [1]

Jenner's experimentum crucis.

We have quoted these admirable items of evidence from the greatest medical authority on the subject, because of the light they throw upon the remarkable experience to which this chapter

[1] See evidence given before a Committee of the House of Commons by Dr. Edward Jenner, March 22, 1802.

relates. Let us now recapitulate the leading points in our army experience of spurious vaccination with reference to the following points upon which there has been much debate and great practical interest in the medical profession and out of it. We propose only to state the points fairly and offer what we believe to be well sustained *conclusions* upon each of them: —

Six propositions or points to be considered.

(1.) There were three kinds of spurious vaccination prevalent in the American armies: (a) that which occurred in consequence of the loss of the genuine and specific property or vaccinia in the once good lymph or vaccine crust used in vaccinating; (b) that which resulted from the impairment or destruction of the vesicle as soon as it began to form, in the marching and excessive exercise of the soldier, and that resulting from the use of the sero-purulent matter of such destroyed vesicle in vaccinating other persons; (c) that resulting from the employment of matter from pustules or crusts that never possessed the attributes of vaccine virus.

First proposition — sources of impaired or spurious virus.

(2.) Scurvy and all the asthenic dyscrasiæ of army life, not only prevented or greatly impaired the normal operation and effect of genuine vaccinia when soldiers suffering such conditions were subjected to vaccination, but those unhealthy conditions of the system frequently became the causes of the morbid phenomena and the obstinate ulcerations, etc., that caused the greater part of the evil experienced from vaccinations in camps and hospitals during the war.

Second proposition — effect of scurvy.

(3.) The normal vaccine vesicle was never proved in our army experience to have communicated any other than normal innocuous virus, but, from the neglect of care in the taking of lymph for vaccination at the precise time of its perfection, and by neglecting to observe the rule never to use lymph or crusts that are not in every respect perfect, and also free from blood or pus, there occurred frequent instances of inoculation with purulent matter or unhealthy blood, so obtained by the vaccinator, especially by soldiers and camp followers who vaccinated themselves unskillfully.

Third proposition — not the normal vesicle but the sero-purulent matter imparts poison.

(4.) By the use of matter, fluid or concrete (purulent or morbid in either case), taken from sores of any specific and enthetic character; as (a) the erysipelatous and the ecthymatous; (b) that of zymotic ulceration and destruction of animal tissues, and possessing the properties of a *morbid poison;* (c) the enthetic poison of syphilis, — primary or secondary, —

Fourth proposition — inoculation by specific infections.

whether by employment of a lancet already defiled with such poison, or by use of vaccine points or crusts contaminated by a syphilitic sore or touch, or, as occasionally happened, the manifestation of syphilitic characteristics in connection with or supervening upon genuine or spurious vaccination.

(5.) The deterioration of genuine vaccinia by transmission through scorbutic and unhealthy persons, — particularly in hospitals and depots where erysipelas, gangrene, pyæmia, or small-pox was prevailing, — or by transmission through soldiers who at the time had feebly felt and retained some protective influence from a former vaccination; and, in general, — principally experienced in the Southern States, — the continued employment and transmission of virus from the adult soldiers, subjected as they were to abnormal and unhealthy conditions for successful vaccination, instead of using lymph from the primary vesicles of vaccinia in healthy children.

Fifth proposition — deterioration of genuine virus.

(6.) The deterioration and destruction of good virus by means of a high temperature, and by exposure to a hot and humid atmosphere.

Sixth proposition — destruction of virus by heat.

In these six propositions are embodied the practical questions which have been examined by medical men in both armies during the war. And in the terms employed to set forth these points, we endeavor to state as clearly and exactly as possible, the leading facts in regard to the conditions concerned in causes of the abnormal results of vaccination, and that spurious semblance of vaccination that produced the morbid results described in this chapter.

CONCLUSIONS.

1. Experience in the late war has established the fact that it is neither prudent nor justifiable for volunteer soldiers or army recruits to be brought into the field of active duty, or even to the great encampments or places of rendezvous, without vaccination that has been *proved by a revaccination* with fresh and genuine lymph.

Vaccination to be proved by revaccination at enlistment.

2. That it is not prudent or justifiable, in vaccination, to depend upon virus obtained from sores or vesicles in soldiers and camp followers, in field or hospital, inasmuch as such virus is not sure to possess the normal endowments of vaccinia, and, especially, as it is liable to be contaminated and rendered poisonous by attributes which, as our observations have shown, may attach to, or combine with, the true vaccine lymph.

Virus from men in camps and hospitals not to be used.

3. The sores, the erysipelas, the destructive sloughing, the

obstinate ulcerations, and the cachexia that ensued upon the kinds of spurious vaccination witnessed in the American armies in the recent war, were of the same nature as the morbid results which Jenner described, and which have occasionally been witnessed by physicians in Europe and America ever since Jenner's time.[1]

The results of spurious vaccination the same now as in Jenner's time.

4. In persons suffering from a scorbutic taint, or any other dyscrasia of the blood and tissues, the vaccine virus is not sure to produce its normal and fully prophylactic effect, nor is the virus which is derived from such persons trustworthy for vaccinations.

Virus from unhealthy persons not to be used.

5. The enthetic or inoculating property of pus, of sero-purulent matter, and — under favoring conditions — of serum, from persons already diseased by constitutional syphilis, erysipelas, ecthyma, and the like, was demonstrated very conclusively in the two great armies during the last two years of the rebellion.[2]

What diseases were inoculated.

6. Syphilitic contamination of virus employed in vaccination in the army was infrequent, and we find no absolute proof that genuine vaccine lymph acquired the *inherent* virus of syphilis, but some of the evidence upon this point is so strong and significant that it seems to amount to probability, and it warrants the conclusion that to vaccinate with virus taken from a person infected with syphilis, or having syphilitic eruptions

Syphilitic poison *may be* inoculated.

[1] Readers may profitably consult the following authorities upon questions we have discussed in this chapter: *Causes and Effects of the Variolæ Vaccinæ*, by Edward Jenner; London, 1798. *Traité de la Vaccine*, Bousquet, Paris, 1833. *Rapport sur les Vaccinations practiquées en France pendant l'armée*, 1854. *Reports of Medical Council of the Royal Jennerian Institution;* London. *Protection against Small-Pox afforded by Vaccination, illustrated by the Returns of the Army and Navy and the Royal Military Asylum*, by T. Graham Balfour, M. D.; *Med. Chirurg. Trans.*, vol. xxv. Dr. J. Marson's *Analytical Examination of Sixteen Years' Experience in the London Small-Pox and Vaccination Hospital; Med. Chirurg. Trans.*, vol. xxxvi. Hebra's *Replies to Questions of English Board of Health. Papers relating to the History and Practice of Vaccination, presented to both Houses of Parliament*, 1857, by John Simon, Esq. *Memoir on Transmission of Syphilis by Means of Vaccination*, by Dr. Pachiotti (see *Lectures on Venereal Disease*, by Wm. A. Hammond, M. D.). M. Viennois *On the Transmission of Syphilis by Vaccination; Archive Gen. de Med.;* Paris, June, July, and September, 1860. *Researches upon Spurious Vaccination in the Confederate Army*, by Prof. Joseph Jones; Nashville, 1867, pp. 134. — This is a most valuable collection of facts from carefully studied experience. *Cases of Spurious and Morbid Results of Vaccination and Revaccination in Boston and Vicinity*, by Drs. Greene, Cabot, Homans, Jackson, Channing, and others; *Transactions of Society for Medical Improvement;* and *The American Journal of Medical Sciences*, 1850. Epidemiological Society's *Report on Vaccination;* London, 1853. Mr. Paget's *Remarks on Transmissions of Diseases by Vaccination*, in Mr. Simon's *Papers on History and Practice of Vaccination*, pp. 138, 139. Also, Mr. Acton's Notes on same subject; with regard to the *Transmissibility of Syphilis;* ibid., p. 118.

[2] The testimony and proofs on this subject, prepared as a separate chapter, are necessarily omitted from this volume; but we are warranted in stating that they are conclusive.

or sores, is culpably hazardous, and that to neglect to ascertain the health of the child or person from whom vaccine virus is taken for use, is also inexcusably wrong.

Transmission of syphilis.

7. The evidence obtained in both armies relating to syphilitic inoculation, by vaccinating, strongly corroborates the conclusions by M. Viennois upon this subject; and, so far as we have ascertained, there was no exception to the law of such transmission from the constitutionally infected, as announced by M. Rollet, namely, that "syphilis always commences with a chancre."

Scorbutic ulcerations and syphilitic sores.

8. The greater proportion of the ulcers following vaccination, and popularly attributed to syphilis, were simply scorbutic ulcerations, or were sores resulting from inoculation by a non-syphilitic morbid poison. The truly syphilitic sores were chancres, and were rarely seen; but wherever they were inflicted upon the soldiers or the civil population, they occurred in distinct groups of cases, and were traceable to an adequate source or first case of syphilitic inoculation, from which a stock of the polluted virus was thereafter derived.

Vaccination to be performed when the person is healthy.

9. Vaccination and revaccination should be performed, in every person, when free from eruptive or inflammatory diseases, and when suffering from no dyscrasia, nor from the operation of any specific zymosis or constitutional taint, and if, to obtain immediate protection against small-pox, it even becomes necessary or expedient to vaccinate persons who are suffering such morbid conditions, the employment of vaccine lymph or crusts from them should be prohibited, especially in armies.

The great lesson on vaccination in our armies confirms Jenner's doctrines.

10. The experience of more than two millions of American soldiers in the war of the rebellion has reaffirmed the great doctrines of Jenner, and has demonstrated anew, and upon a gigantic scale, both the importance and the correctness of his rules for procuring the full benefit of vaccinia and transmitting it to others in all its original and pure prophylactic power. Genuine vaccination was an absolute safeguard against small-pox. In fulfillment of Jenner's immortal prophecy, one million of soldiers, exposed to the variolous contagion wherever they marched to defeat or to triumphs, proved that "the best and truest of all arguments for vaccination, will be those which are engraven with the point of the lancet."

SECTION SECOND.

CONTRIBUTIONS

RELATING TO DISEASES.

SECTION SECOND of this volume is devoted to Special Pathology. As an appropriate introduction to the contributions relating to individual diseases, the comparative mortality in armies from wounds and disease is considered in the first chapter. The diseases distinguished, nosologically, as GENERAL, namely, the Camp Fevers, Periodical, Continued, and Eruptive, Yellow Fever, Acute Rheumatism, and Scurvy, are taken up in the next six chapters. The remainder of the Section is occupied with the following so-called LOCAL DISEASES: Camp Diarrhœa and Dysentery, Pneumonia, Diseases of the Heart, Cerebro-Spinal Meningitis, and the Diseases of Nerves resulting from injuries. This Section embraces elaborate and carefully prepared communications, furnished by distinguished members of the medical profession, whose names are given in the headings of the chapters, and who have embodied therein the fruits of extensive observation during the war. To these are added facts and opinions which have been contributed by numerous medical officers. The latter contributions, viewed in the light of testimony by intelligent and conscientious observers, possess not a little value, and, in conjunction with the contributions of those who have bestowed special study upon the diseases of which they treat, will, it is believed, render this Section of the volume highly useful for reference, especially as regards the prevalence of certain diseases, their varied modifications and combinations, together with the means of prevention and the treatment, under the circumstances peculiar to military service.

CHAPTER FIRST.

THE COMPARATIVE MORTALITY IN ARMIES FROM WOUNDS AND DISEASE.

By EDWARD S. DUNSTER, M. D.,

LATE ASSISTANT-SURGEON, U. S. ARMY.

Error of Popular Opinion. — Purpose of the Writer. — Casualties of the English Forces in the Crimean War. — Mortality in the Crimea. — Effect of Sanitary Measures. — Comparative Mortality from Wounds and Disease. — Consolidated Table of the Losses of the English Army in the Crimean War. — Comparative Mortality among Enlisted Men and Officers. — Comparison of Enlisted Men and Officers as regards Casualties. — Mortality from Disease in the different Arms of the Service. — French Quota of the Allied Army — Total Mortality during the War. — Comparative Mortality from Wounds and Disease. — Statistics of Scrive and Chenu. — Comparative Mortality among Enlisted Men and Officers.—Casualties of the United States Army in the War with Mexico.—Strength of the United States Army.—Total Mortality during the War.—Consolidated Table of the Losses of the United States Army in the War with Mexico. — Comparative Mortality from Disease and Wounds. — Comparative Mortality among Enlisted Men and Officers. — Comparative Mortality in Different Branches of the Service. — Mortality in the Recent Rebellion. — Statement of the Casualties in the Armies of the United States, from the Commencement of the Rebellion to August, 1865.— Recapitulation of the Losses from Wounds and Disease in the Regular and Volunteer Armies and among Colored Troops. — Comparative Mortality from Disease and Wounds. — Comparative Mortality among Enlisted Men and Officers. — Large Excess of Deaths from Disease among Colored Troops. — Mortality in the different Arms of the Service. — The Proportion per One Thousand of Mortality from Disease and Wounds. — Comparative Mortality among Troops from different States. — Proportional Analysis of the Table of Casualties by States. — Mortality in Kansas. — Comparison of Mortality among Regular, Volunteer, and Colored Troops. — Comparison of Losses from Wounds and Disease among Troops from different States. — Casualties among Medical Officers. — Casualties in the Rebel Army. — Losses in other Notable Campaigns; in the Sardinian Army in the Crimean War; in the French Army in Africa; in the English Army in Spain; in the Expedition to Walcheren. — Losses in the English Navy. — Losses in the Russian Army in Turkey. — Conclusions.

Error of popular opinion.

THE opinion has very generally obtained among almost all peoples, that the principal cause of mortality in armies is to be found in the casualties of battle. For the origin and prevalence of this opinion it is difficult to account, inasmuch as the concurrent testimony of all observers is to the effect that the great source of danger to the soldier is his liability to death from disease, consequent, in a measure, upon the exposure, fatigue, and privations incident to his peculiar duties, and in a still greater degree upon the violation of the well-known laws of hygiene. In part, perhaps, this erroneous view may be attributed to the undue importance which in former times was attached by governmental

authorities to the casualties of battle, which too often have been put forward as the measure of a nation's losses in war, while the waste of life from disease in camp, barrack, and hospital, has been allowed to remain unnoticed, because not invested with that popular glory which surrounds death on the battle-field, and because, it must be frankly admitted, governments, for state reasons, have seen fit to discourage the collection of information on this point, or to decline publishing it when known. It is only within a comparatively recent period that careful and competent examinations have been made on this subject, or that state authorities have had the moral courage to make known the results of such examinations. But now it would seem that the inexorable figures of the army returns from the recent wars in Europe, as well as our own civil war, should forever dispel the mistaken views above referred to; and that hereafter it will be impossible for this error to again make way in the face of the truth which is now accessible to all.

Purpose of the writer.

It is our purpose, by an examination of some of these returns, to inquire into the relative mortality in armies from wounds and disease, not so much with the view of learning the aggregate losses of wars, or analyzing the causes of these losses, — a ground which has already been most ably occupied by statisticians and hygeists, — as with the hope of arriving at some general conclusions which may be formularized in such a shape as to prove reliable. Considerable latitude must, of course, be allowed in discussing the subject; for many important points will arise that have but little direct bearing upon the simple and general question as above stated, and yet they are of such great interest and value in elucidating the natural and almost self-suggested subdivisions of our subject, that they come legitimately within the scope of our inquiry. Such, for instance, would be the relative mortality from the two causes mentioned, between officers and enlisted men; among regular troops compared with volunteers; the liability to disease and consequent mortality of the negro, compared with the white soldier, etc. These and such other points as may be deemed in any way pertinent to the object in view, will be touched upon as the subject matter may give occasion for their appropriate introduction.

CASUALTIES OF THE ENGLISH FORCES IN THE CRIMEAN WAR.[1]

England furnished, as her quota of the allied army in the war

[1] Collated from the *Medical and Surgical History of the British Army which served in Turkey and the Crimea during the War against Russia*, etc., the same being the Official Report presented to Parliament in 1858.

with Russia, ninety-three thousand nine hundred and fifty-nine men (93,959), and three thousand nine hundred and five (3905) officers. These troops began to arrive at Constantinople in April, 1854, and were distributed in camp in the vicinity of Gallipoli, on the European side of the Dardanelles, and Scutari, on the Asiatic shore, nearly opposite Constantinople. In June they were concentrated at Varna, in Bulgaria, and in the following September were transferred to the Crimea. Siege operations, of unparalleled hardships and difficulties, were commenced immediately upon disembarkation, and were continued with more or less activity to the close of the campaign in June, 1856. It appears, therefore, that the war was of little more than two years' duration, during twenty-one months of which time the army may be considered as in active service.

English quota of the allied army.

The total mortality during this period was twenty thousand eight hundred and ninety-nine (20,899), so that one out of about every four and one half (4.6) sent out lost their lives, either from sickness, wounds by battle, or, in some few cases, from accident. This number, it should be borne in mind, represents those only who died at the seat of war. Upwards of twelve thousand[1] (12,359) of the troops were invalided and sent home, and nearly six thousand (5705)[2] were discharged for disability, a considerable proportion of whom no doubt died of diseases or wounds contracted while in service. It is also worthy of note that sixty-five per cent.[3] of this mortality occurred in seven months time, from September, 1854, to March, 1855, while, during the period of encampment previous to the transfer to the Crimea, the army was almost entirely exempt from disease. The highest mortality was in January, 1855, during which month the death-rate reached the almost incredible proportion of 1174 per 1000 per annum, of which 1138 was from disease.[4] The continuance of this rate implies the annihilation of the entire army in less than a year. The other forces engaged in this campaign suffered at about the same rate. It is probable, judging from such records as have been made public, that no army in recent times ever presented so high a death-rate as that experienced here in the winter of 1854–55; and naturally enough the anxiety and alarm of the people and government at home were very decided. Sir Alexander Tulloch, who was one of the Commissioners sent out by the home government to inquire into the causes of this mortality, and to apply the

Mortality in the Crimea.

[1] *Loc. cit.* p. 229.
[2] *Loc. cit.* p. 245.
[3] *Idem*, p. 210.
[4] *Idem*, p. 206.

suitable remedies, in commenting upon this point, uses the following forcible language:[1] "Out of about 10,000 men who died during these seven months (winter of 1854–55), belonging to the Crimean army, only 1200 were cut off by the epidemic of cholera; the remainder perished by no foeman's hand, no blast of pestilence, but from the slow though sure operation of disease produced by causes, most of which, at least, appeared capable of mitigation.

"Compared with this, the mortality in our army on all previous occasions sinks into insignificance; even that of Walcheren, which threw the nation into mourning, and for years convulsed our Senate, did not exceed a fourth part of the average here recorded. Armies have perished by the sword, they have been overwhelmed by the elements, but never, perhaps, since the hand of the Lord smote the host of the Assyrians and they perished in a night, has such a loss from disease been recorded as on this occasion."

Effect of sanitary measures.

Relief, however, soon came; for the sanitary measures instituted by the government wrought a marvelous change, and relieved the army of its dangers, and the nation of its disgrace. Nowhere, perhaps, do we find a more pointed example of the positive and beneficial results that follow the strict enforcement of sanitary laws than was seen in the experiences of this army for a twelvemonth subsequent to the time above specified. But we must turn from this interesting subject to inquire into what more especially concerns us, — the proportion existing between the two prominent causes of mortality, wounds and disease. The following tables furnish the desired information in detail.

CONSOLIDATED TABLE OF THE LOSSES OF THE ENGLISH ARMY IN CRIMEAN WAR, FROM ALL CAUSES.

Arm of the Service.	Non-Commissioned Officers and Privates.				Commissioned Officers.			
	Whole Number in Service.	Killed in Action.	Died of Wounds.	Died of Disease.	Whole Number in Service.	Killed in Action.	Died of Wounds.	Died of Disease.
Cavalry	8,293	114	33	1,009	427	8	4	
Artillery	10,723	121	63	1,361	388	10	1	
Sappers and Engineers	1,644	32	23		95	9	6	
Foot-guards and Infantry	6,504 / 66,795	2,331	1,642	13,841	225 / 2,720	130	75	
Total	93,959	2,598	1,761	16,211	3,905	157	86	

[1] *The Crimean Commission and the Chelsea Board*, p. 14.

There were also 86 deaths from accident, suicide, etc., among the enlisted men. The number of officers who died of disease is not stated, but the ratio per cent. to the mean monthly strength is given as 8.4.

SUMMARY.

	Deaths from Wounds and by Battle.	Deaths from Disease and Accidents.	Aggregate Deaths from both Causes.
Enlisted men	4,359	16,297	20,656
Officers	243	*	243
Total	4,602	16,297	20,899

It will be observed, first, that of the total mortality during the war, four thousand six hundred and two (4602) deaths were from wounds, and sixteen thousand two hundred and eleven (16,211) were from disease; the balance of eighty-six being due to accident, suicide, and execution; thus we have, for the entire force, about three and one half (3.52) times as many deaths from disease as from wounds. *Among the enlisted men* the deaths from disease were sixteen thousand two hundred and eleven (16,211), and from the casualties of battle, four thousand three hundred and fifty-nine (4359). The ratio therefore between these two causes of death in this portion of the army is but a trifle higher than that given for the entire force (3.71 to 1). *Among the officers* the proportion existing between these two causes of mortality cannot be ascertained, as the number of deaths from disease is nowhere specifically stated, but the ratio per cent. to the mean monthly strength is given at 8.4. From this it is evident that their losses by disease were very much less than those of the enlisted men, for one out of every six (5.79) of the enlisted men, or over sixteen per cent. of the total sent out, died of disease, and of course the ratio per cent. to the mean monthly strength is still higher.

Comparative mortality from wounds and disease.

Comparative mortality among enlisted men and officers.

Turning now to the casualties of battle as a cause of mortality, it appears that, of the enlisted men, one out of every twenty-two (21.55) lost his life from this cause, while the officers suffered in the proportion of one out of every sixteen (16.07); thus confirming the general conclusion arrived at in these studies, that the proportionate loss of officers in battle and from wounds, is greater than that of the subordinates; while, on the other hand, among the enlisted men, the mortality from disease is greater than that sustained by the officers.

Comparison among enlisted men and officers as regards casualties.

If now we look at the different arms of the service, it will be seen, without entering into any close calculations of the ratios, that the loss of the infantry from disease was relatively the highest, the artillery next, and cavalry the least,

Mortality from disease in the different arms of the service

though the difference between the last two is very slight. So also from wounds the infantry loss was by far the heaviest, the artillery next, and the cavalry least, the difference as before between these two being very inconsiderable. The infantry therefore (in this army at least) is the most dangerous arm of the service, in respect to its losses both by disease and by battle. The explanation of this greater mortality of the foot-soldier will readily suggest itself in the vastly more arduous nature of his duties; his lack of the means of transportation for suitable shelter and extra comforts which the other arms of the service have always at hand, and his greater exposure by reason of his necessary position on the battle-field.

LOSSES OF THE FRENCH ARMY IN THE CRIMEAN WAR.

French quota of the allied army.

The French army in the Crimean War numbered, all told, three hundred and nine thousand six hundred and twenty-eight (309,628) men. They were in active service about the same length of time as their allies, the English; were engaged in a common cause, and operating on common ground, where the liability to endemic disease was about equal. At the same time, the service they performed, especially toward the close of the campaign, was immeasurably more severe than that of the English, as is abundantly shown in the reports of Scrive and Baudens; and the exhaustion of strength and depression of vital energies resulting from this service produced among them severe losses from typhus, — "that terrible scourge of armies," — which fell upon them almost at the close of the campaign, and when the prize so long contended for was just about to be won. Their hospital facilities and sanitary arrangements were more ample and perfect than those of the English, excepting in the later periods of the war, when the bitter experiences of the winter of 1854–55 had compelled the adoption of more liberal and adequate measures for the prevention as well as cure of disease.

Total mortality during the war.

The total mortality during the war is stated by M. Scrive[1] at sixty-nine thousand two hundred and twenty-nine (69,229); the proportion of deaths from all causes, therefore, to the entire strength, was 1 to 4.46, which approximates very closely the loss of the English in the same war. Scrive, however, states in the appendix to his volume (p. 485), that "subsequent to the departure of the troops for the Crimea, the mortality in the Turkish hospitals (the French established some fifteen

[1] *Relation Medico-Chirurgicale de la Campagne d'Orient*, par le Dr. G. Scrive, p. 350.

hospitals in Turkey) reached the number of from 1200 to 1300, and this should be added to the mortality in the hospitals near Constantinople. It follows from this that the total number of deaths in all the hospitals was about sixty-three thousand." This addition, however, would not materially change the proportionate rate of mortality to the entire strength, the ratio thus estimated being 1 to 4.38. Of the entire losses Scrive states that about sixteen thousand (16,320) were killed in battle or died of wounds; therefore, the deaths from this cause, compared with those occasioned by disease, were as one to three and one half. It must in justice be added, that these figures are largely at variance with those given by M. Chenu,[1] who states the number of deaths from all causes at ninety-five thousand six hundred and fifteen (95,615). From this total, however, we can eliminate those who "died in France after the evacuation of the East," and the "loss at sea and in the marine hospitals," leaving us an aggregate of 79,042, — which differs widely from Scrive's list, — and which, assuming it to be correct, would raise the proportion of mortality at the seat of war, to the entire strength, to one out of every four (1 : 3.91). The subjoined table shows the differences between the statements of these two authorities: —

Comparative mortality from wounds and disease.

	Scrive.	Chenu.
Various diseases and cholera, prior to Sept. 20, 1855, in the Turkish hospitals, at Gallipoli, Varna, etc.	5,500	8,084
In the Crimean hospitals, and those distant from Constantinople	28,404	29,095
Hospitals near Constantinople	27,825	27,281
Killed and missing in battle	7,500	10,240
Died without being admitted to either field or general hospital		4,342
Loss at sea and in the marine hospitals		1,548
Died in France after the evacuation of the East		15,025
	69,229	95,615

However these discrepancies may be adjusted, it is evident, taking either set of figures as the basis of calculation, that there were about three and one half times as many deaths from disease as from wounds,[2] which is almost exactly the proportion in which the English forces suffered from these two causes.

[1] *Rapport au Conseil de Santé des Armées sur les Resultats de Service Medico-Chirurgicale aux Ambulances de Crimée, etc.*, par J. C. Chenu, p. 579.

[2] The statement has recently been largely circulated through the press in this country, that

Among the officers there were twelve hundred and sixty-five (1265) deaths; seven hundred and seventy-nine (779) of which were from wounds, and four hundred and eighty-six (486) from disease. Thus not only is the actual loss to the officers greater from the casualties of battle than from disease, but the proportionate loss to the entire strength is heavier than among the enlisted men. As a matter of interest, deserving record, it may be added that eighty-two of the deaths from disease were among the medical officers. Chenu says, "one quarter the effective strength of the medical staff of the ambulances and hospitals died of disease." These deaths were mainly from typhus and cholera, contracted from exposure in the line of duty. Surely there is no more brilliant record than this in the whole history of the war; and it tells plainly the truth, so often overlooked that it is not always on the battle-field that the greatest courage is displayed.

Comparative mortality among enlisted men and officers.

CASUALTIES OF THE UNITED STATES ARMY IN THE WAR WITH MEXICO.

The entire strength of the United States army in the war with Mexico during the years 1846 to 1848 was one hundred thousand four hundred and fifty-four (100.454).[1] This force was made up of three elements, the statistics of which are given separately. The "old establishment" was the regular army as it existed before the war, and was on active duty in Mexico twenty-six months; the "additional force" comprised the ten new regiments, which by law were added to the regular army, but whose term of service expired with the war; they were on duty fifteen months; the "volunteers" were the state organizations mustered into the United States service only for specific terms of enlistment, and were on duty for ten months only.

Strength of the United States army.

The total mortality during the war was twelve thousand five hundred and five (12,505). This number represents only those who died while in service, and does not com-

Total mortality during the war.

the losses of the French in this war from disease were seven times as great as those from wounds. This is not only a manifest error, but also conveys a very erroneous impression both of the *morale* of the French army, which, as M. Baudens remarks, was unsurpassed in its "stoicism, courage, and contempt of death," and of the medical and sanitary provision made for that army. The error arises out of the fact that only those killed on the field of battle are included in the number of "deaths from wounds." This error is copied in the last volume (xvii.) of the *Transactions of the American Medical Association* (p. 496), and conclusions are drawn therefrom very flattering to the excellence of the medical and sanitary service of our army in the recent rebellion, — but which, therefore, unfortunately, are very unjust and inaccurate.

[1] *Statistical Report of the Sickness and Mortality in the Army of the United States, from 1839 to 1855*; prepared by Richard H. Coolidge, Surgeon U. S. Army; p. 610.

prise the very large number who died subsequently to their discharge, from disease or wounds contracted during the war. There were discharged for disability alone, before the expiration of their terms of enlistment, 12,252, or about one eighth of the entire force. The proportion of deaths therefore to the entire strength was one in eight (8.03). Compared with the mortality of the English and French armies in the Crimean War, this result is very gratifying; yet, in view of the comparatively short duration of the war, and the very brief term of service of the larger proportion of the troops (the average for the entire force being thirteen months and one day), as well as the nature of the service, and the character of the country where the operations were carried on, this proportion seems unnecessarily large. The following table shows the details of this loss for the three component parts of the army: —

CONSOLIDATED TABLE OF THE LOSSES OF THE UNITED STATES ARMY IN THE WAR WITH MEXICO.

Designation of the Forces.	Whole number in service, embracing both officers and enlisted men.	Non-Commissioned Officers and Privates.			Commissioned Officers.			Summary.	
		Killed in Action.	Died of Wounds.	Died of Disease.	Killed in Action.	Died of Wounds.	Died of Disease.		
Old Establishment.	15,736	422	307	2,574	41	22	49	Total Men and Officers killed and died of wounds	1,549
Additional Force .	11,186	62	71	2,055	5	5	36		
Volunteers . . .	73,260	467	100	*6,256	46		*	Total Men and Officers died of Disease . . .	10,955
General Staff. . .	272				1		16		
Total . .	100,454	951	478	10,855	93	27	101	Whole number of deaths	12,505

* In the report of volunteers "died of disease," men and officers are included in the aggregate.

Comparative mortality from disease and wounds

It appears from an examination of this table that the aggregate losses in battle and from wounds were fifteen hundred and forty-nine (1549), while at the same time the mortality from disease was ten thousand nine hundred and fifty six (10,956). The proportionate loss, therefore, of the entire force from disease was seven times as great as from wounds, just double the rate that has above been shown to have existed in the English and French armies in the Crimea, and suggestive at once of a double explanation — less fighting on the one hand, and a worse sanitary condition of the other.

COMPARATIVE MORTALITY AMONG ENLISTED MEN AND OFFICERS.

Among the *enlisted men* the deaths from disease compared with wounds were, —

For the "old establishment" as three and one half (3.53) to one.
" " "additional force" " fifteen (15.45) " "
" " "volunteers"[1] " ten (10.20) " "

Among the *officers* the proportion stands, —

For the "old establishment" as three fourths of one (.77) to one.
" " "additional force" " three and one half (3.6) " "

For the volunteers the ratio cannot be ascertained with any degree of accuracy, as the deaths of the officers are included in the table with those of the enlisted men. From these ratios it appears that the mortality from disease among the enlisted men is very largely in excess of that of the officers; and reversing the ratios, or comparing the mortality from wounds with that from disease, it appears that the officers lost more relatively from wounds than the men. As the number of men and officers are included in one aggregate, it would be impossible to ascertain the correct proportion of these losses — officers compared with men — except upon an arbitrary division of the "whole number sent out," *i. e.*, assuming that such a proportion were officers, and the remainder enlisted. But enough has been shown to answer our purposes.

The following table[2] shows at a glance the comparative losses per 1000 per annum among the three subdivisions of the army: —

For each 1000.	Mortality per Annum.	From Wounds.	From Disease.
Old Establishment	104.2	23.2	81.0
Additional Force	161.9	10.2	151.7
Volunteers	115.5	10.0	105.5
Aggregate	117.9	14.2	103.8

Comparative mortality in different branches of the service.

From this it appears that the death-rate from wounds in the "old establishment" was about double that of either the other branches of the service, which is easily explained when the time of service of this portion of the army is recalled, together with the share of the fighting that was assigned to it.

[1] The very small number of officers included in the total (6256) from which this ratio is calculated would not materially vary this result, which may be considered essentially correct.

[2] Compiled from Elliott's "Report on the Mortality and Sickness of the Volunteer Force of the United States Government,"—Sanitary Commission, Document No. 41, p. 25.

On the other hand, the "old establishment" shows a very much smaller death-rate from disease than its associates in the war. The sickness in any given regiment has been said to bear an inverse ratio to the efficiency of its discipline. Baudens conveys the same idea when he says, as the result of his large experience: "I could show that the mortality and sickness in the several regiments always bore an exact relation to the degree of solicitude which the officers bestowed upon the soldier." In this we can probably find an explanation of this small mortality of the "old establishment"; for the strict discipline of the regular army, and the provident care of the officers for their subordinates were in striking contrast with the condition of things that obtained among the new troops. Then, too, the physical stamina of the old troops was better than that of the new, for the recruits were selected with much greater care.

MORTALITY IN THE RECENT REBELLION IN THE UNITED STATES.[1]

The number of troops in the service of the United States.

The whole number of troops mustered into the service of the United States in the recent rebellion was two millions seven hundred and eighty-nine thousand eight hundred and ninety-three (2,789,893). This number was made up from the regular army and the volunteers, white and colored. The war lasted for little upwards of four years, and as regards its severity, pertinacity, and magnificent proportions, has never been equaled in modern times.

[1] The materials for this section are taken entirely from the "Report of Provost Marshal General Fry to the Secretary of War," *Message and Documents*, War Department, 1855–56. Part 3, pp. 72 to 83. As this is at present the only source from which this information could be obtained, the utmost freedom has been taken with it, and in some instances the exact language is quoted, for which, without specifying in every instance, due acknowledgment is here made. This Report is made up from the monthly returns to the Adjutant-General, and the muster and pay-rolls of the army; and while it is not claimed that the figures and calculations there given are absolutely correct, they furnish the most accurate information to be obtained at present, and for the purposes in view in this paper they may be considered essentially trustworthy. It may be added in confirmation of their general reliability, that these returns are the official source of all information relative to the military history of the soldier, and, as such, are relied upon by the War Department to determine the final settlement of accounts and the disposition of the men. The percentage of error is therefore very small, and in all probability will not materially alter the ratios obtained in the study of these figures should a record absolutely without error be obtained at any subsequent time. It is to be hoped the official medical and surgical history of the war, as well as the forthcoming final report of the Medical Bureau of the Provost Marshal General's Department, will furnish such a record, and in a shape more available for statistical purposes than the figures now at hand.

STATEMENT OF THE CASUALTIES IN THE ARMIES OF THE UNITED STATES FROM THE COMMENCEMENT OF THE REBELLION TO AUG. 1865.

States, etc.	Enlisted Men.			Officers.			Whole No. of Deaths from Wounds.	Whole No. of Deaths from Disease.	Total Deaths from these Causes.	Number of Men enlisted during the War in which these Casualties occurred. Service from 3 mos. to 3 yrs.
	Killed in Action.	Died of Wounds.	Died of Disease.	Killed in Action.	Died of Wounds.	Died of Disease.				
Maine	1,620	1,069	5,479	116	66	65	2,871	5,544	8,415	64,708
New Hampshire	1,006	531	2,481	91	33	49	1,661	2,530	4,191	33,025
Vermont	1,133	662	2,964	68	39	34	1,902	2,998	4,900	32,653
Massachusetts	3,624	2,027	7,824	274	104	80	6,029	7,904	13,933	126,236
Rhode Island	446	*	1,052	30	*	21	476	1,073	1,549	21,301
Connecticut	1,094	663	3,246	97	48	63	1,962	3,309	5,211	53,594
New York	8,695	5,021	17,185	427	302	222	14,445	17,507	31,852	404,748
New Jersey	1,231	317	2,933	106	40	33	1,694	2,966	4,660	67,186
Pennsylvania	6,096	3,675	10,973	376	137	117	10,284	11,090	21,374	323,846
Delaware	178	113	207	9	10	7	310	214	524	12,171
Maryland	359	326	824	16	17	39	718	863	1,581	42,128
West Virginia	741	391	1,792	58	23	20	1213	1,812	3,025	32,003
Dist. Columbia	43	8	244	3	1		55	244	299	15,181
Ohio	6,283	4,534	13,195	280	140	159	11,237	14,398	25,635	307,380
Indiana	3,140	2,244	13,172	294	139	220	5,817	13,392	19,209	193,285
Illinois	5,463	2,925	19,570	394	126	364	8,908	19,934	28,842	255,938
Michigan	2,554	1,151	8,421	154	68	78	3,927	8,499	12,426	87,613
Wisconsin	2,237	1,393	6,885	121	67	101	3,818	6,986	10,804	90,888
Minnesota	381	191	1,650	29	7	26	608	1,678	2,284	23,999
Iowa	1,926	1,303	8,515	146	69	127	3,444	8,642	12,086	75,788
Missouri	1,461	767	7,216	89	48	130	2,365	7,346	9,711	108,756
Kentucky	1,103	669	5,151	82	30	124	1,884	5,275	7,129	74,961
Kansas	923	259	2,170	36	8	24	1,226	2,194	3,420	20,095
California	34	57	298	1		1	92	299	391	7,451
Tennessee	1,264	920	2,182	27	11	11	2,222	2,193	4,415	
Mississippi			69					69	69	
Alabama	32	31	288	2		2	65	290	355	
Florida	27	142	102				169	102	271	
Texas	22	11	278				33	278	311	
North Carolina	34	19	248		1	1	54	249	303	
Louisiana	117	101	768	2	2	1	222	769	961	
Arkansas	210	163	544	8	3	1	384	545	929	
Nevada	8	2	225				10	225	235	
Oregon	58	7	665		2	2	67	667	734	
Colorado	61	44	205	2	1	2	108	207	315	1,762
Indian Territory	231	141	416	2			374	416	790	
Washington Territory	14	11	107		4		29	107	136	
Dakota "			10					10	10	
Nebraska "	5	8	122	*1		1	14	123	137	3,157
New Mexico "	7	15	159		1	1	23	160	183	2,395
U. S. Vols. Penitent Reb's	9	5	352				14	352	366	
Hancock's Corps	7	2	406				9	406	415	
Miss. Marine Brigade	136	107	181	3	2	4	248	185	433	
Veteran Reserve Corps	43	70	1,269	1		11	114	1,279	1,393	60,508
Total Volunteers	54,056	32,095	152,013	3,345	1,549	2,141				
Regular Army	1,890	*	2,749	157	*	83	2,047	2,832	4,879	67,000
Colored Troops	1,790	1,037	26,211	124	46	90	2,997	26,301	29,358	180,017
Grand Total	57,736	33,132	180,973	3,626	1,595	2,314	96,089	183,287	279,376	2,789,893

* Included in the killed in action.

RECAPITULATION OF THE LOSSES FROM WOUNDS AND DISEASE IN THE REGULAR AND VOLUNTEER ARMIES, AND AMONG COLORED TROOPS.

Arm of the Service.		Privates and Non-Commissioned Officers.			Commissioned Officers.		
		Killed in Action.	Died of Wounds.	Died of Disease.	Killed in Action.	Died of Wounds.	Died of Disease.
Regulars.	Cavalry	284	*	470	23	*	18
	Artillery	308	*	472	32	*	12
	Infantry	1,298	*	1,807	102	*	53
	Total . .	1,890		2,749	157		83
Volunteers.	Cavalry	6,816	4,018	24,702	378	144	331
	Artillery	1,630	955	8,725	79	47	99
	Infantry	45,610	27,122	118,586	2,888	1,358	1,711
	Total . .	54,056	32,095	152,013	3,345	1,549	2,141
Col'd Troops.	Cavalry	99	32	883	3	1	1
	Artillery	36	31	3,508	3	1	16
	Infantry	1,655	974	21,820	118	44	73
	Total . .	1,790	1,037	26,211	124	46	90
Aggregate		57,736	33,132	180,973	3,626	1,595	2,314

* Included in the Killed in Action.

SUMMARY.

	Deaths from Wounds and by Battle.	Deaths from Disease.	Aggregate Deaths from both causes.
Enlisted Men	90,868	180,973	271,841
Officers	5,221	2,314	7,535
Total	96,089	183,287	279,376

The whole number of men enlisted during the war among whom these casualties occurred is given at 2,789,893, of which one hundred and eighty thousand and seventeen (180,017) were colored troops, and sixty-seven thousand (67,000) by estimate were regulars. The terms of service varied from three months to three years. Reduced to a three years' standard, the equivalent is given as 2,154,311.

From this table it appears that during the rebellion two hundred and seventy-nine thousand three hundred and seventy-six lives were lost, in the army of the United States, from disease and wounds. Many, of course, died after discharge or muster-out of service, from disease or wounds contracted while in the service. There was also an inconsiderable number of deaths from accidental causes, etc. None of these are included in this

Mortality during the rebellion.

estimate. The general proportion of mortality, therefore, to the whole number in service, is about as one out of every ten (9.98).

Comparative mortality from disease and wounds.

Of the entire mortality ninety-six thousand and eighty-nine (96,089) deaths were caused by wounds, and one hundred and eighty-three thousand two hundred and eighty-seven (183,287) were from disease. The proportion of deaths from these two causes, therefore, was about one in two (1.90). In other words the deaths from disease were twice as numerous as those from wounds. It will be remembered, as we have above seen, that in the Mexican War our losses from disease were seven times as great as from wounds. In the Crimean War the losses of the English and French were each four times as numerous from disease as from wounds. The ratio, then, observable in our own recent war, is not only a cause of congratulation to ourselves, for the liability to disease and death, from the sudden changes from the habits and occupations of civil life, from exposure, fatigue, and privation, and from the local noxious influences to which our troops were exposed, to say nothing of the dangers of the battle-field, was fully equal to that experienced in any one of the above-mentioned campaigns; but it also shows conclusively the efficiency of the sanitary regulations enforced in our army; indicates the skill and adequate numbers of the medical staff, and the perfection of that vast hospital system for the care of the sick and wounded, and attests the value of the labors of the Sanitary Commission in giving that supplementary aid, which was so bounteously lavished by them both in hospital and on the field. Another element, too, was at work among our soldiers in this war, that measurably enabled them to resist the encroachments of disease, — *i. e.*, the springiness and buoyancy of spirits resulting from the extraordinary facilities allowed for communication and personal intercourse with friends and relatives at home, by whose approval they were encouraged in victory and sustained in defeat; and again, there was to be noted — in a marked degree — the individual consciousness of the soldier, that on the result of their efforts depended the very existence of the great nation to which they belonged. The influence of such causes — psychological rather than physical — in producing a low rate of mortality in armies, is perhaps too often under-estimated.

Comparative mortality among enlisted men and officers.

Looking more in detail into these figures, it will be seen that out of the whole number of deaths, from all causes, seven thousand five hundred and thirty-five (7535) were officers, and two hundred and seventy-one thousand eight

hundred and forty-one (271,841) were enlisted men. The general proportion, therefore, of mortality, among the officers compared with enlisted men, is as one to thirty-six.

Of the whole number of *deaths from wounds*, five thousand two hundred and twenty-one (5221) were officers, and ninety thousand eight hundred and sixty-eight (90,868) were enlisted men. Thus it appears that one officer was killed or died of wounds, to about every eighteen men. Of the *deaths from disease*, two thousand three hundred and fourteen (2314) were among the officers, and one hundred and eighty thousand nine hundred and seventy-three (180,973), were among the enlisted men, thus showing only one death from this cause among the officers, to every ninety deaths among the enlisted men. Now, as the officers in complete organizations constitute about one twenty-fifth part of the whole number, it appears that the rate of mortality from disease, among the enlisted men, was nearly four times as great as among the officers; while on the other hand, the death-rate from wounds was one and one half times greater among the officers than the enlisted men. General Fry, in speaking of these ratios says, very forcibly: —

"This remarkable disproportion, so greatly to the advantage of the commissioned officer, is owing to several causes. Officers are better sheltered than men, and their food is generally better in quality and more varied in kind, so that they suffer less from diseases of the digestive organs. They are not so much crowded together in tents and quarters, and are, therefore, less subject to contagious and epidemic maladies. They have superior advantages in regard to personal cleanliness. As prisoners of war, too, they were generally treated more leniently, and so furnished fewer names to the mortality lists of Andersonville, Salisbury, and other similar dens of death. Another favoring circumstance, and by no means the least potential, was the superior *morale*, the hopefulness, and elasticity of spirit which is given to a man by investing him with a commission, and its accompanying authority, responsibility, and chances of advancement."

Of the enlisted men, ninety thousand eight hundred and sixty-eight (90,868) died of wounds, and one hundred and eighty thousand nine hundred and seventy-three (180,973) died of disease. This gives a proportion of two deaths from disease, to one by the casualties of battle (1.99 : 1). *Of the officers*, five thousand two hundred and twenty-one (5221) were either killed in action, or died of wounds, while only two thousand three hundred and fourteen (2314) died of disease. The death-rate, therefore, among officers is about twice (2.25) as great from wounds as from disease.

Large excess of deaths from disease among colored troops.

A noteworthy feature in the above tables, is the very large excess of deaths from disease among the colored troops, as compared with the white. While 2997 were killed in action or by wounds, 26,301 died from disease, showing that the deaths from disease were eight times as numerous as from wounds. We have already seen that the proportion for the army at large, was about two to one. The number of deaths from all causes, among the colored troops, proportioned to the total strength, is also worthy of note, for it appears that one out of about every seven in service lost his life; the proportion for the white troops being about one in fifteen. This mortality is the highest shown in the records of this war. These figures appear to indicate pretty conclusively that the negro, as he was found in our armies, was less capable than the white man of enduring the fatigues and hardships, and of withstanding the influences of disease incident to army life. Assuming that where one man dies of disease, at least five others are seriously sick (and this proportion is not probably too large), it will be seen that a very large proportion of the colored troops must have been constantly sick. What the causes of this greater susceptibility of the negro to disease are, hardly come within the scope of this paper; but it is suggested, to use the words of General Fry, "that they were rather psychological than physical, and arose from lack of heart, hope, and mental activity, and that a higher moral and intellectual culture would diminish the defect."

Mortality in the different arms of the service.

In considering the mortality in the different arms of the service, we cannot arrive at any conclusion as to the relative proportion of deaths to the numbers engaged, for we have no statement of the number of troops assigned to these special corps. We can, however, obtain some interesting conclusions as to the relative frequency of death from the two causes — wounds and disease. Taking first the cavalry, and consolidating the three branches of the service, regulars, volunteers, and colored troops, it appears that there were twenty-six thousand four hundred and five (26,405) deaths from disease, and eleven thousand seven hundred and ninety-eight (11,798) from wounds, or a proportion of about two (2.23) to one. In the artillery there were twelve thousand eight hundred and thirty-two (12,832) deaths from disease, and two thousand one hundred and twenty-two (2122) from wounds, giving a proportion of six to one. In the infantry the deaths from disease were one hundred and fifty-four thousand and fifty (154,050), and eighty-one thousand one hundred and sixty-nine (81,169) from wounds. So that the proportion here is a little

less than two (1.89) to one. These figures show that the comparative danger from the casualties of battle is decidedly less in the artillery than either the cavalry or infantry, and somewhat less in the cavalry than the infantry. A similar conclusion, it will be remembered, has before been arrived at in the other armies under consideration. It will also be noticed that among the enlisted men in each arm, the loss of life from disease is vastly greater than from wounds, while among the officers, with the single exception of the colored artillery, wounds and battle killed more than disease. The cause of this greater mortality among officers, from the casualties of battle, is obvious, and needs no explanation here.

The proportion per one thousand of mortality from disease and wounds.

As a matter of considerable interest, though not exactly pertinent to our general inquiry, we give below the proportion per one thousand, which each State and group of States furnished in the mortality from the two causes under consideration. The total number of casualties per one thousand of those in active service, is given in the last column, and is made up from the resignations, discharges, dismissals, desertions, missing in action and accidents, in addition to the causes specified in the first two columns. The officers are included in estimating all these ratios.

PROPORTIONAL ANALYSIS OF THE TABLE OF CASUALTIES BY STATES, RATIO PER 1000.

States.	Killed or Died of Wounds.	Died of Disease.	Total Casualties.	States.	Killed or Died of Wounds.	Died of Disease.	Total Casualties
Maine	44.37	85.67	434.21	Ohio	36.55	46.83	257.81
New Hampshire . .	47.27	76.30	401.22	Indiana	30.01	69.28	251.23
Vermont	58.22	91.81	494.14	Illinois	34.80	77.88	281.43
Massachusetts . .	47.76	62.62	389.82	Michigan	44.82	97.01	481.12
Rhode Island . . .	22.34	50.37	285.66	Wisconsin	42.01	76.86	394.29
Connecticut . . .	35.48	61.64	426.51	Minnesota	25.33	69.83	318.76
				Iowa	45.44	114.02	329.60
New England States	44.76	70.45	408.63	Kansas	61.01	109.18	464.59
				California	12.34	40.11	370.68
New York	35.68	43.00	326.86				
New Jersey . . .	25.21	44.13	331.82	Western States . .	36.81	71.55	303.76
Pennsylvania . . .	31.75	34.24	269 37				
Delaware	25.63	17.57	235.48	West Virginia . .	37.90	56.62	368.65
Maryland	17.04	20.48	179.16	Kentucky	25.10	69.99	279.27
Dist. Columbia . .	3.62	16.07	104.73	Missouri	21.74	67.54	313.93
Middle States . .	31.79	37.88	293.24	Border States . .	25 32	66.76	309.49
Total ratio of 24 Loyal States	35.10	59.22	314.65				

PROPORTIONAL ANALYSIS OF THE TABLE OF CASUALTIES COMPARING REGULARS, VOLUNTEERS, AND COLORED TROOPS, RATIO PER 1000.

Armies.	Killed or Died of Wounds.	Died of Disease.	Total Casualties.
Regulars	30.55	42.27	442.16
Volunteers	35.10	59.22	314 65
Colored Troops	16.11	141.39	290.82

Comparative mortality among troops from different States.

From these tables we see at a glance which States contributed the largest share of mortality, and also the relative mortality from wounds and disease. It is observable that, in general, the battle mortality is highest in the northern tier of States, whether eastern or western. The high ratio of New England, 44.76, corresponds with the ratios of Iowa, 45.44, Michigan, 44.82, and Wisconsin, 42.01. This greater rate of battle mortality among the northern troops might, on a hasty examination, be assumed to imply a greater degree of bravery on the battle-field; but this interpretation is not probably the correct one. An explanation of it will undoubtedly be found in the fact, that, situated far distant from the seat of war, it was not necessary to keep any of their troops in garrison for the protection of their borders; they were, therefore, constantly in active service at the front. A remarkable deviation from this rule, however, is presented in Kansas, which was a frontier State during almost the whole war, and yet shows the highest battle mortality on the list. "Her population is a peculiarly pugnacious one, rendered such by their origin and history. The same singularly martial disposition which induced above half the able-bodied men of the State to enter the army without bounty may be supposed to have increased their exposure to the casualties of battle after they were in the service." Generally, also, those States which show a large battle mortality have also a high death-rate from disease, but the variations can, in some degree, be explained by the nature of the respective services required of the troops from different localities. Thus, an undue proportion of New-England troops served in the unhealthy departments of the South and the Gulf, which, in a measure, accounts for their high mortality, 70.45. The regiments raised in the Western States served mostly in the fever-breeding districts of the Southern Mississippi and Southwest, and this, no doubt, aided in swelling their mortality to 71.55. The Middle States, whose troops served

Mortality in Kansas.

Variations in mortality explained by the natureof the service.

mainly in the army of the Potomac, show a mortality of only 37.88, which is very largely below the general average for the States. Virginia was not only a healthier field of service than the South and Southwest, but it is very generally admitted that the army of the Potomac was the best provided for of all our large armies.

Comparing the three services, — regulars, volunteers, and colored troops, — we see, as has already been shown in another calculation, that the colored troops suffered the highest loss from disease, and the volunteers from wounds. The extreme rate of the total casualties in the regular service is explained by the enormous excess of desertions — a cause of loss with which we are not now concerned.

Comparison of mortality among regular, volunteer, and colored troops.

Finally, it appears from the foregoing tables, that out of the whole number of troops — reduced to the three years' standard, and which is the basis on which the above ratios by States are calculated — furnished by the separate States, the losses from battle wounds and disease were, neglecting fractions, in —

Comparison of losses from wounds and disease among troops from different States.

Maine	1 in 7	Indiana	1 in 8
New Hampshire	1 " 7	Illinois	1 " 7
Vermont	1 " 6	Michigan	1 " 6
Massachusetts	1 " 9	Wisconsin	1 " 7
Rhode Island	1 " 11	Minnesota	1 " 8
Connecticut	1 " 10	Iowa (nearly)	1 " 5
New York	1 " 12	Kansas	1 " 5
New Jersey	1 " 12	California	1 " 20
Pennsylvania	1 " 12	West Virginia	1 " 9
Delaware	1 " 20	Kentucky	1 " 10
Maryland	1 " 26	Missouri	1 " 9
Ohio	1 " 9	Colorado	1 " 6

The casualties among the medical officers during this war were very numerous. The proportionate mortality can only be ascertained when full reports shall have been made of the entire strength of this corps; but it can with safety be asserted that in the losses of medical officers by battle and wounds, no army of modern times ever approached this. The whole number of casualties were 336, namely:[1] Killed in battle, 29; died of wounds, 10; killed by accident, 12; died of various diseases, 285. There were also 35 others wounded during the war.

Casualties among medical officers.

A very incomplete report of the casualties of the rebel army

[1] *Annual Report of the Surgeon-General of the United States Army*, 1866, p. 7.

during this war is appended to the report of the Provost Marshal General (p. 141). The list is made up from the muster-rolls of the various organizations of the Confederate States, which are now in the possession of the archive bureau of the government. None of these returns are complete. They embrace periods of time varying from two months to four years, and the total strength is not given. The following is a summary of these returns: —

Casualties of the rebel army.

	Killed.	Died of Wounds.	Died of Disease.
Officers	2,086	1,246	1,294
Enlisted men	50,868	20,324	58,003
Total	52,954	21,570	59,297

This table shows a larger number killed and died of wounds than died of disease — a conclusion that cannot for a moment be accepted as correct. It not only is at variance with the known experiences of all other armies, so far as we have any records of them, but it implies a degree of well-being among the Confederate troops that is contradictory of what is positively known of their condition, state of discipline, equipment, and supplies. The truth will probably never be known, and perhaps it is as well for the credit of those most directly interested that it should not, though both as a matter of history and as a contribution to statistical science, it would be of great value, and in the highest degree interesting.

Losses in other notable campaigns.

It is not deemed necessary for the purposes of this paper to apply to any other military statistics the minute analysis that has been made of the mortality of the armies that have just passed under consideration. To do so would only weary by its detail, while, at the same time, it would add nothing to the general conclusions we shall submit as fairly proven by these statistics; nor, in our estimation, would it invalidate any of them.[1] But we think it advisable to here present a summary

[1] It is much to be regretted that there are no official statistics of the losses during the Italian War, so called, of 1859. The results of this war — one of the most remarkable, in many respects of modern times — may possibly afford an exception to our second conclusion, as given below; for it must be remembered that the duration of the active campaign was less than sixty days, in which time four battles were fought. Two of these battles — Magenta and Solferino — were among the fiercest and bloodiest on record, and the loss of life was immense. It would seem that so short a period would not suffice for disease to make full headway, and that in all probability the losses from this cause were less than from the casualties of battle.

of the losses in some other notable campaigns, by way of confirming the general proposition, that armies invariably lose more from disease than from wounds, and also of affording standards of comparison for our own recent losses in war.

THE SARDINIAN ARMY IN THE CRIMEAN WAR.[1]

In the Crimean War the Sardinians had an army whose effective strength was about twenty-one thousand men, and in the period of thirteen months (May, 1855, to June, 1856), the recorded mortality was two thousand three hundred and fifty-four (2354), of which twelve (12) were killed in battle. Sixteen (16) died of wounds, and six (6) by accident, while the comparatively enormous number of two thousand three hundred and twenty (2320) died of disease. An epidemic of cholera swept off eighteen hundred and thirty of this number. While this instance of mortality must be regarded as exceptional, if we consider the actual proportion existing between the number of deaths from wounds and from disease, it is a striking illustration of our general proposition, and confirms in a very positive manner the conclusion of M. Meyenne, that "the mortality in time of war is always proportioned to the degree of well-being of the soldier and the sanitary attentions bestowed upon him."

THE FRENCH ARMY IN AFRICA.[2]

M. Boudin gives the following summary of the losses of the French army in Algiers during a period of thirteen years: —

Years.	Effective Strength.	Died of Disease.	Killed in Battle.
1831	17,190		
1832	21,511		
1833	26,681		
1834	29,858	16,482	
1835	29,458		141
1836	29,897		per annum.
1837	40,147		
1838	48,167	2,413	
1839	50,367	3,600	
1840	61,231	9,567	227
1841	72,000	7,802	349
1842	70,000	5,588	225
1843	75,034	4,809	84

[1] *Eléments de Statistique Médicale Militaire*, par le Dr. Meyenne, p. 82. Quoted by him from the Report of Dr. Antonio Comisetti, Chief Medical Officer of the Sardinian Army during the Crimean War. M. Chenu also quotes this report, but his figures are at variance with those of Meyenne's. It may not be out of place to here remark, that no official statistics of the losses of the other armies engaged in this war have been published. Chenu gives (as an approximation) the losses of the Russians at 30,000 killed, and 600,000 died of disease and wounds; of the Turkish army, 10,000 killed, and 25,000 died of disease and wounds. Although these figures do not probably vary very largely from the truth, they are not entitled to any consideration as authority.

[2] "Études sur la Mortalité," etc., *Annales d'Hygiene*, tom. xxxvii. ser. 1re. p. 378.

Thus one eleventh ($\frac{1}{11}$) part of the effective strength was carried off by disease, and only one two hundred and sixty-fifth ($\frac{1}{265}$) by the casualties of battle (*par le fer et le feu*). That is to say, twenty-three times as many died from disease as from wounds. M. Boudin, therefore, has good reason for asserting that "the hospital is the true field of battle for the soldier."

THE ENGLISH ARMY IN SPAIN.[1]

It appears from the official reports published by Mr. Marshall, Inspector of the British Army, that the losses during the last forty-one months of the Peninsular War (a period extending from December 25, 1810, to May 25, 1814), were from disease, 24,930, and from the casualties of battle, 8889. The average effective strength during this time was 61,511. The average effective strength of the officers was 2716, and their losses were, "killed or died of wounds," 566; "died of disease," 374. The total losses of the officers compared with privates was as one to thirty-six, while their numerical strength was as one to twenty-two and one half. Dr. Edmonds remarks that "the number of deaths of officers in any one month is generally indicative of the fighting during that month, but the number of deaths of privates is of very little value in that respect." This is only another way of stating the conclusion which has already been arrived at in this paper, in relation to the proportionate losses of officers and enlisted men from wounds and disease.

THE EXPEDITION TO WALCHEREN.[2]

In July 1809, the British Government sent an army of 39,214 men to the Netherlands, — the same country in which, some sixty-five years previously, the English army was engaged. The experiences of this first campaign, which are so graphically described by Sir John Pringle in his "Observations on the Diseases of Armies," were here again repeated. In about four months time the loss from the deadly marsh fevers was 4175, while only 216 died from wounds. Per one thousand of effective strength, the loss from wounds was 16.7, while that from disease reached the figure of 332. The number of sick was so great that at the end of this period, — four months from the time of leaving England, — only 14,000 effective men were left for duty out of the entire army. It was this campaign which so wrought upon the minds of the

[1] Edmonds, "On the Mortality and Sickness of Soldiers engaged in War," *London Lancet* for 1838, p. 143, *et seq.*

[2] Boudin, *Annales d'Hygiene*, vol. xxxv. ser. 1re. p. 252; and Jarvis's "Sanitary Condition of the Army," *Atlantic Monthly*, Oct. 1862, p. 469.

English people, and to which Sir Alexander Tulloch so feelingly alludes in the paragraph already quoted.

LOSSES IN THE ENGLISH NAVY.[1]

In the English navy, during five years of war, the comparative losses were : —

Years.	Died of Disease.	Killed or Died of Wounds.
1776	1,679	105
1777	5,247	40
1778	4,801	254
1779	4,726	551
1780	4,092	293

Again, from 1830 to 1836 inclusive, the official reports of the English Government show a mortality in the navy of 2175 out of an effective strength of 157,770. Of these deaths only 307, or about one sixth, were from wounds or accident.

THE RUSSIAN ARMY IN TURKEY.[2]

"Out of 115,000 Russians, who invaded Turkey in Europe in 1828 and 1829, 10,000 to 15,000 only recrossed the Pruth. The remainder died in the hospitals of intermittent fever, dysentery, and the plague. . . . From the month of May, 1828, to February, 1829, there were admitted into the field and general hospitals 210,108 patients. The greatest prevalence of disease was in September and October. In this last month 20,000 sick entered the general hospitals alone. The month of February gave the greatest mortality — over one quarter of all sick dying. These facts are not exact enough to enable us to estimate the entire losses of the army during this first campaign, but we can without exaggeration place it at one half of the effective strength, that is to say, about 40,000 men, including the deaths on the field of battle. . . . The number of deaths in the general hospitals alone, from March to July (1829), was about 28,000. There was very nearly the same number in the last five months of the year; so that if we add to these figures the deaths in the regimental hospitals and on the field of battle, we do not exceed the limits of truth in placing the losses for the year 1829 at 60,000." These statements, it is true, do not afford any accurate means of comparison between losses from disease and from wounds, but it is evident from the account as given in full, that the losses from disease were enormously in excess of those from wounds.

[1] Boudin, *loc. cit.*, p. 248.

[2] Boudin, *Traité de Geographie*, etc.; tom. ii. p. 289, *et seq.*, quoted by him from Moltka.

Conclusions.

But it is unnecessary to extend any further these illustrations. They can be collected from the records of all modern wars; they would all convey the same lesson. Enough has already been brought forward in the statements, based upon official statistics, to warrant the following conclusions: —

1. That the aggregate mortality in armies in time of war is very variable — depends upon the nature of the service, the susceptibility of the men to endemic influences, and above all, upon the degree of exactness with which sanitary and hygienic measures are enforced.

2. That in armies the deaths from disease are invariably greater in number than those from wounds, and that there is no fixed proportion between them; the ratios ranging, as we have seen, between two to one and twenty to one, or in other words, from sixty to ninety-five per cent. of the entire mortality is attributable to disease.

3. That officers invariably lose, by the casualties of battle, a larger proportion than enlisted men.

4. That enlisted men invariably lose from disease a very much larger proportion than officers.

5. That the losses numerically among officers are greater from wounds than from disease, while the reverse is true of enlisted men.

6. That the infantry is the most dangerous arm of the service, whether considered in the liability of the soldier to death from disease or from the casualties of battle. The difference between the artillery and cavalry is not very great, but the data are not sufficient to enable one to say which is the more dangerous.

7. That in armies the negro — so far as the experiences of our recent rebellion will justify the inference — is more liable to disease and death than the white man, and therefore not so well adapted for the occupation of a soldier. Further experiences may modify, or possibly even reverse, this conclusion.

CHAPTER SECOND.

CAMP FEVERS. — REMITTENT, TYPHOID, TYPHO-MALARIAL OR MALARIAL TYPHOID, COMMON CONTINUED, AND MOUNTAIN FEVER.

By ROBERTS BARTHOLOW, M. D., Etc.

REPLIES OF MEDICAL OFFICERS TO QUESTIONS CONCERNING CAMP FEVERS, — REMITTENT AND INTERMITTENT, TYPHOID, AND TYPHO-MALARIAL.

Conditions modifying the Symptomatology and Morbid Anatomy of the Fevers of the Army, — Remittent and Typhoid. — Dr. Woodward's Theory of Typho-Malarial Fever. — Classification of the Fevers of the Army into Periodical and Continued. — Subdivision of Periodical Fevers into Intermittent, Remittent, and Typho-Malarial (?). — Subdivision of Continued Fevers into Simple Continued, Typhoid, Malarial Typhoid, and Typhus. — Error of considering all these as Modifications of one Disease. — The Scorbutic Element in Camp Fevers. — Existence of Typho-Malarial Fever considered. — Comparison of Army Typhoid and Army Remittent Fever. — Alterations Characteristic of Chronic Malarial Poisoning. — Etiology of Typhoid Fever. — Emanations from Excreta the Chief determining Cause. — Facts showing Contagiousness of Typhoid Fever. — Simple Continued Fever. — Number of Cases in the First Year of the War. — Occurrence among Recruits and Young Soldiers. — Mountain Fever. — Dr. Ewing's and Dr. Logan's Account. — Malarial Origin of this Variety of Fever. — Remittent and Typhoid Forms of Mountain Fever. — Sources of the Malarial and Typhoid Poison. — Typhus Fever. — Conclusions.

Replies of Medical Officers. — Statistics of Fevers during the First Two Years of the Rebellion. — Replies relating to Intermittent and Remittent Fever. — Statistics of Periodical Fevers. — Extract from Communication by Surgeon H. W. Clark. — Communication from Surgeon Lidell. — Statements by Surgeons Miller, Jones, Windsor, Flagg, and Assistant-Surgeons Gennet and Abbott. — Extract from Letter by Surgeon Dibble. — Infrequency of Typhus Fever. — Frequency of Typhoid Fever. — Two "Walking Cases" of Typhoid Fever. — Proper Use of the Term Typho-Malarial Fever. — Surgeon Evert's Opinion. — Communication by Surgeon Harvey. — Cases Reported by Medical Inspector F. H. Hamilton.[1]

CONDITIONS MODIFYING THE SYMPTOMATOLOGY AND MORBID ANATOMY OF THE FEVERS OF THE ARMY, — REMITTENT AND TYPHOID.

Several distinct febrile diseases have been included under the term "Camp Fever." Dr. Woodward has attempted to show, in Circular No. 6, that there is a disease consisting of these fevers blended, to which this term is properly applicable. He includes under this designation typhoid and remittent fevers, and has proposed the name — typho-malarial — to express his view of the constitution of the mixed disease.

Dr. Woodward's Theory of typho-malarial fever.

[1] Statistics showing the prevalence and fatality of typhoid fever in the Confederate army are combined with statistics relating to pneumonia. *Vide* chapter on "Pneumonia in the Confederate Army," by Professor Joseph Jones. — Editor.

He makes three sub-varieties of the typho-malarial fever: malarial, scorbutic, and enteric (p. 140, 141) — distinctions as unmeaning, clinically, as the terms themselves are tautological. There are essential differences, as we shall show further on, between these groups of diseases thus violently classed together. Moreover, the term typho-malarial is most faulty. It assumes that the typh element is simply a modifying condition, and that the essence of the disease is malarial — an assumption not warranted by the facts.

These several forms of fever preserved as distinct clinical features in the army as the same forms of disease in civil life. Any one who has observed the behavior of fevers in the interior region of this continent — the Valley of the Mississippi and its tributaries — will have been struck with a significant fact: the gradual substitution, as populations increase and the face of nature changes, of continued fever for the malarial fevers. During the period of transition from one form of fever to the other, a mixed type may prevail; or, as the idea may be more properly expressed, a malarial element remains to obscure the distinctive characters of the continued fever. Notwithstanding this occasional conversion of types, the cases which may not be readily assigned to their appropriate classes are indeed few in number. That a more definite classification than the one proposed by Dr. Woodward, and adopted in Circular No. 6, might have been made, is evident enough on an examination of the statistics of fever for the first two years of the war. Taking as examples the two forms, typhoid and remittent, we have this result: whilst the cases of typhoid increased 42 per cent. from the first to the second year, the cases of remittent increased somewhat more than 100 per cent. for the same period. The influence of the bad hygiene of the camp is first seen, and afterward the agency of malaria. When Dr. Woodward's term, typho-malarial, came into use, we find one sixth of the whole number of cases of fever grouped together under this designation. That these cases might have been assigned to either the remittent or continued class, is evident enough on comparing the mortality rates. Whilst one third of the cases of typhoid fever proved fatal, only one twentieth of the cases of typho-malarial, and one eightieth of the cases of remittent fever, terminated fatally! It is clear, therefore, that two thirds of the cases, so-called typho-malarial, were cases of remittent fever only, and the remaining third were probably typhoid, complicated, it may be, with a malarial element. The foregoing statistics show as clearly as figures can, the fallacy of

grouping into a class, indiscriminately, these essentially different forms of disease, which vary as much in mortality as in clinical features.

The fevers of the army may be comprehended in two great classes: —

Classification of the fevers of the army.

Periodical;

Continued.

To the class of periodical fevers belong Intermittent, Remittent, Typho-Malarial (?).

To the class of continued fevers belong Simple Continued Fever, Typhoid, Malarial Typhoid, Typhus.

To consider all the above forms, except intermittent fever, modifications of one disease, is to do violence to the facts of pathology and morbid anatomy. It is assuming that causes in operation in army life produce results essentially different from those produced by the same causes in civil life. Over the great interior region of this continent, under conditions similar to those which obtain in the army, all these forms of fever prevail, — in the sparsely settled country districts and small towns, periodical fevers; in the great centres of population, typhoid fever. The malarial element, all the facts go to show, diminishes rapidly as populations grow dense, its place being supplied with the typh element, which increases correspondingly. Our armies, in respect to these two elements in disease, had somewhat the same relation as large cities. That these diseases — Periodical and Continued — were sometimes more severe in the army, is not remarkable, but that they possessed new features, can hardly be admitted.

Error of considering all these as modifications of one disease.

Another element to which considerable importance has been assigned as influencing the symptomatology, the lesions, and the mortality of camp fever is the so-called "scorbutic taint." Dr. Woodward, in Circular No. 6, remarks, that "recognizable scurvy existed to a limited extent, and a scorbutic taint more or less pronounced, was a prominent phenomenon in most of the diseases of the war. . . . . The scorbutic taint manifested itself very generally in the form of rheumatic pains in the back and limbs, associated with the scorbutic, clay-like appearance of the skin, sometimes even with sponginess of the gums, much more rarely with petechiæ, scorbutic discolorations about the flexure of the knee," etc.

Scorbutic element.

That recognizable scurvy existed to a limited extent, is obvious on examination of the statistics, there being but 1328 cases in the

first year, and 7395 cases in the second year of the war. If it were possible to subtract from these numbers the cases of ordinary stomatitis, so commonly reported as scurvy, the aggregate would be considerably reduced. In a pretty extended course of observation, I did not meet, during the war, a single well-marked case of scorbutus. A scorbutic taint *per se*, cannot be separated from other causes constantly in operation to lower the health of the soldier. With as much propriety a scorbutic taint might be assigned as a complicating condition in those severe cases of typhoid fever occurring amongst the ill-fed poor of our large cities. Certainly, the typhus of the great famine periods in Ireland might, with much more propriety, be considered as modified by scorbutus. The case of lowered vitality, by reason of long deprivation of suitable food, does favor the reception of the typh poison, and does increase the severity of the typhoid disease; but that it adds some special character, which may be defined as the scorbutic type, cannot be admitted. Indeed, any one who has observed scorbutus on a scale of considerable magnitude, will not consider it as having any affinity with typhoid fever. Various intercurrent diseases occur in the course of scorbutus, but not typhoid fever, unless the other conditions necessary for the development of the typh poison are present.

I am convinced we shall better comprehend the true relation of camp fevers, if we consent to study them as they are, and not continue to view them through some medium which gives them a forced and unnatural configuration.

Composite morbific cause of fever.

Our armies during the war were subjected to a composite morbific cause — malaria, faulty alimentation, bad hygiene. The boundary line between these could with difficulty be traced in individual cases, at least so far as the signs and symptoms of disease are concerned. To arrive at a positive determination, it was necessary, not alone to study the morbid anatomy, but to compare the symptomatology with the after-death appearances. I propose in the following pages to give the results of my observations made in both these modes of investigation.

Existence of a typho-malarial fever.

Is there a Typho-Malarial Fever? — The answer to this question involves a discussion of the relative influence of these two elements in the production of camp fever. Dr. Woodward attempts to solve the problem by assuming that there is a malarial form, an enteric form, and a scorbutic form of camp fever (p. 141). In other words, that camp fever is a generic disease modified by malaria, by the typh element, or by scorbutus.

"As these diseases have occurred in our army during the present war, the phenomena of these two affections have continually complicated each other in the same patient; so that in fact the enteric fevers have broken out among men campaigning in a malarial region, with constitutions more or less thoroughly impregnated with the malarial poison; the remittents among soldiers, peculiarly prone by their exposures and mode of life to enteric disease; and both have occurred almost without exception, in men whose health has been more or less modified by camp diet, and who are therefore suffering in some degree from a condition best characterized as the scorbutic taint.

"These three modifying conditions or tendencies, each of which, when acting alone, might produce simple enteric fever, periodic fever, or scurvy, when acting simultaneously produced mixed types of disease that vary infinitely in accordance with the predominance of one or another of the three sets of determining conditions. For these variable resulting fevers, I proposed the general name of Typho-Malarial Fever, which in June, 1862, was, at my suggestion, adopted in the statistical nomenclature of the monthly reports of sick and wounded" (Circular No. 6, p. 109).

Typho-malarial fever and camp fever are, in Dr. Woodward's view, synonymous terms. Studied by the symptomatology this fever is neither remittent nor continued, but partakes of the character of both. Studied by the morbid anatomy, the diseased conditions are made up of the changes peculiar to both remittent and typhoid. There were, therefore, according to Woodward, really no cases wholly typhoid or wholly remittent in the army. If we admit this view, we must also admit that at the present time, among the denser populations of the interior continent, there are no cases unequivocally remittent or typhoid, for the causes inducing these modifications or mixing of types, obtain in this region as much as in the army.

Statistics of remittent and typhoid fever.

The army surgeons, most of whom were, probably, sufficiently familiar with the essential differences between remittent and typhoid fever, reported in the first year of the war 40,047 cases of remittent fever, and 370 deaths, and 21,977 cases of typhoid and 5608 deaths; in the second year 83,716 cases of remittent and 1167 deaths, and 31,374 cases of typhoid and 10,467 deaths; of typho-malarial 22,652 cases and 1129 deaths. These statistics alone are conclusive against the position of Dr. Woodward. The mortality rates, also, exhibit, in the most striking manner, the essential differences between these

several forms of fever. For the first year of the war the mortality of typhoid fever was about 1 in 4, and for the second year 1 in 3; of remittent, the mortality was less than 1 in 100 for the first year, and 1 in 80 for the second; and, lastly, of typho-malarial, the mortality was 1 in 20.

Regarded from the clinical point of view the differences were equally well defined. This may be better exhibited by a comparative statement.

COMPARISON OF ARMY TYPHOID AND ARMY REMITTENT FEVER.

Army Typhoid. — A distinctly continued fever, with daily exacerbations, not more decided than has been usually observed in typhoid epidemics, *e. g.*, Dr. Nathan Smith's account of epidemics in New England.	*Army Remittent.* — A remittent fever, of quotidian or tertian type, usually the latter, and exacerbations terminating in perspiration.
Low delirium, subsultus, and stupor.	No delirium nor stupor.
Diarrhœa (pea-green stools) a constant symptom.	Constipation. Frequently diarrhœa, due to a cause to be presently stated, but the stools dark-colored and offensive.
Tympanites, gurgling and tenderness in the right iliac region.	No tympanites, nor gurgling, nor tenderness in right iliac region.
Rose spots in one third.	No characteristic eruption.
A dusky hue of the face.	Jaundice in some cases; bronzing of the skin in all the others.
Duration not less than three weeks.	Duration from one to two weeks.
Convalescence slow.	Convalescence speedy.
Mortality one in four.	Mortality one in eighty.
Thickening and ulceration of Peyer's patches, enlargement of the mesenteric glands, large and soft spleen, etc.	Thickening of solitary glands, fawn-colored liver, fleshy spleen, etc.

Such are the broad and well-marked differences between the typhoid fever and the remittent fever of our army. A certain number of cases — the proportion is probably correctly expressed in the returns of the second year of the war — occupied a middle ground; cases of typhoid fever complicated with a malarial element. Did the cases of periodical fever present any evidences of a typh complication? Dr. Woodward's term — typho-malarial —

assumes that this was the case. Herein, I venture to affirm, lies the chief error in his views. A typh element did not, in my experience, exhibit itself as a modifying condition in remittent fever. The statistics, especially the mortality rates, quoted from Circular No. 6, tell the same story. On the other hand, typhoid fever, occurring in an organism affected with the "chronic malarial poisoning," was modified somewhat in its symptomatology but still more in its morbid anatomy. The impression of the malarial element was exhibited in heightening the daily exacerbation; in other words, in a greater range of temperature; in periodical sweats; in a less degree of stupor and delirium; in bronzing of the skin; by the presence of bile pigment in the urine, and by other evidences of biliary derangement. As all these modifications in the symptomatology of typhoid fever may and do occur in regions not malarious, it would be impossible to associate them with a malarial complication, if they were not studied in the light of the morbid appearances after death. I have elsewhere been at some pains to show the changes induced in the organs by the slow absorption of the malarial poison. These changes may, but do not usually, produce the phenomena of periodical fever. They seem to occur, almost universally, according to my observation, in men subjected for a long time to small doses of the poison, not sufficient to light up fever, which is the resistance of the organism to the morbific influence. The comparative effect of these two methods of introducing the malarial poison may be likened to the slow introduction of arsenic as contrasted with the effects of a poisonous dose.

Alterations characteristic of chronic malarial poisoning.

The alterations characteristic of chronic malarial poisoning were found in the following named organs: liver, spleen, the solitary glands of the small and large intestines, and the follicles of Lieberkühn. These changes may be expressed, summarily, in the following terms: aberration of pigment deposits and albuminoid degeneration of organs. The liver has a fawn color, and its cells are pale. Early in the course of the changes, the walls of the intestines are thin and transparent, the solitary glands just beginning to show themselves, and the patches of Peyer appearing as a slight cloud when the intestine is held up between the eye and the light. The solitary glands continue to enlarge, and the whole surface of the mucous membrane in the ileum appears to be studded with them; the patches of Peyer become elevated a little above the general surface, and the epithelium covering them is soft and easily detached, and the follicles of Lieberkühn become visible, owing to a deposit of pigment in their

orifices. A pigment deposit also takes place in the orifices of the flask-shaped glands of the large intestine. Coincidently with these changes in the glandular apparatus of the intestine, the veins of the submucous coat enlarge. The spleen is full-sized, enlarged, fleshy, and firm, its trabeculæ distinct, the splenic pulp deficient, and the Malpighian bodies remarkably increased in size.

When, in a subject affected with these alterations, typhoid fever occurs, the lesions of typhoid are superadded to those of malaria. The alterations in the agminated patches and in the mesenteric glands appear to be unaffected by the malarial element. Dr. Woodward professes to have discovered some differences in the form of the ulcers, but after a candid examination of a considerable number of cases, I must be permitted to express my disbelief in the existence of such differences.

The manner in which the malarial element modifies the typhoid disease, and the behavior of the two forms of poison under the same external conditions, are well exhibited in the disease known as "Mountain Fever," the peculiarities of which will be discussed in another part of this paper.

CAUSES.

Etiology of typhoid fever.

Typhoid fever, together with measles and mumps, etc., was the seasoning process to which our soldiers were subjected on entering the army. Personal uncleanliness was one of the causes; crowding in tents or quarters, ill-ventilated and imperfectly policed, was another cause; but the chief determining cause was the air of the camp, poisoned by organic emanations and privy gases. My personal observations of the circumstances under which typhoid fever was developed in the army, have convinced me that the importance of the last-named cause cannot be over-estimated. The cases of fever occurred most numerously where the diarrhœal discharges were most abundant and most exposed to decomposition and dissemination by the air and the water supply. Now, diarrhœa, as this volume sufficiently declares, was so common, that hardly any soldier served a few days or a few weeks without being affected with it. Badly constructed sinks within a few yards of the camp were the rule, and not unfrequently no sinks of any description were used, but the environs of the camp were converted into a general latrine. Privy odor was soon developed, and the drinking water contaminated. When sufficient time had elapsed, typhoid fever declared itself amongst those who had not completed the

Emanations from excreta the chief determining cause.

seasoning process, or those who had acquired a special susceptibility to the poison. That a certain time was requisite to give intensity to the morbific matter, is evident enough from the fact that troops on the march were not subject to typhoid fever, but a few weeks of detention in camp sufficed to develop the typh poison. On the other hand, camping and marching in a malarial region, without prolonged stay in one or a few camps, was attended with the periodical fevers. The peninsular campaign was an instance of the latter (Chickahominy fever), and the various winter or permanent camps were instances of the former (on the Potomac, siege of Vicksburg, winter at Chattanooga, etc.).

Facts showing contagiousness of typhoid fever.

I have observed some facts indicating the propagation of typhoid fever by contagion. Wards which had been occupied by fever patients apparently became poisoned, and other cases admitted into them were exceedingly liable to be attacked with typhoid fever. This occurred in Ward 1, National Hotel Hospital, Baltimore, so frequently, that the disuse of it by wounded became imperatively necessary. The same circumstance was observed at Lincoln Hospital, Washington, and I doubt not at every hospital in which sick and wounded were alike received. I have also seen three instances in which patients contracted fever whilst lying alongside of typhoid cases, and subjected to the emanations both from the person and from the dejections. The particular influence of the peculiar typhoid stools has not been exhibited in any facts coming to my knowledge. It has seemed to me, however, after pretty extensive observation, that stools of ordinary diarrhœa and dysentery, when in state of change after exposure to the action of the atmosphere, were the principal factors in the causation of army typhoid.

SIMPLE CONTINUED FEVER.

Definition.

This affection may be defined as follows: A continuous febrile state, with an exacerbation toward evening, lasting from seven to ten days, and having a strong tendency to terminate after the sixth day by a critical evacuation — by diaphoresis, by diarrhœa, by a free discharge of urine with a great increase of urates, etc. The fever is accompanied by the usual symptoms of that state — anorexia, constipation, diminished urinary excretion, dryness of the skin, and hebetude of mind, but without delirium. Fatigue, anxiety of mind, exhausting drill, suppressed perspiration, organic emanations, foul effluvia, etc., were the apparent causes.

For the first year of the war 11,771 cases of common continued fever were reported, and of these but 146 proved fatal. My own observations warrant me in saying that these figures represent very nearly the degree of prevalence of that disease which I have ventured to denominate "simple continued fever." Having seen no fatal case of it, I am inclined to regard those reported fatal as cases of typhoid. It is to be regretted that this term — common continued fever — was no longer employed after the first year of the war, and that the cases reported under it were assigned to the typho-malarial class chiefly.

Number of cases.

This fever occurred principally amongst the recruits and young soldiers, who were, of course, more susceptible to the action of the causes. It is not improbable that this simple continued fever may be aggravated into typhoid if the state of the organism and other necessary conditions be favorable. So long as the development of a febrile state does not proceed to the formation of typhoid, we may assume that the poison matter, whatever may be its nature, — organic emanations, foul effluviă, etc., — has not yet attained sufficient intensity, or that the vital power of the organism is not enough reduced. Sufficient poison gains admittance, however, to produce a disturbance of the blood and consequent interference in the functions of the excretory organs. The febrile state is the reaction against the presence of these extraneous matters in the organism. The cases which have occurred under my observation having terminated favorably, no opportunity has occurred for the study of the morbid anatomy. There is not, probably, any specific anatomical lesion.

Occurrence among recruits and young soldiers.

The laws governing the modification of continued fever by a malarial element, or the true relations existing between the malarial and typh elements in the so-called mixed types, are clearly exemplified in that form of fever known as *Mountain Fever*. It will, therefore, conduce to a better understanding of the subject in hand to investigate the nature and causes of this fever. Furthermore, as mountain fever occurred amongst our troops operating in the elevated regions of the Rocky Mountains, it is proper to make some allusion to that disease in this place.

MOUNTAIN FEVER.

My personal observations of this disease were made during a service of two years in the territory of Utah, before the outbreak of the rebellion. During the late war cases occurred amongst our volunteer forces serving in Utah, Montana, and the other mountain territories.

The first account of this disease, which was by Dr. Ewing, appeared in the "St. Louis Medical and Surgical Journal" for March, 1855. A report made by me to the Surgeon-General on the medical topography and diseases of Fort Bridger, Utah, including a description of mountain fever, was published in the "American Journal of the Medical Sciences" for April, 1860. In the sixteenth volume of the "Transactions of the American Medical Association," there is a full and elaborate paper on the medical topography and epidemics of California, by Dr. Thomas M. Logan, which contains an abstract of my paper on the subject of mountain fever.

Dr. Ewing and Dr. Logan's account.

According to Dr. Ewing, mountain fever occurs only at an altitude of about 7000 feet, and is a disease *sui generis*, produced in some mysterious way by rarefied air. This opinion, it appears to me, is not at all justified by the facts. My observations are corroborated by those of Dr. Logan. "Dr. Bartholow's views coincide so nearly with our experience in cases of this form of disease, among travellers returning from Nevada Territory, that we cannot do better than adopt his description entire" (p. 550).

In my report I have remarked as follows: "I do not hesitate to declare my conviction that the periodical form of mountain fever is a disease of malarial origin, modified by elevation and rarefied air. The cases which occurred in the 'army of Utah,' happened in those men who had served in Kansas, and been exposed to the miasma of the Platte Valley, on the march over the plains. I saw other cases, and the most violent, amongst teamsters from Missouri and Illinois, who had frequently suffered attacks of undoubted malarial fever. The ordinary intermittents and remittents of the Platte Valley, gradually changed in character as the troops ascended the table lands of the Rocky Mountains, until, having reached the South Pass, they merged into that febrile state already described. Those attacks which, it is alleged, have occurred amongst the *habitués* of the mountains, are not well authenticated cases of periodical fever, but were rather typhoid modified, as I have already shown that affection is, by elevation. In Salt Lake Valley, mountain fever is extremely common amongst the newly arrived emigrants, much less so amongst the resident inhabitants, who have, undoubtedly, typhoid fever, but confounded with the periodical fever, and both known under the same local designation."

Malarial origin.

The origin of mountain fever is briefly indicated in the foregoing extract. The command with which I served had been encamped for some weeks on the banks of the Missouri, near Fort Leaven-

worth, a malarious district, and had subsequently marched and encamped in other malarious districts in Kansas. Cases of periodical fever occurred amongst them. Two months afterward, when we reached the vicinity of the South Pass of the Rocky Mountains, intermittent and remittent fevers appeared in considerable numbers. When we arrived in Utah, the command remained in camp for several weeks in the valley of Ham's Fork, a tributary of Green River. The elevation was about 6000 feet, but the weather for the season was warm. Whilst encamped in this valley, typhoid fever manifested itself, and the cases of remittent increased in number. There were then two forms of the so-called mountain fever. Following Dr. Woodward's example, I might have designated the one, the malarial form of mountain fever, and the other, the typhoid form; but as the two diseases are essentially distinct, there could be no propriety in associating them under one name. The term "mountain fever" is obviously a misnomer, the occurrence of these diseases in that elevated region being merely accidental and not due to any specific cause peculiar to that locality. Having quoted Dr. Logan's approval of my views in general, I should not omit to mention, that he "cannot altogether agree with me, that the periodical form of mountain fever is always found among those who may have recently ascended from the low malarial regions into the more elevated. . . . . It must be confessed, however, that the type of the fever was somewhat clouded."

Remittent and typhoid forms.

I extract from my report a description of the remittent and typhoid forms of mountain fever, to exhibit somewhat more clearly the differences between them.

I. *Remittent Form of Mountain Fever.* — "All cases were ushered in by a chill, more or less decided, which lasted a variable period. In the febrile stage the pulse was full, quick, frequent but soft, and sometimes dicrotic; the skin hot, dry, and mordicant; the tongue heavily furred in the centre, red and dry at the tip and edges. There were present, also, intense cephalalgia, aching in the back and limbs, suffusion of the eyes, loathing of food, and sometimes nausea and vomiting. Delirium occurred in several cases during the exacerbations. The remissions were characterized by debility, listlessness, indisposition to the slightest exertion of body or mind, and a most painful aching of the limbs. The countenance, at these periods, was vacant, dull, and tinged a dirty-yellow; the pulse small, quick, and irritable; the skin moist and perspiring, but the sweating was never profuse. Diarrhœa was a frequent symptom; the stools were thin, yellowish, watery, and

offensive — occasionally greenish, dark-brown or black. The urine was usually scanty, and deposited an abundant lateritious sediment. The chill was not regular in duration, nor did it usually amount to a distinct rigor, and the febrile reaction was extremely gradual in its approach. In some instances the two stages were coincident, and during the highest excitement, a sense of chilliness was experienced. The appearance of the tongue was peculiar — heavily loaded with whitish fur, through which enlarged papillæ protruded, like the strawberry tongue of scarlatina. The most painful, as well as persistent symptom, was the aching of the back and limbs. Having suffered an attack *in propriâ persona*, I can testify to the acuteness of these pains. By some officers of the army, who had had some experience with the *dengue*, it was likened to that affection, and bore amongst them the name of 'break-bone fever.' There was little regularity in the paroxysms, either in duration or periods of recurrence."

II. *Typhoid Form of Mountain Fever.* — After stating that the "typhoid cases during the early stage (first week) were remittent," the report proceeds as follows: "The typhoid fever of Utah has other peculiarities beside the occurrence of remissions. Many of those general symptoms so characteristic were wanting: coma, subsultus tendinum, muttering delirium, floccitatio; but in all were present some mental disturbance and stupor, cophosis, epistaxis, gurgling on pressure over the ileo-cæcal valve, pea-green watery stools; in two instances the 'rose spots,' and frequently the sudamina and sour-smelling perspirations. All the fatal cases were submitted to a *post-mortem* examination, and the characteristic lesions of typhoid fever invariably found."

The occurrence of remittent and typhoid fever in those elevated regions of the Rocky Mountains, remote from the sources of the one, and apparently without the conditions necessary to produce the other, is a remarkable circumstance, to the elucidation of which we may, profitably, apply attentive study.

Intermixture of the typhoid and the remittent type.

Both remittent and typhoid fever exhibited some aberrations from the typical forms of those diseases. Were these aberrations due to the diminished barometric pressure, or were the two types intermixed? The manifestations of the malarial poison are so protean, that we may answer the first question in the negative. The aberrations noted in the paroxysms of the mountain remittent, are not more remarkable than those occasionally observed in regions, unequivocally malarious; but, especially, they are not more remarkable than is observed commonly, in cases

of periodical fever occurring at the North, in persons subjected, for a considerable period previously, to the action of malaria in the South. The typhoid cases occurred in those who had absorbed more or less of the malarial poison whilst sojourning in the malarial regions of Kansas. In the first week, as we have seen, the malarial element asserted itself in giving a certain degree of periodicity to the symptoms, but afterward, this influence was no longer perceived, and the cases proceeded in the way characteristic of typhoid disease.

Sources of the malarial and the typhoid poison.

The source of the malarial poisoning is evident. The ascent into an elevated region only, gave renewed activity to the morbific matter. There are certainly none of the conditions present at the South Pass, to develop malaria. The source of the typh poison may not be so clear. A study of the facts presented in the previous part of this paper, will result in the conclusion that every encampment of soldiers, if in existence a few weeks, has in it the material for the generation of the poison of typhoid fever.

Typhus fever.

I have not alluded to typhus fever as one of the forms of camp fever, for the reason that I have no knowledge of it from personal observation. That cases occurred, especially at Annapolis, amongst our returned prisoners, seems probable. Certainly, the description of these cases, by credible medical officers, was strikingly similar to the accounts of typhus as seen in the great famine periods in Ireland.

CONCLUSIONS.

I may now present, in the form of conclusions, certain propositions, which appear to me to be true in respect to the fevers of the army.

Summary.

1. Camp fever consists of several distinct febrile affections : —

Remittent ;

Simple Continued Fever ;

Typhoid, with or without a Malarial Complication ;

Typhus.

2. Remittent and Typhoid are clinically and pathologically distinct.

3. A malarial element may exist as a complication in typhoid fever, or, more properly, typhoid may occur in a person affected with chronic malarial poisoning.

4. The term — typho-malarial fever — does not express the true relation of the malarial to the typh element.

5. Malarial fever and chronic malarial poisoning, are clinically distinct.

6. When the typh poison is not abundant, a simple continued fever may be produced.

7. Typhoid supersedes periodical fever in malarious districts when populations become dense, and in the army when the same conditions obtain as in civil life, *e. g.*, crowding, organic effluvia, animal *débris*, excreta, etc.

REPLIES OF MEDICAL OFFICERS TO QUESTIONS CONCERNING CAMP FEVERS: REMITTENT AND INTERMITTENT, TYPHOID, AND TYPHO-MALARIAL.

Statistics of fevers during the first two years of the rebellion.

The prevalence of fevers in the armies of the United States during the rebellion is shown by the statistics contained in Dr. Woodward's report, to which reference has been made in the foregoing paper by Dr. Bartholow. During the first year of the war, the whole number of cases in the armies of the United States was 74,619, the number of deaths being 6315; during the second year the number of cases was 138,641, and the number of deaths 13,144, making the total for the two years 213,–260 cases, and 19,459 deaths.[1] During each of these years about one quarter of the men suffered from some form of fever, and the deaths from fever amounted to two per cent. of the strength. "The whole number of deaths from fevers during the first year was nearly one half the total mortality from disease; during the second year, owing to the increased mortality from other diseases, the number was only one third the total mortality from disease, though still maintaining nearly the same ratio to strength." The Circular, issued by the Medical Committee of the Sanitary Commission, contained several questions relating to periodical and continued fevers. The remainder of this chapter will be devoted to some of the replies of medical officers to these questions. The replies will be arranged into —*First*, those relating to remittent and intermittent fever; *Second*, those relating to the continued fevers; and, *Third*, those relating to typho-malarial fever.

REMITTENT AND INTERMITTENT FEVER.

Statistics of periodical fevers.

Statistics showing the number of cases of periodical fevers or of other diseases, occurring in the armies of the United States during the war, could not, of course, be obtained directly by the Sanitary Commission. According to Dr. Woodward's

[1] Circular No. 6, War Department, Surgeon-General's Office, Washington, November 1, 1865.

report, which is based on the returns made to the Surgeon-General's Office, there were 262,807 cases of intermittent fever during the first two years of the war, of which 1788 cases ended fatally; the annual ratio of cases per 1000 of mean strength being 298.64, and of deaths 1.91. In a large proportion of the fatal cases the disease was of the form generally called by writers "pernicious," and commonly known in this country as "congestive intermittent fever." Excluding cases of pernicious intermittent fever, the mortality is reduced to 407 deaths during the two years, or one death to every 631 cases! Dr. Woodward considers that probably in some of the cases of supposed death from congestive intermittent fever, the disease was cerebro-spinal meningitis. Cases of intermittent fever were more rife, throughout all parts of the country, in September and October, than during any other months of the year.

Of remittent fever, during the first two years of the war, the number of cases was 123,763, and the number of deaths 1537.

The agency of malarial poisoning upon diseases and the results of surgery in the war, has been considered in the first section of this volume; also, the prophylactic employment of quinia. Aside from these points of inquiry, an examination of the reports which have been made to the Sanitary Commission, fails to develop any thing which can be presented as an important addition to existing knowledge. To the inquiry as to "any important facts observed in reference to the topographical and meteorological conditions that have concurred in giving origin or intensity to malarial disease in the localities where it has prevailed," nothing worthy of especial note is contained in the replies of numerous correspondents. This statement is also to be made with respect to the management of intermittent and remittent fever.

Extract from communication by Surgeon H. W Clark.

The following extract from a communication made by Surgeon H. W. Clark, 15th Infantry, Ohio Volunteers, dated near San Antonio, Texas, October, 1865, is interesting, as showing the effect of a removal from highly malarious districts to a healthful situation: —

"On the Mississippi River, and at Green Lake, Texas, and between these points and this place, our camps were on low, flat ground, in order that we might be near water. The days were excessively hot, and the nights quite cool. By these circumstances I account for the occurrence of a large number of cases of intermittent and remittent fever which then for the first time appeared; as previously we had never encamped on such ground, nor had to drink such water as that from the Lower Mississippi and the stagnant ponds of the Texas coast. We are now encamped

on a high and dry prairie, without shade, except from arbors constructed with brush and long weeds, and our camps are well supplied with good spring water. The result is, that malarial diseases have almost entirely disappeared, and instead of using an ounce of quinia daily, that quantity is sufficient for two weeks."

Communication from Surgeon Lidell.

The following communication from Surgeon John A. Lidell, U. S. Volunteers, and Inspector of the Medical Department, army of the Potomac, gives the relative proportion of cases of intermittent, remittent, and typhoid fever, in one brigade, in the valley of the Potomac, December, 1861: —

"*January* 5, 1862. — At Camp Observation, above Poolesville, Md., the monthly reports of the surgeons of the several regiments composing Burns's (late Baker's) Brigade, exhibited the following statistics with respect to fevers of all kinds during the month of December, 1861: —

			Feb. Intermitt.	Feb. Remitt.	Feb. Typhoid.
69th	Penn.	Vol.	00	7	00
71st	"	"	00	20	17 with 4 deaths.
72d	"	"	13	124	12 with 3 deaths.
106th	"	"	3	4	6 with 1 death.
	Totals,		16	155	35 with 8 deaths.

"The above-mentioned brigade had an aggregate of 4200 officers and men present. The above schedule embraces all the cases of fever reported. None of them were transferred to general hospital, but all of them were treated in the regimental hospitals at the camp. No death was attributed to either intermittent or remittent fever. Every case of typhoid fever (fever with the enteric lesion) was complicated with difficulties of a malarial origin, which required the administration of quinia in large doses a few times for their removal.

"The table given above shows that the prevailing type of malarial fever, during the month of December, 1861, in the Valley of the Potomac near the mouth of the Monocacy River, where Burns's Brigade was then stationed, was remittent fever."

Surgeon Geo. D. Miller's statement.

Surgeon George D. Miller, 5th Infantry, Wisconsin Volunteers, makes the following statement: —

"Hot days, with cold, damp nights, on damp ground, in shady groves, or in living timber, or on cold camping-grounds, have seemed to cause, or, at least, to intensify, malarial diseases."

Surgeon Amos S. Jones's statements.

The following statements are by Surgeon Amos S. Jones, 40th Wisconsin Volunteers: —

"I think malaria a cause of diarrhœa and dysentery, as well as fever, remittent and intermittent. . . . .

"The malarial poison was always most intense during the hot dry weather following rainy and damp weather after midsummer. It was far more intense in the South than I ever knew it in any place North."

Surgeon F. H. Windsor's communication.

With reference to the effects of malaria being manifested in connection with other diseases rather than by the production of intermittent and remittent fever, and, also, to the protection afforded by previous exposure to malaria, Surgeon F. H. Windsor, 49th Infantry, Massachusetts Volunteers, thus writes: —

"Not one eighth of my men off duty[1] had *pure* malarial disease, whether intermittent or remittent, but the malarial influence showed itself in a very large proportion of the cases of other diseases, and there could be no doubt that in proportion to the *absence* of malarial disease in the homes of the regiments in that army was their suffering from the climate. This was the opinion of very many surgeons in the same division. In other words, the suffering from malaria was in inverse proportion to the extent to which the men had been acclimated to it at home."

Surgeon Samuel Flagg's statement.

Surgeon Samuel Flagg says: "Localities where malarial diseases prevail with the greatest severity were in the vicinity of shallow, sluggish rivers; probably felling of large tracts of forests was influential to a great degree in producing malaria."

Assistant-Surgeon Gennet's account.

Assistant-Surgeon Gennet, 17th Infantry, Ohio Volunteers, gives the following account of the circumstances under which malarial diseases were suddenly developed: —

"At Anderson Station, near Stevenson, Alabama, we were encamped upon the banks of rather a sluggish mountain stream (Crow's Creek), with heavy dews and cold nights, and very hot days, in August and September, 1863. Malarial diseases suddenly appeared, but by prohibiting bathing at midday, by giving more freely of vegetables (green corn, potatoes, and peaches), and less meat, and the prophylactic use of quinine with the more feeble ones of our command, much was done to lessen the severity and the frequency of this class of diseases."

Assistant-Surgeon Samuel W. Abbott's testimony.

Assistant-Surgeon Samuel W. Abbott, U. S. Navy, thus testifies to the immediate effect of the atmosphere of the open sea on the effects of malaria: —

"The crews of the fleet in James River, in the summer of 1862, suffered much from intestinal complaints, — a portion of the fleet being anchored at Harrison's Landing, and along the marshes below that place. On my own vessel, the *Tioga*, frequently twenty-five per cent.

[1] Reports 200 men off duty at one time.

of the crew were unfit for duty. Fevers of a malarial type were prevalent, also diarrhœa and dysentery. I attributed much of the diarrhœa to the fact that the crews of many vessels drank the water of the James River, which had become foul with the offal of thousands of men and beasts who daily bathed in these waters at Harrison's Landing. Not many miles below, the Chickahominy emptied its waters, after flowing through a score of malarious swamps. These waters ebb and flow with the sluggish tide for many miles up the river.

"A few days at Hampton Roads in September, with exposure to the refreshing sea-breeze, greatly improved the health of the fleet."

. . . . . .

"I have observed the healthful influence exerted on the crews of vessels by a sudden transition from the malaria of an inland river to the open sea, and *vice versa*."

Extract from a letter by Surgeon Frederick L. Dibble.

In an extract from a letter written by Surgeon Frederick L. Dibble, Sixth Infantry, Connecticut Volunteers, a case is cited which exemplifies the successful treatment of pernicious intermittent fever with large doses of quinia, and the increased tolerance of this remedy in this form of malarious disease. The letter is dated Hilton Head, S. C., December 4, 1861: —

"The congestive fever, or 'pernicious,' takes hold of us rather severely. Our next neighbors of the Ninth Maine have suffered greatly. The disease calls for the most energetic treatment. I did not dare tell any one that I had given one man one hundred and twenty grains of quinine between seven A. M. and twelve midnight, until I saw that he was sure to get well. Strange to say, it produced no cinchonism, and the patient will soon return to duty."

THE CONTINUED FEVERS.

Infrequency of typhus fever.

The reports elicited by the Circular of the Medical Committee contain but little respecting typhus and typhoid fevers. It is certain that cases of typhus fever were, to say the least, very infrequent in the armies of the United States during the war. The returns to the Surgeon-General's Office, according to Dr. Woodward's report, in the first two years of the war, contained 1723 cases, and 572 deaths. Dr. Woodward, however, states that in many of these cases the disease was not true typhus, but either typhoid or typho-malarial fever. The infrequency of typhus in the camps during the war, or, perhaps, even their entire immunity from this species of fever, is important, as bearing on the question, whether the miasm producing the disease is generated in the concentrated effluvia from the bodies of healthy per-

sons; in other words, whether this disease be ever a result exclusively of crowd-poisoning. That the accumulation of emanations from the living body, and other consequences of over-crowding and defective ventilation, may play an important part in the development of typhus, is doubtless true; but the question is, whether these circumstances are alone sufficient for the production of the special miasm, or whether they act only as accessory causes. The absence of typhus fever in the Andersonville Prison, where a large number of our troops were confined for a long time, with insufficiency of food, and under other depressing circumstances, is a noteworthy fact which will appear in Section Third of this volume.

Frequency of typhoid fever.

Cases of fever, considered as typhoid, were numerous during the war. The statistics embodied in Dr. Woodward's report for the first two years show 53,351 cases, and 16,075 deaths. There is an abundance of testimony going to show that the phenomena of typhoid and of remittent fever were frequently intermingled to such an extent that it was often difficult to determine whether the disease was to be considered as the former or as the latter of these two fevers. From this difficulty arose the custom of applying the name camp fever in doubtful cases; and in June, 1862, the term typho-malarial fever, proposed by Dr. Woodward, was adopted in the statistical nomenclature of the monthly reports. In view of these facts, it is doubtful to what extent cases set down as cases of typhoid fever exemplified this disease disconnected from malarial influence; and hence, testimony relating to simple or pure typhoid fever is not only meagre but open to a certain amount of distrust.

The Circular issued by the Medical Committee of the Commission contained the following inquiries: "Has the typhoid fever which you have observed in camps and hospitals been characterized by well-defined periodicity at any stage? At what stage? In what localities, seasons, and circumstances? Did the administration of quinia produce injurious or beneficial effects in such cases?" Some of the correspondents have replied to these questions. The answers, however, are not sufficiently definite and full to warrant any important conclusions.

Walking cases of typhoid fever.

Two "walking cases" of typhoid fever, reported by Surgeon John A. Lidell, are worthy of being placed on record: —

Case 1. — "A young infantry soldier was brought from the front to the depot field hospital of the Fifth Corps, at City Point, Dec. 12, 1864. He was walking about the hospital camp, on the 13th and 14th, com-

plaining of debility and malaria. He died unexpectedly on the morning of the 15th.

"*Autopsy* a few hours after death:—Rigor mortis strong; adipose tissue scanty, but the muscular development fair; lungs sound; no pleuritic adhesions; pericardium contained about two ounces of pale straw-colored serum; there was a white patch of old flocculent and firm false membrane, about the size of a dime, on the left ventricle of the heart, near its apex; it had evidently resulted from the giving way of an old adhesion between the visceral and parietal pericardium; there were two small milk-spots on the right ventricle; the visceral pericardium was in general considerably more opaque than natural (opalescent); this membrane also appeared to be somewhat reddened, as if recently stained, over the septum ventriculorum on the front of the organ, but there was no plastic exudation; the heart was somewhat (a trifle) larger than natural. The spleen was moderately enlarged and more consistent than natural (moderate hypertrophy with induration). The liver, pancreas, and kidneys appeared to be normal. The stomach was distended with a quantity of milk-and-water colored liquid, together with some gas. The ileum was contracted and generally colored dark-red, especially in the lower portion of it. Peyer's patches were raised from one to two lines above the surrounding mucous surface, and many of them showed excavated ulcerations surrounded by elevated margins. They were oval in shape, situated on the side of the intestine opposite the mesenteric attachment, and their long axes corresponded with the long axis of the digestive tube. Many of the solitary glands exhibited enlargement and ulceration (circular). The mucous membrane of all the lower part of the ileum was dark-red and softened. The contents of both the large and small intestines were dark in color and normal in consistence, showing that diarrhœa had not yet been developed as a symptom. Many of the mesenteric glands were reddened in color, and enlarged so as to vary in size from a small bean to a filbert, and even to a greater size than that in a few instances. The muscles were bright red in color. The blood contained in the large vessels presented a dull watery cherry-red color or appearance. The coagula also were small."

Case 2.—"Private Jackson, belonging to the 71st Pennsylvania Volunteers, died rather unexpectedly Oct. 14, 1861. Dr. Dwinelle informs me that he had been in the regimental field hospital about ten days, suffering from symptoms of fever, with prostration and diarrhœa, which, however, were readily controlled by remedies. The prostration was not marked, for the patient insisted on dressing himself and sitting up on the afternoon before his death. His tongue had been inclined to be dry, and he had had moderate delirium, especially at night, for several days. On coming to the hospital he stated that he had been unwell for several days. The treatment consisted in the administration of quinine as a tonic and antiperiodic; of opium, to restrain his diarrhœa; of nu-

triments, such as beef-tea, farina, etc., and the application of epispastics to his abdomen. The hospital attendants state that he rose in the night apparently to use the close stool, that he suddenly sank down backwards as if he had fainted, and immediately, or in a very short time, expired.

"*Autopsy* eight hours after death: — Cadaver somewhat emaciated; rose-colored spots on chest and abdomen; abdominal walls contracted; muscles red; small intestines, especially lower part of ileum, reddened, and the capillary vessels present an injected appearance; mesenteric glands much larger than natural, and pale-red in color; on opening the lower portion of the ileum, Peyer's patches are found to be raised one or two lines above the surrounding surface, oval in shape, with ulcerations of varying depth in the interior of the patches which caused them to have elevated and everted edges, and a ragged, uneven base. The largest patch of typhoid deposit and ulceration was fully one and one half inches in its long diameter. Thus it was seen that the enteric lesion of typhoid fever was very well shown. The contents of the ileum were semi-fluid and yellowish in color. The intestines were not flatulent."

TYPHO-MALARIAL FEVER.

Proper sense of the term typho-malarial.

The general favor with which the term typho-malarial has been received, and the readiness with which it has come into vogue, show that it expresses a pathological doctrine consistent with clinical experience. As contended by the writer of the first portion of this chapter, the term properly denotes the conjoined operation of malaria and the special cause of typhoid fever; in other words, it should be restricted to cases in which periodical fever and typhoid fever are united. The blending of these two forms of fever is not a new doctrine. It has been taught for many years by Professor Dickson, and by other medical teachers in this country, in place of the doctrine that periodical fever is liable to conversion into typhoid fever. But the typhoid disease thus produced had not acquired a nosological place and name prior to the introduction of the term by Dr. Woodward. An important result of medical experience during the war is the establishment of the claims of a disease, presenting typho-malarial or malarial typhoid characters to be considered as a separate form of fever, its symptomatic features varying much in different cases, according as the malarial or the typhoid phenomena preponderate. The name, typho-malarial, was adopted in the monthly reports in June, 1862. During the following year there were reported under this name 22,652 cases, of which 1129 died.

The institution of a new form of fever in the nosology must

needs lead to considerable confusion until its diagnostic characters are fully ascertained. The points in the differential diagnosis, as contrasted, on the one hand, with pure typhoid fever, and, on the other hand, with simple or unmixed remittent fever, require, in addition to abundant data, considerable time and labor for their full elucidation. The clinical history of typho-malarial fever is, of course, to be based on the results of the analysis of a large number of cases carefully recorded by competent observers. The communications in the hands of the Commission do not embrace the materials for such an investigation, nor for investigating the etiology and determining the comparative effects of different methods of treatment. We must content ourselves here with a few brief extracts from the replies to the Circular issued by the Medical Committee.

Surgeon O. Everts, whose observations were confined mostly to camps in Virginia, writes as follows: —

Surgeon Everts' opinion.

"The fevers usually reported as continued, remittent, typhoid, typhus, or typho-malarial, were, according to my judgment, in general essentially one and the same. Cases of pure malarial fever, I think, were rare."

Dr. Everts is of the opinion that the typhoid phenomena were often attributable to the injudicious use of active cathartics. He thinks that defective alimentation, and especially the bad preparation of food, contributed largely to the production of typho-malarial fever.

The following extract is from a communication from Surgeon A. S. Coe: —

Extract from communication by Surgeon A. S. Coe.

"Typho-malarial fever was endemic at Kelly's Ford, Va., in the winter of 1863–64. After the Mine Run campaign we went into camp at Kelly's Ford. The situation of our camp was bad in the extreme; it was low and swampy, with a thick vegetable mould on the surface, and a clay sub-soil underneath; water could be procured by digging six inches below the surface at all times. Soon after our arrival typho-malarial fever prevailed to an alarming extent. We soon after were ordered to Culpepper, and went into winter-quarters about one and a half miles northwest of the town. The health of the troops immediately began to improve, and soon there was almost an entire absence of sickness of any sort. In one sense of the term nearly all prevailing diseases of a camp might be called endemic — they are invariably influenced and modified by causes peculiar to camps. The fevers of camps are of a mixed character, arising from a blending of the two kinds of poison. A pure type of remittent fever, according to my observation, is very rare, and I have seen but a few cases of typhoid fever

with tympanites and ulcerated bowels since entering the field. The term typho-malarial is very properly applied to the prevailing form of fever."

The following is communicated by Surgeon William A. Harvey, of the Sickle U. S. Army General Hospital, Alexandria, Va. : —

Surgeon Harvey's communication.

"I cannot say that I have seen a case of pure, unmixed typhoid fever in the army during the three years in which I have been attending the sick in the General Hospital and in the field.

"I have met with cases exhibiting in part the symptoms and signs characteristic of this fever, but almost uniformly with others so foreign that the disease was plainly entitled to some other name. The army fever is *typho-malarial*. This fever is shorter in its course than typhoid, and in a larger proportion of cases proves fatal. This is owing undoubtedly to the scorbutic condition of army patients, and the various causes impoverishing the blood — the same conditions which render secondary hemorrhage so fearful and fatal in surgical cases.

"I have seen no typhus in the army. There was a class of cases of rather unfrequent occurrence, in which were extreme debility with fever, ecchymosed blotches over nearly the whole surface, and constipation. These cases I was in the habit, at first, of calling cases of typhus; but subsequent observation and reading convinced me that they were cases of typho-malarial fever occurring in scorbutic persons. They were generally fatal. The type of this fever is uniformly low, demanding tonics and stimulants almost from its inception. I am not aware that this fever is preventible by any known means, other than exclusion from the exciting and predisposing causes. I have observed that the new troops from the North were liable to be attacked within six weeks from first exposure; afterwards the immunity was quite complete. I have no evidence of the contagiousness of this fever."

Cases reported by Inspector F. H. Hamilton.

Prof. Frank H. Hamilton, late Medical Inspector U. S. Army, has communicated an account of gangrene of the toes occurring as a sequel of camp fever, in ten cases at David's Island Hospital, Long Island Sound, in June, 1865. These cases were under the charge of Dr. Keitland, at David's Island, and previously under the charge of Acting Assistant-Surgeon Martindale. The following is the account in the language of the reporter : —

"Ten men were admitted with gangrene of the toes and feet, and about thirty more were admitted at the same time into this general hospital. Corporal Matthews says that in his own case, and in all the cases which he saw, the toes were, from the first, dry and black (dry gangrene). All these patients had been in the prisons in Florence, S. C. All had fever before the gangrene occurred. The fever was called "*camp fever*."

Matthews was in Florence about three months. He never had meat during this period — neither fresh or salt — (from November until February 28th, 1865). Another patient, Kimball, was also four months at Camp Sumpter, Andersonville, where he had salt or fresh beef every day. This was under a Dutch captain. He never had vegetables of any kind during nine months, except sweet potatoes three or four times at Florence. At Florence they had cattle pease, indian meal, rice once or twice. Of indian meal one pint was allowed daily, and of pease three tablespoonfuls. Each man cooked his own pease and meal together in a quart cup with water. About half the time they had a very little salt. There was one time of about two weeks when baked corn-bread was substituted. Most of them had scurvy. Money was uniformly taken from them, with the promise that it would be returned to them when they left. This was not done. Those who secreted their money bought food surreptitiously. The men were kept in an open stockade. A few old shelters were obtained by the men. The hospital was built of pine slabs, open and cold, without stoves. There were fire-places, but no fires, except occasionally. During the winter water froze sufficiently to hold a man. In the hospital there were no floors; bunks were made without straw or ticks. Each man had one tick or coverlid."

CHAPTER THIRD.

CAMP MEASLES.

By ROBERTS BARTHOLOW, M. D., Etc.

TESTIMONY OF MEDICAL OFFICERS RESPECTING THE PREVALENCE FATALITY, ETC., OF CAMP MEASLES.

Prevalence of Measles, and its Fatality. — Liability of Recruits to the Disease. — Dr. Salisbury's Theory of Fungi. — Observations of the Writer with respect to this Theory. — Circumstances rendering Recruits especially liable to the Disease. — The Eruption in One Hundred Cases. — Desquamation in Camp Measles. — Delirium in Fatal Cases. — Symptoms and Affections pertaining to the Respiratory System. — Symptoms referable to the Heart. — Symptoms referable to the Mouth, Fauces, etc. — Symptoms referable to the Kidneys. — Sequelæ of Camp Measles, Typhoid State, Bronchitis, and Pneumonia. — Chronic Pneumonia and Diarrhœa. — Two Methods of Treatment. — A rational Method of Treatment proposed. — Testimony of Medical Officers. — Means of Protection against Losses by Death and Discharge from this Disease. — Testimony to Prevalence, Fatality, etc., from Surgeons Long, Gill, Anderson, Sanborn, Jones, Norton, Phillips, Leavitt, Wilbur, New, Windsor, Seal, Flagg, Whittaker, Bailhache, and Prof. Eve. — Communication by Surgeon Benjamin Woodward. — Communication by Surgeon Samuel L. Adams.

Prevalence of measles.

An epidemic of measles appeared amongst each successive levy of troops. This disease was very injurious to the efficiency of the army. But a part of the injury is represented by the immediate mortality: a variety of secondary affections — sequelæ, so-called — continued the ravages begun by the original disease. According to Circular No. 6, "21,676 cases and 551 deaths were reported during the first year of the war; 16,345 cases and 1313 deaths during the second; but there is reason to believe the actual number of cases was considerably greater, since it is well known that the disease frequently prevailed epidemically in new regiments, after the men began to come together in the State to which they belonged, but before they were mustered into the service of the United States, and therefore before the medical officers began to report to the Surgeon-General's Office. . . . . The direct mortality was not great, being only one death to every twenty cases, but tedious catarrh, pneumonia, and pleuro-pneumonia were frequent sequelæ; and a part of the mortality from these affections was due indirectly to measles."

Mortality from measles.

That measles was more prevalent than the returns exhibit is certainly true, but that the immediate mortality may be expressed in the proportion of one death to twenty cases,

is certainly incorrect. We have carefully collected some statistics on this point in two large general hospitals, so placed as to receive a large number of cases. The mortality in the general field hospital at Chattanooga, Tennessee, was 22.4 to 100 cases. It may be objected to these results, that they occurred in a hospital the hygienic condition of which was unfavorable to recovery from measles. But this objection cannot be urged against the statistics of General Hospital No. 1, Nashville, which was well appointed in every respect. In this hospital the mortality was 19.6 to 100 cases, or nearly one in five. The medical reports were often vitiated by a false method of expressing results. Some prominent complication arising in the course of a disease was not unfrequently entered on the report of sick and wounded as the cause of death, instead of the disease itself. Thus, in cases of measles, pneumonia or bronchitis was assumed to be the cause of death, and the fact thus appears on the report. Until they came to learn more of its virulence, by many medical officers it was considered disreputable to lose a case of measles. In the two hospitals in which I made these observations I was at especial pains to secure correct returns, and hence my conviction that the degree of mortality as expressed in Circular No. 6 is short of the truth.

Liability of recruits.

At the State rendezvous, or during the first months of service, all those recruits exposed to contagion became affected, unless they enjoyed exemption by reason of a previous attack. In some instances it was not possible to trace the source of contagion. In the absence of such information, the non-contagionists assumed that the local conditions were sufficient to develop the disease. The advocates of this view were not numerous. The positive facts of contagion were too numerous to be overborne by such uncertain negative testimony as the absence of any ascertained source of infection. Early in the war (first part of 1862), Dr. Salisbury of Newark, Ohio, proposed a fungus theory in explanation of the origin of camp measles.[1]

Dr. Salisbury's theory of fungi.

"At the military camp — Camp Sherman — Newark, Ohio, the measles first appeared on December 4th, the same day that Mr. Dille exposed himself to the straw dust. From November 23d to 30th, the weather was cool, damp, with considerable sleety rain and snow. During this time (there being between six and seven hundred men in camp) many of the tents were furnished with ticks, which were filled with straw for the men to sleep on. In the centre of each tent was a fire, built in a hole in the ground, from which the smoke was led off by an underground flue, extending to the outside of the tent.

[1] *American Journal of the Medical Sciences*, July, 1862.

The straw ticks were arranged around the fire, several in a tent, and each tick accommodated two men. On December 1st, the weather became colder, and snow fell to the depth of about one inch. On the 2d, which was quite warm, this melted and wet the soil and dampened the straw ticks. December 4th, the measles made their first appearance in Camp Sherman. The men came from different parts of the county, and no one knew that he had been exposed to the disease. Some had been in camp two weeks, and no one supposed to have that disease had visited the camp. Subsequent inquiries have failed to discover any one who brought it there, or to account for the appearance of the disease from contagion. On the first day (December 4th), there were eight cases, and within a week after there were forty. The disease then disappeared for ten or twelve days from its first appearance. Between the 14th and 16th, the disease again made its appearance, and within a few days there were between forty and fifty cases more, when the disease ceased altogether. These last cases, occurring so near the usual time at which the disease ordinarily makes its appearance after exposure, renders it probable that they were communicated from the first cases. . . . . Bearing upon this may be mentioned the circumstance that, in almost every instance where our soldiers have gone into camp, in a short time after, the disease called *camp measles* has made its appearance without any previous exposure, so far as known, to the measles. It should also be stated that their beds have usually been straw."

It appears from another paper, by Dr. Salisbury, published in the succeeding number — October — of the same journal, that measles had been prevailing during the previous spring and summer in a county adjoining that in which Camp Sherman was situated. Says Dr. S.: "About the 30th of May, 1862, measles made its appearance amongst the boys of the Ohio State Reform Institution, situated in Fairfield County, Ohio. It was introduced into the establishment by a boy who was taken in before he had entirely recovered from the disease." It would not, therefore, seem difficult to account for the origin of measles at Camp Sherman, since this disease was prevailing in a neighboring county.

To give additional force to his views, Dr. Salisbury attempted to prove, by inoculation, that the straw fungus would produce measles. The symptoms observed by him after inserting into a puncture in the arm the spores and cells of the fungi, were the following: "Symptoms resembling a slight cold, with a little chilliness, catarrhal symptoms and sneezing." Dr. S. remarks, in his first paper (July, 1862): "It is now four weeks since the exposure, and no signs of measles in any of the cases inoculated." He was

not fortunate, however, in procuring exemption by inoculation at the State Reform Institution; for we find (October, 1862), in the first place, that the inoculations were not followed by those symptoms which he believes to indicate "modified measles," and in the second place, a certain number of the boys inoculated became affected with genuine rubeola. In fact, it is quite evident that the epidemics of measles noted by Dr. Salisbury, behaved as the eruptive fevers usually do — they did not attack all who were exposed to contagion, and during the prevalence of them, various anomalous cases were observed. It was the inoculation of some of these anomalous cases which deceived Dr. Salisbury.

Observations of the writer with respect to Dr. Salisbury's theory.

With a view of ascertaining how far such a cause could have had an agency in the production of measles, special inquiry was made on this point in one hundred cases, with the following result: eighty-five had not, and only fifteen had, slept or lain on hay or straw since enlistment. It appeared, further, that the disease was particularly rife amongst the volunteer troops of East Tennessee, an agricultural region, the inhabitants of which must have been frequently exposed to the wheat straw fungi. Measles prevailed equally amongst the colored troops of the army of the Cumberland, who, before enlistment, were, it may be presumed, accustomed to sleep on straw.

Circumstances rendering recruits especially liable to the disease.

The new and unnatural experiences to which recruits were subjected, induced a condition of the organism exceedingly favorable to the reception and development of a morbific agent. The epidemics of measles occurred in the fall, winter, and spring. The camps were damp, the air poisoned, the diet insufficient. Catarrhal affections occurred in the proportion of 512.10 per 1000 of mean strength, or in somewhat more than half the strength of the army. There was, accordingly, a serious disturbance in the vicarious relation between the skin and kidneys, and the skin and mucous surfaces, intestinal and bronchial. An amount of the specific poison of measles under ordinary conditions insufficient to develop an epidemic would, in these circumstances, grow into a formidable epidemic. We have here a ready explanation of the origin and propagation of camp measles, without resorting to the agency of straw fungi, whose effect, if they have any, must be limited to the production of "hay catarrh," or "hay asthma."

The eruption in one hundred cases.

The eruption was distinct in sixty-five cases; not well marked in thirty-five, but the other phenomena of the disease were characteristic. Death occurred in two cases before the

appearance of the eruption, the poison being so intense as to destroy the vitality of the blood (necræmia). There was nothing peculiar, either as to the time of appearance or character of the eruption. In the colored soldiers, the difficulty in making out the eruption depended upon the depth of color; in the pure negro, the eruption was yellowish, being somewhat lighter than the surrounding integument; in the mulatto, a dusky or yellowish brown; in both, the eruption was ill-defined. The other symptoms were quite as characteristic in the colored as in the white troops, so that there was really no difficulty in making a diagnosis in any case.

Desquamation in camp measles.

The desquamation of the epidermis was a more distinctly marked process in camp measles than in the epidemic measles of civil life. Considerable patches of epidermis were sometimes thrown off. This stage of the disease, in severe cases, was characterized by a remarkable increase in the gravity of the symptoms. Coincidently with the desquamation, bronchitis, capillary bronchitis, lobular and lobar pneumonia, cerebral disorder, ileocolitis, and congestion of the kidneys, were prominent in the procession of morbid phenomena.

Delirium in fatal cases.

In the fatal cases (twenty-eight in the series of one hundred cases selected for analysis), more or less violent delirium occurred; in some instances the delirium was maniacal, requiring the presence of attendants to keep the patients in bed. These symptoms were explained by the lesions discovered on *post-mortem* examination: injection and hyperæmia of the brain substance; engorgement of the vessels of the choroid plexus; fluid in the ventricles and in the sub-arachnoid space; in three cases, recent lymph on the surface of both hemispheres; and in one case, a large, soft, black coagulum overlying the upper portion of the hemispheres.

Symptoms and affections pertaining to the respiratory system.

The most important of the symptoms were those pertaining to the respiratory system. In addition to the phenomena observed in ordinary measles, capillary bronchitis, pneumonia, and pleuro-pneumonia were pronounced complications in camp measles. In the fatal cases, these accidents were the usual cause of death. In the twenty-eight fatal cases, the following was observed to be the condition of the lungs: In all the lungs were much engorged, completely filling the thoracic cavity; in all more or less bronchitis existed — in eight that condition to which may be applied the term capillary bronchitis; in eight cases, the finer bronchial tubes being involved, a condition of *atelectasis* was observed in both lungs — on the anterior face of the

lungs isolated lobules, and on the posterior face large patches of lung, being in this state; in six cases double pleuro-pneumonia existed; in ten cases the pneumonia and pleuro-pneumonia were confined to the right lung, the left lung being in the state of congestion and *atelectasis* already described. The capillary bronchitis and the collapse of portions of lung tissue seemed precedent to the development of pneumonia, for these collapsed portions of lung became the seat of the first development of the pneumonic consolidation. The bronchial glands participated in the destructive processes going on in the pulmonary tissue; they enlarged, became soft and pulpy, and, in one instance, suppurated largely, producing an abscess which dissected up the loose areolar tissue posterior to the esophagus and ascended to the level of the *os hyoides*.

Coincident with these changes in the lungs, the action of the heart became labored and rapid. The lips were blue, and the anxiety of the patients extreme. These symptoms had an obvious cause in the state of the heart and great vessels — the right cavity, the ascending and descending *vena cava*, and the pulmonary artery were found after death distended with large coagula, and the left cavity empty. The congestion of the brain already alluded to, and the congestion of the kidneys to be noted presently, were probably due to this obstruction in the pulmonary circulation, rather than to any direct action of the morbid agent upon these organs. The blood itself was altered; it was thin and watery, and the coagula were soft, and although the blood appeared black there was an evident increase in the white corpuscles. In one fatal case purpuric spots were observed in the integument and in other textures.

Symptoms referable to the heart.

"The mucous membrane of the mouth and fauces was red and punctated; the tongue bright red and loaded at the sides and posteriorly; the filiform papillæ prominent. There were always more or less deep injection of the soft palate, swelling of the tonsils and uvula, and small, circular, whitish ulcers, covered with a soft exudation on the buccal and labial mucous membrane. The swelling of the mucous membrane of the pharynx, involving the orifices of the Eustachian tubes, and the considerable enlargement of the tonsils, were the causes of the deafness experienced in a large number of cases. Deglutition was painful and difficult from these causes, and from the sometimes thickened, erect, and inflamed epiglottis. Vomiting was rare, but diarrhœa existed in two thirds of the cases." Characteristic lesions were found in the intestinal tract — in the ileum, cæcum, and colon.

Symptoms referable to mouth, fauces, etc.

Early in the disease the changes consisted in a deep redness (port-wine color) of the ileum, — the veins of the sub-mucous coat being distended so that their arborescent distribution was beautifully shown, — distension and elevation of the solitary glands and greater distinctness of the follicles of Lieberkühn, and of the tubular glands of the large intestine, than is usual in the natural state. These are the phenomena observed, due especially to the action of the measles poison; subsequent changes in the glandular apparatus of the intestinal tract are to be studied amongst the sequelæ of measles.

Symptoms referable to the kidneys.

With respect to the kidneys, the earliest symptoms observed were a diminution in the amount of urine excreted, and an increase in the specific gravity and morbid deposits. In three of those severe cases in which the eruption was either absent or imperfectly developed, in which the respiration was greatly embarrassed from congestion of the lungs, and in which coma and convulsions announced serious lesion of the brain, there was total suppression of urine. The urinary deposits consisted of the urates, mucus, and epithelium, and sometimes blood. The chlorides disappeared in the cases of atelectasis as well as those of pneumonia, but as regards this observation there must be expressed some doubt, since the physical signs are hardly distinctive enough to assume its correctness. Albumen and casts were not detected in a single instance. Convalescence was usually announced by a sudden increase in the quantity of the urine — so sudden, indeed, in many cases, as to entitle this phenomena to be considered "critical."

The kidneys, on *post-mortem* examination, exhibited changes explanatory of the symptoms observed during life. They were always found in a state of hyperæmia; the cortical substance being dark-brown, the pyramids deep purple, and the papillæ red. By pressure, from the tubular orifices of the papillæ could be forced urine of the appearance of milk — an appearance due to the quantity of epithelium contained in it. The tubules themselves, on microscopic examination, were seen to be crowded with epithelium and the *débris* of cells.

Sequelæ of camp measles.

Camp measles was formidable not only in consequence of the immediate mortality but also by reason of secondary diseases, the product of changes induced in organs by the measles poison.

The sequelæ were of two classes: —

1st. Those in which the diseases of organs continued, after the

phenomena proper to rubeola had disappeared, without an intervening stage of convalescence: the typhoid state, bronchitis, pneumonia.

2d. Those which supervened after an apparent or incomplete convalescent stage: chronic pneumonia, phthisis, chronic dysentery.

The typhoid state was a close approximation to typhoid fever. The enlargement and elevation of the solitary glands characteristic of the disease became more evident in the typhoid state, and the agminated patches, also, thickened. There was, however, no corresponding alteration of the mesenteric glands, neither did the characteristic ulceration of the patches take place. The usual objective symptoms — low delirium, subsultus, diarrhœa, sordes, dry tongue, etc. — were well marked. The bronchitis and pneumonia continued after the disappearance of the other symptoms, and were the immediate cause of death in many cases. The pneumonia was the direct result of changes in those portions of the pulmonary tissue in the state of atelectasis.

Typhoid state, bronchitis and pneumonia

After a period of convalescence, which was imperfect and unsatisfactory, the sequelæ proper began to manifest themselves. Chronic pneumonia has been alluded to as one of these secondary affections. It may be well questioned whether this term is, in strict propriety, applicable to those changes which slowly but progressively ensue in the collapsed lobules. They become *carnified;* deposits take place in the connective tissue between the air-sacs, and the neighboring portions of lung tissue become the seat of a passive congestion. It is very probable — although upon this point I do not possess any positive facts — that the so-called acute tuberculosis, which so frequently followed measles, consisted of nothing more than the deposition of a plastic material in the carnified portions of the lung.

Chronic pneumonia and diarrhœa.

A chronic ileo-colitis (army diarrhœa) was a very common secondary trouble. This was nothing more than a legitimate effect of those changes in the glandular apparatus of the small and large intestines, which, we have seen, were produced by the measles poison.

During the war, two methods of treatment were followed: the antiphlogistic remedies and regimen, and the stimulant. The results were not satisfactory by either of these methods. Many cases, if left to themselves, terminated favorably by the unassisted efforts of nature. An increase in the amount of the urinary secretion, a diarrhœa, or a sudden diaphoresis, were

Two methods of treatment.

phenomena marking the crisis and decline of the disease. The true therapeutics consisted in producing or favoring the occurrence of these critical discharges when the proper period of their appearance arrived.

A rational method of treatment

Congestions of organs, the proper performance of whose functions was essential to life, occurring suddenly, and due of course to some serious lesion of the blood not cognizable by our present means of investigation, were the sources of danger. The effort to relieve these congestions by general bleeding, proved fatal in every case in which it was employed under my observation. The use of antimonials and mercurials was either prejudicial or of non-effect. The stimulant method was not more successful. After a careful study of the morbid anatomy, I ventured to propose a rational method of treatment. To relieve the congestion of the brain and lungs, and the overloaded right cavity and great venous trunks, I proposed ligatures, applied alternately to the thighs, to remove from the general circulation so much of the venous blood as could be thus with safety retained in the limb; counter irritation, by saline cathartics and hot pediluvia, and by cups to the neck when the brain was the organ to be relieved, and by sinapisms and cups to the thorax, when the lungs were involved; under all circumstances the activity of the kidneys was to be promoted by saline diuretics, congestion of these organs to be relieved by cups and sinapisms to the lumbar region, and the functions of the skin to be maintained by suitable diaphoretics, and during the stage of desquamation by inunctions of oil. Circumstances prevented the trial of this method of treatment in a large number of cases, but in the few cases in which it was followed the results were in every way confirmatory of its usefulness. At least, no case thus treated died — a negative result, truly, but of value as indicating the possibility of greater success than by the other methods of treatment pursued during the war.

TESTIMONY OF MEDICAL OFFICERS RESPECTING THE PREVALENCE, FATALITY, ETC., OF CAMP MEASLES.

Numerous correspondents bear testimony to the extensive prevalence of measles among newly-recruited troops, especially from the country; to a considerable fatality resulting from this disease, especially in the winter months, or when cases are treated in crowded hospitals, and when the disease is associated with the effects of malaria or scurvy; also, to the fact that a large number of those who do not fall victims to the disease or its sequels, are in-

capacitated by it for remaining in the service. Enough of this testimony will be subjoined to show that measles is truly one of the most formidable of camp diseases. In respect of its importance as a disease of the camp, it offers a striking contrast to its occurrence among young subjects in civil life.

Means of protection against losses by death and discharge from this disease.

The means of securing for armies protection against the losses by death and discharge from the prevalence of this disease, claim more attention than they appear to have hitherto received. Aside from higher considerations than those relating to military policy, it is very desirable to adopt measures to diminish the fatality from the disease, and lessen its disqualifying effects with reference to the efficiency of armies. The value of a soldier, in a military point of view, is not a little enhanced by his having had this disease, and either escaped or recovered from its sequels. Measures which suggest themselves are — 1st. Providing for the exposure to the disease of those recruits who have not experienced it, at a favorable season, and for the management of cases under the most favorable hygienic conditions; and 2d. If this measure be not practicable, isolating cases promptly whenever they occur, so as to prevent exposure to the infectious miasm.

The Circular issued by the Medical Committee contained the following question: "Have you observed aught peculiar to measles in camps, as regards production, clinical history, or complications?" The communications elicited by the Circular contained no facts nor statements tending to show that measles in camps differs in any essential particulars from the disease as presented in civil life. The larger death-rate, the greater liability to serious or tedious sequels, and the debilitated condition of the system, which is apt to follow, are attributable to the various depressing influences incident to camps, to the coexistence of the scorbutic condition in some cases; and, in certain situations, the disease attacks those who are suffering from malarial poisoning. It is to be added, that nothing has been communicated in support of the theory advanced by Professor Salisbury, of Cleveland, Ohio, which refers the origin of the disease to the spores of a peculiar vegetable fungus generated in straw under the influence of heat and moisture. One of the correspondents of the Commission, however, Dr. Benjamin Woodward, as will presently be seen, has observed an eruption resembling somewhat that of measles, which he attributes to the source just stated.

The subjoined extracts from a number of the communications

which the Committee have received, will enable the reader to form an idea of the extent to which measles prevailed, the formidable character of the disease, etc : —

Surgeon Long's testimony.

"Measles have prevailed to a very great extent. When regiments, raised in rural districts, first come into the service, at least seventy-five per cent. have measles. The sequelæ have disabled many. Regiments from large towns and cities have not suffered as much." [1]

Surgeon Gill's testimony.

"Measles generally prevail among raw troops, especially if they lie in camp or barracks for any length of time; and occasionally it proves very destructive to the efficiency of the command. In the 95th Ohio Volunteer Infantry, at Memphis, during the months of January and February, 1863, there were about forty cases died in hospital of the disease, and a number of cases were afterwards discharged from service on account of sequences of the disease." [2]

Surgeon Anderson's testimony.

"We had 320 cases of measles in the winter of 1862, and in a great many cases the disease was followed by pneumonia and typhoid fever. In nearly every case the man was rendered unfit for duty for a long time, if not altogether." [3]

Surgeon Sanborn's testimony.

"Measles was largely prevalent during the first two months. Some died; and of the convalescents from severe measles, hardly any have been good soldiers." [4]

Surgeon Jones's testimony.

"I have seen scores suffer, and many die, from the effects of measles in camp. I think it one of the very worst diseases that can attack a soldier." [5]

Surgeon Walton's testimony.

"Soon after our troops were mustered into the service, in 1861, at least one half of them were rendered ineffective, either from measles or its sequelæ. Taking into account its immediate effects and its sequelæ, measles is assuredly the worst disease I ever saw in camp. More soldiers died, and were discharged, from it and its sequelæ, than from any other disease, during the first twelve months. Perhaps it would not be saying too much to say that, during this period, more died and were discharged from this than all other diseases. The most severe and fatal sequelæ were bronchitis, pneumonia, and typhoid fever. No soldier should be put on duty at night or in bad weather, until he has fully recovered." [6]

Surgeon Phillips' testimony.

"We had about two hundred cases in January and February, 1863, about forty of which died of typhoid pneumonia and erysipelas, which prevailed as an epidemic at that time. At the early organization of the regiment, I earnestly advised the introduction

[1] Surgeon O. M. Long, 11th Illinois Vols.
[2] Surgeon H. Z. Gill, U. S. Vols.
[3] Surgeon H. Anderson.
[4] Surgeon J. E. Sanborn. Iowa Vols.
[5] Surgeon Amos S. Jones, Wisconsin Vols.
[6] Surgeon J. C. Walton.

of rubeola, which would have, in all human probability, saved these forty men; but it was not permitted." [1]

"Measles prevailed extensively among the negroes at Baton Rouge in 1862–63, and was very fatal, chiefly, I was led to believe, on account of the prevalence of scurvy, at the same time. The disease prevailed among the United States troops; confined, however, mostly to regiments from the State of Maine. It was less fatal than among the negroes." [2] Surgeon Leavitt's testimony.

"Over *ten per cent.* of 5th Wisconsin Volunteers were affected with measles during the summer of 1861, most of whom were thereby unfitted for active service in the field during the greater part of their first year of service." [3] Surgeon Wilbur's testimony.

"Within six months after my regiment went into the field, as many as one third of the men had measles. The result, in several cases, was sufficient disability for discharge, and a few died after being sent to general hospitals." [4] Surgeon New's testimony.

"While the 49th Massachusetts lay on Long Island (N. Y.), measles prevailed to a great extent in some Maine regiments encamped in the vicinity; but by careful and early isolation of the few men we had attacked with it, we escaped easily." [5] Surgeon Windsor's testimony.

"I was at the General Hospital, Chattanooga, Tenn., in March, 1864, when General Hovey's new Indiana Brigade passed through that country, and I treated many soldiers of that command sick with measles, many of whom died. I have treated many cases of measles in camp with the simplest remedies, allowing the patient to occupy the same bed and place in the tent as when well, with the most satisfactory result. As a rule, I excused soldiers from duty for from three to four weeks after convalescence from measles. Whenever practicable, I would advise that the soldier be left in camp and not removed to hospital when attacked with this disease. Those who have been treated in camp, have usually recovered entirely within six to eight weeks after attack." [6] Surgeon Seal's testimony.

"In every camp and hospital under my charge, I have had cases of measles. At the first encampment of the Massachusetts 25th regiment, at Annapolis, Md., November, 1861, measles went through the entire regiment, in most cases leaving the patient feeble and debilitated. This was fully appreciated at our first engagement at Roanoke Island. Subsequent diseases attacking those who had recently had measles were often fatal. In the winter of 1862, Surgeon Samuel Flagg's testimony.

[1] Surgeon James Phillips.
[2] Surgeon D. F. Leavitt, 3d Mass. Cavalry.
[3] Surgeon Geo. D. Wilbur, 5th Wisconsin Vols.
[4] Surgeon Geo. W. New, 7th Indiana Vols.
[5] Surgeon F. W. Windsor, 49th Mass. Vols.
[6] Surgeon Norman Seal, 88th Indiana Vols.

and spring of 1863, I had charge of the garrison at Plymouth, N. C., at that time garrisoned mostly by North Carolina troops. Measles prevailed very generally both among the troops and the inhabitants of the town. Very few cases proved fatal, nor were they followed by other diseases. During the winters of 1863, 1864, and 1865, on Long and Gallop's Islands, measles prevailed very generally, most cases resulting favorably." [1]

Assistant-Surgeon Whittaker's testimony.

"Of the six hundred recruits received after I joined the regiment, about one hundred were attacked with measles the succeeding winter; some of these, according to their own account, had had the disease before. It is a great pest. To have measles in a regiment is worse than a heavy battle. Even under favorable circumstances the sequelæ of measles are to be dreaded, and they are formidable in camp. If there be any latent tendency to phthisis, it is very apt to be developed. In some dysenteric symptoms are consequent, or a protracted and wasting diarrhœa; and some remain in a debilitated condition for months or years, not sick enough to remain in hospital, but not well enough to go on duty; subject to pulmonic symptoms from every slight exposure, or to frequent attacks of diarrhœa. The post hospital at Corinth, Miss., was so crowded, that we were obliged to receive patients with measles, from regiments stationed on the outposts, into our regimental hospital; among these were a number of Alabamians belonging to our army, who, from some constitutional peculiarity, appeared to suffer worse effects from the disease than our own men; and among them it was less likely to terminate favorably, although they received the same care, and had as good treatment.

"Moreover, when measles becomes prevalent, it is difficult to keep cases out of the wards appropriated to other diseases; and if a patient in the advanced stage of some disease gets measles, there is not much hope for him." [2]

Surgeon Bailhache's testimony.

"Rubeola has prevailed to a wonderful extent throughout the army; it is surprising how many persons attain to the age of puberty without having suffered with this disease. Ten per cent. expresses the ratio in my regiment, and it was even greater among those troops raised principally from the country and small towns. When occurring in the spring or summer, it runs its course without ill effects; but in the fall or winter, a fatal result is not infrequent, and the general health of the patient is feeble long after convalescence. Lung affections more particularly follow in the train of this disease when contracted in cold weather." [3]

The prevalence of measles, and its importance as regards the rate of fatality, and its disabling effects among those who do not

[1] Surgeon Samuel Flagg.

[2] Assistant-Surgeon John Whittaker, 31st Ohio Vols.

[3] Surgeon P. H. Bailhache.

immediately succumb, were not less marked in the Southern armies than in those of the United States. To this fact, Professor Paul F. Eve testifies as follows: —

Testimony of Professor Paul F. Eve.

"Measles prevailed extensively in the new regiments, especially in those from the country, and greatly impeded their organization. It so diminished the effectiveness of the troops, and proved so fatal in camp, that companies, battalions, and whole regiments had to be disbanded for a time, and the men sent home. This disease, so simple in childhood and so successfully managed in domestic life, often becomes quite the reverse to this from exposure and the hardships in camp. This is no new feature in the history of measles. Being a self-limited affection, it must run its course, and the province of the physician is to watch the operations of Nature and to prevent complications and the development of unpleasant symptoms. It is, moreover, an infantile malady, and the camp is truly no place for puerile complaints. The common-sense view, then, of the subject, is to place the patient, wherever practicable, under the circumstances most favorable to his recovery when attacked with measles, and this undoubtedly is under the parental roof.

"Measles, during the organization of regiments, and then bowel affections, diarrhœa especially, were *the* diseases of the late Southern army. Those advanced somewhat in years, will recollect how our troops suffered from this latter affection in the Mexican War. Many even of those who returned home lingered for months with chronic diarrhœa, the soldier's bane in hot climates, and found relief at last only in the grave."

Communication by Surgeon Benjamin Woodward.

The following paper, communicated by Dr. Benjamin Woodward, Surgeon 22d Infantry, Illinois Volunteers, is entitled: "Notes on Measles, as seen at Bird's-Point and New Madrid, Mo., in the autumn, winter, and spring of 1861–62; near Corinth in the summer of 1862; at Park Barracks' Hospital, Louisville, Ky., in the autumn and winter of 1862, and at the General Hospital, Tullahoma, Tenn., in March, 1864."

"Among the troops coming fresh from home to Cairo and Bird's-Point in the autumn of 1861, measles was epidemic. If the men were attacked soon after coming into camp, and before they had been subjected to the malaria of the region, the disease had all the characteristics manifested in civil life, and could not be distinguished from cases among adults at home; and it is therefore to the peculiarities of the disease in the army that I shall refer. Cairo, Ill., Bird's-Point, Mo., Fort Holk, Ky., and the whole vicinage of that region, is one immense swamp, receiving the drainage of Illinois, Missouri, and Kentucky. Probably in no region of the West are

malarious influences so constantly at work. Every form of disease is complicated by malaria, and rapidly takes on asthenic characteristics, rendering those subjected to any infectious or contagious disease sure to acquire it, and rendering their systems incapable of resisting or rallying from its depressing influences. In no form of disease was this more manifest than in the epidemic of measles which, in the fall of 1861 and the winter following, nearly decimated the regiments quartered in that region, and never was the infectious nature of a disease more strongly marked. From the exigencies of the service, and the crowded condition of all the hospitals, it was not possible to separate eruptive diseases from others — they were indiscriminately mixed in the fatal wards. The initiatory fever and rigor were, in nearly every case, like ague; and, indeed, the most of the men either had, or had had, ague. In those cases occurring in men fresh from their country homes, the coryza and tumefaction of the eyelids, together with the fever, were diagnostic of the disease; and when the eruption appeared, it was of a bright good color, having the true crescentic form, and if there were no complication the disease ran its course kindly: but when the patient had been subjected to the depression of malaria the pulse was rapid, feeble, and soft, the tongue dry, the skin of a dusky, livid color, and the eruption, instead of being bright and clear, was dark-livid, having more the appearance of diffused ecchymosis than any thing else, and, instead of the distinct crescentic form, ran together in large dark patches. In these cases there was nearly always inflammation of the mucous surface of the nose and throat, which often degenerated into ulceration and destruction of the soft parts, and the whole condition became typhoid. Pneumonia was developed in a large number of cases, and I think it safe to say, it always was typhoid in its character. Diarrhœa and dysentery had been prevalent all the season to such an extent that hardly a man escaped. There were thus complications to contend with which taxed the skill and perseverance of the medical officers to the utmost. In the worst class of cases the pulse often ran as high as 140 to 150 per minute, very feeble and soft; the tongue became dry and dark brown, with the edges and tip fiery red; the skin was cold and clammy; the eyes red with continual weeping; the urine scanty and ammoniacal. If blood was drawn and examined with the microscope, the white cells were in great proportion, as in leucocytosis. I am not aware whether this condition of the blood in measles has ever been pointed out, but so far as my own examinations have extended, it always obtains, when

the disease has assumed a malignant character. In those cases in which pneumonia supervened, this last was always of a low or typhoid character, indicating an eminently tonic and sustaining treatment. In many cases, while the desquamative process was going on, and even after its completion, we had the same tendency to dropsy that is found so prevalent after scarlatina, and the urine was albuminous. None of these last cases recovered, so far as I know. I was enabled to make but one autopsy of such a case, and in that there was marked congestion of the kidneys, and they had a waxy consistence and appearance. In this case the liver was mottled, and the lungs had the well-known appearance of typhoid pneumonia. One very remarkable fact was, that in every case where the patients lay on straw that was not perfectly sweet and fresh, the eruption assumed a livid, unhealthy hue with extreme irritation of the surface, and in many cases became pustular; this condition I will refer to in the after-part of this paper. These have been the marked characteristics of the disease in all the localities I have mentioned where the patients have been crowded in hospitals. It can hardly be profitable for me to speak of modes of treatment, for it is evident that, from the general character of the disease, it could but be eminently tonic and antiseptic. In the congested condition of the lungs which often obtained in the pneumonia, blisters were used in some cases, but always with a bad effect, for the vitality was so low that sloughing of the surface often took place, and their depressing influence was marked in all. Warm stupes were found far more advantageous, and had a soothing influence on the patients. I have referred to the influence of the straw on which the patients lay; it has often occurred to me to find cases of an eruption so simulating measles, that but for the absence of the fever and other diagnostic marks, it might readily be taken for that disease when the men had lain on old musty straw.

"My attention was first called to this while General Pope's army was operating at Island No. 10, and New Madrid. The men found some old straw stacks which they appropriated for bedding, and very soon we had a large number of so-called measles, but which, on a critical examination, were found to be only a cutaneous disease. After long and patient search I traced it to the straw, which was found to be covered with a fungus which I believe to be *Puccinia graminis*. I was led to this view from the well-known fact among farmers, that hogs and cattle lying in old straw, especially

that of buckwheat, are attacked with a cutaneous disease which keeps them continually scratching; and I found that when the men no longer lay on this mouldy straw, the eruption disappeared. So in genuine measles, when the straw of their beds was at all mildewed, the eruption took on an unhealthy character. This may seem out of place, but I always find eruptive diseases aggravated by impure bedding.

"We are at this time having a few cases of measles at this hospital (Tullahoma, Tenn.), among new recruits just from the North; but, so far, there is nothing remarkable in their cases. So far as my own experience goes, it is of the utmost importance to isolate cases of measles from all others as much as possible, but where this cannot be done, it will be found that the vapor of bromine kept diffused in the wards will act as a prophylactic, and few, if any, new cases will originate."

The following is communicated by Dr. Samuel L. Adams, late Surgeon U. S. Army and Navy: —

Communication by Surgeon Samuel L. Adams.

"Rubeola was a terrible scourge to the Kentucky troops in the beginning of the war. Of those who had been reared in the rural districts, many had never had the disease, and the greater part of these contracted it. In two companies of our regiment we had fifty cases in January, 1862. I had seen this disease at Camp Dick Robinson in the previous autumn; and an order had been issued that, as soon as any cases appeared in our camp, the patients should be sent to the general hospital. Nine patients were sent to the hospital in accordance with this order. On going to the hospital, with two additional cases, after four or five days, I found five of the nine patients had died, and two more were moribund. Believing that I could do better for my men in my field hospital, I obtained leave to bring back my two cases, and to retain all that might subsequently occur. Of the cases treated in the field hospital, I lost but two, and in these two cases death took place, after a protracted illness, from tuberculous disease. I refer to these facts in explanation of the preference which I have for treating cases of this disease in the field rather than in the crowded wards of an in-door hospital. Fresh air seemed necessary to the successful management of the cases. The disease passed through its course without presenting any peculiarities, but what was called typhoid pneumonia was apt to follow. The treatment pursued was as follows: I required my patients to drink freely of cold water, to keep themselves well covered in bed, but to

have plenty of fresh air. As soon as the eruption appeared, quinia and whisky were given freely, and continued until recovery took place. This treatment seemed to aggravate the febrile condition for a day or two, but I think it prevented the occurrence of pneumonia or typhoid symptoms. No expectorants were used."

CHAPTER FOURTH.

YELLOW FEVER ON THE ATLANTIC COAST AND AT THE SOUTH DURING THE WAR.

By ELISHA HARRIS, M. D.

Predictions concerning Yellow Fever. — Assurances of Hygienic Protection. — The Capture of New Orleans did not open a Highway for Yellow Fever. — Sanitary Police in New Orleans. — The Troops in a Condition to take Yellow Fever. — Constant Exposure of New Orleans. — Quarantine. — Yellow Fever at Wilmington, N. C. — Commencement of the Epidemic. — Statistics of the Epidemic. — Arrival of the *Kate*. — Infected at Nassau, N. P. — Dr. Wragg's Report. — The Hygienic Condition of the City. — Facts relating to Origin. — Sporadic Cases. — Importation. — Remarkable Fatality. — Yellow Fever at Key West and the Dry Tortugas. — The Gunboat *Tahoma*, 1864. — Outbreak on the Tortugas. — Localizing and Personal Causes. — Key West and Nassau as *points d'appui* of Fever Infection. — The Epidemic at Hilton Head, S. C., in the Autumn of 1862. — The Ship *Delaware* as the Carrier. — The Manner of communicating the Infection. — A Series of Cases in Hospital. — Decline of the Disease. — Origin and Localizing Causes. — Two Distinct Outbreaks of the Epidemic. — Epidemic Causes. — General Mitchell and his Staff. — Fever at Beaufort traced to Hilton Head. — Diagram and Medical Topography of the Infected District at Hilton Head, 1862. — Yellow Fever at Newbern, N. C. — Number of Fatal Cases. — Heroism of the Physicians. — Beaufort and Morehead City. — The "Roll of Honor." — Was the Newbern Epidemic of Exotic Origin? — Conclusions.

Yellow Fever in the Gulf Ports. — Rigid Quarantine at New Orleans. — Liability to Exotic Infection Excluded. — The Question of Domestic Origin for the first Time susceptible of Solution. — One Class of River Craft prepared to generate Yellow Fever; but the City Secure. — All the Gulf Ports and some Texian Towns Inland infected. — The Galveston Epidemic. — A District of the City escapes Yellow Fever by Exclusion from Intercourse with the Epidemic Quarter. — The Fever was conveyed Inland. — Experience in New Orleans in 1862-65. — New Orleans as Liable as any Gulf Port. — The Fever widely Epidemic in the Gulf Ports. — Exotic Germs and Localizing Causes of Past Epidemics. — The Exotic and the Domestic Factors controlled by Sanitary Measures. — River "Rams," etc., furnished the Artificial Causes. — Internal Sanitary Police of the City. — The Chances of Exotic Infection excluded. — Medical Topography of the Delta. — Temperature and Humidity, Cryptogamic and Infusorial Life and Decay. — Persistent Scourging by Yellow Fever before the War. — The City full of *Uncreolized* and most Susceptible Men. — Low Death-rate in 1864-65. — Death-rates and Epidemic Causes. — Sanitary Government of the City. — Yellow Fever in Iron Boats in 1863; not of imported Origin. — New Orleans Quarantine Record of 1863-64. — Locality of Naval Hospital. — Record of the Naval Epidemic. — Foul Vessels long at Anchor; Twenty-five Boats become Infected. — The Boat-landing becomes Infected. — Hygienic Truths Taught by this Record. — Conclusions.

Pathological Inquiries. — Therapeutical Experience.

Predictions concerning yellow fever.

Our civil war had scarcely commenced when throughout both the North and the South it was prophesied that the great scourge of the tropics, yellow fever, would decimate any northern armies that might penetrate the "Cotton States" within

the "yellow fever zone." With like assurance it was asserted that from the James and the Savannah to the Mississippi and the Gulf, unacclimated soldiers would quickly be disabled by the pernicious malarial fevers that prevailed over more than half the region, and for nearly half the year, south of the Ohio.

Assurances of hygienic protection.

Medical men who had not learned the prophylactic power of hygienic measures against the yellow fever, and of quinine against the paludal malaria, mentally admitted, and sometimes openly said, that these forebodings of evil to our armies would probably prove too true. But patriotism and the war spirit heeded no dangers; and, fortunately, there are some certainties in medicine and hygiene which seldom disappoint the physician who puts his trust in a judicious and timely application of the agencies and the principles upon which such certainties are founded. The records, both of yellow fever and of all the malarial fevers, in the armies during the late war, have demonstrated more conclusively than ever witnessed before, that the doctrines of hygiene can be trusted to work out all they promise for the protection of cities, navies, and armies.

Capture of New Orleans did not open a highway for yellow fever.

In April, 1862, when the naval forces under Commodore Farragut (now Admiral) braved the fires of Fort St. Philip and of the threatening fleet that vainly forbade approach to New Orleans, such valor might have opened the highway to pestilence and the grave when the national standard was restored to the metropolis of the Gulf States, had not the general commanding that expedition carried with him the baton and broom of sanitary reform. On the 1st of May, 1862, Major-General Butler promulgated his first general order, announcing the policy he determined to pursue in the control of municipal affairs in New Orleans; and in a single paragraph it was explicitly made known to the inhabitants that all sanitary laws and regulations would be rigidly and promptly enforced. A provisional city government having been organized, its new police force, under military regulations, devoted its chief attention to the duties imposed by the sanitary regulations for the city.

Sanitary laws in New Orleans.

The efficient health government that had been so promptly inaugurated by General Butler continued in full force until the end of the war. During the year 1862, New Orleans and the entire Federal fleet remained free from yellow fever. The military forces saw much hard service; the transports in which they came were both unclean and unhealthy; their camps and quarters were insalubrious; and during the autumn of that first year of military occupation the soldiers and

The troops in a condition to take yellow fever.

the naval forces on the river suffered much from malarial fever.

Favorable location of New Orleans. Quarantine.

The quarantine station was maintained at the usual point, between sixty and seventy miles down the river; but, in the absence of trade with the permanent habitats of the yellow fever in the West India Islands, the quarantine officers had light service, and the city was measurably secure against imported infection. Best of all, its sanitary police had rendered it secure against its own domestic sources of the scourge. In subsequent pages we will examine this lesson of experience in regard to the yellow fever at New Orleans and on the Mississippi River.

The war being at an end, and the records of experience in towns exposed to yellow fever in the insurgent States being now freely accessible, we here propose to recall the facts concerning this fever in those towns during the year 1862. This is essential to a correct understanding of the history of yellow fever as it prevailed, and as it was prevented from prevailing, during the war. We quote such information as we have received by correspondence, and as we find well authenticated in published records in the South during the progress of events to which they relate.

Yellow Fever at Wilmington, N. C. — In June, 1862, it was

Commencement of the epidemic.

reported that yellow fever had commenced in a filthy alley in Wilmington; cases of black vomit were reported in July, and on the 4th and 5th of August two fatal and confirmed cases of the fever occurred in another filthy quarter. Dr. Wm. T. Wragg, a distinguished student of yellow fever, reported, as the result of correspondence and inquiry, that the epidemic in Wilmington continued to increase after the 1st of July, and that the acme of its ravages was reached in the third week of October, when four hundred and twenty-one cases and one hun-

Statistics of the epidemic.

dred and two deaths occurred. The "Wilmington Journal," November 17, 1862, gave the following statistics of the epidemic: —

Up to September 19	8 cases	6 deaths
Week ending Sept. 26	26 "	9 "
" " Oct. 3	267 "	82 "
" " " 10	395 "	40 "
" " " 17	431 "	102 "
" " " 24	194 "	111 "
" " Nov. 1	116 "	40 "
" " " 8	47 "	30 "
" " " 15	21 "	21 "
Up to November 17	2 "	5 "
Total	1507 cases	446 deaths.

Dr. Wragg states that, at the period here mentioned, the population of Wilmington was about five thousand, and that there was one case of fever out of less than four inhabitants, and one death to every eleven of the inhabitants that remained alive; and he adds the remark, that of the population of Wilmington at that time, at least one half were negroes, who suffered much less than the white inhabitants of the place. Hence it would appear, conclusively, that more than half of all the white population was attacked by the fever, and that at least one out of every five white inhabitants was killed by it.

It will ever remain a vexed question whether that epidemic was wholly of spontaneous origin, or had its inception from imported germs by the blockade runners. We quote the following facts relating to this point, premising that there seems to be scarcely a doubt that the epidemic had obtained foothold in that horribly filthy city prior to the 4th of August: On the afternoon of August 6th, the steamer *Kate*, a noted blockade runner, arrived from Nassau, which port she left on the 2d of August. Yellow fever was epidemic there at the time of departure; and so intensely infected was the atmosphere in that port that the steamer *Kersonese* and other vessels became thoroughly infected by it while lying at the wharf or at anchor. It was proved that the *Kate's* firemen and crew contracted the disease while in the port of Nassau; the fact also appears that the infection continued to strike down officers and men connected with that vessel more than two weeks subsequent to arrival at Wilmington. We give these facts for what they are worth; and, from the events that preceded the arrival of the *Kate*, there was good reason for the opinion of Dr. Wragg, that this epidemic had a spontaneous origin. The following passages from his report show what kind of local causes prevailed in connection with the outbreak of the epidemic: —

Arrival of the *Kate*.

Infected at Nassau, N. Prov.

Dr. Wragg's report

"During July, August, and September, the entire country was deluged with rain. Ponds formed on high and dry places where water was never known to accumulate before, and, owing to neglect of the culverts, especially on Front Street, near Roberts' Foundry, a large, long, shallow pond was formed, the bottom of which was composed entirely of the sweepings of the streets — old shoes, rags, pieces of tin, and refuse matter of all descriptions, which had been thrown in by the town carts in order to raise the valley to a level with the adjoining streets. This spot is known by the name of the Rouse Lot. The bottom of this pond was alternately dry from

Unhygienic condition of the city.

evaporation and exposed to the intense heat of the sun, and then again filled by fresh rains, when it was covered by green slime, and exhaled a most offensive odor. One square south of this pond, in the direction of the prevailing winds, the first cases commenced."

According to the statements of Dr. Anderson and Dr. Wragg, there were well-marked cases of yellow fever in several of the filthy quarters of Wilmington previous to the arrival of the steamship *Kate*. But it is known that the *Kate* had yellow fever in her ship's company, and that immediately after the arrival of that vessel the fever became epidemic and alarmingly fatal; yet it does not appear certain that any of the new centres of the infection were derived from the infected blockade runner. The chief point of general interest to the medical profession in reference to the Wilmington epidemic, aside from its terrible fatality, is that which relates to the question of the indigenous origin of the infection. Though it is barely possible that yellow fever has sometimes originated solely from local causes at points as far north as the ports of North Carolina, we regard the evidence relating to the Wilmington epidemic in 1862 as being very strongly in favor of its exotic origin. One of the most significant facts bearing upon this question is that which appears in the records of the disease in that city of filth concerning the wide distribution of the infection in different quarters of the place. This fact was observed within five days from the date of the *Kate's* arrival. Now, had that ship been the chief or only focus of the pestilence, such a dispersion of the infection would scarcely have been possible, except by dispersion of her cargo and clothing. To what extent this actually occurred we cannot now ascertain.

The *Kate* was infected.

Facts relating to origin.

Sporadic cases.

The infected ship, here mentioned, arrived the 6th of August. Up to September 10th, there had been only eight cases and six deaths among citizens and soldiers. The culminating point in the epidemic was attained in a little less than five weeks after that date. We here close this brief record of yellow fever in Wilmington, — the chief of depots for the blockade runners, — simply remarking that the pernicious malarial fever, which is the indigenous product of the paludal banks of the Cape Fear River, on which that city is situated, may have been mistaken for the yellow fever in the early cases that now stand charged to the epidemic, and that other and earlier blockade runners than the *Kate* may have conveyed the infection thither from Nassau or Havana.

Importation.

Matagorda, Texas. — There was a fatal outbreak of yellow fever

at Matagorda, Texas, during the autumn of 1862. It was attributed to an infected blockade runner. Out of a population of five hundred persons, one hundred and twenty died, and about two hundred and fifty, or half the inhabitants of the place, suffered from the fever. Mobile reported the existence of the fever from imported sources; but only in the little towns of Wilmington, N. C., and Matagorda, Texas, within the entire coast-line of *blockaded* ports, did this scourge of the American and African tropics inflict much injury during the year 1862.

Remarkable fatality.

Yellow Fever at Key West and the Dry Tortugas. — Upon these two isolated and salubrious sand keys, the infection of yellow fever had never found a congenial soil until they were crowded by soldiers, and almost daily exposed to perils of intercourse with the Gulf Squadron, and to constant intercommunication with the infected West Indian ports. Early in the autumn of 1862, the infection obtained foothold, and began its fatal ravages among the regiments there. The fact that the port of Key West became intensely infected, is shown by the circumstances attending the transportation of the yellow fever infection from that port, by a great number of vessels that merely called there. The case of the gunboat *Tahoma* illustrates this fact. That vessel called at Key West to leave a large cannon, and tarried only while transferring it from ship to shore. In July, about a month subsequently, while in the northern latitudes, yellow fever became epidemic on board of that vessel; yet, her only exposure to an infected atmosphere was that brief detention at Key West.

The gunboat *Tahoma* in 1864.

The Dry Tortugas, crowded with an unhappy population of prisoners of war, and visited every few days by gunboats directly from the harbor of Havana and the infected shores of Key West, invited the ravages of yellow fever, the germs of which had been borne from the infected places just mentioned. Salubrious as these sand keys — now for the first time populous, and for the first time smitten with yellow fever [1] — had been reputed to be, it would appear from the records of their sanitary condition, and from the unexampled massing of men there, that the requisite conditions for a yellow fever epidemic were present; and so far as temperature and humidity are concerned, those natural factors of an epidemic atmosphere may be said to be present there almost every year. But the fact to which we would call attention more especially is

Outbreak on the Dry Tortugas.

[1] For an account of a reputed outbreak of yellow fever at Allenton, Key West, in 1824, see La Roche *On Yellow Fever*, vol. ii. p. 391; and Ticknor, in *North American Journal*, vol. iii. p. 213–217.

this, namely, that in the tents and military quarters, in the prison gangs, and in the military hospitals there, there existed artificial and personal conditions of insalubrity that gave vehemence to the epidemic ravages of the fever poison. Even on board the *Tahoma*, where there were twenty-six cases of yellow fever in seven weeks in a northern climate, and on board the transport steamship *Delaware*, in which a large number of cases of yellow fever occurred in September, on the passage from Hilton Head to New York, abundant evidence was furnished that the initial and all-essential fact in the etiology and geography of yellow fever, is that which relates to the implantation of the epidemic germs or the *fomites*, in a locality where temperature, humidity, and personal conditions favor their pestilential propagation.

Localizing and personal causes.

Yellow fever prevailed at Key West in 1862, 1863, 1864, and its port became the *point d'appui* of the fever infection to many gunboats and other vessels. Nassau, on the island of New Providence, usually a healthy port, became infected in July, 1862; and from its important relations to the blockade running in Southern ports, we find a well-sustained medical opinion at Savannah and Wilmington, that it served as the chief focus of infection to those cities. And the manner in which the epidemic first reached Nassau is worthy of note in this place. It was, briefly, thus: The ship *Flying Cloud* came into Nassau directly from Havana, and discharged her cargo there; while the British steamship *Kersonese* came alongside to leeward of her; yellow fever was prevailing on board the *Flying Cloud* at the time; but the *Kersonese* left immediately on a northern trip, and several of her crew died of black vomit before reaching the Bermudas. The fevers, meantime, gained foothold on land at Nassau, and for the first time in its history prevailed epidemically there.[1]

Key West and Nassau, as *points d'appui* of fever infection.

The Epidemic at Hilton Head, S. C., Autumn of 1862. — The steamship *Delaware*, formerly a passenger vessel plying between Cape May and Philadelphia, was employed in the coast service during the summer of 1862. In the course of a trip to St. Augustine, Fla., and the Dry Tortugas, during the last week in July, this vessel returned to Hilton Head on the 26th day of August, having touched at Key West on the 12th of that month, and remained two days at the wharf of that infected place. Though there was some sickness on board during the trip, it does not appear to be certain that there was any case

The ship *Delaware* as the carrier.

[1] See statement by Dr. Anderson in Dr. Wm. T. Wragg's *Report on the Yellow Fever Epidemic at Wilmington, N. C., in the Autumn of* 1862.

of yellow fever prior to her arrival at Hilton Head, August 26th ; but soon after arrival, there were three fatal cases of yellow fever on board. After undergoing some sort of quarantine, she came alongside the long wharf and discharged a quantity of tents which she had brought up from the infected station at which she had called when on her trip. Several persons sick with yellow fever were taken from her and placed in the hospital, and she then proceeded northward to New York, having on board, when she was quarantined off Staten Island, four men freshly attacked by the pestilence, and the corpse of one who had died of it on the passage. Ten cases of the fever occurred subsequently while the vessel was in quarantine during the last of September. The writer investigated the history of this outbreak of fever on the *Delaware*, immediately after the events occurred, and came to the conclusion that the vessel had become infected while at Key West, and that the planting of the infection at Hilton Head occurred, naturally, as a result of the unshipping of the tents, etc., from the infected quarter of the vessel. And, in addition to this, the ship lay alongside the wharf an entire day, unloading, and was but a few yards from the quarters of the officers and men.

Comes to the wharf and discharges a quantity of tents from Key West.

The manner of communicating the infection.

The sick were sent directly to the hospital at Hilton Head, and during the months of September, October, and November, thirty-seven persons were admitted at that hospital with yellow fever, of whom twenty-one died. The whole number of such admissions during the month of September, was eleven, during the month of October, nineteen, and in November there were seven. The acme of the epidemic seems to have been reached on the 10th of October, when ten were admitted to the hospital, besides a large number were placed under medical care in quarters ; but the greatest fatality occurred in the twelve cases that were admitted prior to October 10th, for of those only two survived. An intelligent medical officer has well described the character of the fever as it appeared among detailed men in the quartermaster's department, commencing with a series of cases that began October 9th. After describing a walking case that was admitted on this date, and who died on the 10th, the reporter goes on to state : — [1]

A series of cases in hospital.

"On the same morning, shortly after his death, another man *walked* into the hospital. I met him on the corridor and thought he had come in on some business. He also was from the quartermaster's department. He was admitted into one of the wards under my care. He had

[1] Dr. Thos. T. Smiley: *Boston Med. and Surg. Journal*, January 8th, 1863.

scarcely any fever, and seemed rather to be weary than sick, but he gradually grew worse, delirium and black vomit came on, and notwithstanding all our efforts, he died forty-eight hours after he had walked into the hospital.

"The occurrence of two decided and strongly-marked cases of yellow fever, in men of the quartermaster's department, both of whom had been at work in the same neighborhood near General Mitchell's headquarters, impressed us with the unwelcome fact that there was a centre of infection near the place, and that whether it had sprung up from the remnants of the disease left by the *Delaware* or not, or whether it was of spontaneous production, it had now become naturalized amongst us. This impression amounted to a certainty when, soon afterwards, six more cases were presented for admission, all engaged in the same employment and from the same locality.

"From the 10th to the 22d of October, there were no new applications for the admission of yellow fever cases into the hospital, and we began again to hope that the disease was extinct. But in this we were again disappointed, for from the latter date to the end of the month there was almost daily a succession of new cases. During the last week in October we also heard of a considerable number of cases which did not enter the hospital. It was during this week that the lamented General Mitchell, who had, without doubt, contracted the disease at Hilton Head, went up to Beaufort to die.

"After the 1st of November the number of cases gradually diminished, and after the 10th they ceased altogether; the weather, from about October 25th, having become much cooler. The character of the cases, however, in November, was not less severe than of those previously admitted; on the contrary, some of the most malignant cases occurred during that period. By some authors it has been stated that toward the close of epidemic yellow fever the cases become much milder. This does not correspond with our experience, as some of the last of our cases were amongst the worst.

Decline of the epidemic.

"Throughout the yellow fever districts of the South, the appearance of the first frosts is looked for with great anxiety, as there is an absolute certainty that it will bring the disease to a close for that season. Our experience here affords a clear proof of the correctness of that observation. The first frosts took place on the 7th, 8th, and 9th of November."

This outbreak of yellow fever at Hilton Head in 1862 is full of instruction in regard to the unhygienic conditions that favored the propagation of its infectious poison; and we have reason to conclude that had the physical laws which governed the propagation of this pestilence been thoroughly understood and officially regarded, the epidemic would have been avoided. The loss of Major-General O. M. Mitchell, the distinguished astronomer

Origin and localizing causes.

and patriot, gave to that epidemic a lamentable importance never to be forgotten. The fact that yellow fever was known to be prevailing very fatally at Key West and in the West Indian ports, was a warning not to be disregarded. Yet, after various orders concerning the ship and the quartermaster's goods (tents) on board, the *Delaware* came up to the wharf adjacent to Major-General Mitchell's head-quarters, and there discharged the tents. The ship remained twelve hours at the wharf; the tents were deposited in a store-house near by head-quarters; and, in view of the fact that but few of the ship's company had been attacked by the fever, and that the ship proceeded without restraint up to Seabrook, five miles distant, to take in coal, no official question seems to have arisen in regard to the sanitary propriety of the free pratique that was given to the ship and the infected tents.

The *Delaware* comes to the wharf and discharges tents, etc., from Key West.

Some of the sick that left the *Delaware* were sent directly to general hospital; others tarried about the military quarters a day or two with their baggage, etc. The circumstances attending the progress of the epidemic indicated the following important facts in its local etiology: 1st. That the group of patients first admitted to hospital from the *Delaware*, and the soldiers that arrived on that ship, must have received the fever infection before leaving Key West, or during their passage and detention on the vessel. 2d. That two distinct outbreaks, or, rather, two distinct waves of exacerbation, of the epidemic subsequently occurred, and were directly traceable to the vicinity of the "long wharf," and the store-houses adjacent to it, the first of these local outbreaks having commenced on the 9th of October, a fortnight after the first group of cases, directly from the *Delaware*, had been buried, and the second outbreak having commenced October 22d. 3d. That the last outbreak was the most obstinate and fatal. The last admission of yellow fever to general hospital at Hilton Head occurred on the 10th of November, three patients, two of whom died on the third day after admission, and one of whom recovered and returned to duty.

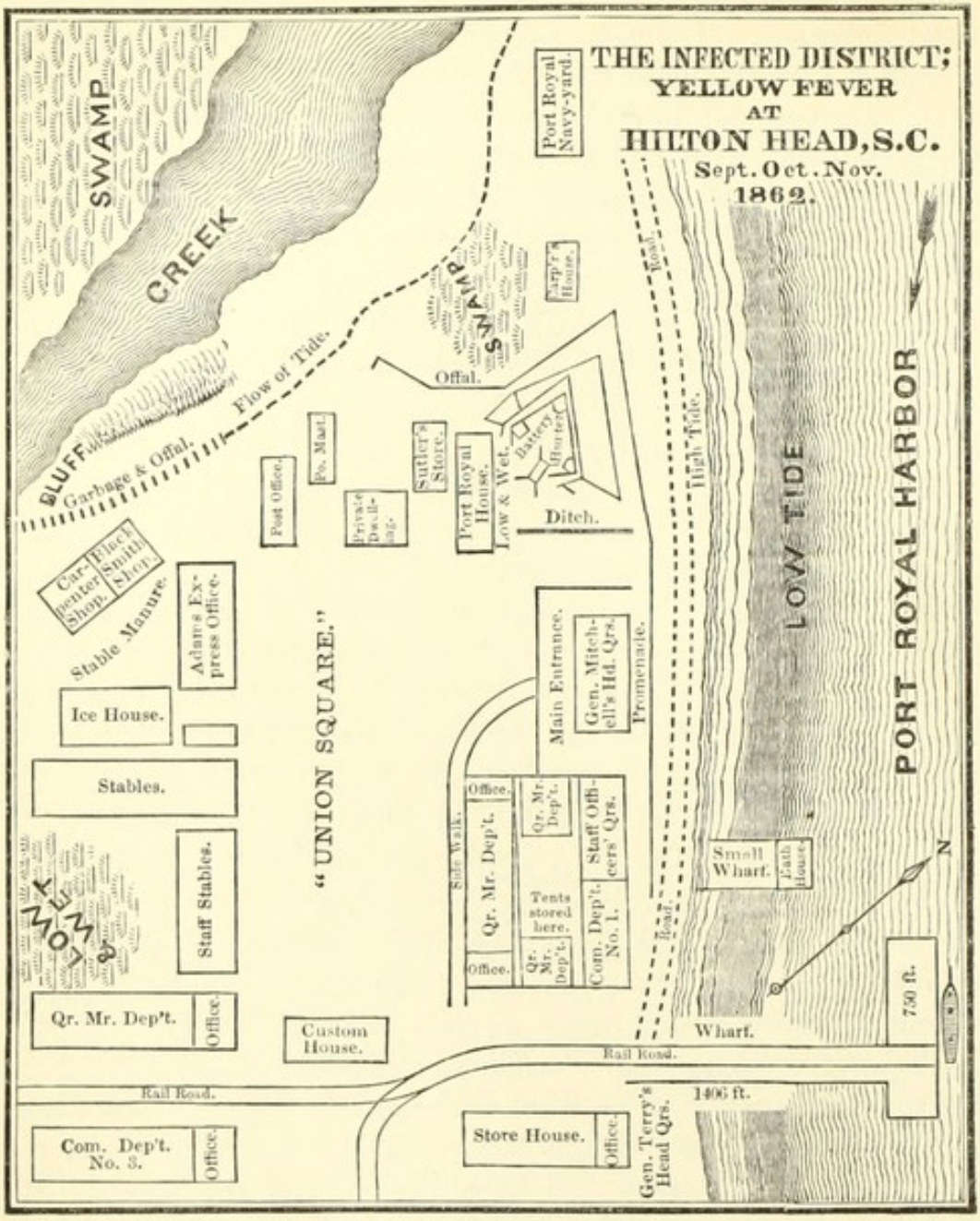
Three groups of patients.

Two distinct outbreaks of the epidemic.

Epidemic ceased Nov. 15.

In the last week of October a large number of cases occurred near head-quarters, and it was during that last relighting of the epidemic that Major-General Mitchell, the commander of the department, was seized by the pestilence and for greater safety moved up the river to Beaufort, where, after a brief illness, his brilliant career was terminated by the black vomit.

General O. M. Mitchell and his staff.



Colonel Elwell, the chief quartermaster, and other valuable officers, suffered severe attacks of the fever. Though the fever did not become epidemic at Beaufort, a considerable number of cases occurred there, and all of them, as nearly as can be ascertained, were traceable to the infected spot at Hilton Head, or to infected material of one kind and another which was brought up from the head-quarters of fever around "Union Square," whence General Mitchell and numerous others had fled.

Fever at Beaufort traced to Hilton Head.

NOTE. — By the kindness of Dr. Meredith Clymer, late Medical Inspector U. S. Army, and Medical Director of the Department of the South, and by permission of the proprietors of Dr. Smiley's map, we are enabled to present the above very accurate diagram of the infected quarters at Port Royal.

The records of this untimely and lamentable visitation of yellow fever involve some of the most important and practically interesting questions respecting the propagation and the epidemic phenomena of this scourge of the American tropics. The diagram upon the opposite page correctly represents the locality which became infected after the arrival of the *Delaware* at the long wharf adjacent to General Mitchell's head-quarters. No comment need be added to such a topographical sketch; for every physical condition that is known to favor the propagation of the yellow fever poison was manifestly present about Long Wharf and the military head-quarters.

Medical topography of the infected region.

At so late a period in the year it is doubtful if the theory of domestic origin could be successfully advocated in regard to this fatal epidemic at Hilton Head. It scarcely admits of doubt that the *Delaware* became the vehicle of the transportation of fever poison from Key West, and that the "breaking bulk" for unshipping of tents, etc., while remaining an entire day at the head of Long Wharf; the housing and exposure of the tents in the quartermaster's sheds adjacent to the General's head-quarters; and the presence of persons with uncleansed clothing and "kit," discharged from the infected ship without sanitary control, constituted the sources of infection.

Was the fever of domestic or exotic origin?

Yellow Fever at Newbern, N. C. — Early in the autumn of 1864, yellow fever raged in its most pestilential manner in Newbern, Beaufort, and Morehead City. Its ravages were chiefly limited to Newbern, and the camps in its vicinity; its outbreak there, at the beginning of autumn, was attended by circumstances that led Dr. Hand, Surgeon U. S. Volunteers, the Medical Director there, to conclude that the epidemic originated on the spot, and was in nowise dependent upon imported infection or *fomites*. The rare intelligence and faithfulness of that medical officer impart a decided importance to the conclusion here mentioned. We must, however, admit the fact that the incessant communication of naval vessels between the Gulf Squadron and Newbern will forever prevent any positive conclusions upon the vexed question which to the Medical Director's mind, familiar as he was with all the circumstances of the outbreak, seem satisfactorily settled in favor of the theory of domestic origin. We are certain of the fact that, from the massing of refugees and freed people in Newbern and its vicinity, and from various unhygienic conditions in Newbern, Beaufort, and Morehead City, both the soil and the population were well prepared for the pestilence.

Opinions of medical officers regarding origin.

Unhygienic conditions.

During the three months in which the epidemic prevailed, there were upwards of three thousand deaths caused by it, and of this number only about one hundred and fifty occurred among the old residents of the city. The first circumstantial report which the U. S. Sanitary Commission received from its agent there, Dr. J. W. Page, in the first weeks of the epidemic, mentioned the fearfully rapid and fatal progress it was making, and it stated, —

The number of fatal cases.

"The dead-house is constantly full. Lieutenant-Colonel Stone, and Major Lawson, of the 2d Massachusetts Volunteers, died yesterday; Aid-de-Camp Hathaway died to-day; Dr. Bell, Surgeon U. S. Volunteers, in charge of hospitals, has little chance of recovery; the surgical staff is breaking down with overwork; we need medical help. Dr. Hand, the Medical Director, is doing heroic service; Dr. Bellargée came up to assist him, but was prostrated with the fever after the fourth day of arrival."

Dr. J. W. Page's statements.

Such was the state of affairs at the end of the first week after the recognition of the epidemic. We quote these facts to show its vehement rapidity and virulence. Three weeks later, Dr. Page, whose heroism and endurance enabled him to work night and day through the whole epidemic, wrote as follows: —

"The mortality is frightful. The surgical staff is fearfully overworked. Our Medical Director, Dr. Hand, has lost all his clerks. The times show more heroism and greater depth of true patriotism in these young men than even the incidents of the battle-field; and those who thus offer their services after their time has expired, richly deserve to be noticed by the War Department."

Heroism of the physicians.

It will be observed that the onset of the fever was sudden, and its progress rapid. The vast number of northern soldiers and citizens, added to the crowds of refugees and freedmen, offered an unlimited supply of susceptible material for the pestilence. Its ravages reached Morehead City and Beaufort by means of the constant intercommunication that was necessarily kept up with Newbern; and Dr. Page informs us that all cases at Morehead City were traceable directly to Newbern; but that at Beaufort, during the month of October, the epidemic gained an independent foothold, and at this place it lingered until frost put an end to it. On the 24th of October, Dr. Page wrote as follows: —

Beaufort and Morehead City.

"The mortality has been fearful. In the block above my quarters, fifty-five died, and in an adjacent row of dwellings, extending from Middle to Hancock Streets, not a white person survives. Up to this date at least twelve hundred of the white population in the town have fallen by

the pestilence. The disease seemed to culminate on the 16th of October."

A large number of medical officers, during the progress of this epidemic, sacrificed their lives by heroism in their official duties. The names of Drs. Cummings, Baker, Wilson, Babbitt, Branigan, and Bellargée, the first victims in the medical staff, will ever be perpetuated on the scroll of honor.

The "Roll of Honor."

The two points to which the reader's attention is invited in the records of this epidemic are: First — The impossibility of demonstrating beyond doubt the original source of the infection at Newbern. Second — The persistency and wide extent of the epidemic.

In all respects, these epidemics at Newbern and Beaufort strikingly resemble that which swept over Norfolk and Portsmouth in 1855; and the evidence now before the writer warrants the opinion, at least, that the exotic germs of the fever were planted on the banks of the Neuse, at Newbern, previous to the outbreak of the epidemic. It is worthy of remark in this place, that, at Nassau, N. P., at Key West, Havana, the Tortugas, and especially at Charleston, S. C., yellow fever prevailed severely. Its ravages in the city last named were fearful. At Nassau, Key West, and the ports of Cuba, the fever poison was so intense during the summer and autumn of 1864 that a ship or gunboat, in ordinary condition, almost necessarily became infected after tarrying but a day or two close in shore at the sickly ports. From twenty-two of those sickly places, that year, yellow fever was brought into the harbor of New York under quarantine. Hence, as we cannot disassociate the prevalence of yellow fever that then characterized the shipping of the Gulf and Atlantic coasts from the ravages committed by the infection in the towns here mentioned, we would the more carefully put on record the fact, that there was a predominant opinion among the medical officers at Newbern and Beaufort, as well as at Wilmington and Charleston, that the infection was of domestic origin. Studying the facts at this later period, and after much inquiry, the writer regards the probabilities of an exotic origin in the cities mentioned much stronger than those of its domestic generation there.

Was the fever of exotic origin?

Probabilities and reasons.

Conclusions.

Yellow Fever in the Gulf Ports. — The Gulf Squadron and the West Indian fruit vessels began to suffer from yellow fever early in the summer of 1862, and in several instances such infected vessels reached Pensacola and the quarantine station below New Orleans with yellow fever on board. At the

Rigid quarantine at New Orleans.

latter station, which is nearly seventy miles below the city, a rigid quarantine was maintained against all exotic sources of the fever. No vessel recently from any infected or reasonably suspected place, and not one that either had yellow fever on board, or that was at the time liable to prove infected, could obtain permission to proceed further up than the quarantine station near the Passes.

Liability to exotic infection excluded.

Whatever might prove to be true concerning the domestic indigenous origin of yellow fever at New Orleans, the importation of any germs of the epidemic, by way of the Gulf of Mexico, became almost impossible. With the military regime of Major-General Butler, there was, for the first time in the history of New Orleans and the southern ports, an opportunity effectually to test the protective value of an absolute exclusion of all non-indigenous germs of the great scourge that, for half a century, had afflicted the metropolis of the South. The results of that exclusion of the exotic infection of the fever were entirely satisfactory in 1862, and until the end of the war; for, as we shall presently show, the city remained free from the scourge in 1862, and in the two subsequent years suffered only from the indigenous production of endemics of the fever in a special class of the river craft that created in its oven-like decks all the known conditions for generating this most destructive and subtle fever poison.

The question of domestic origin, for first time susceptible of solution.

One class of river craft prepared to generate yellow fever; but the city secure.

But while New Orleans escaped the epidemic in 1862 and the three succeeding years, and only knew of the presence of the infection by the records of the Naval Hospital in the city, and the quarantine establishment seventy miles away, the cities of Mobile, Galveston, and Houston were scourged by it, and were able to trace its introduction by certain infected blockade runners from the West Indian ports. In 1862 the towns of Corpus Christi, Brownsville, Matagorda, and Sabine, in Texas, were visited by this pestilence; and, in 1864, the city of Galveston was terribly ravaged by it. Dr. Warner, in a letter to the "Houston News," in the autumn of that year, mentions the following important facts: —

All the Gulf ports, and some Texian towns, inland, infected.

"The spring months had been unusually dry. In July and August we had heavy rains, followed by oppressive heat. The first case of the fever that occurred was one of the crew that had freighted at Tampico, ran the blockade, and landed at our wharves the 15th of August. The vessel was visited daily by citizens. . . . . During the first eleven days of September there were seventeen deaths, thirteen of which were attributed to congestion of the brain; but, on the

The Galveston epidemic.

14th, the epidemic character of the disease became so apparent that no further denial could be made, and hence no more deaths were reported from 'congestion of the brain.' . . . . The total number of yellow-fever deaths in Galveston to November 20th, was two hundred and fifty-six. . . . . Seventy-one of the men in Elmore's regiment were treated for the fever, with a loss of seventeen. This forms the best basis for a conclusion as to the rate of its mortality. . . . . Numerous cases have come within my knowledge, of persons leaving the city, after having contracted the disease, and the fever ran the same virulent course as in the city, but invariably terminated with the individual subject, and was not communicated to other occupants of the same house, though near the city.

Progress of the epidemic in Galveston.

"Among the troops that were removed from the city at the commencement of the epidemic, but few cases have occurred, and these were traceable to their persistency in visiting the city; while at the South Battery and Fort Scurry, where the rule of non-intercourse was strictly adhered to, not a single case occurred, although those points are low, damp, and unhealthy, surrounded by stagnant pools, and subjected to whatever influences might arise from disturbance of the soil, and the close proximity of several fatal cases."

A district of the city escapes yellow fever by exclusion from intercourse with the epidemic quarter.

The Galveston physicians entertained little doubt that the epidemic in that city was introduced by the ship *Tampico*. The fever followed the soldiers as they moved out of the city. At Mellican, where there was a number of prisoners, there were sixty-three cases and twenty-one deaths from black vomit. At Houston, the epidemic was exceedingly fatal. On the 12th of October two hundred cases of the fever were reported under treatment within the city limits; but during the subsequent week a cold "norther" seemed to arrest the propagation of the infection; yet before the beginning of November, and within a week after the "norther" subsided, the fever reappeared in its most virulent type, and continued to prevail until frost.

The fever was conveyed inland.

The Experience in New Orleans — 1862–65. — Had yellow fever failed to appear epidemicly in the Gulf Squadron; had not Key West and the Tortugas been visited by it; and had Pensacola, Galveston, Houston, Sabine, Matagorda, and the towns on the Rio Grande remained free from the scourge, then it might have been reasonably claimed that there was an absence of the epidemic tendency on the Gulf coast. But as we have seen, there must have existed, in 1862 and in 1864, a very decided epidemic tendency in all that region. In the year last named it is known that yellow fever prevailed very extensively

New Orleans as *liable* as any Gulf port.

throughout the yellow fever zone of the Gulf; for no less than fifty-five infected ships and one hundred and eight patients with yellow fever arrived in the bay of New York from twenty infected West Indian ports.

The fever widely epidemic in the Gulf ports.

The vexed question concerning the origin of yellow fever in New Orleans, has been discussed in that city and by medical writers in all countries the last fifty years, with inconclusive results.

That the exotic germs of the fever had very frequently been introduced and suddenly lighted up the fires of pestilence in the city, was historically true; but that some of the severest epidemics of the fever owed their origin to domestic causes, had long been believed by such trustworthy medical observers as Drs. Fenner, Axson, and Barton; but that the fatal force and wide diffusion of all the New Orleans epidemics had been mainly due to local causes — mostly of a removable nature — was universally admitted to be true.

Exotic germs and localizing causes of past epidemics.

In the late war, the possibility of absolutely excluding the imported factors or infective germs of yellow fever, was triumphantly attested by the military administration. On the other hand, as will appear in the following narrative of events, both the possibility and the certainty of producing the yellow fever poison, and creating a local epidemic by means of certain unhygienic combinations, was tested on a grand scale in a certain class of the river war-boats in which the worst characteristics of the sickly quarters of Havana, St. Jago de Cuba, and Vera Cruz were self-created. Major-General Butler's "iron rule" on the one hand, and Commodore Ellett's "ram fleet" on the other hand, supplied the requisite conditions for applying absolutely decisive tests to the settlement of the vexed question to which we have here alluded.

The exotic and the domestic factors controlled by sanitary measures.

The river "Rams," etc., furnished the artificial causes.

For more than three years the Provost Marshal, the Military Governor, the Mayor (an appointee of the provisional government), together with the medical director of the post and certain subordinate health officers, have vigilantly administered the regulations relating to municipal hygiene and cleanliness in New Orleans and its vicinity. During all that period the accustomed scourgings of yellow fever have been suspended in that city, while the dire forebodings and prophecies of the inevitable pestilence that would quickly destroy the northern soldiery on reaching the Gulf coast remain unrealized. The conditions under which the "Crescent City" has obtained this remarkable immunity from a doom which her own bitter experience seemed to

Internal sanitary police of the city.

fasten upon her, are now as well understood as were the apparently inexorable causes of her former insalubrity.

Such immunity from her accustomed scourging of yellow fever had not been enjoyed by New Orleans for the last half century. Even her wisest hygienists had been generally discredited and often derided when they publicly taught — as Fenner, Barton, Simonds, and Bennett Dowler had most faithfully — that the active and localizing causes of yellow fever and the high death-rate in that city were preventable. There was a truthfulness worthy of the medical profession, in the words of Dr. Barton, who, as President of the New Orleans Sanitary Commission, sitting in grave and scientific consultation upon the terrible visitations of yellow fever, unhesitatingly declared the causes of that pestilence and the city's excessive insalubrity "*entirely susceptible of cure.*" [1] Still, few persons appreciated the truth of Dr. Barton's words of prophecy, when he said that "upon the broad foundation of SANITARY MEASURES we can erect a monument of public health, and that if a beacon light be erected on its top, and kept alive by proper attention, this city will be second to none in this first of earthly blessings." [2]

The chances of exotic infection excluded.

Three classes of facts, concerning which neither doubt nor uncertainty can be alleged, have conspired to give precise relations and a very definite value to the series of events we are about to consider: *First.* The relentless rigor and precision of a military government precluded the ordinary violations of quarantine regulations, while it gave peculiar certainty to the execution of sanitary regulations in the city. *Second.* The official usages and the armed discipline of the naval fleet in the harbor of New Orleans and upon the river, enabled the medical officers to trace to its source every case of yellow fever that occurred in the gunboats. *Third.* The climate of the city and of the river districts, during the past three years, was not perceptibly different from the climate of previous years and the periods of yellow fever epidemics; the same evils from imperfect culture and drainage, imperfect levees and extensive crevasses, flooding and subsequent evaporation from vast areas of overflowed land, continued to recur in the latter as in former years. In short, all the physical conditions that are supposed to promote the prevalence of yellow fever — excepting only such as are immediately controllable by a sanitary police — prevailed continually and in unusual force in the delta of the Mississippi during this period of immunity from that disease.

The seasons favored an epidemic.

[1] See Dr. E. H. Barton's *Report on the Sanitary Condition of New Orleans.*

[2] *Idem*, p. 452.

Medical topography of the delta.

The medical topography of the delta of the Mississippi River and of the entire State of Louisiana, is such as would be supposed to favor both the origination and epidemic prevalence of yellow fever. Redeemed from the sea, but not from the myriad bayous and swamps connected with the overflowing Father of Waters, whose alluvial deposits have formed the land of the great delta that extends from the Red River to the Gulf, *two fifths* of the entire State of Louisiana is still subject to overflow from the river and its bayous, and not less than *one eighth* of the entire State is constantly submerged. By way of the Southwest Pass, New Orleans is about one hundred and ten miles from the Gulf, yet it is only six miles from the Custom-house to Lake Pontchartrain, one of the remaining grand inlets of the sea, forming the northern limits of the city. The surface of a vast district which has been redeemed from the bayous of Pontchartrain is at present two feet lower than the surface of tide-water, and eight or ten feet lower than the surface of the river opposite the city.

Temperature and humidity.

Temperature and Humidity. — During the three months of summer the temperature seldom falls much below 80° F. from 8 A. M. until sunset. The subjoined table of meteorological observations gives the mean temperature for the months of August and September, 1865 : —[1]

August.

Mean Temperature at 8 A. M.	Mean Temperature at 2 P. M.	Mean Temperature at 9 P. M.	Mean Daily Temperature during month.
$84\frac{2}{3}$	$89\frac{1}{2}$	$84\frac{1}{3}$	86

September.

$80\frac{1}{2}$	$82\frac{4}{5}$	$80\frac{1}{2}$	$81\frac{1}{4}$

The degree of humidity is of course very high; the average temperature for the "dew-point" being about 76° F. for the summer months. The weight of moisture in the atmosphere has an average, during summer and autumn, of from five to seven grains to the cubic foot of air. Southerly and very moist winds prevail nearly three fourths of the time in summer and autumn. Cryptogamic life is everywhere manifested by mould and fungi. The processes of putrefaction and decay are even more rapid than the production and growth of these low and evanescent forms of organic life. Green slime and putrescent effluvia, which, previous to the present sanitary government, assailed the senses, were constantly

[1] We are indebted to Dr. A. W. Smythe, Resident Medical Officer at the Charity Hospital, and to Dr. Heber Smith, Visiting Physician, for meteorological observations in New Orleans in the summer and autumn of 1865.

exhaled from the streets, the gutters, and the canals; while the basins and canals, unless constantly exhausted and cleansed by the drainage machines, were prolific sources of pestilential maladies.

Cryptogamic and infusorial life and decay.

The frequent showers are succeeded immediately by vehement solar radiation; and finally, as the autumn approaches, the swamps and the mud-soil become sufficiently desiccated to generate the most pernicious miasmata. We find it stated, however, that before the swamps were cleared, when the entire region of New Orleans was virtually in a state of submergence, the town was not unhealthful. The legends of longevity of the early settlers seem almost fabulous; but we find Dr. Lind stating that in his day, "the inhabitants of New Orleans suffer no inconvenience from their situation in the marshes, even in the rainy season."[1] This fact, stated by Lind, appears probable, because the town then occupied only a narrow margin for a little distance back from the river, while all the regions beyond were *constantly submerged*.

The Sanitary History of New Orleans before the War. — Constantly recurring epidemics of pestilential diseases had, for two generations, seemed to pronounce the doom of the Crescent City, and, notwithstanding the vast interests of commerce, there have been dismal forebodings of inevitable decadence of wealth and commerce. Between the years 1829 and 1855 inclusive, there were not less than *twelve* great epidemics of yellow fever, or one every second year. Those twelve epidemics killed 22,884 inhabitants, or an average of 1907 in each epidemic, which gives an average of 888 persons killed by that fever, year by year. As the fever prevailed to some extent almost every year, the actual average for each year was about 1000 victims.

Persistent scourging by yellow fever before the war.

During the epidemic years the average death-rate, from all causes, was nearly 75 deaths to the 1000 inhabitants. The average annual death-rate during all that period, and up to the year 1861, was about *six and a half per cent.*, or 65 per 1000. There were years when the death-rate exceeded ten per cent.

Fresh immigration of northern or foreign-born persons was always accredited as the chief source of any excessive mortality; and to become *creolized* (naturalized to the climate) was esteemed almost equivalent to a limited life assurance policy. But we have now seen that during the period of military occupation by the national troops, a hundred thousand northern men, *uncreolized* and unacclimated, have annually arrived in or passed through that city without a single indi-

The city full of *uncreolized* and most susceptible men.

[1] Lind *On Hot Climates*, p. 35.

vidual being smitten with yellow fever, except in the few instances in which soldiers *detailed* to assist at the boats on the levee in receiving and conveying yellow fever patients to the Naval Hospital on New Levee and Erato Streets.

The summers of 1862, 1863, 1864, and 1865 passed without any sign of a yellow fever epidemic. The total number of deaths in July, 1865, was seven hundred and ninety-three, and in August just past, the number was but six hundred and twenty-three. Compare this with the mortality in that city in August, 1853, when six thousand two hundred and one of the inhabitants died! Or compare with the average mortality of the three years, 1853, 1854, and 1855, which gave more than one thousand deaths per month, though the population was far less than during the summer of 1865.[1]

Low death-rate in 1864–1865.

It cannot be claimed that there have been any favoring circumstances in the seasons, the dryness, or the humidity, that can account for such hygienic changes. During the four years of military occupation the levees have been cut and *crevassed*, and the country overflowed, more than in any former period; and then, in August, 1865, for example, the swampy surfaces surrounding the city were desiccated, *less than a single inch* of rain having fallen that month; while in the early part of the succeeding month (September), as in the months of spring and summer, floods have descended.[2] Now, from the sanitary officers of the city we learn that diseases and mortality have been chiefly diminished in connection with the abatement of the worst of those local conditions that are recognized as the *localizing causes*. These causes, in the language of Dr. E. H. Barton, consisted mainly in, —

Dr. Barton's classification of causes of the epidemics.

"1. Bad air.

"2. Offensive privies, intramural cemeteries, various manufactories, stables, slaughter-houses, filthy streets, etc.

"3. Bad water — stagnant water — and bad drainage."[3]

These were the causes of disease first noticed and officially controlled by the military government under the national forces. From the 15th of May, 1862, until the time of the writer's visit to the city in July, 1865, the orders for cleansing and scavenging, as well as the power to enforce all sanitary regulations, emanated from the Provost Marshal. The Mayor of the city, the Military Governor, and the General commanding, faithfully coöperating in

[1] The total population, including the permanent and the transient military forces in the city, was little less than 200,000.

[2] The rain precipitation in September, 1865, was 12.29 inches.

[3] Barton's *Report on Meteorology, Vital Statistics, and Hygiene*, read before the Louisiana State Medical Society, March, 1857. See vol. ii., Fenner's *Southern Medical Reports*.

the maintenance of the sanitary government, it is easy to understand how the health-reform of New Orleans was brought about.

The Medical Director of the department acted as the official sanitary counsellor, and was President of the Board of Health. A special Sanitary Inspector, under military authority, reported daily upon the insalubrious districts and premises of the city and suburbs, with reference to the protection of the citizens and the military forces from the localizing causes of sickness.[1]

The sanitary government of the city.

The Appliances and Means of Sanitary Reform. — 1. The streets, the courts, the market-places, and all the private and public premises of the city were cleansed and kept in a state of unusual cleanliness by an absolute authority.

Cleanliness enforced.

2. The drainage of the city was a matter of constant official concern, and the steam-drainage works kept in great activity night and day. [As all the drainage is superficial, by gutters, ditches, and canals, the mechanical appliances for

Drainage, how increased.

[1] The following note from General James Bowen, the late Provost Marshal of New Orleans, gives an instructive view of the simple and effective methods by which official authority was applied in the work of sanitary government. The practical experience of General Bowen, not only in his official service at the South, but more especially in public institutions in New York, gives to his opinions very high authority.

"NEW YORK, *September* 19, 1865.

"MY DEAR SIR, — I will reply to the questions in your note of the 18th instant, in the order you have stated them.

"There were no special military regulations to maintain the cleanliness of New Orleans. The Ordinances of the local civil authorities passed before the Rebellion were rigorously enforced by Brigadier-General Shepley, Military Governor, and this enforcement was in the main sufficient to secure thorough cleanliness.

"The health of New Orleans was deemed to be so dependent on the cleanliness of the streets, that a careful surveillance was maintained by all the military officers you mention, and any laxity observed was reported to General Shepley.

"The acting Mayor, a staff officer of General Shepley until January, 1864, and subsequently Captain Hoyt, appointed acting Mayor by Major-General Banks, had under their control a Civil Police force, the members of which discharged the duties of Health Wardens.

"The chief authority in the sanitary, as in every other branch of the municipal government in New Orleans, was the Major-General commanding the department: but the duty of maintaining the public health by the enforcement of the Quarantine Laws and the Health Laws of the city, was lodged with Brigadier-General Shepley, and it was discharged with fidelity and zeal.

"The chief Medical Director of the department, and the whole medical staff in New Orleans, were assiduous in making provision to secure the health of the city — by such preventive measures against disease, other than the cleanliness of the streets, as were deemed necessary.

"Two medical or sanitary commissions were appointed at different times: one by Major-General Banks, to select an extra-mural burial-ground, and to report on quarantine, etc.; Dr. J. V. C. Smith, Dr. J. C. Faget, and Dr. Holliday constituted that Commission. The other Commission was appointed by myself, and consisted of Dr. G. W. Avery and Lieutenant-Colonel Tisdale. They were charged with the duty of inspecting the sanitary condition of all military depots and quartermasters' stations in New Orleans, Carrollton, and Algiers. It was an arduous duty, thoroughly performed, and they received the warm commendations of the commanding General.

"From a careful observation during two years in New Orleans, I am satisfied that it was only by the rigorous exercise of military power in the enforcement of the sanitary regulations that the city was exempt from the yellow fever; and that with the usual lax administration of such laws by civil authority, the city will again be subject to its visitation.

"With great respect, your obedient servant,

"JAMES BOWEN.

"To Dr. E. HARRIS, U. S. Sanitary Commission."

drainage, located at the junctions of canals and bayous leading toward Pontchartrain, maintain an important relation to civic purity and the public health. Some of the water-lifting machines exhaust from the canals and basins at the rate of more than 100,000 cubic feet per minute, raising the sewage from the lowest levels of the town, and sending it forward toward Lake Pontchartrain by way of the bayous.] During the frequent rain-falls, when the water floods the gutters and covers whole streets, cleaners were busily at work with hoes and stiff brooms, adding the effectiveness of their arms to the process of cleansing by water-flushing.

Water-supply.

3. The water-supply, which is wholly from the river, was, from the beginning of the military government, a matter of first-rate importance. Though the river surface is higher than the plane of the city, the supply depends mainly upon steam-pumps and reservoirs. The pumps were ordered to be kept in the highest activity, and the water company was held accountable for any failure in its works.

Flushing and scrubbing the streets and gutters.

4. Street-cleaning was literally a *cleansing;* the faithful broom was immediately, and all night long, as constantly as night returned, succeeded by a flushing stream of water from the hydrants, flowing through and thoroughly washing out the gutters and the pavement-joints, aided by the sleepless sweepers, thus rendering the Augean work complete. So clean a city had never before been seen upon the continent.

Scavenging.

5. Scavenging and domiciliary hygiene were enforced by order of the Provost Marshal. Privies and garbage, stables and butcheries, damp and unventilated quarters, and the haunts of vice and debauchery, were all brought under police control. The privies in populous streets, and those connected with places of public resort, were sometimes cleansed as frequently as twice each week. All animals for the markets were impounded at the outskirts of the city, and the cattle-boats were there scrubbed and cleansed before proceeding down to the commercial levees. And as an illustration of the salutary exercise of authority over improper habitations, the writer would mention that he saw all the tenements upon the first floor of an entire block vacated by peremptory orders in a single day.

Yellow fever in river-boats, 1863.

Well-marked and fatal cases of yellow fever occurred in New Orleans in the autumn of 1863, and in the autumn of 1864. In the former year the Charity Hospital received two cases, both of which proved fatal. Both were boat hands from the steamer *J. H. Hancock*, a river tug. In 1864 there were five undoubted and fatal cases of yellow fever, terminating in black

vomit. The writer conversed with the physicians who attended these patients, namely, Professor Crawcour, Dr. Bennett Dowler, and Dr. Smythe; and Dr. Huard has furnished notes of a case that occurred in the parish prison. These five cases occurred in persons who resided or daily visited in the vicinity of Erato, Tchapitoulas, and New Levee streets, near the hospital landing. They were exposed to known causes of the fever. Other cases may have occurred; if so, they have eluded all search.

We have referred to the two cases from a tug in the river, in the autumn of 1863. Nearly one hundred other cases of the fever occurred in the river fleet and in the Naval Hospital that season. The circumstantial history of all these cases shows that they were not of imported origin. They nearly all occurred in crowded, filthy, and unventilated gunboats that were at anchor in the river at New Orleans. Owing to the inaccessibility of medical officers who had charge of the patients on them, the tabulated history of these cases gives way, in this place, to the more complete records of yellow fever in the autumn of 1864.

Not of imported origin.

By the politeness of Dr. Baldwin, the Medical Officer at the quarantine station, we have been furnished with the subjoined copy of his official records of the vessels in quarantine for yellow fever during the years 1863 and 1864.

New Orleans quarantine records, 1863–1864

"On July 4th, 1863, the Spanish man-of-war *Pizarro*, from Havana, was ordered into quarantine while on the way up the river. There were fifteen cases of yellow fever on board.

"September 22d, the U. S. war steamer *Hollyhock* was sent down to the quarantine station, from New Orleans, with eleven cases of yellow fever on board. Seven recovered, and four died.

"October 8th, the steamer *Quincy* was sent into quarantine with five cases of yellow fever, from New Orleans. Three died, and two recovered.

"October 20th, the U. S. steamer *Estrella* was sent down to the quarantine station, from New Orleans, with seven cases of yellow fever. Two died, and five recovered.

"October 1st, 1864, the 'ram' *Monarch* was sent from the anchorage opposite the city, with twelve cases of yellow fever, of which three died.

Records of 1864.

"October 3d, the 'ram' *Tennessee* was sent from the city with four cases of the fever, of which one died.

"On the 10th of October, the steamer *Arkansas*, which had, a few days previously, passed down the river, bound to Texas, returned to the quarantine station, from the Gulf, with nearly all hands sick. Five died of black vomit while at the station."

We have mentioned the five cases of black vomit that occurred

near New Levee Street, in 1864. The Naval Hospital occupied a pile of old buildings on that street, with yards and accessory buildings towards Erato and Tchapitoulas streets. One block of buildings — storehouses — intervenes between the hospital and the river levee and landings. The accompanying record of yellow fever in 1864, in that hospital, and in the idle gunboats in the stream, sufficiently accounts for the concentration of infection in the particular locality in which the five cases occurred outside of the hospital premises. Other cases occurred, but they were directly dependent on intercourse with the infected vessels, and the bedding brought from those vessels. Having, by courtesy of the medical attendants on the sick here mentioned, been favored with opportunities to make an exhaustive study of the cases of which we here present an abstract, it seemed a duty to place this record in a permanent form, in this volume of the Sanitary Commission's Memoirs.

Locality of Naval Hospital.

RECORDS OF THE NAVAL EPIDEMIC.

Name and History of the Vessels in which Yellow Fever occurred.	Dates and Records of Cases.
The *Meteor*. — Had been lying at New Orleans some two months; crew, about 200 men. Came up the river from "Head of the Passes," but had been at anchor off the city.	First case, Sept. 12th. Last case, Oct. 14th. 2 cases; 1 death.
The *Portsmouth*, Ship. — Had been lying at anchor before the city for two years. No communication with infected vessels allowed. Has visited no other port since leaving Portsmouth, N. H.	First case, Sept. 21st. Last case, Dec. 18th. 8 cases; 1 death.
The *Tennessee*, Iron-clad. — Captured, August 5th, 1864, in Mobile Bay. Dirty when captured, ill ventilated, heat excessive, very damp; ship leaked badly, provisions, clothing, etc., covered with mould when not aired daily. Crew consisted of about 110 men. When this ram was captured it was manned from various healthy vessels of the fleet, none of the crew having been on shore since leaving a northern port, and having no communication with any vessel except the supply-ships	First case, Sept. 26th, 1864. Last case, Oct. 12th, 1864. Total cases while at New Orleans, 15. Total deaths, 3. Total cases subsequently, at quarantine, 4.

from Boston, New York, and Philadelphia. The first man taken sick was a negro, native of New Jersey. The case proved fatal. He had not been on shore since he left New York.	Grand Total, 19.
The *Monarch.* — A three-decker, river-boat of Ellet's "Ram Fleet." Was a dirty old craft, bulkheaded and closed all around; utterly unventilated; arrived at New Orleans from up the river about the 1st of Sept. Lay in the river opposite the city three weeks, then torn open for repairs at Algiers. A violent outbreak of the fever occurred Oct. 1st, whereupon boat and all on board were taken to the Quarantine Station.	First case, Oct. 1st. 12 cases and 3 deaths occurred in the course of a few days.
The *General Bragg.*	First case, Oct. 22d. Last case, Nov. 1st. 3 cases.
The *Mobile.* — This case evidently was connected with the hauling of the ship close to the levee, for coaling, at the foot of Erato Street, *the infected district.*	First case, Oct. 6th.
The *Kickapoo.* — A Mississippi monitor; a new ship. Came down the river to go to Mobile; anchored near the levee about the 1st of October.	First case, Oct. 15th. 1 case; 1 death.
The *Augusta Dinsmore.* — A despatch steamer, making a trip to the coast of Texas about once a month: when in New Orleans, usually laid alongside the wharf near the Naval Hospital.	First case, Oct. 22d. 3 cases; 1 death.
The *Arizona.* — A side-wheel steamer, captured when New Orleans surrendered; had yellow fever badly in 1863. Laid further up the stream than most of the others, probably three and a quarter miles. Had been in New Orleans most of the summer.	First case, Oct. 8th. 2 cases; 1 death.

The *Port Royal.* — A side-wheel double-ender.	First case, Oct. 18th. 1 case; 1 death.
The *Oneida*, steam sloop. — Lying off Julia Street; was badly injured at the fight in Mobile Bay, Aug. 5th; came directly to New Orleans; arrived about the 25th of Aug.; laid in same place until ordered to quarantine about Oct. 14th, where eight or ten cases more occurred. No chance of infection from any source except by the development of the disease on board.	First case, Oct. 3d. Last case, Oct. 14th. 7 cases; 4 deaths.
The *Virginia.* — Captured iron steamer (screw) of about 500 tons. Had laid for several weeks at anchor in the stream; hauled in to the levee off Julia Street, about Sept. 10th; was undergoing repairs; had been blockading; had not been in any foreign port. She lay nearest to the point at which men were engaged in building a pier, *taking the soil from between two piers.* This digging went on through nearly all the month of September. The surgeon, paymaster, and senior engineer, died in the city, but were not patients in this hospital. Their deaths occurred about the middle of October. They contracted the fever on board.	First case, Oct. 3d. Last case, Oct. 17th. 27 cases; 5 deaths.
The *Conemaugh.* — Side-wheel, double-ender. Came from Mobile Bay, Sept. 1st, 1864, quite clean. Laid at anchor opposite the city. This vessel went up to the mouth of Red River, where one fatal case occurred about Oct. 10th.	First case, Sept. 23d. Last case, Sept. 27th. 3 cases; 2 deaths.
The *Fort Gaines.* — An iron-clad, in the Lake Police service on Pontchartrain.	First case, Sept. 23d. Last case, Oct. 18th. 7 cases; 3 deaths.
The *Hollyhock.* — Tug-boat, side-wheel, full steam power, very dirty and hot; used	First case, Sept. 26th. Last case, Oct. 26th.

for towing the government vessels; when not towing, laid alongside the levee; had free communication with infected vessels; dirt, filth, and slovenliness characterized every part of the boat.	9 cases; 4 deaths. *Was also infected in* 1863.
The *Estrella.* — Side-wheel iron steamer, captured blockade runner. Dirty; came over from Mobile Bay about the 28th Aug., 1864. Suffered from yellow fever in 1863. Was undergoing repairs, when fever appeared.	First case, Sept. 26th. Last case, Sept. 27th. 3 cases; 1 death. 2 at quarantine. Total, 5 cases.
The *Arkansas.* — A steamer captured at New Orleans; had been running between New Orleans and the Texas blockading fleet; lay at foot of Erato Street when the fever broke out; only three cases were sent to the Naval Hospital; about 40 occurred on board during a trip from New Orleans to the Gulf, off Texas and back to Quarantine Station (trip of 12 days); there were 14 fatal cases; the disease prevailed most among engineers and firemen. Had been lying in the river for about three weeks before the outbreak of fever on board.	First case, Sept. 24th. Last case at New Orleans, Sept. 26th. 3 cases; 3 deaths. Total cases, 43. Total deaths, 17.
The *Carrabasset.* — An iron-clad on Lake Pontchartrain. Like all the iron-clads, very close, the engine-rooms being wholly inclosed.	First case, Oct. 3d. 1 case.
The *Ida.* — Tug-boat (screw), small, carrying about a dozen men, often lying along the levee over night; very hot; confined space for the men; excessively filthy.	First case, Sept. 26th. Last case, Oct. 13th. 6 cases; 3 deaths.
The *Tallahatchie.* — An iron-clad, stern-wheel river-boat.	First case, Oct. 2d. 5 cases occurred.

Yellow Fever Contracted in the Naval Hospital. — Hospital Attendants.

A guard detailed from some regiment, six in number, were taken sick in hospital.	Oct. 4th. Oct. 27th.

This guard assisted at the reception of patients, lifting their bedding, etc., etc., helping to carry them into the hospital. They occupied a room wholly removed from the wards of the hospital.	Nov. 1st. Nov. 2d. Nov. 3d. 5 cases; 1 death.
Men employed in the house as nurses, peculiarly exposed to contaminated clothing that was brought with the patients. There is no doubt that these nurses were exposed to the most active causes of fever by means of the clothing and bedding conveyed with the patients from shipboard.	Oct. 4th, 1 case. Oct. 10th, " Oct. 19th, " Oct. 22d, " Oct. 22d, " Nov. 14th, " 6 cases; 1 death.
Assist.-Surgeon J. H. Bragg, M. D., attended patients at their reception to the hospital. Was exposed in same manner as the guard and attendants.	Oct. 3d. Died Oct. 21st.

[Acknowledgment of special obligations is due to Dr. Jones, Surgeon, U. S. Navy, in charge of Naval Hospital at New Orleans, and to Dr. Wm. C. Lyman, late Assistant-Surgeon, for aid in tracing the history of these cases, and to the latter officer for a complete medical record, upon which the foregoing table is partly founded.]

CONCLUSIONS.

First appeared in foul vessels, long at anchor; twenty-five become infected.

The fact appears to be indisputable that yellow fever visited twenty-five vessels in the fleet anchored in the river in front of New Orleans during the summer of 1864, and that the disease appeared first, namely, as early as September 12th, in vessels that had been for a long time at anchor there. The brief notes here appended supply the best commentary we could wish. Filthiness, crowding, excessive heat and moisture, and utter lack of ventilation and lighting, together with the stagnation of the local atmosphere of those oven-like boats, incident to anchorage in a tideless stream, constitute the leading facts relating to the infected vessels.

To test the merit of this view of the *spontaneous origin* of the fever, the writer obtained the written history of every case of which any note was made at the Naval Hospital and elsewhere; and also obtained from the quartermaster in charge of water transportation, a record of the one hundred and twenty ordinary steamers and sailing-vessels that were under his control. Of these *active* vessels, only one had yellow fever on board. That these

ordinary mercantile and transport vessels under control of the quartermaster were open, ventilated, and moving briskly about from place to place, yet infinitely more exposed to all sources of exotic infection, is the only comment this point in our records requires.

Our records show that not less than one hundred and ninety-one cases of yellow fever occurred on board the twenty-five vessels here mentioned in the fleet at New Orleans, in the year 1864, and that of these fifty-seven proved fatal. Also, that in addition to these, there were twelve cases and three deaths among employees and guard at the Naval Hospital and the boat-landing on Erato Street. Five other cases of black vomit occurred in citizens exposed to the same cause in the vicinity of the landing. The total number of cases was two hundred and eight; the total deaths sixty-five. At the Quarantine Station no other cases or vessels than those mentioned in our record were seen in 1864; and from July 4th, 1863, to September 10th, 1865, only twenty-three deaths from yellow fever occurred, and only one vessel, besides those we have here designated, brought cases of the fever to the Quarantine Station — that, the Spanish war ship *Pizarro*, in 1863.

The hygienic truths taught by the events to which this record refers, abundantly vindicate the principles and the methods of sanitary improvement which are advocated by the medical profession.[1] These truths may be entitled as follows: —

1. The insalubrious circumstances that produce a constantly high death-rate, and the localizing causes of disease generally, are the most important and the most preventable causes of the epidemics that afflict cities.

2. That the climate and the topographical disadvantages that have hitherto been popularly supposed to be the essential causes of the insalubrity of New Orleans are but unimportant factors of insalubrity which sink into insignificance when the preventable causes of disease within the city are controlled.

[1] In a letter received from Dr. E. D. Fenner, of New Orleans, September 25th, 1865, he says: "The experiences of the public health the past three years, strongly corroborate the propositions I had taught for the ten preceding years."

In an article on the health of New Orleans, published in his *Southern Journal of Medical Sciences*, in May, 1866, Dr. Fenner says: —

"The writer only remained in the city during the first year of its occupation (1862); but for that period he can testify, from personal observation, to the extraordinary efforts that were made by the military authorities to improve its sanitary condition. . . . . Such efforts were never made here before, although so often urged by the medical profession in previous years. . . . . In spite of all the sufferings and sorrows incident to the war, we may still be thankful that this great sanitary experiment was made. . . . . The exemption of New Orleans from epidemics of yellow fever during the period of military occupation cannot be attributed to the agency of quarantine. . . . . For twenty years we and some others have labored to convince the people of New Orleans that *the only way to make the city healthy is, to make and keep it clean.*"

3. That yellow fever, the most dreaded scourge of New Orleans and the American tropics, was unequivocally generated in a large number of filthy and unventilated gunboats and other naval vessels lying idly at anchor within a mile from the densest portions of the city.

4. That by fomites, or some other material agency, the infection of yellow fever was communicated to the guard and to certain other persons who were exposed in a narrow district at the Naval Hospital landing in Erato Street, and near New Levee and Tchapitoulas streets.

5. That the infected vessels were so closely sealed in by their exterior covering of iron plates, that they possessed all the local conditions that are known to be required for the spontaneous production of the yellow fever poison in its worst habitats; that they discharged no cargoes, nor any fomites or infected things except the clothing and pillows that went with the sick to the Naval Hospital by the river at the foot of Erato Street; that all the vessels which became infected in the river and on Lake Pontchartrain were constantly under armed surveillance and such internal discipline as absolutely prohibited the transmission of any infected thing to the shores except when accompanying persons to the Naval Hospital, and that when such fomites did go to the boat-landing and hospital, they seemed to communicate the fever to the persons on guard.

The "ram-boats" acquire all the qualities of the habitats of the fever.

6. That vessels and river-boats of ordinary construction and in active service, escaped yellow fever.

7. That the quarantine against the introduction of yellow fever from other places was absolutely perfect.

8. That the fever poison which was generated in the vessels of the "ram" fleet proved its power to infect the locality of the boat-landing, and to kill a number of the hospital attendants who were exposed to it there.

9. That the failure of the fever poison to propagate itself beyond the immediate vicinity of the boat-landing, that the entire absence of yellow fever in the city, and that the absence of all epidemics in its population during the three years of military rule, is justly attributed to the excellent sanitary regulations which were enforced.

10. That there can be no reasonable doubt that the restraints of quarantine prevented exotic causes of yellow fever from being disseminated, and possibly prevented epidemic outbreaks of the fever in the city, and that it is regarded as reasonably certain that

with the aid of such artificial conditions as prevailed in the "ram fleet," the infective poison of the fever may be and was generated at New Orleans in 1863 and 1864, and that by good sanitary conditions the city was saved from the pestilence that gained foothold at the hospital landing by the riverside.

The circumstances attending the prevalence of yellow fever during the war, so far as we have succeeded in obtaining full records of each outbreak, warrant the following special conclusions: — Conclusions.

1st. That the sanitary necessity for rigidly excluding the exotic infection of yellow fever, was shown at various places into which it was imported; while, as at Newbern, the fever became epidemic without being directly traceable to imported infection.

2d. Local causes, high temperature, and humidity, were in full force at Newbern and Wilmington, N. C.; and were in great excess at Galveston, Matagorda, Key West, and the Tortugas, and at the two latter places there was conclusive evidence that the epidemic was of imported origin; it is fair to conclude, therefore, that Newbern and Wilmington became infected by the constant communication they held with yellow fever ports. This conclusion is based upon the very strongest probabilities.

3d. The yellow fever in the vessels at anchor in the Mississippi River at New Orleans, and in the two iron-clad picket boats on Lake Pontchartrain, certainly originated on board of them, and could have been prevented by the same kind of sanitary care that prevented both the origin and the spread of the infection within that city during the three years of military rule there.

Pathological Inquiries. — Our inquiries concerning the special pathology of yellow fever at the various places in which it prevailed, revealed no important facts that were not previously well established. The first stage of the fever was, with great uniformity, marked by cerebral congestion and excessive *malaise;* the snuffy black vomit often occurred before the third day, and the hemorrhagic vomiting and purging was, in many cases, excessive. Wherever we have recorded the prevalence of the epidemic, it is found that essentially the same medical and pathological facts were observed: namely, suspension of the urinary secretion; the rapid subsidence of fever in cases not complicated by cerebral and spinal engorgement; prostration of the cardiac and arterial force, the pulse sinking to 40 or 50 per minute, even in the walking cases; and, especially, the occurrence of acute fatty degeneration of Pathological observations. The kidneys. The pulse.

the liver, in patients that died after the fourth or fifth day of the fever; yet in reference to this point no observer, so far as we can learn, during the war added any new facts to those which Drs. A. Clark, T. H. Bache, Leidy, and Lyons had presented. In a certain number of the cases at Hilton Head, and particularly in the patients at Beaufort, S. C., the physicians observed evidences of the intercurrence or presence of symptoms and pathological conditions that pertain to paludal intermittent and pernicious fever. Similar observations were made at two or three places in Texas, also in Wilmington, and in a class of cases at Newbern.

The liver.

Complication by paludal malaria.

Therapeutical Experience. —Wherever the yellow fever epidemics were uncomplicated by the common malaria of the locality, there appears to have been great uniformity in the medical testimony in favor of the mild and palliative method of treatment, with a prudent employment of gentle opiates. Yet there appears to have been some apparent success in the employment of sedative doses of calomel and quinine, but the weight of testimony strongly predominates against such practice, except in cases complicated by the congestive malarial fever, or in cases that chanced, fortunately, to yield to the sedative effect of the "heroic doses" at the very onset of the attack. In some of the cases which occurred later in the epidemic at Newbern, Hilton Head, and Beaufort, where there was an intercurrence of congestive pernicious fever, there was manifest benefit from the heroic treatment. But in the early period, and at the acme of each epidemic, especially in the more strongly marked hemorrhagic cases, all the resources of therapeutics oftener proved unavailing than successful; and, as Dr. Robert Lyons graphically remarked of the Lisbon epidemic, "Disease, in one of its most appalling forms, held sway, and Art stood helpless by."

The palliative treatment.

The "heroic treatment" — when useful.

Curative treatment was often unavailing.

Both in the army and the navy, throughout the regions exposed to yellow fever, where were constantly employed a thousand ships and vessels, and more than a hundred thousand northern soldiers in the national service, medical officers won greater triumphs by preventive measures than by all the resources of therapeutics and pharmacy; while by ceaseless and unflinching personal care of the sick and the well, in the presence of pestilence, the physicians achieved results and exhibited the true heroism and wisdom which have entitled them to the honors due to brave and skillful officers in war, and to the public gratitude that is awarded to savers of men.

CHAPTER FIFTH.

THE ACUTE RHEUMATISM OF THE TROOPS IN NEW MEXICO.

By ROBERTS BARTHOLOW, M. D., Etc.

NOTE RESPECTING THE PREVALENCE OF RHEUMATISM.

Strength of Garrison at Fort Union, New Mexico. — Statistics. — Number of Cases of Rheumatism. — Relation of Climate to the production of Acute Rheumatism. — Climate of Fort Union. — Humidity not a Cause of Acute Rheumatism. — Electrical Phenomena in New Mexico. — Agency of the so-called Rheumatic Diathesis, Hereditary and Acquired. — Acute Rheumatism a Substitution for Epidemic Erysipelas. — Special Characters of Rheumatic Disease of New Mexico. — The Cases characterized by Severity and the Number of Parts affected. — Bronchitis and Pneumonia occurring as Complications. — Mortality. — *Post-mortem* Examinations. — Points of Similarity between Erysipelas and Acute Rheumatism. — Conclusions. — Note respecting the Prevalence of Rheumatism.

Strength of garrison at Fort Union, New Mexico.

The cases of acute rheumatism upon which these observations are based, occurred in the military hospital of Fort Union, New Mexico, in the spring of 1861. The mean strength of the garrison was two hundred and twenty-five. The command consisted of three companies of the "Mounted Rifles," now 3d Cavalry, and two companies of the 2d Dragoons, now 2d Cavalry. These troops had been engaged, during the previous summer and winter, in the usual expeditions against the hostile Indian tribes of that region. Whilst on this duty, both officers and men enjoyed unusual exemption from disease. The effects of prolonged exposure and meagre diet, were not experienced until the return of the troops to their cantonments, when diseases of defective nutrition and of mal-assimilation began to manifest themselves.

Number of cases of rheumatism.

The number of cases of acute rheumatism — twelve — occurring in so short a period of time, is large in proportion to the strength of the command. The medical statistics of the army for 1855–59,[1] exhibit the remarkable fact, that New Mexico is preëminent in respect to the prevalence of this disease. The number of cases in this Territory, during the period embraced in these statistical returns, was 171 per 1000 of mean strength, whilst on the Gulf coast of Florida it was 140 per 1000; on the coast of New England, 85 per 1000; and in Texas, only 13 per 1000. A

[1] *Statistical Report on the Sickness and Mortality in the Army of the United States*, etc.; prepared by Richard H. Coolidge, M. D., Assistant-Surgeon U. S. Army.

careful study of all the circumstances under which this singular result is attained, may serve to elucidate some of the obscure etiological and pathological questions connected with that disease.

I. RELATION OF CLIMATE TO THE PRODUCTION OF ACUTE RHEUMATISM.

That rheumatic disease is more common amongst our troops in New Mexico than in other localities, does not prove that there are in that Territory special climatic conditions to produce it. By medical authorities in general, a variable and humid climate in the temperate zone is assumed to be causative, but the climate of New Mexico is dry and equable, rather than humid and variable. As my own observations were made at Fort Union, it is necessary to give, somewhat in detail, the climatology of that post.

Climate of Fort Union.

Fort Union is situated in Northern New Mexico, on the eastern water-shed of the Rocky Mountains, in lat. 35° 54′, and long. 104° 57′. The elevation above the Gulf is 6670 feet. The mean annual temperature for a period of five years was 47.80° F. The mean maximum temperature for the same period was 90° F., and the mean minimum temperature was —5° F. But as these extremes were exceptional, a more correct statement of the character of the climate in this regard, will consist in giving the mean temperature for the seasons : —

Mean temperature of	Spring	(5 years),	48.17°
"	"	"	Summer	"	67.76°
"	"	"	Fall	"	47.25°
"	"	"	Winter	"	29.90°

During the same period, the mean annual rain-fall was 21.41 inches, and the average number of fair days was 277. In respect to the quantity of rain, the various military posts of New Mexico, equally remarkable for the prevalence of rheumatism, differed considerably. Thus the mean annual rain-fall at Albuquerque was only 7.90 inches. That humidity, therefore, cannot be considered a cause, is evident by contrasting the statistics of the disease on the Gulf coast of Florida, and on the coast of New England. It would rather seem, indeed, that the opposite condition, or dryness, was more influential. We find this fact distinctly stated in a volume of the medical statistics of the British Army : " . . . In the mild and equable climate of the Mediterranean or the Mauritius, the proportion of rheumatic affections is even greater than in the inclement regions of Nova Scotia and Canada ; and, though some of the provinces of the Cape of

Humidity not a cause of acute rheumatism.

Good Hope have occasionally been without rain for several years, these diseases are more frequent in the dry climate of that command, than in the West Indies, where the condition of the atmosphere is as remarkably the reverse; yet have extreme cold and atmospheric vicissitudes, coupled with excess of moisture, been assigned as satisfactory causes for their prevalence." A very satisfactory table illustrating the same point, is given by Dr. Forry.[1] "It thus appears," he observes, "that these diseases (the rheumatic affections) which are generally ascribed to sudden variations of temperature conjoined with excess of moisture, are less under the influence of atmospheric agency than is commonly supposed."

Electrical phenomena in New Mexico.

There are, possibly, other climatic peculiarities, which may serve to account for the prevalence of acute rheumatism in New Mexico. The atmosphere of this region is remarkable for electrical phenomena. Land-spouts and whirlwinds are of hourly occurrence. Electrical excitation of suitable objects is constantly observed, as, for example, the production of brilliant sparks on removal of the clothing at night. Hence, we may conclude, although we have no specific observations on this point, that ozone is abundantly present. Certainly, oxidation of foul effluvia takes place rapidly. But little odor in the warmest weather was evolved from the offal of the butcher's shambles in the immediate vicinity of the post. The dependence of catarrh and erysipelas upon the action of ozone, is a probable, but as yet, not an admitted fact. These diseases are comparatively prevalent in New Mexico. Erysipelas is almost the only eruptive fever observed there, and catarrh occurs in the proportion of 217 per 1000 of mean strength. We shall offer some observations to show a singular relationship between the erysipelas and the acute rheumatism of New Mexico.

II. AGENCY OF THE SO-CALLED RHEUMATIC DIATHESIS.

Diathesis, hereditary or acquired.

An hereditary or acquired predisposition, or diathesis, is assumed by most authors to play an essential part in the causation of this disease. Fuller,[2] especially, is an advocate of this view. In seventy-one of the two hundred and eight cases analyzed by him, he was able to trace an hereditary predisposition. These numbers are not striking. In the twelve cases observed by me, there appeared to be no relation whatever to

[1] "Statistical Researches, relative to the Etiology of Pulmonary and Rheumatic Diseases, etc.:" by Samuel Forry, M. D., Medical Staff U. S. Army; *American Journal of the Medical Sciences*, January, 1841.

[2] *On Rheumatism.* Chap. ii., p. 50. Phila. edition, 1864.

hereditary predisposition — for in no case could the disease be traced to the immediate ancestors.

That an acquired predisposition, or epidemic influence, existed, is probable enough; but to define its characters is a problem, the solution of which is not yet attainable. The cases upon which these remarks are based occurred in quick succession, in enlisted men who had been exposed to great fatigue on a scant diet, but having for many weeks enjoyed the ample food and good hygiene of the post. There were no cases of scorbutus in the command, nor, indeed, any evidences of a scorbutic taint. The syphilitic cachexia, however, was common. Although none of the patients with rheumatic disease were at the time suffering from syphilitic poisoning, there were sufficient evidences of former contamination with the almost universal disease. Yet there did not appear to be any causative relations, and certainly there was no analogy between ordinary syphilitic rheumatism and the acute rheumatic disease.

Acute rheumatism a substitution for epidemic erysipelas.

The acute rheumatism of the military post seemed to be a substitution for the epidemic erysipelas of the neighborhood; for during the time cases of the former were occurring in the hospital, the latter was prevailing in the surrounding Mexican towns, and amongst the *attachés* of the post, although not amongst the men of the command proper. The peculiarities of the erysipelatous disease were these: the fauces were frequently involved, producing great difficulty of deglutition, before the eruption manifested itself on the integument of the face; there were present acute pains in the joints, with stiffness, but without inflammation or swelling; there were free perspirations, and an acid state of the urinary secretion.

This relationship will be better studied when we have passed in review the symptomatology of the acute rheumatic disease of New Mexico. We shall then, probably, have further reasons for questioning the influence, or the existence even, of a rheumatic diathesis, *per se*.

III. SPECIAL CHARACTERS OF THE RHEUMATIC DISEASE OF NEW MEXICO.

The cases characterized by severity, and the number of parts affected.

The cases which happened under my observation were remarkable chiefly for their severity and the wide extent of tissue involved in the morbid process, almost all of the movable articulations becoming affected. Two of the twelve cases commenced by pericarditis — the affection

of the joints making its appearance subsequently. The pericarditis in these two cases was very violent, the effusion being so great as to produce very obvious bulging of the cardiac region, and to interfere seriously with the movements of the heart.

Three of the cases presented the complications of bronchitis and pneumonia (fibro-bronchitis and rheumatic pneumonia). As affections of the lungs are not common in New Mexico, it is exceedingly probable that the cases of pneumonia, which do occasionally occur, are of this character. The average duration of the cases was thirty-five days. Treatment seemed to have but little influence in moderating the violence or in shortening the duration of the disease.

Bronchitis and pneumonia occurring as complications.

The mortality was very large: two of the twelve cases proved fatal. This, however, is a much larger ratio of mortality than is usual in New Mexico; for a series of years the deaths were only one to four hundred and sixty cases. The fatal cases, however, were probably reported under the lesion which was the immediate cause of death, as, for example, pneumonia, a practice not infrequent in the army. Beside the inflammatory action in the lungs and bronchi associated with the other phenomena of acute rheumatism, my observations have convinced me that the idiopathic pneumonia of New Mexico is of the rheumatic character. The difficulty of making an exact determination prevents a more substantial statement of the fact than a mere expression of opinion. The statistics of pneumonia in that territory are as follows: 12.4 cases per 1000 of mean strength; deaths 1 to 5.7 cases.

Mortality.

The two fatal cases were carefully inspected *post-mortem*. There was nothing peculiar in the condition of the joints; but the pericardium was found to be distended with fluid, and the large masses of lymph upon the surface of the heart presented in perfection that condition known as the "pine-apple heart."

Post-mortem examinations.

IV. ANALOGY OF THE ERYSIPELAS AND THE ACUTE RHEUMATIC DISEASE OF NEW MEXICO.

Between these two forms of disease there are many points of similarity, which may be briefly stated as follows: —

Epidemics of the two diseases occur simultaneously. They happen at the same seasons, under the same hygienic conditions, and appear to be governed in their propagation by the same laws.

Points of similarity between erysipelas and acute rheumatism.

One of the diseases may be substituted for, and prevail to the exclusion of, the other.

The erysipelas manifests a tendency to attack internal organs, and frequently commences in the fauces and bronchi. It is accompanied by pain and soreness in the joints, with lessened mobility, and occasionally by free perspirations and acid urine.

There would appear to be, hence, a peculiar morbific agent, which, applied to the integument, produced erysipelas, and when brought into contact, through the blood, with the fibrous structures, produced the rheumatic disease.

V. CONCLUSIONS.

The rheumatism of New Mexico does not appear to have any relation to those climatic peculiarities which are frequently assigned as causes.

The occurrence of the disease is apparently independent of hereditary tendency.

A diathesis exists, but it must be regarded as an acquired diathesis.

The atmospherical causes which have relation to it are the same as those which produce erysipelas. These causes are, *probably*, a state of high electrical tension, absence of moisture, and excess of ozone.

The strong analogies between the erysipelas and rheumatism of New Mexico suggest the possible identity of the two diseases, — the local manifestations varying with the tissue involved in the morbid process.

NOTE RESPECTING THE PREVALENCE OF RHEUMATISM.

The fact that the Medical Committee of the Sanitary Commission have received no communications relating to acute rheumatism, except the foregoing paper by Prof. Bartholow, is perhaps evidence that this disease, as occurring usually among soldiers during the war, presented no peculiar features worthy of note. It would be an interesting point of inquiry, whether the liability to endocarditis and pericarditis during the course of the disease was greater or less than in cases occurring in civil practice. Data for determining the answer to this question are not available. With respect to the prevalence of acute rheumatism, the number of cases reported during the first year of the war was 26,257, and during the second year 45,677 ; making the total for the two years 71,934.[1] The number of cases of chronic rheumatism reported during these two years was 59,974. Of the individual diseases during the year

[1] Circular No. 6, Nov., 1865.

ending June 30, 1862, for which discharges on surgeon's certificate of disability were ordered, rheumatism is highest on the list. During this year there were 3585 discharges for disability attributed to rheumatism. That the term rheumatism, however, was often used loosely in sick reports and certificates of disability, is rendered highly probable by the manner in which the term is frequently used in civil practice. Dr. Woodward states that most of the army surgeons who were called upon to treat cases in which scorbutus manifested itself in the form of rheumatic pains, having had in their previous practice little experience with scurvy, were accustomed to report these cases as rheumatism. He also states that many cases of malingering were thus reported. It is well known that in cases of lumbago and of neuralgia the disease is often called rheumatism; and the name chronic rheumatism is apt to be applied to all persistent affections of joints, muscles, and tendons.[1] Hence, the figures just quoted, representing the returns made to the Surgeon-General's Office, doubtless afford an exaggerated idea of the frequency of rheumatism during the war. — EDITOR.

[1] Circular No. 6

CHAPTER SIXTH.

SCURVY IN ITS MEDICAL ASPECT.

By SANFORD B. HUNT, M. D., Etc.

First Appearance of the Disease during the War. — Prevalence during the War. — Scurvy Incident to the present Army Ration. — Causation of Scurvy. — Scurvy in the Army attributable to Diet. — Dietetic Origin shown by History. — Discrepancies as regards Theories of Causation. — Scurvy dependent on Lack of Albuminoids and Salts. — Fresh Animal Blood in Scurvy. — Healthy Blood the Typical Food. — The Salts derived from Vegetable Food. — Causes of Prison-Scurvy. — Relative Value of Albuminoids and Salts. — Acids in Scurvy. — Symptoms and Pathology of Scurvy. — Essential Pathology. — General Debility the First Manifestation. — Symptoms in Advanced Cases. — Symptoms those of Exhaustion. — Ecchymotic Œdema. — Destructiveness of Tissue the Characteristic of Scurvy. — Morbid Characters of Scurvy in Pus. — Diarrhœa. — Characters of Inflammation. — The Pathological Conditions dependent on Depravation of the Blood. — Treatment to be based on the Pathology and Causation. — Total and Partial Starvation. — Saline Remedies. — Phosphate of Lime. — Remedies for Diarrhœa. — Object of Treatment to repair the Starvation. — A Complete Diet the most Reliable. — Reports by Drs. Charles A. Lee, Andrews, Frank H. Hamilton, Varian, Woodward, and McDonald.

Somewhat to the surprise of those who did not appreciate the value of dietetic hygiene, scurvy became one of the most common and easily recognized diseases of the army. From the prominence given to it by the histories of the voyages of Anson and Cook, and in the subsequent explorations of Kane and other Arctic voyagers, it had come to be regarded as a peculiarly naval disease, and very many intelligent observers were astonished to find that, in the heart of our rich agricultural country, it might present itself in its most obstinate and fatal forms.

First appearance of the disease during the war.

Its first manifestation, of which we have any satisfactory record, was in the Peninsular Campaign of 1862, when, after the "seven days' battles," it appeared at Harrison's Landing, and was the source of much suffering. Of this occurrence Surgeon O. M. Everts, U. S. Volunteers, says: —

"The first appearance of any thing exciting my suspicion of scurvy occurred at Harrison's Landing, July, 1862. The symptoms were extreme languor and want of elasticity in the tissue; fetor of breath and ecchymosis of the lower extremities. . . . . Purple spots, resembling purpura hæmorrhagica, were not infrequent. I did not observe many cases where the gums were much swollen or livid, and the tendency to hemorrhage was not a marked characteristic. . . . . It was at first assumed that there could not be a prevalent condition of

scurvy. The Medical Director of the army rejected the idea, and many medical officers failed to recognize its presence. Surgeon A. N. Dougherty called attention to it, asserting the presence of scurvy in his command. A committee was sent to investigate the question, and fully confirmed it."

From this time on, until the end of the war, scurvy became one of the recognized diseases of the army, and its causation was made a subject of study by medical officers. It occurred in all armies subjected to hardships, especially in the West; and it is not to the credit of officers that its worst and most fatal manifestation should have been made after the war had closed, and during the occupancy of the frontier of the Rio Grande by the Twenty-fifth Army Corps. This corps, made up entirely of colored troops, sailed from the James River in May, 1865. For a year before that, scurvy had been so prevalent as to call out from the generals commanding divisions and corps the warmest thanks to the Sanitary Commission for antiscorbutic supplies; and we regret that we cannot include in this paper the earnest letters, to the agents of the Commission, of Generals Hancock, Burnside, Ord, Ricketts, Potter, Cutter, and others, which lie before us. Yet, in spite of all these premonitions, the Twenty-fifth Corps sailed for Brazos Santiago with no preventive means. At the time of embarkation there were some cases of scurvy reported in a few of the regiments. On the 23d of June, and before the troops had all reached their destination, Dr. George A. Blake, the Inspector for the Sanitary Commission at New Orleans, wrote to Washington, earnestly urging the Government and the Commission "to provide for the want that will surely exist in our army," and quoting previous experience as to the necessity of vegetables, especially in that semi-tropical climate. Under this inspiration, and influenced by urgent appeals from the Rio Grande, the Commission shipped thirteen hundred barrels of onions and large quantities of pickles to the Thirteenth and Twenty-fifth Corps. Of these, Dr. A. McDonald, Sanitary Inspector, says: "These were the only fresh or pickled vegetables of any kind issued as a ration to the troops previous to August 21st, at which time the Commissary was in receipt of a few barrels of potatoes, but not near enough for one good ration to the troops. The consequence of this want of vegetable food is apparent in the fact that the amount of sickness from dietetic diseases increased from one fourth of one per cent. in the month of May, to more than thirteen per cent. of the several commands, as reported for the month of June; and that *early in September the num-*

Prevalence during the war.

ber reported in eighteen regiments had been, from scurvy alone, six thousand cases. Allowing an average of seven hundred men per regiment, the number of troops taken sick with scurvy previous to September 15th would reach the astounding amount of *forty-seven per cent. of the command reported.*"

Scurvy incident to the present army ration.

We have quoted these statements merely to enforce the important truth, that under our present army ration, with the vicissitudes incident to it, scurvy is one of the most frequent and embarrassing of army diseases, and one, which being very preventable, should attract the attention of Sanitarians and of the national authorities. The pecuniary loss to the nation, by a badly regulated and insufficient army ration, constitutes one of the great burdens of taxation now pressing upon the people. Good soldiers, without number, have been wasted during the war of the rebellion, and had "preventable diseases" been stricken out of the list of army diseases, a thousand million dollars might be deducted from our national debt.

CAUSATION OF SCURVY.

Definition of scurvy.

The most succinct and terse definition of the causation of scurvy that we can devise, is this: Scurvy is a disease produced by a diet deficient in albuminoids and neutral salts; or by external conditions which prevent their proper assimilation when taken into the system. The latter clause, although it is the minor proposition, is important, inasmuch as it accounts for cases of scurvy occurring on shipboard or in prisons, when the diet is sufficient, but where deprivation of light, air, and exercise impair the powers of digestion and assimilation, and favor the development of scurvy, or its congener, purpura hæmorrhagica, in the system. Such instances of scurvy, occurring under a good diet, are only apparently contradictory of the general and accepted theory of the disease, namely, that it is purely the offspring of a faulty diet.

Scurvy in the army attributable to diet.

The causation of scurvy can be best studied in its pathological conditions. The deficiencies of the system are only another name for its wants; and when, in any disease, we find a normal constituent of healthy blood or flesh absent, we may be sure that this absence is involved in the causation of the disease. Either it is absent because it was not presented in the food, — as in army scurvy, — or because it could not be properly assimilated by the digestive organs, as in prison scurvy. And, as none of these secondary causes exist in army scurvy, where confinement, darkness, and indolence do not enter in among the pre-

disposing causes, we must be right in attributing its phenomena to diet alone.

The army ration is carefully, and we believe truthfully, discussed elsewhere in this volume. The result of that discussion, if correct, is to show that the ration has an excess of fats and starches, and is deficient in albuminoids, salts, and phosphorus. And wherever that deficiency was greatest, there scurvy most prevailed. The history of scorbutic diseases confirms this statement. In the scurvy, as described by early voyagers, we find a diet confined to salted meats assigned as the only cause. A little later, and after the triumphant voyage of Cook around the world, in which a remarkably good diet was assisted by the cheerful temper that attended the whole expedition, we find melancholy and confinement assigned as causes of scurvy. Lord Anson, in his "Voyage around the World," compiled by Waller, London, 1776, says: "Whatever discouraged our people, or at any time damped their hopes, never failed to add new vigor to the distemper." Bampfield, in his "Tropical Dysentery and Scorbutic Dysentery," London, 1819, says: "A diet of salted meat is not absolutely necessary to the induction of scurvy between the tropics, and in the summer season in Europe. I have seen the scorbutic ulcer induced in the Baltic in those who never tasted salted meats, and who were allowed as many potatoes and pickles as they chose to eat, with plenty of fresh lemons and lime-juice. They were not cured until they were sent on shore, and placed on the full allowance of a naval hospital, and had the advantage of a change of air." And he sensibly adds: "Scurvy may be induced in any one at sea, whose diet *is not sufficiently nutritious*, whatever may be the articles of the materia alimentaria." Ballingall says: "I am strongly inclined to believe that all insufficient, exclusive, or artificial kinds of diet, persevered in, are apt to produce symptoms of this disease." Dr. Deas observes, with reference to the position of troops on the Black Sea: "I have my doubts if even fresh diet will be a sufficient protection. Lime-juice with salted meats is certainly not so." McLeod, in his "Notes on the Surgery of the Crimea," reiterates. He says: "Scurvy was the great destructive agent, and with which it was most difficult to cope."

Dietetic origin shown by history.

In all the uncertain utterances of the earlier writers, we discern only an imperfect comprehension of the facts, and a logical deduction from data that are incomplete. Nothing is absolutely untrue, but the truths are clouded by theories previously entertained. It was evident to these students that

Discrepancies as regards theories of causation.

the causation of scurvy was in the food provided; but against this evidence stood the apparently contradictory truth, that even under good diet men sometimes had scurvy. To reconcile this it was necessary to understand that the primary causation is in the diet; but that, secondarily, unfavorable circumstances of air, light, and exercise, may render any diet unavailable. And beyond this, it was necessary to comprehend the difference between the prison-life of the sailor and the free, out-of-door existence of the soldier. At sea, the causes may be mixed; on land, they are found only in the food. Nearly all investigators have sought the cause of scurvy in some single deprivation; some accusing salt meats, some want of fresh vegetables, and some the absence of certain saline elements of the blood. All are true — none absolutely right.

Scurvy dependent on lack of albuminoids and salts.

It is not difficult to find a theory of causation that will reconcile all these discrepancies. There are, at last, but three varieties of food, namely, — nitrogenous, or albuminoids; carbonaceous, or fats and starches; and the different salts. All of these are alike acted upon by external causes, have the same relative importance, and may therefore be considered without reference to external conditions. The carbonaceous foods are never wanting in armies, and we can thence derive the conclusion that the absence of fats and starches is not the cause of scurvy. The process of exclusion, then, confines us to albuminoids and salts. We know that both of these are frequently lacking, and that in the albuminoids preserved in brine the most valuable of the saline constituents, with the most soluble portion of the albumen, are washed out. If, then, in the treatment of the resulting disease — scurvy — we find that a restoration of these lost elements brings about a return to health, the argument is complete, and none of the facts of the past are contradicted.

Fresh animal blood in scurvy.

Dr. Kane, in his Arctic expeditions, fully demonstrates this idea when he graphically describes the life-giving effect of fresh animal blood upon the most hopeless cases of scurvy. Every fox that was caught was carefully bled to death, and every drop of its blood was husbanded as the most valuable of remedies for scurvy. This blood contained only albumen and salts, yet it was enough to give new life to dying men, and enable them to endure the unending tortures of their frozen prison. As if more broadly to illustrate this theory of causation, the history of the war has repeatedly reproduced the same conditions. The rations given to the 25th Army Corps when at sea, were bread and bacon — in other words, fat and starch. After their landing at the mouth of

the Rio Grande, the same food was supplied, and it was not until fresh vegetables and fresh meat were supplied that they recovered from the scurvy. In 1864 a negro regiment camped upon the prairies of the Cherokee Nation, and, living on bacon and hard bread, developed scurvy. A change to fresh beef, and the administration of the neutral salts of potash, at once brought about a cure. These are only isolated instances, but we venture the statement that no existing experience will contradict them.

The study of these discrepancies in the theory of causation can be simplified by a reference to the essential nature of foods. Fresh, healthy blood is the typical food. It requires no process of digestion or assimilation, and, transfused from the veins of one living person to those of another, it at once relieves the exhaustion of hemorrhage, and becomes a part of the new system in which it has found a domicile. We imperfectly imitate this condition in a fresh-meat diet, but in our methods of killing and cooking we sacrifice all the fluids that can be drained away, including all their wealth of albumen and salts. The carbonaceous elements remain unchanged and unharmed.

Healthy blood the typical food.

To supply this loss, which is much more one of salts than of albumen, our appetites teach us to resort to the vegetable foods, the original source of the salts we have lost in our killing and cooking of animals. By a kindly provision of Nature, the fruits and vegetables, scanty in their supply of nitrogenous elements, and requiring almost constant eating to furnish them in sufficient quantity, have grateful acid, sweet, or sapid flavors, that constitute a sort of bribe for us to use them. Their nutritive value as starches or albuminoids is far inferior to the cereals and the meats. They have an average of more than eighty per cent. of water, never exceed three per cent. of albumen, and the remainder is starch and the various earthy salts. Except the salts, all the nutritive elements can be much more economically provided in the cereals and the meats; and it therefore becomes evident that the salts are the valuable element in vegetables. They are generally combined with an excess of acid or of sugar that gives them flavor and induces us to crave them.

The salts derived from vegetable food.

If, then, we assume that the essential value of fresh vegetables is in the salts they contain, we have a solution that harmonizes all the various theories of the causation of scurvy. The action of phosphorus in building up the nervous system and the bones, of lime as the basis of the osseous structure, of sodium in the gastric juice, of iron in the blood globules, and of magnesia and

sulphur in other less readily comprehended processes, is pretty well understood. Healthy blood must have them, and, as they are all originally derived from the vegetable kingdom, we can see that it makes little difference where we find them — whether in the blood of a fox, like Dr. Kane, or in the juice of an onion, as in the sanitary experience of the late war. We lose these salts entirely in a diet of fat pork and hard bread; we have them imperfectly provided in a diet of fresh meats and flour with the dry, starchy vegetables, as rice and beans; and we create a perfect diet when to all of these we add the succulent fruits and tubers.

Causes of prison scurvy.

It only remains to account for the comparatively few instances like that recorded by Bampfield and mentioned by writers on prison scurvy, where a fair vegetable diet was not sufficient to prevent scurvy. Such instances are exclusively confined to prisons and ships, where the elements of dampness, darkness, confinement, and depression of spirits, must be taken into the account. These, by their depressing influence, may so impair the nervous system as to render even a good diet of no avail. But we are safe in asserting, that in armies, especially active armies, where exercise, air, and change of scene combine to invigorate the digestive organs, scurvy has never occurred except from the deprivation of albuminoids and salts.

Relative value of albuminoids and salts.

The relative value of these two, it is difficult to compute. Practical observation of the astonishing recoveries attending the free administration of potatoes, onions, and succulent fruits, would lead us to suppose that the salts are the more essential of the two. Yet we have known commands afflicted with scurvy to recover without the use of vegetables, and have ascribed the cure to a change from salt to fresh meats, and the use of the neutral salts of potash. Perhaps the truth may be in the recognized fact that the salts are essential to the prevention of the decomposition of albumen in the living blood. Where any of them, common salt for instance, is withdrawn, the blood loses its due viscidity, and the globules present ragged and irregular cell walls. It may be, therefore, that the salts are essential, not only as structural elements, but as antiseptics to prevent the decomposition of the blood. All sound albumen has a decided salty flavor. If the albumen we feed has enough of salts, as it would have in fresh blood, the vegetables may be spared; but ordinarily we must look to the latter for the needed preservative power.

The use of acids, as lime-juice and vinegar, is no longer looked upon as a sufficient prevention of scurvy. Their action is probably

far less important than had been supposed. They are grateful to the taste, they assist actively in the removal of urea from the blood, and they doubtless develop and give regenerative power to such salines as may exist in the system; aiding, for instance, in the solution of effete bone, and making it immediately available for new wants of the system. Aside from these doubtful uses, it is not rational, with our present knowledge of vital chemistry, to consider them as *per se* preventive or curative.

Acids in scurvy.

SYMPTOMS AND PATHOLOGY.

The essential fact in the pathology of scurvy, as may be argued from the preceding discussion, is a dyscrasia which includes an imperfectly organized blood globule and a marked deficiency of saline, viscid albumen in the circulating fluids. The causation and the pathology are identical. What is absent in the food is absent in the blood; and the train of phenomena that follows is the mere manifestation of a particular form of deprivation, or, in other words, starvation.

Essential pathology.

After an indefinite period of deprivation of appropriate foods, a condition is developed which figured largely in certificates of disability for discharge from the army, as "general debility." A soldier becomes worthless without any obvious evidences of disease. He complains of weakness, hebetude, loss of appetite, disinclination to exertion, is slow and torpid in intellect, has palpitation of the heart, stiffness and soreness of the muscles, and suffers from pseudo-rheumatic or neuralgic pains. Very frequently the symptoms stop here, and either some accident of diet brings about a recovery, or month after month may pass without amendment. We have seen men grow heavy, sodden, and pot-bellied in this way. Not sick enough to go to the hospital, they were kept along as "sick in quarters," still exposed to the slow fires of the original causes, until finally they wearied out the patience of the surgeon, and by sheer dint of hopelessness coerced him into some form of certificate for discharge. These cases were to the discredit of the service; for such men usually recovered rapidly as soon as they reached their homes and were classed as malingerers.

General debility the first manifestation.

In more advanced cases than these, the recognized phenomena of scurvy were presented. Simple œdema of the extremities occurred; the skin became remarkably sensitive to the bites of insects, which frequently resulted in obstinate ulcers; the ulcers assumed a gray, ashen hue, and slowly extended them-

Symptoms in advanced cases.

selves; then purpuric spots appeared, principally upon the extremities, and at first of a rather lively red color; and later in the disease a condition, which we can only describe as "ecchymotic œdema," appeared, in which the legs, especially, became swollen and of a dull, purple color; resulting from the dissolution of the blood globules and their infiltration among the tissues. In this process of infiltration not the cellular tissue alone, but the muscles themselves, became involved; so that the phrase "wooden muscles" has been applied to them, and the patient is confined to his bed by a muscular stiffness and swelling which is almost a false anchylosis. Among the local manifestations we find only occasionally swelling of the gums and loosening of the teeth; but it is much more usual to observe fetor of the breath arising from a profuse flow of saliva, which tends rapidly toward decomposition.

Symptoms those of exhaustion.

The general symptoms at this time, are those of exhaustion. The appetite is variable; the pulse full and soft, without tension or elasticity; palpitation of the heart and sudden faintings are frequent, and diarrhœa occurs, in which undigested food is conspicuous. Old cicatrices dissolve and become open ulcers, around which no reparative wall of induration is found, while the tissues around show a still further tendency to dissolution, and the most trivial wounds refuse to heal. The tendency toward death is not strong, and when it occurs, it is through the slow process of starvation and the gradual deterioration of all the powers and functions.

Ecchymotic œdema.

The "ecchymotic œdema" of which we have spoken, indicates a broken-down and dissolute condition of the blood globules by which their coloring matter becomes effused with the serum in the tissues, and gives to the skin the deep purple, almost black, color mentioned above; and, also, a lack of albumen and plastic elements in the liquor sanguinis. This aplastic condition is tersely and graphically grouped in its pathological aspects by Dr. David Prince, late surgeon U. S. Volunteers, in a comparative sketch of the phenomena of malaria and scurvy, as manifested in their surgical relations. As the malarial point of view is secondary in this connection, we omit it, and condense from Dr. Prince the external pathology of scurvy.

The bites of mosquitoes and small insects ulcerate and become of an ashy color with a tendency to bleed.

Destructiveness of tissue, the characteristic of scurvy.

When the scorbutic taint is sufficiently intense for its local manifestations to be marked, its great characteristic is destructiveness of tissue, as if the system were living upon itself, the tissues least perfectly organized and least

abundantly supplied with blood yielding first — the weaker serving as food for the former. Thus, among tissues, cicatrices give way first, and among locations, the legs and feet first dissolve in ulceration. A part of this liquefactive tendency is manifested in salivation with fetid breath.

In the mal-assimilation of scurvy, there seems to be a want of the power of cell-formation necessary to a well-developed suppuration. The abortive pus is thin and easily decomposed, and in this state is easily absorbed by the virus, which, in consequence of the aplastic state of the blood, fail to become closed on the borders of the inflammation, favoring septic infection through the tendency to liquefaction. The action is one rather of feeble than of perverted assimilation.

Morbid characters of scurvy in pus.

Among the general characteristics of scurvy, it is remarkable that the appetite generally remains good to a late period. The various glandular excretions remain free, so that there are nowhere retained secretions, whether of blood-cell productions, as in the spleen, or of alimentary excretions, like those of the liver and intestinal glands, while an active gastric juice performs its share of the digestive process.

The diarrhœa of scurvy runs off with food, showing imperfect duodenal and intestinal digestion of food which the appetite has craved, and is of a very watery character, bidding defiance to ordinary remedies, and only yielding to diet while the attendant fevers are extremely low in their grade and liable to sudden death from the liquid character of all the secretions.

Diarrhœa.

The inflammations which would line the pericardium or the synovial membrane of the knee joint with a dense gelatinous exudation in a plastic state of the blood, in scurvy produce a thin and abundant secretion, suppressing the action of the heart by pressure, and swelling the knee to its utmost. The muscular swelling is attended with hard nodes from confinement of a similar exudation within the sarcolemma.

Characters of inflammation.

A review of all these pathological conditions, with the correlate evidence of the causation and the symptoms, leaves little or no doubt that scurvy is a depravation of the blood, consisting of a deficiency of albumen and salts, occasioned by a like deficiency in the food of albumen and the various salts derived from vegetables. This depravation is the offspring of direct starvation, in the shape of absence of albumen and vegetables in the food; or of indirect starvation in external causes, as darkness, want of exercise, or depression of the mind.

The pathological conditions dependent on depravation of the blood.

TREATMENT.

Treatment to be based on pathology and causation.

It will be evident to the practical physician, that the disease we have described, to be cured, must be treated with especial reference to its causation and pathology; and these two are so identical in all their chemico-physiological relations, that they may be considered as presenting the same indications.

Total and partial starvation.

Starvations are sometimes total and sometimes partial. In a total deprivation of food, few morbid phenomena are developed. The body burns itself out in a slow fire, and finally dies from an exhaustion which does not interfere, to any great extent, with the harmony or parallelism of the functions. In partial starvation, dyscrasia is produced, owing to inequalities in the nutritive supply. Boussingault's ducks starved to death rapidly when surfeited with butter. Fed on the compounds of carbon and hydrogen alone — and this is the common cause of army scurvy — the blood loses its albumen, its saline constituents, and its phosphorus, and becomes a mere dilution of dextrine.

Saline remedies.

No drugs can remedy such a condition. In spite of the materia medica the lack of phosphorus will destroy the brain, the want of salines will promote the putrefactive tendency, and the absence of albumen will deprive the blood of its histogenetic functions. It is, therefore, only among the saline drugs that we find any thing like a remedy; and where scurvy depends simply upon an absence of fresh vegetables, while albuminoid food is still available, we may successfully resort to the salts. We have already quoted the case of a regiment, encamped upon the prairies of the Cherokee Nation, in which a well-developed scorbutic condition was rapidly cured by a change from bacon to fresh beef, with the addition of the neutral salts of potash. In this instance it was evident that the deficiency was not in sodium, and probably not in phosphorus, for good hard bread usually contains a nearly sufficient amount of that. It might be in iron, sulphur, or lime, — the latter hardly probable in a limestone country, — and so, by the process of exclusion, potash was voted to be the deficiency, and when it and albumen were supplied the diseases disappeared.

Phosphate of lime.

In other instances or localities, as in primitive rock regions, lime might be the deficient element; and, when superfine flour was used, phosphates also would be lacking. In such cases the phosphate of lime would be the remedy, and would imperfectly take the place of the natural supply from the vegetable kingdom.

In still other cases, and where the particular salt absent is still further in doubt, it would be well to combine all the elements, and thus reach the deficiency.

Beyond these compensations for the existing starvation, there is but little to be accomplished with drugs. In very few diseases are they so totally inefficient. The diarrhœa which so frequently accompanies scurvy, is notably beyond the control of the usual remedies. It is a mere straining through of serum in the mucous membranes which lack tonicity — in a word, are leaky. Tonics, especially quinine, have naturally been largely exhibited, but with little benefit. Astringents have a somewhat better record. As in the allied disease, known in civil practice as purpura hæmorrhagica, the employment of gallic acid and other vegetable astringents, with port wine and acid drinks, has a certain degree of efficacy. The mere vegetable acids alone, as lime-juice and vinegar, have lost reputation, but have some value as ready solvents of any alkalies that may be present in the food or in the system.

Remedies for diarrhœa.

In all these, however, the practitioner will find himself disappointed. It is very difficult to ascertain exactly which of them the disease calls for, and in the absence of proper foods all of them are only palliative.

The remedy for scurvy is to repair the starvation of which it is the result. Dr. Kane has conclusively shown that fresh and pure blood of animals will meet this indication, and it does so, because it meets all the possible conditions of starvation, saline or albuminoid. But it is also known that land or army scurvy may be occasioned by either of the two starvations, so that we may cure by fresh vegetables alone in those cases where fresh beef has not been wanting, or by beef alone where vegetables have been in sufficient supply. Among the vegetables the onion and potato rank highest; and the rapid cures they effect lead us to place much confidence in the theory of Surgeon-General Hammond, that potash is the essential salt in the treatment of scurvy — provided always that the scurvy be from vegetable-starvation. Our records are loaded with instances of rapid cures effected in large commands by the antiscorbutic supplies forwarded to the army by the Sanitary Commission, and it is with some regret that we omit to quote them.

Object of treatment to repair the starvation.

It is safer, however, to rely upon a diet complete in itself — the same diet required to maintain the well soldier in the "athletic constitution" — modified only by the feeble-

A complete diet the most reliable.

ness of his assimilative powers and the peculiar cravings of his appetite. As an illustrative instance, we may cite the hospital of the First Division of the 16th Corps, at Selma, Ala., in the spring and summer of 1865, under the charge of Surgeon Murta, 8th Wisconsin Volunteers. Scurvy was prevalent in the command, and was manifested in very pronounced and painful forms. The treatment, owing to favorable conditions, could be made nearly perfect. It was almost purely dietetic, and the food consisted of young onions, lettuce, sweet potatoes, berries, etc., as vegetables; with chickens, milk, eggs, custards, mutton and beef as meats; while sour wines were allowed to special cases. The result was in all respects most satisfactory, and was a subject of just pride to those in charge.

If we review this diet table, we shall see that it contains all the elements of healthy blood; that in whatever salt or organic food the previous starvation originated, the want was made good in the hospital diet, which embraced such a variety as to tempt the appetite, and had such merits in cooking as to be easily assimilable. In this process of enriching the blood was centred the whole treatment. Drugs were mere adjuvants, and were especially directed to such existing complications as were detected.

In general, we are inclined to the belief that, while the importance of fresh vegetables in the prevention and cure of scurvy has not received more than its share of attention, too little regard has been paid to albuminoid diet, and to the mental and external causes that are also active in the causation of this malady.

APPENDIX.

Reports from medical officers.

In the contributions from army surgeons and inspectors appointed by the Sanitary Commission, we have a mass of material upon the subject of scurvy, all of which has value enough to lead us to regret that we cannot give to each the prominence it well might claim. From a few of the nearly one hundred reports before us we quote remarks that serve to illustrate the general mass of the material from which we have drawn the foregoing essay.

Professor Charles A. Lee's report.

Prof. Charles A. Lee, speaking of the 18th Michigan Volunteers, says that it was favorably encamped and well policed, but confined to hard tack, salt pork, and beans.

"The first thing that attracted the attention of the surgeon was the uncontrollableness of diseases and the total inefficacy of medicines. The number of the sick constantly increased, especially cases of intermittent, in which quinia was found wholly valueless. A change of diet for soft bread, potatoes, onions, and fresh meat quickly removed the scorbutic diathesis."

Dr. George L. Andrews, Medical Inspector of the Sanitary Commission, speaking of the condition of Grant's army at Young's Point, opposite Vicksburg, in the spring of 1863, says: — Dr. Andrews' report.

"Probably many medical officers have been misled in their diagnosis by the absence of swollen and bleeding gums and patches of extravasation upon the legs. . . . Yet there was at that time a good deal of scorbutus in that army. Many had died from anæmia, many from 'anasarca,' many from chronic diarrhœa and dysentery, and many were still suffering from these and other diseases dependent upon defective nutrition. . . . I saw a cicatrix on the front of one man's leg, just below the knee, and said to be twenty years old, which had melted down under these depressing influences, and which rapidly healed again under improved external circumstances and the free use of vegetables."

In Anson's Voyages the breaking down of a cicatrix of fifty years' standing is recorded.

Frank H. Hamilton, Lieutenant-Colonel and Medical Inspector U. S. A., writing from Nashville in the spring of 1863, says: — Report of Inspector Frank H. Hamilton.

"We found in the absence of vegetable diet a cause for a great part of the mortality of our troops, both after the receipt of wounds and from other causes. Indirectly, it may account for suppurative gangrene, pyæmia, erysipelas, diarrhœa, dysentery, fever, rheumatism, etc., and we fully believe that one barrel of potatoes per annum is to the government equal to one man."

Wm. Varian, Surgeon U. S. Volunteers, writes: — Surgeon Varian's report.

"In the spring of 1863, the 'Army of Kentucky,' of which I was at that time Medical Director, while lying at Franklin, Tenn., developed many cases of scurvy, the result of long confinement to transports, severe marching, wet camps, and an insufficient supply of antiscorbutic food. At this time minor injuries, such as abrasions, contusions, etc., had an ulcerative tendency. The bites of insects, also, in many instances, assumed the character of spreading and sloughing ulcers — in one instance of a gangrenous nature. Great difficulty was experienced in arresting ulcers from this cause, and the tendency to their production was not arrested until by a proper and sufficient sup-

ply of antiscorbutic diet the general health of the troops had been improved."

Dr. Woodward's report.

Dr. Benjamin Woodward, Inspector for the Commission, writing from Duvall's Bluff, Ark., says: —

"The 47th U. S. Colored Troops are suffering greatly from scurvy. The surgeon of the regiment and other medical officers agree that colored troops, having been used to an abundance of vegetables, suffer more from scurvy than any other class. Next are the Germans. Among the negro troops scurvy takes a virulent form; the limbs become anasarcous, effusions take place into the large joints, and sores break out all over the body. General dropsy is frequently the consequence of the disease."

Dr. McDonald's report.

Dr. A. McDonald, Inspector for the Sanitary Commission, in speaking of the deplorable condition of the 25th Corps in the summer of 1865, when stationed on the Rio Grande, says: —

"Suffice it to say, that a good ration of pickles, most of which were onions, followed in a few days by full rations of fresh onions, produced a rapid change in the condition of these men. An inspection of the First Division of the Corps, made within a week after these issues, showed that the men were in better condition; those previously 'sick in quarters' were out gaining strength and cheerfulness; those sick in hospital were much improved, according to the surgeons' statements and the results of personal observation. We can only wish that means for transportation had been much more extensive, that the supply had been more liberal, and that Government had more quickly and fully followed up the benevolent action of the Commission by a regular and ample supply of fresh vegetables for these troops. The commanding general and chief quartermaster of the Corps furnished an ample transportation after the landing of these supplies, and aided by all means in their power every effort for their proper distribution, in which endeavors they were cheerfully seconded by the officers of the several divisions."

To continue these extracts would only involve repetitions that are needless. Very many of the contributions, also, relate exclusively to scurvy in its surgical aspects, and will find place in another volume.

CHAPTER SEVENTH.

CAMP DIARRHŒA AND DYSENTERY.

BY SANFORD B. HUNT, M. D., Etc.

EXTRACTS FROM COMMUNICATIONS BY MEDICAL OFFICERS, RESPECTING CAMP DIARRHŒA AND DYSENTERY.

Frequency and Importance of these Diseases. — Their Prevalence in the United States Army. — Prevalence in the Confederate Prisons. — Symptomatology. — Pathology. — Anatomical Characters, and Intercurrent Affections. — Medical Geography in Relation to their Prevalence. — Forry's Geographical Divisions and Statistics. — Woodward's Statistics. — Comparison of Latter with Forry's Statistics. — Forry's Statistics, showing Relations to Intermittent Fever. — Woodward's Ditto. — Mortality in Different Regions. — Conclusion respecting the Agency of the Causes of Intermittent Fever. — Woodward on Effect of Latitude in General Hospitals. — Causes Independent of Latitude. — Altitude. — Prevalence in Low and Humid Localities. — Experience of British Army in the Establishment of Hill Stations in India. — New England Hospitals. — Special Causes. — Dietetic Causes. — Agency of Scurvy. — The Bivouac a Special Cause. — Predisposition from Previous Attacks. — Crowd-Poison, etc. — Causes at the Andersonville Prison. — Treatment. — Use of Purgatives and Opium. — Removal to the North. — Value of Drugs. — Dietetic Management. — Experience in Selma, Alabama. — Importance of Hygienic Measures. — Extracts from Communications by Medical Officers. — Intermittent Type of Diarrhœa. — Extracts from Communications by Dr. B. Howard, Surgeon B. Woodward, Surgeon Batwell, and Surgeon Ewing. — Conclusions respecting Malarial Influences. — Report by Dr. Salisbury. — Surgeon B. Woodward's Report on Agency of Cryptogamia. — Defective Police of Camps. — Suggestions by Surgeon Gay. — Remarks by Surgeon B. Woodward. — Surgeon Benedict's Account of Diarrhœa at Fort Pickens. — Surgeon Batwell on Relations of Diarrhœa to the Nervous System. — Remarks by Surgeons Bailhache and Jewett. — Surgeon Dwyer on Agency of Hard Bread. — Diarrhœa caused by Fresh Mutton. — Report of Surgeon Stevenson. — Explanation of Apparent Discrepancies of Opinion.

Under this head we group all those fluxes from the bowels, which constitute in themselves the leading pathological feature, and are not merely accidental or intercurrent with other diseases. Thus limited, diarrhœa and dysentery, common as they are in civil life, figure as the great scourge of camps and armies. Under various names, designed to indicate some peculiar malignancy, these maladies have formed a prominent feature in the necrology of all wars. Records of the armies of antiquity abound in instances of their ravages, while the improvements of modern science, medical and military, have not sufficed to do more than to limit and, in some degree, control their destructive power.

The records of the British armies abound in facts of this nature. Colonel Sir A. M. Tulloch states, that out of an aggregate of 25,433 men of His Majesty's army, serving in Bengal Proper, from 1823 to 1836, there occurred 8499 cases of dysentery and diarrhœa. In Madras, from 1842 to 1848, 82,342 men furnished 19,720 cases of the same diseases. Martin says:[1] "The losses of the French army in Egypt were greater by dysentery than by the plague; the deaths by the latter disease being 1689, while by the former they were 2468. During two and a half years the British army on the Peninsula lost 4717 men by dysentery."

Frequency and importance of these diseases.

Assistant-Surgeon Woodward, U. S. A., in Circular No. 6, gives a much larger ratio of these diseases than any stated above. To explain this it need only be mentioned that the United States system of medical reports includes the slight cases that appear at sick-call, as well as the graver kind that find a bed in hospitals; and that the acute and chronic forms of both diarrhœa and dysentery are included in the statement, and wisely, inasmuch as the chronic diarrhœa of many of the reports was really an ulcerative disease of the mucous membranes which might, with equal propriety, be classed as dysentery. By grouping, therefore, Dr. Woodward retains a truthful and striking statement that would be lost in any over-nice attempt at classification. He says:—

Prevalence in the United States army.

"The extreme frequency of diarrhœa and dysentery makes it most important to understand these disorders. They constitute more than one fourth of all the cases of disease reported during the period under consideration. The annual number of cases for the whole army was greater than three fourths of the mean strength, and, next after camp fever, they were the chief cause of mortality from disease. The total number of cases reported during the first year was 215,214, with 1194 deaths; during the second year, 510,461 cases and 10,366 deaths; the total 725,675 cases and 11,560 deaths. It will be seen that the proportionate mortality of the second year is by far the greatest, showing the prevalence of cases of a more formidable type."

The annual ratio of deaths per 1000 of mean strength for the first year of the war was 4.10; for the second year, 16.08; for the two years, 12.36. The statistics of the last two years of the war are not available. It is believed, however, that they would exhibit no diminution in the frequency or mortality of these diseases. Dr. Woodward remarks, that "a certain length of time is required before the influences to which a soldier is exposed culminate in

[1] *On Tropical Diseases*, London, 1856.

chronic diarrhœa." And it may be further remarked that these influences are constant; that the soldier does not generally, or often, become acclimated or accustomed to them; and that second attacks are extremely common.

In the military prisons of the Southern Confederacy these diseases assumed a horrible frequency and mortality. From a report made by Dr. Joseph Jones, C. S. A., to the Confederate Surgeon-General, we group the following frightful statistics from the Confederate States army-prison at Andersonville, Georgia. During the six months from March to August, inclusive, in 1864, there occurred 4529 deaths from diarrhœa and dysentery among less than 40,000 Federal prisoners confined there during that time. Later than that, we are given to understand, the mortality was largely increased; as, on the 21st of September, the deaths up to that time, from all causes, were stated at 9479, from a total population of 40,611; that is, one in 4.2 or 23.3 per cent. of the prisoners died.[1] None of these deaths are included in Dr. Woodward's tables; and in view of the fact that his statistics, gigantic as they are, include only the first two years of the war, with much smaller armies than those of the two following years; and, in the case of the Andersonville prison, fail to include the far more melancholy autumnal period that succeeded, we need say nothing more as to the importance and frequency of these diseases in our army, or of the imperative duty of carefully searching out their laws of causation.

Prevalence in the Confederate prisons.

Symptomatology. — The diseases under mention are usually preceded by constipation, and are ushered in by frequent, usually painless movements, attended by some anorexia and general malaise. As the disease progresses, it exhibits more pain, uneasiness, flatulence, and abdominal gripings, often preceding the stool, which being over, the painful sensations cease only to return again at gradually decreasing intervals. It often happens that a certain periodicity manifests itself, the night being passed in quiet and comfort until nearly daylight, when griping stools occur with great frequency until toward noon, after which they decrease in number. This periodicity does not, however, present the usual phenomena of intermittents, and is not amenable to quinine. The stools present no uniform characters. Even in the same patient they vary remarkably from hour to hour: now like pea-soup; again frothy like soap-suds, and accompanied with much gas; and at other times containing undigested food, or exhibiting all shades

Abdominal symptoms.

[1] Vide Third Section of this volume.—Editor.

of color, as of black, of a tar-like melanoid consistence, green and gelatinous, brown and fecal, and at last muco-purulent, extremely offensive, sometimes containing shreds, and mixed with blood and thin watery fæces.

Constitutional symptoms.

In the mean time the constitutional symptoms become of the gravest character. The mind is irritable, the countenance anxious, food fails to convey nutriment, the tongue is red and dry, the eye prominent. As emaciation proceeds, the skin is tightly retracted across the cheek-bones, dirty, brown discolorations make their appearance, the surface is rough and dry, and emits an offensive odor. Sometimes in greatly prolonged cases there is œdema and general paleness. In the fatal cases the patient perishes from mere exhaustion, or passes off in a feverish, muttering delirium.

Pathology. — The essential fact in the pathology of all these various forms of flux is the same, and autopsies reveal no distinction between cases of diarrhœa and dysentery. They are alike an inflammation of the colon or of the small intestine, or of both, attended by ulceration of the mucous membrane. The solitary follicles of the colon are seen to be enlarged simply, or ruptured, with punched-out ulcerations following. The intestinal wall is thickened and changed in color to a red, brown, black, or greenish hue. As ulceration extends, it burrows in the sub-mucous connective tissue, ulcers thus communicating with each other by sub-mucous canals. The edges of the ulcers become undermined, overhanging, and ragged, with sloughs. In other cases a caco-plastic lymph, greenish or black in color, and very nearly identical with the false membrane of diphtheria, is deposited. Sometimes these deposits are detached and found in the stool as a tubular cast of the intestine.

Anatomical characters.

The seat of these ulcerations is usually in the large intestine and the ileum and the point of the origin of ulceration is in the solitary follicles, and not in the agminated glands. They are sometimes attended by metastatic abscesses in the liver, and often by apthous or diphtheritic exudation in the mouth and air passages.

Intercurrent affections.

In cases of recovery the process is slow, and liable to interruption from many causes. Often true typhoid fever supervenes, suddenly destroying the life. In other cases the process of waste has gone so far, that it is very difficult to set up a new nutrition. The various phenomena of starvation are present. In the muscular system it is often found to have produced atrophy

of that most important muscle — the heart. The pulse becomes very rapid, and what is called "functional disease of the heart" is recognized, or there may be developed actual and permanently disabling organic disease. So, too, the brain suffers its form of starvation. A dull apathy settles upon the patient, and sometimes actual insanity follows. This was frequent at Andersonville.

No mere record of deaths, like that we have given in preceding pages, can express the grand total of the loss by these diseases. They live in their sequelæ, in the cachexiæ which attend prolonged starvation, and their necrology can only be complete when we have counted the unnumbered deaths which have occurred after the return of the soldier to his home.

Medical Geography. — There is no part of the United States where diarrhœa and dysentery are not endemic. Their causation exists in a greater or less degree at all places; and the history of the late war seems to indicate that even in periods of their greatest frequency they were not truly epidemic, but owed their increased vigor to the presence of a greater number of the usual causes in a more active condition. Geographically, however, lines of demarcation can be drawn between districts only slightly subject to their attacks, and others which develop them in great number and fatality. And by a comparison of these we shall be able to segregate the climatological from the special causations.

Forry's geographical divisions and statistics.

Forry,[1] in discussing the mortality of the U. S. army, as it existed twenty-five years ago, shows that at the various posts in the Northern Division the proportion of deaths to cases, from fluxes, was 1 in 665; while in the Southern Division the proportion of deaths to cases was 1 in 141. He gives also the following statement: —

		No. of Cases per 1000 men per annum.
Northern Division.	Posts on the New England Coasts	170
	Posts remote from the Ocean and the Inland Seas	305
	Posts on the Great Lakes	253
Southern Division.	Coast from Delaware Bay to Savannah	455
	Southwestern Stations	597
	Lower Mississippi	456
	Eastern Florida	495

These facts repeat themselves in the statistics of the late war. We copy the following table from Dr. Woodward's report in Circular No. 6, including only the first two years of the war: —

[1] *Climate of the United States.*

WOODWARD'S STATISTICS OF NUMBER OF CASES AND DEATHS FROM DIARRHŒA AND DYSENTERY IN EACH OF THE THREE REGIONS.

	Year ending June 30, 1862.				Year ending June 30, 1863.			
	Taken Sick.	Died.	Ratio per 1000 of Mean Strength taken Sick.	Ratio per 1000 of Mean Strength Died.	Taken Sick.	Died.	Ratio per 1000 of Mean Strength taken Sick.	Ratio per 1000 of Mean Strength Died.
Atlantic .	114,925	238	646.01	1.30	231,564	2,742	816.22	8.80
Central .	98,470	951	1019.54	9.36	276,567	7,617	902.62	23.49
Pacific .	1,819	5	271.10	0.75	2,330	7	267.42	0.80
Total,	215,214	1,194	765.40	4.10	510,461	10,366	852.14	16.08

Comparison with Forry's statistics.

The regional contrast here is quite as strong as in Dr. Forry's analysis, and the two together prove that, independently of causes incident to the camp — as diet, exposure, etc. — there are certain climatic or geographical conditions which have a most important control, to some extent, over the frequency, and to a much larger degree over the fatality of the fluxes. These *general* causes seem to be allied with marsh miasm and the causation of intermittents. That alliance is shown in the following table from Forry: —

FORRY'S STATISTICS SHOWING RELATIONS WITH INTERMITTENT FEVER.

RATIO PER ONE THOUSAND MEN OF CASES OF INTERMITTENT FEVER, COMPARED WITH CASES OF DIARRHŒA AND DYSENTERY.

	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Year.
Intermittent Fevers . .	45	75	156	93	368
Diarrhœa and Dysentery .	54	107	166	75	405

This relationship is further exhibited by a comparison of the statistics of the first two years of the war: —

WOODWARD'S STATISTICS SHOWING RELATIONS WITH INTERMITTENT FEVER.

RATIO PER ONE THOUSAND OF MEAN STRENGTH TAKEN SICK FROM INTERMITTENT FEVERS AND FROM DIARRHŒA AND DYSENTERY.

For Year Ending June 30, 1862.

	Atlantic Region.	Central Region.
Intermittent Fevers	195.94	382.88
Diarrhœa and Dysentery . . .	646.01	1019.54

For Year Ending June 30, 1863.

Intermittent Fevers	194.03	436.96
Diarrhœa and Dysentery . . .	816.22	902.62

If we take the mortality as the standard of comparison, we find the contrast even more striking. For the two years the entire mortality was, — Mortality in different regions.

	Atlantic Region.	Central Region.
Deaths from Intermittents . .	2.10 per 1000	5.43 per 1000
" " Diarrhœa and Dysentery	9.10 "	32.85 "

We are thus authorized to conclude that the climatological causes producing intermittents have also a large influence in the causation of fluxes and in determining upon them a fatal tendency. In the paludal districts of the Central Region the cases are both more frequent and more fatal than in the less miasmatic regions occupied by the greater portion of the armies east of the Alleghanies. In the general hospitals the effect of latitude (through climatological conditions) is thus mentioned by Dr. Woodward: — Conclusion respecting agency of the causes of intermittent fever.

"During the second year of the war, the proportion of deaths from chronic diarrhœa and chronic dysentery in the general hospitals of New England was one in every forty-nine (48.8) patients admitted for these disorders; in the general hospitals of New York City and State, including the hospital at Newark, New Jersey, one to every nineteen (18.7) cases; in the general hospitals of Pennsylvania and Delaware, one to every fifteen cases; in the general hospitals of Maryland and the District of Columbia, including those of Washington, Georgetown, Alexandria, Frederick, Baltimore, Annapolis, etc., one to every eleven cases (11.4); in the general hospitals at Fortress Monroe and on the coasts of North and South Carolina, one to every seven cases (7.1). Woodward on effect of latitude in general hospitals.

"The mortality was greater in the central region of the Continent, but the relative influence of latitude was still observed. In the general hospitals of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Kentucky, including those at Cincinnati, Louisville, and St. Louis, the mortality was one death to every nine (8.53) cases; in those of Tennessee, Northern Mississippi, and Arkansas, including among others the hospitals at Nashville, Memphis, and Helena, one in five (5.4); in the hospitals of Louisiana, including New Orleans and Baton Rouge, one in four.

"Nor will a separate consideration of the mortality from these affections in the hospitals of the great cities on the Mississippi River be less instructive. In the hospitals of Keokuk, Iowa, the mortality was one in nine cases (9.1); in St. Louis, one in five (5.2); in Cairo, one in four (3.98); in Memphis, one in five (5.4); and at New Orleans, somewhat less than one in five (4.7). The extreme mortality, it may be noted, is not at the point furthest south, but at Cairo, situated on the alluvial peninsula formed by the junction of the Mississippi and Ohio

rivers, where, as is well known, most intense malarial influences prevail."

Causes independent of latitude.

But a further investigation will show that latitude is not the only causative element among the geographical or climatological conditions. Thus we find, that on the annual isotherm of 48°, including the New England States on the east, and the hospitals of Wisconsin and Iowa on the west, the eastern mortality was one in every forty-nine patients; the western mortality was one in every nine cases. The isotherm of Washington (55°) is also the isotherm of Cincinnati and Louisville; yet the former has a mortality of only one in every eleven cases, while the latter have a mortality of one to every nine. Fort Monroe loses one in seven. Memphis, on the same isotherm, loses one in five. And from Cairo south the mortality decreases.

Latitude, then, if we accept it as a mere expression or synonym of heat, is not the only climatological element of causation. Marsh miasm must be included as a combined element, and its due importance should be recognized.

Altitude. — Elevation constitutes an important element in causation. Universal experience has proven that these fluxes, like their congener cholera, seek low and humid localities, such as were occupied by vast numbers of our troops in the Mississippi Valley. The great camp held by Grant and Sherman, in the bend opposite Vicksburg, in the early period of the siege of that city, combined the causative elements of heat, humidity, and low grounds. Most of the camps immediately on the shores of the western rivers, were so low as to be subject to inundation, or were only protected by levees.

Prevalence in low and humid localities.

The British army in India has had a not very successful experience in the establishment of hill-stations for the prevention or cure of these diseases and paludal fevers. The lack of success seems to be due to bad selection of sites and defective sanitary police. The report of the "Commission to Inquire into the Sanitary State of the Army in India" (London, 1861), thus accounts for their failure: —

Experience of British army in establishment of hill-stations in India.

"The majority of the stations being on the outer face of the mountain ranges, and at an elevation where the heaviest rains occur, receive the first impact of the monsoon, and the consequence is that they are all wet and subject to cold fogs. The annual rain-fall in the Himalayan stations varies from seventy inches to one hundred and thirty inches, as at Darjeeling. The rain-fall at Mahableshwur, in Bombay, is actually two hundred and forty inches *per annum*. . . . . One

thing is quite clear, that it will never do to trust simply to elevation above the plains to keep the army in health. Malaria has been blown up the ravines in India far above the fever range, over sites otherwise perfectly healthy; and those who slept within its influence have been attacked with fever and died."

In the far less humid climate of the United States, it has usually been possible to attain either altitude or those atmospheric qualities that we seek in altitude, namely, a cool, dry, rare, and non-malarial atmosphere. Such were the conditions that obtained in the New England hospitals, and rendered them so successful in the cure of fluxes. Only two hospitals were constructed with special reference to securing a considerable altitude. One of these was at Claysville, on the mountains near Cumberland, Maryland; the other on Lookout Mountain, near Chattanooga. New England hospitals.

We have thus endeavored to estimate the causative importance of general geographical or climatic conditions in the production of fluxes. In the main, the troops of the West had the same food, shelter, and clothing as the troops in the East; and their vastly greater mortality must be, therefore, ascribed to climatic and geographical causes. Yet there were not wanting many instances in the West to show that it rests within the power of a wise hygienic administration to control, in a great measure, these general causes, and, so to speak, to lock the doors of the system against their ingress.

Special Causes. — Among the special causes which promoted and assisted the climatic conditions may be enumerated defective diet, exposure to rapid radiation of animal heat, crowd-poison, and depressing mental agencies. These causations, powerful enough in themselves to create fluxes on northern hill-sides, were terribly reënforced in the hot, malarial valleys of the South; yet it was found that the climatic causes could be successfully resisted, provided the special causes could be controlled and avoided. Enumeration of special causes.

Opinions among army surgeons differed largely as to the causative value of foods. With some the army ration was looked upon as the active generator of these diseases, while others laid more stress upon those conditions of exposure, such as sleeping on the damp ground, etc., all of which resolve themselves into a too rapid radiation of animal heat, a chilling of the surface, and a consequent tendency to internal congestions. Probably the truth lies between the two, and partakes of both. It was usually after difficult marches, or the exposure of siege opera- Dietetic causes.

tions, that diarrhœa became prominent. Such labors usually involved *all* the special causes under consideration, and it is not easy to ascribe to any one its relative importance.

Great stress was laid by Dr. Salisbury (*vide* "Appendix to Report of Surgeon-General of Ohio" for 1863) on the excess of starches in the ration, and the hard army biscuit was accredited as the great cause of chronic diarrhœa. Torula were certainly found in the dejections, and perhaps other algoid forms. It is also true that in chronic diarrhœa starches are very imperfectly digested, often undergoing fermentation and decomposition into carbonic acid gas, and doing much to perpetuate the disease. But it is not yet proven that starches create the fluxes in systems subjected to no other elements of causation. The proof, as it now exists, goes no further than to show that an excess of starches is a very unfit diet for men exhausted by fatigue and exposure, and under those circumstances becomes provocative of disease. The physiological facts indorse this theory. In a diet too exclusively of starch, or of fats and starches combined, the whole digestive labor is thrown upon the small intestines. The stomach renders little assistance, and the system is mainly deprived of albuminoids. And the history of the disease shows that as diarrhœa progresses the intolerance of starch increases — a phenomenon that cannot be due to its carbonaceous character merely, because fats are at the same time often well digested, and prove very beneficial in supporting the system.[1]

Agency of scurvy.

Scurvy occupies a prominent position among the causes of diarrhœa and dysentery. That degeneration of the blood is almost always due to some form of starvation, usually of fresh vegetables and albuminoid foods. It uniformly presents itself among troops who have been fed too exclusively on hard bread and bacon, and is as uniformly absent where free foraging is allowed. In the same ratio we find the fluxes and the scorbutic taint usually complicates them. Its most pronounced form, in which it becomes almost or quite a purpura hæmorrhagica, may be absent, or none of the physical signs be present. Yet its more secret manifestations in lumbago, rheumatic pains, and general malaise are nevertheless present to mark its influence in the causation and perpetuation of the diarrhœa or dysentery.

The bivouac is another active, special cause. Wherever we

[1] An amusing instance of dietetic causation of diarrhœa occurred in the observation of the writer, when an entire army corps for several days received no rations except fresh beef, and either corn in the ear, or later, corn-meal. No salt could be procured, and as a consequence there was a lack of gastric juice to digest the beef. The result may be imagined. It was a universal diarrhœa which, however, left no permanent injury behind it.

travel in southern latitudes, and especially in paludal regions, we find that instinct and tradition have taught the people to raise their houses from the ground. They rarely dig cellars, but they set the frame of their dwellings on posts, allowing the air to circulate freely beneath the floor. This essential hygienic precaution is necessarily neglected in the bivouac, and too often in camps of a more permanent nature. The result is, that the soldier, after the fatigues of the day, rolls himself in his blanket on the humid ground, rapidly parts with his animal heat, and often wakes during the night — even in tropical regions — to find himself chilled, and to feel the poison of terrene miasms creeping through his system. Internal congestions result, and manifest themselves more frequently in diarrhœa and dysentery than in any other method. And by way of contrast, it may be mentioned that, in winter, when great camp-fires are maintained, or in the hot seasons, in the arid and invigorating breezes of the great plains of the West, the bivouac rarely affects the health of troops.

The bivouac a special cause.

Previous attacks of diarrhœa or dysentery often assume a place among the special causations. Unlike camp fevers, the fluxes have a tendency to repeat themselves. For a long time after an apparent cure of chronic flux, it is easily renewed by a careless diet or by undue exposure. Thus, this disease manifests a constantly increasing tendency. Veteranship is no protection against it, and so far as statistics prove anything on this point, they show that the longer a soldier has been subjected to the vicissitudes of a campaign, the more likely is he to have diarrhœa or dysentery. In the first year of the war, the ratio of death, per thousand men, from these diseases, was 4.10; in the second year it was 16.08. It is believed that, like scurvy, gangrene, and secondary hemorrhage, the fluxes will be found to have similarly increased in fatality during the third and fourth years of the war; while camp fevers, on the other hand, will exhibit a decreasing ratio.

Predisposition from previous attacks.

Crowd-poison, Filth, and Starvation are causative elements that usually coexist. To some extent, they doubtless existed in the Union armies, but were always evils of short continuance; nor do our records exhibit any facts which would authorize scientific deductions. Unfortunately, however, a study of these causes is presented to us in the terrible statistics of the Confederate prison at Andersonville, Georgia. And, lest we should be accused of exaggeration, we shall confine ourselves entirely to the facts as reported by Surgeon Joseph Jones, C. S. A., in his official communications to the Confederate Surgeon-General at Richmond.

Crowd-poison, etc.

Dr. Jones was ordered to Andersonville (Camp Sumpter) to undertake pathological investigations there — a duty which he performed with marked humanity and zeal, though without succeeding in procuring the necessary ameliorations.

Causes at the Andersonville Prison.

The causes of disease, however, were carefully studied, and seem to exclude all except controllable dietetic and sanitary conditions. Thus, the elevation is stated to be four hundred and thirty-five feet above the level of the sea. Of the soil Dr. Jones speaks as "sandy, with but little vegetable mould," and in the sand the microscope detected no organic remains. Geographically, Camp Sumpter is upon the upper margin of the tertiary, "or more properly, the upper or burr-stone strata of the eocene formation." Of the water, he says: "I carefully analyzed the waters from various localities, and found them remarkably pure; the water of the wells and small streams did not differ to any extent in specific gravity from that of distilled water, and contained only traces of the chlorides and sulphates and of the salts of lime, magnesia, and iron. The well of water upon the summit of the hill on which the Confederate General Hospital is situated, is of remarkable purity, and, in fact, it may be considered as equal to the purest well-water in the world." Of the waters of the stream passing through the stockade, he says they "are of great purity, containing only traces of the sulphates and chlorides of lime, magnesia, and iron." As to climate, it is in latitude 32°, at an elevation not sufficient to affect the temperature, of which he says: "The mean temperature of Andersonville, Georgia, may be assumed, without any great deviation from the truth, at about 65° for the spring, 82° for the summer, 65° for the autumn, and 55° for the winter; or 65° for the year." The precipitation of rain at Perry, thirty miles from Andersonville, is 46.7 inches per annum. He speaks of the climate as generally "more salubrious than one half the territory of South Carolina, Georgia, Alabama, Mississippi, and Louisiana"; and, in summing up, says, with painful emphasis: "In conclusion, as far as my physical and pathological investigations extended, I was compelled to believe that the diseases that proved so fatal to the Federal prisoners confined at Andersonville, Georgia, were due to causes other than those connected with the soil, water, and climate. . . . . The heat may have proved a cause of debility, but still the fearful mortality could not properly be referred to this condition of climate, or to all the other elements of climate combined."

Yet, in a locality thus chosen, and which excludes all the climatological causations of the diseases under question, a period of only

six months with a population varying from 7500 to 32,000, and aggregating less than 40,000 admitted to prison, the number of deaths from diarrhœa and dysentery was 4529, and if we add to that the deaths from scurvy, 5528. The total mortality from all causes was, in the six months of March to August, 1864, inclusive, 7712. In the period from February 24th, 1864, to September 21st, 1864, the mortality from all causes was 9479. Dr. Jones says in his report: "The entire number of Federal prisoners confined at Andersonville was about 40,611; and during the period of near seven months from February 24th to September 21st, 9479 deaths were recorded. That is, during this period, near one fourth, or more exactly one in 4.2, or 23.3 per cent. terminated fatally."

By the process of exclusion we are compelled to believe that, in the absence of climatic causes, this "fearful mortality" was due exclusively to the very controllable causes of crowd-poison and starvation. In reference to the first of these, Dr. Jones gives the following statement, which we copy, premising that, during the month of June, the area of the prison was enlarged from seventeen to twenty-seven acres: —

1864. Month.	Mean Strength.	Total Area.	Square feet to each man.
March	7,500	ft. 740,520	98.7
April	10,000	"	74.
May	15,000	"	49.3
June	22,291	"	33.2
July	29,030	1,176,120	40.5
August	32,899	"	35.7

This area consisted of two opposing hill-sides, divided by a stream, with swampy margins not inhabitable. How much this stream and swamp decreased the general area is not stated. "It was," says Dr. Jones, "covered with the excrements of the men, and thus rendered wholly uninhabitable, or, in fact, useless for every purpose except that of defecation." This area was further decreased by the internal arrangement of the camp. We continue to quote from Dr. Jones: —

"But few tents were issued to the prisoners, and these were, in most cases, old, torn, and rotten. . . . . No shade tree was left in the entire inclosure of the stockade. With their characteristic ingenuity and industry, the Federals constructed for themselves small huts and caves, and attempted to shield themselves from the rain, and night-damps, and dew. . . . . In the location and arrangement of the tents and huts within the stockade, no order appears to have been followed; in fact,

regular streets appeared to be out of the question in so crowded an area."

Thus we find that in this abyss of horror an average of about one rod square of area was considered enough for six men to perform all the offices of life, of sleeping, exercise, cooking, and the offices of nature. In such a crowd, *filth* was inevitable. Let Dr. Jones describe it: —

"More than thirty thousand men crowded upon twenty-seven acres of land, with little or no shelter from the intense heat of a southern summer, or from the rain and dew, with coarse corn-bread from which the husk had not been removed, with scant supplies of fresh meat and vegetables, with little or no attention to hygiene, with festering masses of filth at the very doors of their rude dens and huts, with the greater portion of the banks of the stream flowing through the stockade a filthy quagmire of human excrements alive with working maggots. . . . . The slightest scratch of the surface, even to the bite of small insects, was frequently followed by such rapid and extensive gangrene as to destroy extremities, and even life itself."

The picture needs no further touches. In this filth and starvation of a crowded mass of helpless humanity, all the purer and nobler instincts perished by atrophy; mind and body starved together, and the sad fatuity and apathy of the one was no less painful than the emaciation of the other. Here is exhibited the vast power of causes of diarrhœa and dysentery, which are known to be controllable; and the still more repulsive feature of the power of man to create, organize, and systematize morbific elements, until they become an engine of death more fatal than the battle-field.

TREATMENT.

Use of purgatives and opiates.

The treatment of the acute forms of diarrhœa and dysentery in the army, presented no peculiarities to distinguish it from civil practice; unless we mention the very liberal use of cathartics at the outset, Epsom salts being the favorite prescription, though castor-oil was also largely used. Constipation preceded most of the cases, but, whether it had or not, it was found that a thorough purgation of the bowels from all irritants was the best and most speedy method of securing rest and opening the way for the successful administration of opiates. Vast numbers of cases were thus successfully terminated.

Removal to the North.

But in others the disease progressed, became follicular, and finally ulcerative. In the treatment of these great difficulty was experienced, from the fact that the patient was still

exposed to the causes of his malady; and it came to be a fixed doctrine at southern and southwestern stations, that confirmed cases had no security for cure except by removal to the North. This soon became a governmental policy, and hospitals were established in New England, along the lakes, and in the Northwest, to which chronic cases were sent in great numbers. Among patients not thus removed, but treated in southern hospitals, much vacillation and irresolution were exhibited in the prescriptions of surgeons; as happens in all diseases the treatment of which by drugs is usually unsuccessful. To trace the history of an individual case, was to find that the prescriber had run the rounds of all remedies, from opium to astringents, from astringents to quinine, from quinine to bismuth, and from bismuth to nux-vomica, from nux-vomica to mercurials; returning almost always to opium as the drug which at least alleviated, if it did not cure.

Value of drugs. Dietetic management.

The value of drugs was, perhaps, over-estimated, in this as in all other diseases of assimilation, and only a careful avoidance of the original causes of the malady, and an equally careful recognition of their continued existence in the system, could secure any degree of success. The scorbutic and the malarial taints were almost uniformly present, the former very frequently in as pronounced a form as the latter. The bowels, enfeebled by the inflammatory process, were unable to perform their normal function of the digestion of starches, and the diet, therefore, became necessarily albuminoid. A full nutritious diet of albuminoid and antiscorbutic food assumed the first importance in the treatment. Coupled with this came pure air and absolute cleanliness. And with these hygienic measures alone, when they could be properly enforced, it was possible to treat chronic diarrhœa and dysentery with a fair degree of success, even in the great heats of a southern summer.

Experience in Selma, Alabama.

In the month of May, 1865, the First Division of the 16th Army Corps reached Selma, Ala. Its service had been peculiarly severe and irregular, and its commissariat had unavoidably been deficient. Scurvy, in its most pronounced and obvious forms, was prevalent, and with it many cases of chronic diarrhœa. It was determined to fully test the dietetic and hygienic treatment. A large, cheerful, and airy ward was assigned to "diseases of starvation and assimilation," under charge of Surgeon Murta, hospital surgeon of the division. The patients were frequently bathed or sponged. Their shirts and bedding were often changed, and a warm covering at night was insisted upon. The

police of the ward was extremely stringent. The diet consisted of eggs, custards, milk, chickens, beef and beef soup, and fresh vegetables, as tomatoes, onions, lettuce and greens, with a very slender allowance of bread. No corn-starch, arrowroot, or gruels were allowed. As a stimulant, claret wine was employed for those not requiring so active a stimulant as brandy or whisky. Drugs of all sorts were, as far as possible, excluded, being employed only *pro re natâ*, for temporary emergencies. Under this regimen a most gratifying measure of success was obtained, and the records of that hospital would compare favorably with many of the more fortunately situated northern sanitaria.

Importance of hygienic measures.

It has become a confirmed belief with the writer, that the diseases under question are not, in our present state of knowledge, to be cured by the apothecary; and that no treatment will be successful that does not reverse the causative conditions. As the patient has been exposed to cold, fatigue, malaria, filth, and starvation, he must now be subjected to warmth, rest, pure air, cleanliness, and nutritious diet. As under these natural remedies, his mind becomes cheerful, his nervous system acquires tone, his starved and attenuated muscles are reconstructed, it will be found that the local follicular or ulcerative disease slowly disappears, and the function of intestinal digestion is at last restored. But in all cases the process is likely to be tedious, and often years may elapse before health becomes so firm as to resist ordinary imprudences of diet. The tendency of these diseases to return is constant, and no soldier, however well-recovered he may seem, is as strong a man in the future.

EXTRACTS FROM COMMUNICATIONS BY MEDICAL OFFICERS RESPECTING DIARRHŒA AND DYSENTERY.

Intermittent type of diarrhœa.

There is a good deal of evidence to show that chronic diarrhœa often assumes a truly intermittent type, and becomes then amenable to the influence of quinine. This periodicity should be carefully distinguished from that diurnal exacerbation already mentioned, in which the tormina and discharges come on with violence at an early hour in the day, subsiding after noon, and ceasing almost altogether during the evening and most of the night. This daily intermission seems to have its origin only in the hours of food and sleep, and was never relieved by quinine. The intermittent diarrhœa of which a number of our contributors speak, has evidently another causation, and is rapidly benefited by the exhibition of quinine.

Of this class of cases Surgeon B. Howard says, in speaking of the sanitary condition of the army after the battle of Antietam, September, 1862: —

Extract from communication by Surgeon B. Howard.

"About the 24th, amongst our own men, diarrhœa became very prevalent. As I was at that time acting Medical Purveyor of the army, I was being applied to every hour for opiates and astringents, which it had been impossible for me to obtain. From careful inquiry of the various surgeons who visited me, I found that the diarrhœa was, in most cases, better one day, and worse the next, the alternations occurring in much the same order as the paroxysm and intermission of intermittent fever.

"At my suggestion, several surgeons, in lieu of the astringents which I was unable to furnish, administered sulphate of quinine, and proceeded to treat their patients as for intermittent fever.

"In a few days I was greatly pleased to find some of them returning to report that its effect had been as prompt and decided as in intermittent fever. I then took occasion to inquire of the people in that region, and found that this form of diarrhœa was by no means uncommon there.

"An old physician, who had practiced for twenty years in the village of Sharpsburgh, told me he had found it most common on the lower grounds, and in parts where malaria most prevailed; that he had treated some cases of diarrhœa in those parts of the country which would yield to none of the usual remedies, and could be controlled only by quinine.

"The *occurrence* of this diarrhœa I attributed to the sudden change of temperature to which the surface of the body, in these men, was so suddenly subjected, — the direct rays of a very hot sun, and the cold night dews succeeding each other rapidly, — while, in many cases, the protection which even a blanket could furnish, was not available to modify the effect of this sudden transition.

"The apparently *specific* character of the diarrhœa I attributed to the present and previous exposure to malarial influences; the diarrhœa, occurring in a system surcharged with malaria, taking on the type determined by the dominant morbific agent then operating within the system.

"The diarrhœa would, I supposed, disappear by the removal of its immediate causes in most cases, the specific disease remaining; while control of the dominant morbific tendency would, as the greater includes the less, modify the diarrhœa accordingly.

"This idea was afterwards corroborated, in some degree, by the old physician previously mentioned, who informed me of cases in which, the diarrhœa responding to treatment directed solely to it, chills and fever would set in, by interchange; but if the treatment was vigorously and mainly addressed to the chills and fever, both these and the diarrhœa, as symptoms of a common cause, would gradually cease."

In the same connection Dr. Howard says: —

"I have been informed by Dr. S. F. Elliott, Surgeon of Volunteers, in charge of General Hospital, St. Helena, N. C., that in the autumn of 1863, there were in the hospital about four hundred patients.

"About one fourth of the whole number were affected with intermittent diarrhœa; they would have diarrhœa for about a week, when this would suddenly cease, and immediately the patient would be attacked with a chill and the usual symptoms of intermittent fever; or, in some cases, instead of intermittent, the fever would be of a remittent type. This would continue about a week, and then the diarrhœa would be substituted, constant alternation being kept up until the disease was eradicated.

"The treatment was principally quinine, the diarrhœa being treated, for the relief of immediate symptoms, by astringents."

Surgeon B. Woodward, in speaking of an epidemic of chronic diarrhœa occurring at Cairo, Ill., on the peculiarly malarial peninsula at the confluence of the Ohio and Mississippi, in August and September, 1861, after describing the usual symptoms of the malady, says: —

Extract from communication by Surgeon B. Woodward.

"The character of the dejections and other symptoms showed hepatic derangement (a torpid condition) in a large number of cases. These nearly all complained of "fullness" and pain in the region of the liver. Endeavoring to analyze these cases, I was convinced that, though the abdomen was flaccid, there was congestion of the liver and portal vessels, and to relieve this resorted to Tripler's method with salines. This relieved the "fullness," evidently by depleting the engorged vessels. As soon as this was obtained, they were put on R. Quinia ℈i., Hyd. C. Cret. grs. xii., Opii grs. iij., in Chart. No. iv., one every three hours; this arrested the paroxysms of fever. The evacuations now generally became fecal, and a tonic and antiperiodic treatment soon completed the cure. Attention was paid to the diet, which was nourishing and bland. In those cases where there was less evidence of congestion of the portal circulation, the salines were not used, but quinia, ginger, cret. preparata, and iron by hydrogen, were used. My experience with opium, in either large or repeated doses, has not been satisfactory unless the liver was too active. The action of gallic acid has been better than that of tannin. I have been thus prolix for the reason that, wherever malarial diarrhœa has prevailed, the same treatment, substantially, has been satisfactory. In malarial regions we always found the prevalence of wet, or even damp weather, aggravated the disease, and made it far more prevalent. I believe that the Sibley tents, then in common use, in which the men were crowded close to the ground, and which could not be well ventilated, caused malarial diarrhœas that would have been avoided by a more rational method of shel-

tering the men. Malarial diarrhœa has often prevailed when its true character was unsuspected, except by those of large experience; but a history of the antecedents of the men, with a knowledge of the localities from which they came, revealed the true region of the malady."

Surgeon Edward Batwell, 14th Michigan Infantry, says: —

"This condition was very observable when our troops lay before Savannah previous to its evacuation. The men were encamped in the immediate vicinity of a swamp; all the surroundings presented the most favorable exciting causes for malarious disease. There was an air of lassitude and weariness about every person — a desire of lying down. Every one you met was *yawning*, and complaining of pains in the limbs, back, or head. The bowels were irregular, the urine was very high-colored, and yet this chain of symptoms did not produce any febrile excitement, or induce the men to apply for medical aid — saying "they were only tired from the long march." A dose of blue pill and quinine relieved those who *did* seek assistance, and change of camp from within the fortifications to the high land about the city afforded relief to all. The fact was very observable all through the Atlantic campaign."

Extract from communication by Surgeon Batwell.

While before Savannah: —

"As soon as the swamps (the outlet to which had been dammed by the Rebels) were drained off, dysentery of a most fatal form became prevalent amongst the soldiers. Its onset was of a decided malarial character, and quinine speedily removed its periodicity, but exercised no beneficial influence over the graver part of the disease; indeed, no remedy seemed to check the dysenteric symptoms, which invariably proceeded, despite the utmost exertions, to a fatal result. Out of fifty-three cases recorded on the register of the hospital of the Second Division 14th Army Corps, but four recovered; and this was the experience of other divisions of the same corps. Water was in my opinion the prolific source of the mischief, the larger proportion of the troops of this corps getting all their supply from the canal, or from mere surface wells in its immediate neighborhood."

Surgeon George C. Ewing, 115th Pennsylvania Volunteers, says: —

"I have seen cases of diarrhœa which, in my opinion, were caused and kept up by malarial influence. I found that this diarrhœa was decidedly benefited, and many cases cured, by quinia, when the ordinary remedies totally failed even to give relief."

Statement by Surgeon Ewing.

From the above and concurrent testimony, it is evident that camp diarrhœa, aside from its obvious special causes, is amenable to the general morbific influences of malarial regions, and that its treatment may be considerably mod-

Conclusions respecting malarial influences.

ified for that reason. The malarial poison may appear, first, in a regular or irregular periodicity of the diarrhœal attack; or, second, as an addition to the general malady, not obviously affecting or affected by it, and its cure having little influence upon the flux itself.

Report by Dr. Salisbury on agency of starch diet.

In the Report of the Surgeon-General of Ohio for 1863, Dr. Salisbury communicates a paper, attributing to a starch diet the peculiar prevalence of chronic diarrhœa, and asserting in effect, that the flatulence attending it was but a chemical development of carbonic acid gas from the fermentation of starches within the alimentary system; that yeast plants were found in large numbers in the stools; and that, toward death, the so-called apthæ often appearing in the mouth and pharynx were true cerevisiæ. The subject of the excess of starches is elsewhere discussed in these volumes. We have only to append the little we have which can be construed as bearing upon the microscopic phenomena attending the diarrhœa of camps.

Surgeon Benjamin Woodward says: —

Surgeon Woodward's reports on agency of cryptogamia.

"In reports made at various times, I have stated that 'microscopic cryptogami had not only been detected on fæces exposed to the air, but also on the mucous coat of the intestines.' These examinations were made at various times and places, and with all the care possible — not to establish a theory, but to ascertain the cause of the disease. I inclose the original drawings of these organisms, which I had sent home. Having no camera lucida, they were made as accurately as possible by the eye. In every case they had the form of the common prickly pear (*Cactus opuntia*). On fæces which had lain on damp shaded ground, in warm weather, they have been abundant; but the direct rays of the sun seem either to destroy them or prevent their formation. I have generally found them among weeds and bushes, or other shaded places. I never could detect any spores; but it has been noticeable that in camps situated where there was not thorough ventilation — especially in damp, warm weather — the disease was most common and virulent; and that in those camps most neglected in their police it was far more common than in those whose police was good. During the spring of 1863, while the army under General Rosecrans lay at Murfreesboro', those regiments that occupied low ground between hills or strips of timber-land suffered much more than those in better ventilated situations.

"The 22d Illinois Infantry were encamped to the southeast of the 16th Missouri, which was notorious for its bad police and the prevalence of diarrhœa; and the left flank of the 22d, which rested on the right of the 16th, suffered from diarrhœa much more than the right,

which rested on the 42d Illinois Volunteers, whose surgeon, Dr. Hanson, was thorough in his camp police. I was at that time Division Inspector, and was led to mark the differences in the health of regiments, and it was always found that the 42d and 27th Illinois, whose police was rigid, had the least sickness of any in the division. In those regiments where the sinks and latrines were well constructed and covered, the cases of this form of diarrhœa were rare. An Indiana and Missouri battery were encamped on the shores of Stone River, about half a mile apart. The localities were alike; but in the case of the Indiana battery the grounds were covered with filth, and diarrhœa was terribly prevalent; while the Missouri battery, whose grounds were kept as clean as a door yard, enjoyed the best of health. It was found necessary to report the Indiana battery to General P. Sheridan, who commanded the division, and he put the battery under the charge of a young assistant-surgeon, Dr. Elliott, who, by his thorough police and general hygienic arrangements, soon made it as healthy as any in the command.

"The conclusions at which I have arrived are, that camp diarrhœa is caused by cryptogamic formations generated in camps and barracks, and disseminated in the air; and that good and absolutely perfect police will insure against this form of disease."

Defective police of camps.

No special causation of camp diarrhœa is more strongly insisted upon than the defective police of camps and their environs. No surgeon questions the evil effects of this cause, though some fail to insist upon it as decidedly as others. The idea is as old as the Mosaic police of the camps of Israel, and there is abundant evidence that moving columns of troops, which make a new camp every evening, and thus escape the filth of older camps, are much more free from diarrhœa than permanent cantonments, however well policed. Upon this point and sundry other conditions of causation, prevention, and cure, we append the following testimony.

Surgeon Norman Gay, U. S. Volunteers, offers the following practical suggestions: —

Suggestions by Surgeon Gay, on camp police.

"Among all the causes of sickness in the armies, particularly diarrhœa, badly constructed sinks for the men, and pits for kitchen slops and garbage are the greatest. I have no hesitation in saying that one half of the diarrhœa in the armies of the United States was caused by miasm, from the fecal matter, kitchen slops, and garbage deposited in and around their camps. I will give one case which will illustrate, and is but one of many that came under my notice while on duty with troops in the field. In the winter of 1863–64, while in charge of the left wing, 16th Army Corps, on receiving the reports of sick and wounded, for the month of De-

cember, one of the regiments reported sixty-eight cases of diarrhœa, with three deaths; while the other regiments reported only from six to seven cases, and no deaths. Knowing that the command were all in good locations, and fed with the same food, I immediately visited the regiment, and, on inspection, I found the grounds between the tents in fair condition. They had three sinks, which had been used a little, but left without filling in dirt from time to time, or having their sides policed as is required.

"The men preferring to go to the surrounding bushes near the camp to using the sinks, it was permitted by the colonel commanding. As the regiment had been some five weeks in camp, one who is acquainted with duties in the field with troops, can form a correct idea of the surrounding fields and bushes. For from one to two hundred yards on three sides of the camp, the grounds were covered with fecal matter, the odor from which pervaded the entire camp. The grounds were ordered to be policed, fecal matter buried, sinks properly made, and a guard put on to compel every man to use them.

"At the end of four days, the sick report, which was mostly diarrhœal, was reduced three fourths, and at the end of a week the disease disappeared — a disease from which three had died, and quite a large number disabled for the summer campaign; a disease depending entirely on the miasm from the surrounding filth.

"The old plan of digging a trench fifteen or twenty feet long, from two to three feet deep and wide, leaving it open at the top, exposing the deposits to the hot sun and rains, then inclosing with bushes, which prevent the escape of the miasm, with, in addition, the frequent neglect of filling in dirt or policing the sides, makes one of the most disgusting places a man could well find, and, I believe, one of the great foci of disease in our army's encounter. Not unfrequently a shower of rain fills up the trench, and flows its contents over the surrounding grounds. This cannot be corrected when it occurs, and the camps suffer. The men have to spend more or less time breathing the poison of these places, or go to the ravines and bushes surrounding the camp, which soon infects the entire neighborhood.

"The following is a plan of sink which can be constructed at almost any camp, and which corrects most, if not all, the defects of those formerly in use. Dig a vault ten feet long and eight feet wide, and from six to fifteen feet deep, as the nature of the ground will admit; put a log or timber on either side of the vault, resting their ends on the earth at either end of the vault. The log should be dropped a little below the surface. Cover the vault with rails or planks, except the centre, where you will have a chimney or ventilator from fifteen to twenty feet high. The bench or pole is placed on the outside of the log by digging a slide, so that the fecal matter shall slide under the log into the vault. The vault should be covered with dirt sufficient to keep out the

heat of the sun and prevent the gas from escaping, except through the chimney. The space between the logs will act as a chamber, into which the gases rise and pass off through the ventilator. Sinks built in this way will last for weeks or months and not be offensive.

"The best plan for kitchen sink or pits is the following: Dig a vault from six to seven feet square, and from six to twelve feet deep. Cover with rails or planks, except a place for a barrel with both heads out, through which to pass the slops and garbage into the vault. The barrel should have a cover, to be taken off only when pouring in slops. The dirt thrown around the barrel prevents all escape of gas or unpleasant odor, and furnishes no support for flies, which are so troublesome in camps. The plan of hauling off the slops was adopted by many regiments, but from my experience I would not advise it. The place where the barrel sets is always more or less filthy from overfilling and other accidents so frequently, that it is usually a nuisance in the camp and a harbor for insects. The theory of hauling off is good, but it does not work in practice, from the frequent neglect and carelessness of the men."

Surgeon B. Woodward says: —

"A great natural law or instinct teaches all carnivora to cover their ordure with earth; even the domestic dog and cat do this imperfectly, while the whole of the feline and canine races, in the wild state, do it perfectly. There is a recognition of this as a law of health in the Levitical code, which insisted that every one 'should have a paddle on his weapon.' No fact is better established than that even large bodies of men travelling even in great emigration parties, are never troubled with this form of diarrhœa, for the reason that they do not remain long enough to be affected by the forming fungi. A preventive is well constructed and often policed sinks, with earth enough each day thrown in to cover thoroughly all the fecal matter. The disease has generally manifested itself in home camps, where the care of police was imperfectly understood, and still less perfectly enforced than in the camps in actual service. It is not at all improbable that the disease once generated may be propagated through breathing the air infected from the lungs of diseased men." Remarks by Surgeon B. Woodward.

Surgeon M. D. Benedict, 75th New York Volunteers, in a history of his regiment, ascribes diarrhœa rather to excesses of diet. The command landed at Fort Pickens, Dec. 14–15, 1861, weather warm and pleasant. He says: —

"We had very soon a full supply of fresh beef, salt beef, salt pork, potatoes, and soft bread, all of excellent quality. The men ate very heartily. Surgeon Benedict's account of diarrhœa at Fort Pickens.

"*Diarrhœa* began to appear within ten days, and became largely prevalent, accompanied by *profuse discharges of fresh blood per*

anum, without tenesmus or other symptoms of irritation or inflammation. Only a few more escaped entirely an attack of the disease, and these, in every case, were men of frugal and abstemious habits, who did not consume more than one third to one half of their rations.

"During the latter half of the month of January, 1862, a cargo of fruit arrived from Havana, consisting of oranges, lemons, limes, bananas, and pine-apples. These were furnished the men in great abundance, and during the time they were plenty, but a small proportion of ordinary food was consumed, the *company* and *regimental funds* being largely increased by savings on rations. Under this fruit-diet the cases of diarrhœa disappeared with remarkably celerity. Upon the exhaustion of the fruit, the diarrhœa returned, but was less general and not so severe."

Surgeon Edward Batwell attributes much importance to the condition of the nervous system. He says: —

Surgeon Batwell on relations of diarrhœa to nervous system.

"Whilst the army of Buell followed Morgan into and through Kentucky, and back after the battle of Perryville to Tennessee, very little camp diarrhœa made its appearance, and that, too, when the troops were new and unacclimated; but as soon as they encamped around Nashville, they began to suffer dreadfully. So many solutions have been offered to explain the cause of diarrhœa amongst soldiers, that we find it impossible to give preference to any, believing, as we do, that the same cause does not always produce the same effect. Why is it that some have diarrhœa, and others are constipated, whilst under the same exciting cause? Does it arise from an overloaded state of the intestines, or from badly cooked or unwholesome rations? But the only solution we ever endeavored to thoroughly investigate, was that of considering the great influence exerted over the disease by the nervous system. Any one who has ever suffered from camp diarrhœa, can testify to the sense of utter prostration and listless indifference experienced, and that, too, before it could have been induced by debility. I have asked very many surgeons, relative to the nervous condition of patients laboring under chronic diarrhœa. The invariable answer was, that the cases were chiefly amongst those of an extremely nervous disposition. Again, it was observed that the disease prevailed more particularly amongst men and companies *raised in the country*, — those who always had the care of mothers and sisters, and the comforts of a well-regulated home, — whilst the 'Roughs' brought up in towns and cities, who did not appreciate home (if they had one), nor had ever experienced care or attention in their moments of illness, were almost exempt from disease of this sort. Who has not observed the effect produced on the former, even if almost 'moribund,' when told they would be permitted to return on furlough to their homes? And who has not seen those same men return to their regiments strong, hale, and healthy,

after being a short time at home? The policy adopted by military authorities relative to not allowing men to go (under proper authority) to their family during illness, produced more deaths, and was more destructive of human life in the army, than the much-spoken-of and atrocious treatment of our brave and heroic brothers, in the prison pens of Macon or Andersonville. Better that a large number of 'malingerers' should be guilty of the *crime* of going to their homes for a short time, than that the thousands whose death stands on our hospital records, as resulting from 'chronic diarrhœa,' should be permitted to pine and wish *and die* for a brief but life-saving furlough."

Surgeon P. H. Bailhache says: —

"The *predisposing* causes of diarrhœal maladies in the army are evidently hot weather, fatigue, malarial poison, and irregular habits, while the *exciting causes* are, exposure to the cold damp ground at night, with insufficient clothing or bedding, or bivouacking in the open air, and under every variety of weather; partaking of food at irregular intervals, which is often scanty, precarious, and of bad quality; overloading the stomach with green fruit and other indigestible matter; indulging in large draughts of water while over-heated; resting upon the damp ground or in the heat of the sun while upon the march; in many cases debauchery and intemperance whenever opportunity presents itself, — all these are fruitful causes of the diseases of the digestive organs and alimentary canal, which are manifested by acute diarrhœas and dysenteries. If not arrested by the ordinary means of oil and astringents, these diseases soon assume a chronic character (subacute inflammation of the mucous membrane of stomach and bowels), and they are difficult to control, particularly in the field where the exciting causes continue to exist." Remarks by Surgeon Bailhache.

Surgeon C. C. Jewett, after alluding to the ordinary causations, says: —

"One or two of these causes, from their peculiarity to the life under consideration, and their frequency of action, require a little notice. No causes in army life, excepting in some localities miasmata, more frequently operate in the production of chronic diarrhœa than improper food and the gaseous exhalations of animal decay. Improper food includes the want of variety and too great concentration of the ration as perhaps necessarily furnished on an active campaign, and the short allowance engendered by the deliberate reductions of the same by the soldiers themselves, by throwing away a portion before starting on a march or an improvident use during the first few days after filling the haversack, but also unwholesome articles obtained from sutlers, and what is a frequent peccant article, the beef of cattle too recently killed, the consumption of which it is impossible always to prevent in Remarks by Surgeon Jewett.

the hurried march of troops. The most frequent sources of suffering from animal putrescence are found in the vicinity of places where beeves are slaughtered, in contiguity to battle-fields, and on the reoccupation of old camps. The pestiferous air from the battle-field of Fair Oaks caused more deaths from diarrhœa among the troops camped in and about it, than did the bullets of the enemy to those engaged, and the 120th New York and 11th New Jersey regiments have a sad record of deaths from occupying old camps.

"The effects of proper hygienic measures were very marked in warding off or moderating this disease. Those regiments, as far as my observation goes, were most free from it that were best officered, and who had in consequence well selected camps; where the sun had free access, the water was sweet, and the prevailing winds blew over them from no sources of putrefaction or swampy tracts (advantages which can be often seized); where the policing was thorough — latrines, each day filled in with two or three inches of fresh earth, whose drainage was good, where slops and refuse were not allowed to be thrown — and where the tents were daily thrown open for ventilation. Such regiments had more comfortable quarters, fuller and more properly cooked supplies, were warmly clothed, were depressed in fewer instances by discontent and other passions arising from want of confidence in superiors, and enjoyed in consequence of all better health."

Surgeon R. A. Dwyer, 175th Ohio Infantry, attributes diarrhœa to hard bread especially. He says: —

Surgeon Dwyer on agency of hard bread.

"I have seen hard bread give rise to more chronic diarrhœa than all other causes combined. I have seen it occur under a great variety of circumstances, and at all seasons of the year, in the valleys and on the mountains, and I am fully convinced that hard bread was the cause. I have seen it disappear when soft bread was issued, and suddenly reappear when hard bread was issued. Hard bread usually causes a constipated condition of the bowels for a few days, during which time a fermentation takes place, with a gaseous distention of the bowels, and a yeasty diarrhœa sets in. The food taken during the day ferments by evening, and the diarrhœa is worse at night or early in the morning. The bowels become more irritable as the disease progresses, and the passages are more frequent. The fermenting process seems to increase, and all the food taken — no matter what the quality or kind — seems to be subject to the same process as long as hard bread is used, and very frequently continues after a change of diet, and chronic diarrhœa is formed. I have seen a number of cases get apparently well, and an ability to digest hard bread was apparently acquired, but I always observed that those men were very liable to a recurrence of the disease from very slight causes."

FRESH MUTTON CAUSING GENERAL DIARRHŒA IN THE SIXTH NEW YORK ARTILLERY, COL. J. B. KITCHING. REPORTED BY PROF. C. A. LEE.

This regiment, when encamped in the Shenandoah Valley, at Front Royal, in the summer of 1864, and living chiefly on hard biscuit and salt pork, were supplied with several hundred sheep, which were slaughtered and dressed about four o'clock in the afternoon. Between five and six o'clock the men all ate heartily of the mutton, which was cooked while the meat was still warm.

"At eight o'clock the same evening, the regiment took up its march for Middletown. About three hours after commencing the march, the men began to fall out of the ranks, being attacked with sudden and violent diarrhœa. In the course of an hour, *every man in the regiment, including the officers, was attacked in a similar manner.* The disease was of but a few hours' duration, as the regiment, on the next day, returned to their usual rations of hard tack and salt meats, with occasional vegetables — as potatoes. No serious results followed the attacks, although the strength of the men was considerably reduced in consequence of the copious alvine discharges."

Surgeon B. F. Stevenson reports as follows: —

Report of Surgeon Stevenson.

"The first morbid link in the chain of predisposing causes to chronic diarrhœa I have thought to be an interference with the healthy functions of the skin. The intimate relations subsisting between the integument and the mucous tissues are well understood, and the certainty with which we may prognosticate disturbance of the pulmonary and intestinal mucous membranes from a suddenly repelled cutaneous discharge, is equally well understood.

"Soldiers, as a general rule, neglect the functions of the skin more than those of any other organ. They sleep under less covering than before entering the service; they do not attend to ablutions of the surface, and the transpiratory pores become obstructed. On picket-duty they are frequently restrained from any exercise, and at night, even in warm seasons of the year, the surface becomes chilled, and in winter benumbed and paralyzed with cold. These causes combined constringe the capillaries and give a centripetal direction to the fluids of the body. When the functions of one organ have been interfered with, it is a law of the animal economy that some other organ shall do vicarious duty, and the weaker one for the moment is called to do double duty, and this call to extra duty generally finds the bowels in the condition to respond to the call. The ration furnished the army has of necessity to be concentrated food. The hard bread, the pork, and beef contain, in a given bulk, more nutriment than the same bulk where succulent green vegetables are used, and the soldier but too frequently permits his eyes to govern his appetite. He bolts his bulk of bread

and pork unmasticated, and his digestive organs, already predisposed to disease from the amount of duty thrown on them from a repelled cutaneous transpiration, revolt, overtasked, and lapse into a state of passive looseness, which runs into subacute inflammation, and which, 'growing by that it feeds on,' but too often ends in ulceration, disorganization, and death."

Explanation of apparent discrepancies of opinion.

The discrepancies in the above opinions are more apparent than real. Nothing is more obvious than that all diseases are subject to the influence of climate, diet, and habits of life. To this rule chronic diarrhœa is no exception, and the frequency and fatality it exhibits in armies is due rather to the combination of several causes, than to the prevalence of any one. The most important causations are, doubtless, bad police of camps, defective diet, and exposure to rapid radiation of the animal heat.

Enough has been quoted to show how controllable these elements may become in a well-organized army, and the sanitary lessons taught by the stern experience of the late war are not likely to be lost in any future conflict.

CHAPTER EIGHTH.

PNEUMONIA AS IT APPEARED AMONG THE COLORED TROOPS AT BENTON BARRACKS, MO., DURING THE WINTER OF 1864.

By IRA RUSSELL, M. D.,

SURGEON U. S. VOLUNTEERS.

NOTE RESPECTING THE PREVALENCE AND FATALITY OF PNEUMONIA AND OTHER INFLAMMATORY AFFECTIONS OF THE RESPIRATORY SYSTEM AMONG THE UNITED STATES TROOPS DURING THE WAR.

Number of Cases and of Deaths. — Division of the Disease into the Congestive Form, the Typhoid Form, and Pleuro-Pneumonia. — Congestive Variety most prevalent in January. — Severity of the Winter. — Congestive Form; its Symptoms and Physical Signs. — Chlorides in the Urine. — Typhoid Pneumonia; its Symptoms and Physical Signs. — Pleuro-Pneumonia; its Symptoms and Physical Signs. — The Disease attributable to Over-crowding and to Measles. — Number of Cases after Measles. — Differences found after Death in Cases following Measles. — Table 1, showing Number of Days in Hospital; the Affection of one or both Lungs; Stage of Disease at time of Death; and Weight of Lungs in One Hundred Fatal Cases. — Table 2, showing the Dates of Deaths in One Hundred Cases. — Table 3, showing Duration of the Disease, Amount of Effusion, etc., in Fifty Fatal Cases of Pleuro-Pneumonia. — Table 4, showing Duration in Fifty Fatal Cases of Pneumonia, and Thirty-eight Cases of Measles. — Table 5, showing the Order in which the Lungs and Several Lobes were attacked; the Stage of the Disease in each Lobe at the time of Death; and the Weight of each Lung, in Fifty Cases among Colored Troops at Wilson Hospital, Tennessee. — Table 6, showing Days in Hospital in Cases of Measles, and of Pneumonia ending in Recovery. — Treatment of Pneumonia. — Agents generally used. — Liability to Sudden Prostration. — Importance of the Carbonate of Ammonia. — Quinia as a Prophylactic. — Classes of Patients at Benton Barracks. — Liability of the Negro to Pulmonary Disease. — Efficacy of Treatment in Cases among Negroes. — Pleuritic Adhesions, found after Death, more frequent in Negroes. — Weight of Lung less in Negroes. — Note respecting the Prevalence and Fatality of Pneumonia, and other Inflammatory Affections of the Respiratory System.

During the winter and spring of 1864, six regiments of colored troops were recruited at Benton Barracks. Pneumonia made its appearance among these troops about Christmas, and continued with undiminished severity until the last of April, when it suddenly abated.

From January 1st to May 1st, seven hundred and eighty-four cases of pneumonia were treated in the hospital, of which one hundred and fifty-six died. Besides the above there were six hundred and seventy-five cases of measles treated in the hospital, of which one hundred and thirty died, death being caused mainly by pneumonia or other pulmonary complications. The pneumonia presented well-marked varieties with symptoms

Number of cases and of deaths, and varieties of the disease.

peculiar to each. These varieties I have designated as congestive, typhoid, and pleuro-pneumonia.

Congestive variety most prevalent in January.

During the month of January, when cold and exposure operated to its fullest extent as a predisposing cause, the congestive form was the most prevalent. That the vicissitudes of the climate and the inclemency of the weather exert a powerful agency in producing this disease and aggravating its severity, is most evident.

Severity of the winter.

The winter of 1864 was unparalleled for severe cold weather in the vicinity of St. Louis, the like of which had never been experienced by that important personage, the "oldest inhabitant." All who carefully watched the progress of the disease noticed that a few warm days lessened very much the frequency, and diminished the severity, of cases among the soldiers in the barracks. It was also observed in the hospital that when the weather was very cold and disagreeable, and when we were deprived of suitable fuel, as we unfortunately were during the coldest of the weather, the symptoms became very much aggravated, and the number of deaths were greatly increased. The sudden abatement of the disease in the latter part of April and early in May was undoubtedly due to the warm and pleasant weather which began to prevail at that time.

I. CONGESTIVE FORM.

Symptoms in this form.

The patient, after suffering for several days with catarrhal symptoms, attended with more or less mental stupidity or indifference, was suddenly taken with a severe chill very similar to that accompanying pernicious fever; the surface cold, and the pulse either very small and feeble or imperceptible; the respirations short, frequent, and oppressed; great prostration, with severe pain in the head, back, and limbs. This state of depression continued from twelve to forty-eight hours, when either reaction took place, or death closed the scene. When the patient survived the chill, and reaction became fully established, a fever of a low asthenic form ensued, attended with a feeble arterial and imperfect capillary circulation; frequent cough; expectoration at first of frothy mucus, viscid and streaked with blood, but soon becoming muco-purulent, copious in quantity, amounting in many cases to from one to two pints in twenty-four hours. Few cases exhibited the rusty colored or brick-dust sputa, common to the ordinary forms of pneumonia. Pain, in some cases, continued after reaction, and was severe in the head and chest; in other cases it was wholly

absent; the mind was generally stupid or dull, but occasionally there was boisterous delirium. This form of the disease usually ran its course very rapidly to a fatal termination. Coma, as a rule, preceded death.

Physical examinations of the chest, in the severe congestive form, showed often that both lungs were attacked. There was marked dullness on percussion, sometimes confined to a distinct portion of each lung, at others extending over the whole of one side of the chest. In a few cases in the early stage auscultation revealed fine crepitation in some portion of the affected lung; but in general this sign was either absent or existed but transiently. Bronchial respiration and mucous râles were frequently present. Physical signs in congestive cases.

Whenever there were well-marked physical signs of hepatization the chlorides were invariably found to be absent in the urine when tested for by nitric acid and the nitrate of silver. A return of the chlorides was observed when resolution of the hepatized lung was fully established. This form of pneumonia was almost invariably fatal. Chlorides in the urine.

II. TYPHOID PNEUMONIA.

This variety was usually ushered in without a severe chill. From the first the disease assumed a typhoid type, and was more protracted before death or recovery than in the preceding variety. This form was remarkable for the freedom from pain of the patient, and, were it not for the physical signs and increased frequency of respirations, pneumonia would hardly have been suspected. The tongue was usually brown, with red edges, and sometimes dry and cracked; teeth covered with sordes, and the mouth filled with a tough, tenaceous mucus; the pulse, always feeble and diminished in volume, varied much in frequency in different cases, and in the same case at different times, varying from sixty to one hundred and fifty per minute. The expectoration was sometimes scanty, and at other times copious; at first it consisted of viscid mucus, but it soon became muco or sero-purulent, with a fetid and disagreeable odor. The cough was usually not severe nor frequent. Symptoms of this form.

Percussion revealed dullness over the affected portion or portions of lung. Auscultation seldom or never showed fine crepitation, but there was frequently a mucous or subcrepitant râle.[1] During the course of the disease, emaciation pro- Physical signs in typhoid pneumonia.

[1] For the comparative frequency with which the different lobes of the lung are first attacked, see Tabular Statement.

gressed with great rapidity, and there was a corresponding loss of strength. A dark jaundiced appearance of the sclerotic coat of the eye was frequently observed.

III. PLEURO-PNEUMONIA.

Symptoms in this form.

Pleuritis, with copious effusion of serum and lymph into the pleural cavity, was a frequent complication in cases of the above variety. The *post-mortem* examinations revealed the existence of this complication in sixty-four out of one hundred and fifty cases. A marked peculiarity of the variety which I have distinguished as pleuro-pneumonia was the frequent absence of pain in the pleura during the stage of active inflammation, and had it not been for the physical signs the disease would not have been suspected. Occasionally cases occurred in which the pain was severe. Relapses, in this form of the disease, were frequent and fatal. Patients who had become convalescent, and to all appearances in a fair way to recover, became suddenly worse upon slight exposure, improper indulgence, or change of weather; a severe chill occurred, followed by great prostration of strength, copious effusion into the pleural cavity, and speedy dissolution.

Physical signs in pneumonia.

In every variety of pneumonia, the physical signs were of the utmost importance in determining the extent and character of the disease, as in many instances the symptoms afforded a very imperfect indication of the real condition of the lungs.

I would here remark that I watched the progress of this disease with much interest and care. Autopsies were frequently made, and the morbid appearances carefully noted. I have endeavored to ascertain, as far as practicable, the causes that operated in producing the disease, and the most effectual mode of combating it.

Disease attributable to over-crowding and measles.

Among the causes, beside those already referred to, the vicissitudes of the weather and exposure of the men, ochlesis, an epidemic influence and measles, may be mentioned.[1] One hundred men were crowded into rooms originally meant but for fifty, necessarily rendering the air very impure; and this evil was rendered greater by the faulty construction of the barracks and imperfect ventilation. The effect of an epidemic influence is shown by the fact that physicians and nurses, who had not been greatly exposed to the vicissitudes of the weather and the other causes mentioned, have suffered from it. Besides, the surgeons on duty with the regiments in the barracks report that men

[1] The pernicious effect of ochlesis was very manifest.

occupying the same bunks with those affected were very much more liable to be attacked than those more remote. Some of the most intelligent surgeons were led to believe that the disease was actually contagious.

A very large proportion of the cases of measles treated in the hospitals had pulmonary complications. More than fifty per cent. of the well-marked cases of pneumonia following measles proved fatal. This liability did not seem to depend upon the severity of the primary disease. Frequently, two or three days after convalescence had been fully established, patients who were able to walk about the wards, and having a good appetite, suffering only with slight catarrhal symptoms, were attacked with a chill, sometimes slight, at others severe, followed by fever, pain in the chest, head, limbs, and back, oppressed respiration, frequent or almost continuous cough; the pulse usually small and frequent. The expectoration, at first muco-sanguineous, soon became sero-purulent and copious in quantity; the disease ran its course rapidly to a fatal termination, or eventuated in a slow and tardy convalescence. *Post-mortem* examinations usually showed a marked difference in the morbid appearances of the lungs in pneumonia following measles, from those of pneumonia produced by other causes. Hepatization was less marked; the lung tissue was oftener œdematous or filled with a sero-sanguineous fluid, and contained a sufficient quantity of air to make it float on water; when pressed between the fingers, a large quantity of bloody serum exuded.[1]

Occurrence after measles.

Differences found after death in cases following measles.

I am satisfied that the lung frequently passed from this œdematous condition, without passing through the stages of red and gray hepatization, into that of purulent infiltration. The mucous membranes of the large bronchial tubes were always found greatly inflamed and softened; and it is believed that frequently death resulted in consequence of capillary bronchitis.

The following tables have been prepared with special regard to accuracy: —

Account of the tables.

Table I. embraces one hundred fatal cases of pneumonia, showing the number of days sick in hospital; the lungs, one or both attacked; the stage of the disease of each lung at the time of death, whether congestion, red hepatization, gray hepatization, or purulent infiltration; and the weight of the lungs.

Table II. shows the day and number of deaths occurring on the same for one hundred cases.

[1] Much more than is usual in the stage of simple engorgement in the ordinary forms of pneumonia. The lung tissue was also much more softened and more easily broken down.

Table III. contains the same facts as Table I. with reference to fifty cases of pleuro-pneumonia, giving in addition, the amount of effusion in the pleural cavity in each case.

Table IV. shows the duration of the disease in fifty cases of pneumonia and thirty-eight cases of measles before death.

Table V. embraces fifty cases of pneumonia occurring in Wilson Hospital, Tennessee — among colored troops — not included in the foregoing tables, and shows the order in which the lungs and several lobes of the lungs were attacked, and the stage of the disease in each lobe at the period of death, together with the weight of each lung.

Table VI. shows the duration of the disease in fifty-three cases of measles recovering in January, and forty-five in February; of sixty-two cases of pneumonia recovering in January, and fifty-seven recovering in February in hospital at Benton Barracks, Missouri.

TABLE I.

SHOWING NUMBER OF DAYS IN HOSPITAL, THE AFFECTION OF ONE OR BOTH LUNGS, STAGE OF THE DISEASE AT TIME OF DEATH, AND WEIGHT OF LUNGS IN ONE HUNDRED FATAL CASES.

No. of Cases.	Number of Days.	Age.	Right Lung.	Left Lung.	Congestion, R.	Congestion, L.	Red Hepat. R.	Red Hepat. L.	Gray Hepat. R.	Gray Hepat. L.	Purul. Infil. R.	Purul. Infil. L.	Weight R. Lung.	Weight L. Lung.
		YRS.											OZ.	OZ.
1	5	25	1	1	–	–	1	–	–	–	–	–	20	10
2	7	22	1	1	–	1	–	–	1	–	–	–	21	15
3	6	21	1	1	–	–	1	1	–	–	–	–	23¼	28¾
4	16	21	1	1	1	–	–	–	–	–	–	1	26	18½
5	4	35	1	1	–	1	–	1	1	–	–	–	50	20
6	19	–	1	1	–	–	1	–	–	1	–	–	51	42
7	11	25	1	1	–	–	1	–	1	–	–	1	22	15
8	7	–	1	1	–	–	1	–	–	1	–	–	26	47
9	15	–	1	1	–	–	1	–	–	–	–	1	17	14
10	12	–	1	1	–	–	–	–	1	–	1	1	20	15
11	12	–	1	1	–	–	–	–	–	–	1	1	23	21
12	10	40	1	1	–	–	–	–	–	1	1	–	14	38
13	4	20	1	1	1	–	–	1	–	–	–	–	12¼	34
14	5	35	1	1	1	1	–	–	–	–	–	–	16	15
15	18	12	1	1	–	–	1	–	–	–	–	1	21	14
16	15	21	1	1	1	–	–	1	–	–	–	–	20	30
17	15	30	1	1	1	1	–	–	–	–	–	–	16	13
18	7	25	1	1	1	1	–	–	–	–	–	–	16	10
19	17	23	1	1	–	–	–	1	–	–	1	–	19	23
20	8	25	1	1	–	–	–	–	1	1	–	–	79	25
21	4	30	1	1	–	–	1	1	1	–	–	–	42	22
22	21	24	1	1	–	–	–	–	1	1	–	–	30	26
23	3	45	1	1	–	1	–	–	1	–	–	–	67	18
24	19	20	1	1	–	–	–	–	1	–	–	1	41	12
25	7	30	1	1	1	–	–	–	–	1	–	–	14	43
26	2	30	1	1	–	–	1	1	–	–	–	–	31	30
27	4	30	1	1	1	1	1	–	–	–	–	–	22	20
28	6	20	1	1	1	–	1	1	–	–	–	–	20	19
29	16	35	1	1	–	–	–	–	–	1	1	–	18	34
30	16	25	1	1	–	–	–	–	1	–	–	1	23	17
31	9	30	1	1	–	–	–	–	1	1	–	–	41	36
32	7	21	1	1	–	–	1	1	–	–	–	–	30	26
33	7	45	1	1	–	–	–	–	1	1	–	–	31	25
34	6	23	1	1	–	–	–	–	1	1	–	–	36	27
35	9	30	1	1	1	1	–	–	–	–	–	–	19	21
36	9	30	1	1	–	–	1	1	–	–	–	–	32	25
37	3	21	1	1	–	–	1	1	–	–	–	–	25	28
38	7	25	1	1	1	–	–	1	–	–	–	–	22	28
39	8	35	1	1	–	–	–	1	1	–	–	–	38	20
40	7	25	1	1	–	–	1	1	–	–	–	–	26	16
41	16	–	1	1	–	–	1	1	–	–	–	–	23	22½
42	16	30	1	1	–	–	–	1	–	–	1	–	23	28
43	7	23	1	1	–	–	1	1	–	–	–	–	28	21
44	7	21	1	1	–	–	1	1	–	–	–	–	29	21
45	24	28	1	1	–	–	–	–	–	1	1	–	31	30
46	8	24	1	1	–	–	1	1	–	–	–	–	33	28
47	9	30	1	1	–	–	1	1	–	–	–	–	28	26
48	5	25	1	1	–	–	1	1	–	–	–	–	25	28
49	5	25	1	1	–	1	1	–	–	–	–	–	24	17
50	7	25	–	1	–	–	–	–	–	1	–	–	–	32
51	18	–	1	1	–	–	–	1	–	–	1	–	19½	24
52	11	35	1	1	–	–	1	–	–	1	–	–	26	29
53	7	30	1	1	–	1	1	–	–	–	–	–	27	17

TABLE I. *Continued.*

No. of Cases.	Number of Days.	Age.	Right Lung.	Left Lung.	Congestion, R.	Congestion, L.	Red Hepat. R.	Red Hepat. L.	Gray Hepat. R.	Gray Hepat. L.	Purul. Infil. R.	Purul. Infil. L.	Weight R. Lung.	Weight L. Lung.
		YRS.											OZ.	OZ.
54	17	40	1	1	–	1	–	–	1	–	–	–	32	14
55	10	35	1	1	–	–	–	1	1	–	–	–	24	24
56	9	40	1	1	–	1	–	–	–	–	1	–	22	17
57	14	25	1	1	–	–	–	–	1	–	–	1	27	18
58	5	30	1	1	–	–	1	1	–	–	–	–	22	26
59	26	24	1	1	–	–	1	–	–	–	–	1	23	18
60	5	21	1	1	–	–	1	1	–	–	–	–	21	16
61	7	25	1	1	1	–	–	1	–	–	–	–	20	22
62	13	45	1	1	–	–	–	–	–	1	1	–	21	23
63	7	–	1	1	–	1	–	–	–	–	1	–	12	15
64	22	25	1	1	–	–	–	–	1	–	–	1	34	21
65	20	40	1	1	–	–	–	–	–	1	1	–	27½	36
66	2	14	1	1	1	1	–	–	–	–	–	–	14	12
67	6	25	1	1	–	–	1	–	–	1	–	–	28	22
68	14	45	1	1	1	–	–	–	–	–	–	1	25	12
69	17	35	1	1	–	–	1	1	–	–	–	–	35	35
70	2	29	1	1	–	–	1	–	–	–	–	–	37	30
71	24	30	1	1	–	–	1	–	–	–	–	1	32	24
72	4	20	1	1	1	1	–	–	–	–	–	–	21	18
73	18	30	1	1	–	–	–	1	1	–	–	–	29	13
74	22	25	1	1	–	–	–	–	–	1	1	–	19	33
75	14	–	1	1	–	1	–	–	1	–	–	–	35	14
76	7	45	1	1	–	–	–	–	1	1	–	–	34	28
77	10	20	1	1	–	1	1	–	–	–	–	–	24	14
78	7	25	1	1	–	1	1	–	–	–	–	–	27	15
79	6	23	1	1	1	1	–	–	–	–	–	–	21	20
80	11	30	1	1	–	1	–	–	1	–	–	–	43	20
81	20	26	1	1	–	–	1	1	–	–	–	–	24	24
82	14	23	1	1	–	–	–	1	–	–	1	–	14	21
83	12	26	1	1	1	–	–	1	–	–	–	–	15	28
84	6	27	1	1	1	–	–	–	–	–	–	1	19	24
85	4	27	1	1	–	–	–	1	1	–	–	–	32	24
86	7	27	1	1	1	–	–	1	–	–	–	–	18	24
87	3	40	1	1	1	–	–	–	–	1	–	–	17	46
88	22	50	1	1	–	–	–	–	1	1	–	–	29	32
89	9	27	1	1	–	1	–	–	1	–	–	–	27	18
90	4	27	1	1	1	1	–	–	–	–	–	–	23	19
91	28	–	1	1	–	–	–	–	–	–	1	1	18	21
92	9	25	1	1	1	–	–	–	–	1	–	–	19	30
93	2	30	1	1	1	–	–	–	–	1	–	–	12	31
94	13	30	1	1	1	–	–	–	–	–	–	1	21	18
95	17	45	1	1	–	–	–	–	1	1	–	–	–	24
96	13	35	1	1	–	1	–	–	1	–	–	–	35	20
97	13	30	1	1	–	–	1	1	–	–	–	–	23	20
98	7	30	1	1	–	–	–	–	1	1	–	–	31	28
99	20	30	1	1	–	–	–	–	1	1	–	–	28	26
100	23	29	1	1	–	–	1	–	–	1	–	–	–	–

Remarks. — This table shows the age, number of days sick, the lung affected, whether right or left, the stage of disease in each lung, whether Congestion, Red Hepatization, Gray Hepatization, or Purulent Infiltration, and weight of each lung. From which it appears that in all but one case both lungs were affected. The right lung was in the stage of Congestion, in 24 cases; of Red Hepatization, in 35 cases; of Gray Hepatization, in 29 cases; of Purulent Infiltration, in 15 cases. The left lung was in stage of Congestion, in 23 cases; of Red Hepatization, in 34 cases; of Gray Hepatization, in 26 cases; of Purulent Infiltration, in 16 cases. The most advanced stage of the disease is taken in each lung.

From the above, it appears that the average number of days sick is $11\frac{1}{10}$.

TABLE II.

SHOWING THE DATES OF DEATH IN ONE HUNDRED CASES.

Days.	Deaths.	Days.	Deaths.	Days.	Deaths.	Days.	Deaths.	Days.	Deaths.	Days.	Deaths.	Days.	Deaths.
1	–	5	6	9	7	13	4	17	4	21	1	25	–
2	4	6	6	10	3	14	4	18	3	22	4	26	1
3	3	7	17	11	3	15	3	19	2	23	2	27	–
4	7	8	3	12	3	16	4	20	3	24	2	28	1

TABLE III.

SHOWING DURATION OF THE DISEASE, AMOUNT OF EFFUSION, ETC., IN FIFTY FATAL CASES OF PLEURO-PNEUMONIA.

No. of Cases.	Number of Days.	Age.	Right Lung.	Left Lung.	Congestion R.	Congestion L.	Red Hepat. R.	Red Hepat. L.	Gray Hepat. R.	Gray Hepat. L.	Purul. Infil. R.	Purul. Infil. L.	Weight R. Lung.	Weight L. Lung.	Effusion.	
															R. Lung.	L. Lung.
													oz.	oz.	oz.	oz.
1	16	24	1	1	–	–	1	1	–	–	–	–	21	26	9	39
2	40	25	1	1	–	–	–	–	–	–	–	1	16½	19	36	–
3	23	35	1	1	–	–	–	–	1	–	–	1	36	16	–	20
4	15	–	1	–	–	–	1	–	–	–	–	–	29	–	–	10
5	11	30	1	1	–	–	1	1	–	–	–	–	27	21	–	14
6	12	40	1	1	–	–	–	1	1	–	–	–	36	25	–	8
7	28	18	1	1	–	–	–	–	1	–	–	–	29	9	–	46
8	9	25	1	1	1	1	–	–	–	–	–	–	26	20	–	12
9	14	45	1	1	–	–	1	1	–	–	–	–	28	29	9	–
10	5	22	1	1	1	–	–	–	–	–	–	–	24	11	–	46
11	11	35	1	1	–	1	1	–	–	–	–	–	26	16	–	15
12	6	24	1	1	1	–	–	–	–	–	–	–	21	20	11	6
13	14	27	1	1	1	–	–	–	–	–	–	1	19½	25	16	35
14	8	25	1	1	–	1	–	–	–	–	–	–	10	22	6	–
15	18	23	1	1	–	–	–	1	–	–	1	–	20	31½	–	36
16	22	25	1	1	–	–	–	–	–	–	1	1	20	24	12	–
17	15	35	1	1	–	–	–	–	–	–	1	1	24	21	–	14
18	11	22	1	–	–	–	–	–	1	–	–	–	53	14	–	7
19	22	22	1	1	1	–	–	–	–	–	–	–	19	19¾	–	64
20	22	20	1	1	–	–	–	–	–	1	1	–	14	45	15	–
21	6	25	1	1	1	–	–	–	–	1	–	–	17	36	21	–
22	9	25	1	1	–	1	1	–	–	–	–	–	25	18	–	17
23	20	21	1	1	1	1	–	–	–	–	–	–	19	15	–	20
24	12	25	1	1	–	–	–	1	1	–	–	–	42	23	–	11
25	32	30	–	–	–	–	–	–	–	–	–	–	14	17½	8	10
26	20	25	1	1	–	–	–	–	1	–	–	1	28	28	18	–
27	26	23	1	1	–	–	1	1	–	–	–	–	24	28	24	–
28	17	30	1	1	–	–	1	1	–	–	–	–	–	–	32	–
29	22	21	1	–	–	–	–	–	1	–	–	–	–	–	48	–
30	19	21	1	1	–	–	–	–	1	1	–	–	38	32	8	–
31	23	21	1	1	–	–	–	–	1	1	–	–	–	–	6	–
32	14	20	1	–	–	–	–	–	1	–	–	–	–	–	32	–
33	15	30	1	–	–	–	–	–	1	–	–	–	–	–	32	–
34	28	23	1	1	–	–	–	1	–	–	1	–	24	28	–	24
35	15	23	1	1	–	–	–	–	–	–	1	–	22	11	–	19
36	42	40	1	1	–	–	–	–	–	–	–	–	25	19	15	–
37	60	–	1	1	–	–	–	–	–	–	–	–	14	17	–	50
38	23	30	1	1	–	–	–	–	–	1	1	–	22	28	–	18

TABLE III. *Continued.*

No. of Cases	Number of Days.	Age.	Right Lung.	Left Lung.	Congestion R.	Congestion L.	Red Hepat. R.	Red Hepat. L.	Gray Hepat. R.	Gray Hepat. L.	Pural. Infil. R.	Pural. Infil. L.	Weight R. Lung.	Weight L. Lung.	Effusion.	
															Right Lung.	Left Lung.
													oz.	oz.	oz.	oz
39	5	15	1	1	1	–	–	1	–	1	–	–	17	22	–	8
40	16	25	1	1	–	–	–	–	1	–	–	–	23	25	8	14
41	16	25	1	1	–	1	–	–	–	–	–	1	24	18	17	–
42	12	25	1	1	–	–	–	–	–	–	–	–	24	20	18	–
43	3	26	1	1	–	1	–	–	1	–	–	–	36	19	9	–
44	17	23	1	1	–	–	–	1	1	–	–	–	42	21	10	–
45	35	25	1	1	–	–	–	–	1	–	–	–	32	18	–	21
46	5	14	1	1	–	–	–	–	1	–	–	–	28	17	3	–
47	16	24	1	1	–	–	–	–	–	–	–	–	22	12	39	–
48	5	21	1	1	–	–	–	–	–	1	1	–	26	24	–	6
49	11	18	1	1	–	–	–	–	–	1	–	–	22	19	–	5
50	8	35	1	1	–	–	1	–	1	1	–	–	25	57	–	4

TABLE IV.

SHOWING DURATION IN FIFTY FATAL CASES OF PNEUMONIA, AND OF THIRTY-EIGHT CASES OF MEASLES.

DEATHS IN HOSPITAL, FEBRUARY, 1864.

Inflammation of Lungs.				Measles	
No. of Days Sick.	No. of Cases.	No. of Days Sick.	No. of Cases.	No. of Days Sick.	No. of Cases.
2–6	6	17	2	4–6	3
7	3	19	1	7	5
8	2	20	2	8	2
9	5	21	3	10	6
10–11	2	24–28	6	11	1
13	3	33–38	2	12	4
14	3	40	2	13, 15, 17	6
15	3	60 and 72	2	18	3
16	3			19, 20, 21–26	5
				29–40, 56	3

Total number of cases 50
Average number of days sick 17
" " " " rejecting last 3 . 13.62

Total number of cases 38
Average " of days in hospital before death 14+
Average, rejecting extreme cases . . 11.921+

TABLE V.

SHOWING THE ORDER IN WHICH THE LUNGS AND SEVERAL LOBES WERE ATTACKED, THE STAGE OF THE DISEASE IN EACH LOBE AT THE TIME OF DEATH, AND THE WEIGHT OF EACH LUNG IN FIFTY CASES AMONG COLORED TROOPS AT WILSON HOSPITAL, TENNESSEE.*

No. of Cases.	Order of attack of Right and Left Lung.		Order of attack of Lobes of Right Lung.			Stage of disease of Lobes of Right Lung.			Order of attack of Lobes of Left Lung.		Stage of disease of Lobes of Left Lung.		Weight of Right L.	Weight of Left L.	Remarks.
	R. Lung.	L. Lung.	Superior Lobe.	Middle Lobe.	Inferior Lobe.	Superior Lobe.	Middle Lobe.	Inferior Lobe.	Superior Lobe.	Inferior Lobe.	Superior Lobe.	Inferior Lobe.	oz.	oz.	
1	1	2	2	N	1	R	N	P	N	1	N	R	25	20	
2	2	1	N	N	1	N	N	C	N	1	N	P	24	26	Bronchitis.
3	1	2	1	1	1	R	R	R	N	1	N	C	23	9½	
4	1	N	1	1	1	R	R	R	N	N	N	N	16½	8½	Typhoid Fever.
5	2	1	1	1	1	C	C	C	1	2	R	C	21	24	Measles sequelæ.
6	1	-	3	2	1	R	G	P	-	-	-	-	30	11	Left Lung collapsed
7	1	2	1	1	1	R	R	R	1	1	C	C	42	22	with 24 oz. effusion.
8	1	2	1	2	N	G	C	N	N	1	N	R	34	37	Effusion R. Side 12 oz.
9	1	N	1	2	3	G	R	C	N	N	N	N	55		Pleuritis Left Side.
10	1	2	1	N	2	R	N	R	1	N	R	N	50	31	
11	1	2	1	N	2	P	N	G	1	1	C	C	36	23	
12	1	2	1	N	2	P	N	C	1	2	R	C	38½	27	
13	1	2	2	1	N	P	P	N	1	1	R	R	20	21	
14	2	1	1	1	1	R	R	R	1	1	P	P	50	24	Pleuritis Left Side.
15	1	2	N	N	1	N	N	G	2	1	R	R	43	39	
16	1	2	N	1	2	N	P	C	1	1	G	G	22½	30	
17	N	1	N	N	N	N	N	N	1	1	G	G	14½	42	
18	2	1	1	N	2	P	N	C	1	2	P	R	30	20	
19	1	2	1	N	2	P	N	R	2	1	R	G	25	24	
20	2	1	2	N	1	C	N	R	1	2	R	R	23	44	
21	2	1	2	N	1	C	N	G	N	1	N	G	21	25	
22	1	N	3	1	2	C	R	C	N	N	N	N	39	18	
23	1	2	2	3	1	G	C	P	1	1	C	C	44	23	
24	1	2	3	2	1	C	C	R	1	N	C	N	26	15	Bronchitis of L. Lung
25	1	N	2	N	1	G	N	P	N	N	N	N	30	11	Bronchitis of Left
26	1	2	3	2	1	C	P	P	1	1	C	C	27	20	Lung.
27	2	1	N	N	1	N	N	R	N	1	N	P	28	23	
28	2	1	1	N	1	C	N	C	1	2	P	G	21	49	
29	1	N	1	1	1	P	P	P	N	N	N	N	24	10	
30	1	N	3	2	1	G	G	G	N	N	N	N	49	12	
31	2	1	N	N	1	N	N	C	1	2	G	R	19	51	
32	2	1	3	2	1	R	R	P	1	1	C	C	41	18	
33	1	N	N	N	1	N	N	G	N	N	N	N	29	9	
34	1	2	N	N	1	N	N	G	1	2	C	C	35	16	
35	2	1	1	N	2	R	N	C	2	1	C	P	19	30	
36	2	1	1	1	1	R	R	R	2	1	C	G	38	40	
37	1	2	3	2	1	C	C	G	N	1	N	C	35	14	
38	1	2	1	1	1	G	G	G	1	1	C	C	43	26	
39	2	1	2	2	1	C	C	R	1	1	R	R	24	24	
40	2	1	1	1	1	C	C	C	2	1	C	R	15	28	
41	1	2	1	1	1	R	R	R	2	1	C	R	32	24⅞	
42	1	2	2	3	1	C	C	R	1	1	C	C	30	27	
43	1	2	3	2	1	G	G	P	2	1	C	R	43	24	
44	2	1	N	N	1	N	N	C	1	2	G	R	17	46½	
45	1	2	1	2	3	G	G	R	2	1	C	R	27	18⅝	
46	2	1	2	3	1	C	C	C	2	1	C	G	19⅞	27⅜	
47	1	2	2	3	1	C	C	G	1	1	C	C	35½	20	
48	2	1	1	1	1	C	C	C	1	1	R	R	23	28	
49	1	2	2	2	1	C	C	R	2	1	C	R	29	21	
50	1	2	2	2	1	G	G	P	2	1	C	G	32	31	

From the above Table it appears that the right lung was attacked first in 32 cases; the left lung in 18; superior lobe, right lung, 21; middle lobe, right lung, 14; inferior lobe, right lung, 37; three lobes simultaneously, 11; superior lobe, left lung, 24; inferior lobe, left lung, 32; both lobes simultaneously, 14. Superior lobe, right lung, in stage C, 15; R, 11; G, 9; P, 6; N, 9. Middle lobe, right lung, in stage C, 12; R, 9; G, 6; P, 4; N, 19. Inferior lobe, right lung, in stage C, 14; R, 15; G, 9; P, 9; N, 3. Superior lobe, left lung, in stage C, 19; R, 9; G, 4; P, 3; N, 14. Inferior lobe, left lung, in stage C, 13; R, 15; G, 8; P, 4; N, 9.

* Figures 1 and 2 show order of attack; letter C, congestion; R and G, red and gray hepatization; P, pus or purulent infiltration; N, normal.

TABLE VI.

SHOWING, FROM THE RECORDS OF THE HOSPITALS AT BENTON BARRACKS, ST. LOUIS, MO., THE NUMBER OF DAYS IN HOSPITAL IN CASES OF MEASLES AND INFLAMMATION OF THE LUNGS, ENDING IN RECOVERY.

DAYS IN HOSPITAL, OR NUMBER OF DAYS SICK. JANUARY, 1864

Measles.				Inflammation of Lungs.			
No. of Days Sick.	No of Cases.	No. of Days Sick.	No. of Cases.	No. of Days Sick.	No. of Cases.	No. of Days Sick.	No. of Cases.
16	8	10	12	17	4	10	19
18	3	11–20	20	18	4	11–20	21
19	3	21–30	13	19	2	21–30	15
20	4	31–43	8	20	3	31–50	7
			53				62
Average number of days sick . 18.962+				Average number of days sick . 1.7596+			
" rejecting 8 extreme cases 16.866+				" rejecting extreme cases 1.5145+			

FEBRUARY, 1864.

50	2	1	2	12–30	38	10	7
58	1	9	2			11–20	24
	18	10	2			21–30	14
	or fully	11	2			31–40	7
9–15	one half,	12	2			41–60	5
	if we re-	13	2				57
	ject the	14	3				
	extreme	15	5				
	cases.	16	1				
		20–25	7	Average number of days sick . 21.754+			
		26–34	7	" rejecting first 4 and last 5, being extreme cases . . . 20.938			
		38–58	10				
			45				
Average number of days sick . 21.466							
" rejecting last 10 cases . 15.714+							

It will be perceived by the above tables that there was great diversity in the length of time in which recovery took place, but it is believed that they give a very fair representation of all the cases of the kind referred to occurring in the hospital. In some the recovery was very rapid; in others very slow and protracted.

TREATMENT.

Diversity of opinion among surgeons.

At first there was a diversity of opinion among the surgeons on duty in the hospital respecting the proper mode of treatment of the disease. In a few instances bleeding, calomel, and antimony were employed, but the impropriety of

this plan of treatment was soon manifest, and a more general uniformity of opinion respecting the asthenic type of the disease, and the importance of tonics and stimulants in its treatment were entertained. The agents most generally used were carbonate of ammonia, senega, quinine, capsicum, alcoholic stimulants, and in the advanced stages iodide of potassium and the muriated tincture of iron, together with pretty free use of opiates to allay pain and cough. The tincture of veratrum viride and the tincture of sanguinaria were found useful in controlling vascular action. Stimulating pediluvia, sinapisms, wet and dry cups to the chest, and blisters in the advanced stages of the disease were found useful. Beef soup, milk punch, and nourishing diet were found to be of the utmost importance. Great care with faithful watching by the surgeon was of especial importance in consequence of the frequent changes in the symptoms and condition of the patient, passing, as he not unfrequently did, in a few hours, from a state of high febrile excitement to one of great prostration. Dr. J. M. Martine, who spent most of his time in his ward, passing from patient to patient, carefully noting the changes occurring, and meeting these changes by appropriate remedies, was very much more successful than other surgeons who gave less attention to their patients.

Agents generally used.

The liability to sudden, rapid, and dangerous prostration was one of the most alarming features of the disease. The surgeon, on making his morning visit, not unfrequently found a patient doing apparently well, and at his evening visit found him dead. Dr. Martine, by his faithful and constant attendance, and the free administration of stimulants during the period of prostration, saved in this condition many who probably otherwise would have died. The quantity of brandy and whisky borne by patients under such circumstances was very great, amounting sometimes to a quart a day.

Liability to sudden prostration.

I wish to speak particularly of the importance of the carbonate of ammonia given in large and frequent doses in typhoid pneumonia. It appears to me to fulfill various and frequent indications. It is a valuable diffusible stimulant; it affords a concentrated material for assimilation and nutrition; and it undoubtedly promotes the liquid state of the plastic material of the blood.

Importance of the carbonate of ammonia.

I have given some attention to the use of quinine as a prophylactic prescribed in free doses during the period of malaise, which usually precedes the attack of this disease, and I am

Quinine as a prophylactic.

satisfied that it exerts a great and controlling influence in preventing the accession of the chill with which the disease is ushered in, affording pretty good evidence, in my opinion, that malaria is an element to be taken into the account in the treatment of this disease.

GENERAL OBSERVATIONS.

The hospital at Benton Barracks afforded a good opportunity for observing the characteristics of this disease as it affected different races and classes of persons.

Classes of patients at Benton Barracks.

There were in the hospitals under my charge white and colored soldiers, contraband and white refugee women and children. Pneumonia was prevalent among them all. The attacks were not as frequent among the white soldiers, nor were they as fatal. Among the other classes mentioned little difference was observed, except the greater frequency of the disease, and greater mortality among the white refugees, consisting mostly of women, children, and old men from Arkansas, Louisiana, and West Tennessee. They were noted for their indolence, ignorance, filthiness, and inveterate consumption of tobacco. The women were particularly addicted to chewing, smoking, and dipping the pernicious weed. Among this class the disease was much more intractable and fatal than among the contrabands and colored soldiers.

Liability of the negro to pulmonary disease.

The greater liability of the negro race to pulmonary diseases than the white, is apparent when contrasted with the well-to-do in the world of the latter race; but when contrasted with the poor whites, as seen in refugee camps, the contrast is in favor of the negro.

Efficacy of treatment in cases among negroes.

It is often said — even by surgeons in charge of colored regiments — that it is of no use to "doctor" a sick negro; that he will die, do what you may. I am satisfied that no greater mistake can be committed.[1] When I hear a surgeon making such a statement, I regard it as evidence of culpable indifference and neglect. Among no class of patients have I seen better results from treatment than among colored soldiers when proper care and study has been given to their disease.

The great liability of the negro to inflammatory pulmonary dis-

[1] I had the care of seven hundred wounded negro soldiers after the battle at Nashville, and I never saw wounds do better — there was much less gangrene and pyæmia than among the wounded white soldiers. It is true, however, that the colored wounded were treated and retained near the battle-field, while the white were transported first to Nashville and then to Louisville and further north.

ease is shown by the fact that in an equal number of autopsies of whites and negroes, a very much larger porportion of the latter are found to have old pleuritic adhesions than the former. The frequency of tuberculosis is not any greater in the negro than in the white race, if I may rely upon the evidence furnished by several hundred *post-mortem* examinations of each race — a fact differing, I believe, from the commonly received opinion upon that subject.

Pleuritic adhesions, found after death, more frequent in negroes.

I have found the weight of the healthy lungs in the negro to be on an average four ounces less than in the white man, and I would suggest if this disparity in the size of the lungs may not have something to do with the inability of the negro to endure forced marches with equal facility with the white soldier, as has been frequently shown during the war.

Weight of lung less in negroes.

NOTE RESPECTING THE PREVALENCE AND FATALITY OF PNEUMONIA AND OTHER INFLAMMATORY AFFECTIONS OF THE RESPIRATORY SYSTEM, AMONG THE UNITED STATES TROOPS DURING THE WAR.

Inflammatory diseases affecting the respiratory system enter largely into military as into civil practice. Dr. Woodward, in his report, contained in Circular No. 6, War Department, Surgeon-General's Office, Nov. 1st, 1865, states that the cases of inflammatory affections of the respiratory system during the first two years of the war amounted to 304,254. Of these cases 8090 proved fatal. Inflammatory affections of the air passages were the most numerous: the cases of catarrh, epidemic catarrh, together with acute and chronic bronchitis, amounted to 248,773; and in addition to these there were 8516 cases of laryngitis. The cases reported as pleurisy numbered 15,438. The number of cases of pneumonia reported during the first two years was 31,527. As regards fatality, the deaths from pneumonia exceeded greatly those from all the other inflammatory affections of the respiratory system: the deaths from the latter were 999; whereas, of the 31,527 cases of pneumonia, 7091 were fatal. The number of cases of pneumonia to each death is 4.4. This death-rate in cases of pneumonia is much larger than is usual in civil hospitals and private practice. How is this fact to be explained? Dr. Woodward suggests explanations which doubtless in a great measure account for it. In a large proportion of cases pneumonia occurred as a sequel of measles, and abundant testimony to the mortality under these circumstances has been presented in a previous chapter. In many cases those attacked with pneumonia were affected with chronic

diarrhœa and chronic malarial poisoning; and in not a few instances it is probable that deaths were reported from pneumonia when this or some other affection of the lungs was developed in the course of the diseases embraced under the name "camp fever." The death-rate may thus be explained without reference to the treatment — the latter doubtless differing considerably, according to the different views held by army medical officers. Dr. Woodward states that the mortality from pneumonia was greater in the British army in the Crimea than during the late war in this country, the death-rate in the former having been one to every 3.6 cases. — EDITOR.

CHAPTER NINTH.

ON THE PREVALENCE AND FATALITY OF PNEUMONIA AND OF TYPHOID FEVER IN THE CONFEDERATE ARMY DURING THE WAR OF 1861-1865.

By JOSEPH JONES, M. D.,

PROFESSOR OF PHYSIOLOGY AND PATHOLOGY IN THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF NASHVILLE, TENNESSEE; FORMERLY SURGEON IN THE CONFEDERATE ARMY.

Importance of Pneumonia in view of its Prevalence and Fatality. — Table giving Mean Strength, the Total of Sick and Wounded, the Cases of Pneumonia, and the Percentage of Pneumonia in Mean Strength, etc., in the Confederate Army during Nineteen Months, 1862-63. — Analysis of this Table. — Cases most Numerous in the Winter and Spring Months. — Table illustrating the Prevalence of Pneumonia in the Armies serving in Different Sections of the Confederate States. — Cases in Virginia; in the Army of the West, etc. — Cases of, and Deaths from Pneumonia, Typhoid Fever, and other Diseases in the General Hospitals of the Army of the Potomac, Northern Virginia, and other Hospitals, during Fifteen Months, in 1862-63. — Common Continued and Typhoid Fever identical. — Percentage of Deaths from Pneumonia. — Fatality from Pneumonia and Typhoid Fever. — Fatality from other Diseases. — Cases of, and Deaths from, Typhoid Fever, Pneumonia, and some other Diseases in the General Hospitals in and around Richmond during Seven Months in 1862-63. — Cases of, and Deaths from, Pneumonia, Typhoid Fever, and several other Diseases, in the General Hospitals in Virginia. — Cases of, and Deaths from, Pneumonia, and some other Diseases, in the General Hospital at Charlottesville, Va., during Twenty-six Months, from July, 1861, to August, 1863. — Fatality in Hospitals at Savannah, of Pneumonia and Typhoid Fever. — Table showing the Numerical Relations of, Cases of, and Deaths from, Typhoid Fever and Pneumonia in the General Hospitals in Virginia and Georgia. — Progressive Diminution of the Prevalence of Typhoid Fever during the War. — Table illustrating the Numerical Relations of Pneumonia and Typhoid Fever in the Confederate Armies during Nineteen Months, 1862-63. — Cases and Deaths from all Causes, and Cases of, and Deaths from, Pneumonia and Typhoid Fever in the General Hospitals of Charlottesville and Staunton, Va.

Importance of pneumonia in view of its prevalence and fatality.

The prevalence of pneumonia in the Confederate army, and the high rate of mortality amongst the cases treated in the field and in the general hospitals, invested this disease with peculiar interest and importance; and the writer urged upon the Surgeon-General the importance of a thorough examination of the relative value of the different modes of treatment employed by the Confederate surgeons. The following pages contain facts relating to pneumonia, which were contained in a report to the Surgeon-General during the progress of the recent civil war: —

TABLE GIVING THE MEAN STRENGTH, OFFICERS AND MEN, THE TOTAL SICK AND WOUNDED, AND THE TOTAL CASES OF PNEUMONIA, AND THE PER CENT. OF PNEUMONIA IN MEAN STRENGTH, AND IN SICK AND WOUNDED IN THE CONFEDERATE ARMY DURING NINETEEN MONTHS, JANUARY, 1862, TO JULY, 1863, CONSOLIDATED FROM FIELD AND HOSPITAL REPORTS, BY JOSEPH JONES, M. D., ETC.

Month and Year.	Field Reports.						Hospital Reports.			
	Mean strength officers and men.	Total sick and wounded entered during month.	Aggregate sick and wounded during month.	Cases of Pneumonia.	Per cent. of cases of Pneumonia in mean strength.	Per cent. of cases of Pneumonia in sick and wounded during month.	Total sick entered during month.	Aggregate sick and wounded.	Cases of Pneumonia.	Per cent. of cases of Pneumonia in full, sick and wounded during month.
1862.										
January.	232,138	90,757	115,416	3,960	1.70	4.35	3,292	5,727	337	10.24
February	219,069	71,572	96,463	2,041	0.93	2.84	2,472	4,798	365	10.72
March .	165,047	50,385	63,387	1,849	1.12	3.67	2,341	3,999	408	17.00
April . .	58,304	23,243	27,559	891	0.06	3.83	2,543	6,784	540	21.23
May . .	58,690	25,985	30,491	360	0.61	1.38	9,700	14,067	656	6.76
June . .	136,362	78,583	94,487	881	0.65	1.12	16,605	26,120	812	4.89
July . .	79,999	41,700	55,997	825	1.03	1.98	18,918	28,437	491	2.59
August .	113,407	50,987	64,436	430	0.379	0.84	21,546	31,662	303	1.46
September	125,408	42,450	51,432	179	0.142	0.421	46,733	55,726	473	1.01
October .	156,734	48,605	59,841	384	0.245	0.79	39,170	53,970	465	1.18
November	270,480	71,328	90,472	2,282	0.84	3.20	44,890	50,164	2,587	5.76
December	172,800	67,461	85,769	2,985	1.72	4.42	29,032	44,282	1,811	6.23
1863.										
January	192,776	76,620	96,053	2,676	1.38	3.49	12,542	27,784	1,117	8.90
February	215,458	60,135	80,889	1,997	0.92	3.32	13,378	28,652	963	7.19
March .	313,848	92,788	117,171	2,816	0.89	3.03	12,809	24,812	1,086	8.48
April . .	190,518	60,407	74,806	1,779	0.93	2.94	14,884	26,628	1,252	8.41
May . .	163,711	49,589	63,211	1,593	0.97	3.20	41,889	57,822	1,130	2.69
June . .	107,153	33,805	43,114	267	0.249	0.79	27,389	46,702	483	1.76
July . .	72,396	20,849	24,807	77	0.106	0.37	37,073	55,708	263	0.98
Total . .	160,231	1,057,349		28,273			397,406		15,542	

Analysis of foregoing table.

From this table it appears that in the Confederate army with a mean monthly strength of 160,231 officers and men, 1,057,349 cases of disease and wounds were entered upon the field reports during a period of nineteen months (January, 1862, to July, 1863, inclusive); and of this number pneumonia constituted 28,273.

Seventeen and six tenths per cent. of the mean strength of the army, on an average, suffered with pneumonia during a period of nineteen months; and this disease constituted two and seven tenths per cent. of all cases of disease and wounds entered upon the field reports.

During this period of nineteen months, 397,406 cases of disease and wounds were entered upon the hospital reports, and of this number 15,542 were recorded as pneumonia; and this disease, therefore, constituted 3.15 per cent. of all the cases of disease and wounds entered upon the hospital reports.

The cases of pneumonia entered upon the field and hospital reports were relatively most numerous as compared to the mean strength and the total sick and wounded during the months of December, January, February, March, and April; whilst the smallest number of cases were recorded upon the field reports and transferred to the general hospitals during the months of August, September, and October. As a general rule the cases of pneumonia diminished, as the temperature became more elevated, and the vicissitudes of the season less marked. The month of July, 1862, is an apparent exception, but it will be observed that the number transferred to the general hospitals was very small, only 491, or 2.59 per cent. of all diseases and wounds; and during the same month, in 1863, the number of cases of pneumonia is smaller relatively than in any other month, being only 0.106 per cent. of the mean strength, and 0.98 per cent. of the sick and wounded transferred to the general hospital.

Cases most numerous in the winter and spring months.

The disease, therefore, would appear to depend in large measure upon seasons; or, in other words, upon the effects of exposure to cold and wet, and to marked vicissitudes of heat and moisture. The following table presents data for the investigation of the effects of elevation, geographical position and temperature upon the prevalence of pneumonia: —

TABLES ILLUSTRATING THE PREVALENCE OF PNEUMONIA IN THE ARMIES SERVING IN DIFFERENT SECTIONS OF THE CONFEDERATE STATES, GIVING MEAN STRENGTH, CASES OF WOUNDS AND DISEASES ENTERED DURING EACH MONTH, AND CASES AND DEATHS OF PNEUMONIA (THE DEATHS GIVEN ONLY WHEN THE RECORDS ARE COMPLETE). CONSOLIDATED FROM FIELD AND HOSPITAL RECORDS ON FILE IN THE SURGEON-GENERAL'S OFFICE AT RICHMOND, BY JOSEPH JONES, M. D., ETC.

Table I.

CONFEDERATE FORCES SERVING IN VIRGINIA AND NORTH CAROLINA.

Month and Year.	Field Reports.			Hospital Reports.	
	Mean Strength, Officers and Men.	Total Sick and Wounded entered during Month.	Total Cases Pneumonia.	Total Sick and Wounded entered during Month.	Total Cases Pneumonia.
1862.					
January . .	187,951	73,740	3,247	1,690	367
February . .	181,309	60,413	1,617	1,508	220
March . . .	136,970	42,027	1,516	1,302	187
April . . .	26,807	10,419	470	–	–
May	27,422	11,393	205	6,048	376
June	60,642	29,011	246	8,811	310
July	32,298	12,863	203	9,446	177
August . . .	50,390	17,349	94	17,318	231
September . .	82,406	25,037	95	33,476	165
October . . .	107,519	29,286	227	29,702	256
November . .	148,864	32,141	788	30,724	1,422
December . .	33,568	7,503	185	26,522	1,649
1863.					
January . . .	44,258	13,144	307	11,142	990
February . .	59,293	10,937	337	11,969	880
March . . .	150,362	29,710	1,094	11,051	940
April	62,089	10,264	264	12,893	1,079
May	45,196	8,903	130	33,964	856
June	41,756	9,672	68	24,318	418
July	39,432	9,355	36	32,052	220
August . . .	19,396	443,167	11,025	303,886	10,743

TABLE II.

CONFEDERATE FORCES SERVING IN SOUTH CAROLINA, GEORGIA, AND FLORIDA.

Month and Year.	Field Reports.					Hospital Reports.			
	Mean Strength Officers and Men.	Total Diseases and Wounds entered during Month.	Total Deaths from all Causes.	Pneumonia Cases.	Pneumonia Deaths.	Total Sick and Wounded.	Total Deaths.	Total Cases Pneumonia.	Pneumonia Deaths.
1862.									
January .	19,148	8,627	75	326	10	1,602	57	70	24
February .	25,262	6,746	82	272	27	965	83	145	38
March . .	25,730	7,305	78	281	25	1,039	85	221	50
April . .	28,986	11,109	78	407	–	1,726	20	287	43
May . .	26,313	11,148	55	116	14	2,168	142	164	59
June . .	28,620	10,487	104	50	2	3,643	212	111	40
July . .	22,608	9,495	70	57	10	4,492	232	61	6
August .	23,784	10,091	52	24	1	2,970	87	18	1
September	24,266	9,807	52	23	–	2,355	104	23	7
October .	25,007	9,404	57	24	1	2,131	50	10	–
November	24,710	7,202	27	47	3	1,645	36	37	4
December	20,570	5,742	14	75	3	1,350	48	58	15
1863.									
January .	19,709	4,455	19	85	7	1,400	47	127	9
February .	31,880	7,065	22	118	8	1,309	28	83	9
March . .	38,901	10,157	28	151	6	1,758	79	146	18
April . .	33,363	9,402	29	92	5	2,041	67	173	23
May . .	26,307	7,641	31	46	3	1,932	77	79	18
June . .	23,109	6,372	23	22	1	1,634	57	28	6
July . .	19,478	5,748	28	4	1	3,598	73	16	–
August .	25,670	157,313	924	2,120	127	39,750	1,584	1,862	370

TABLE III.

CONFEDERATE FORCES SERVING IN AND AROUND MOBILE, ON GULF OF MEXICO.

Month and Year.	Field and Hospital Reports.				
	Mean Strength Officers and Men.	Total Sick and Wounded entered during Month.	Total Deaths.	Pneumonia Cases.	Pneumonia Deaths.
1862.					
January . . .	8,178	2,918	96	224	39
February . .	3,431	1,048	28	37	4
March . . .	–	–	–	–	–
April	2,511	1,715	27	14	3
May	4,955	3,444	46	39	1
June	7,025	4,971	135	123	–
July	3,625	3,146	127	38	9
August . . .	9,208	5,296	158	31	7
September . .	9,425	4,929	72	11	3
October . . .	9,126	4,536	55	40	7
November . .	9,571	3,899	67	121	10
December . .	8,923	3,610	74	114	23
1863.					
January . . .	9,213	3,708	39	89	7
February . . .	9,231	2,845	41	94	10
March . . .	9,417	3,233	36	84	6
April	5,121	1,815	40	43	4
May	4,366	2,063	58	40	12
June	4,683	2,006	42	14	4
July	3,539	3,291	59	7	2
August . . .	6,752	58,453	1,201	1,163	151

Table IV.

ARMY OF THE WEST AND OF TENNESSEE SERVING IN TENNESSEE, KENTUCKY, ALABAMA, AND MISSISSIPPI.

Month and Year.	Field Reports.					Hospital Reports.			
	Mean Strength Officers and Men.	Total Sick and Wounded.	Total Deaths from all Causes.	Pneumonia Cases.	Pneumonia Deaths.	Total Sick and Wounded.	Total Deaths.	Total Cases Pneumonia.	Pneumonia Deaths.
1862.									
January .	–	–	–	–	–	–	–	–	–
February .	–	–	–	–	–	–	–	–	–
March . .	–	–	–	–	–	–	–	–	–
April . .	–	–	–	–	–	2,010	116	253	24
May . .	–	–	–	–	–	1,484	121	116	14
June . .	40,675	34,114	1,435	462	158	4,151	219	326	13
July . .	10,658	11,197	799	469	87	4,980	252	241	10
August .	30,025	18,251	455	267	49	1,258	65	42	–
September	9,311	2,677	29	53	6	10,902	586	280	62
October .	15,082	5,379	127	96	7	7,347	276	202	37
November	33,791	9,720	145	498	51	12,527	859	1,124	285
December	48,958	19,747	1,190	518	123	1,160	136	114	44
1863.									
January .	50,604	27,066	434	917	108	–	–	–	–
February .	63,494	20,800	520	1,001	150	–	–	–	–
March . .	61,226	27,728	600	1,056	144	–	–	–	–
April . .	64,441	28,169	648	977	141	–	–	–	–
May . .	55,121	21,873	481	660	67	5,993	209	195	44
June . .	–	–	–	–	–	1,437	55	37	7
July . .	–	–	–	–	–	1,423	31	27	2
August .	40,273	226,711	6,963	6,974	1,090	54,672	2,916	2,957	542

Table V.

ARMY OF THE VALLEY OF VIRGINIA, GENERAL T. J. JACKSON.

Month and Year.	Field and Hospital Reports.				
	Mean Strength Officers and Men.	Total Sick and Wounded entered during Month.	Total Deaths.	Pneumonia Cases.	Pneumonia Deaths.
1862.					
January . . .	9,278	4,956	63	284	26
February . .	8,193	2,594	22	241	9
March . . .	7,418	1,389	75	38	3
April	9,554	2,014	6	37	–
May	16,731	4,856	100	81	2
June	18,099	8,741	216	83	6
July	15,589	7,613	119	155	4
August . . .	15,643	6,423	237	31	–
September . .	21,123	5,949	298	10	–
October . . .	34,200	8,663	31	74	–
November . .	–	–	–	–	–
December . .	–	–	–	–	–
1863.					
January . . .	–	–	–	–	–
February . .	–	–	–	–	–
March. . . .	–	–	–	–	–
April	–	–	–	–	–
May	–	–	–	–	–
June	–	–	–	–	–
July	–	–	–	–	–
August . . .	15,582	53,198	1,167	1,034	50

In the Confederate forces serving in Virginia (chiefly in this State) and North Carolina, with a monthly mean strength of 79,396, during a period of nineteen months, 443,167 cases of disease and wounds were entered upon the field reports, and of this number pneumonia constituted 11,025; that is, on an average during this period, 13.88 per cent. of the mean strength was affected with pneumonia, and this disease constituted 2.48 per cent. of all cases entered upon the field reports. During the same period 303,886 sick and wounded were entered upon the hospital reports, and of this number, 10,743, or 3.53 per cent. were recorded as pneumonia. Cases in Virginia.

In the army of the West, afterwards called the army of Tennessee, which operated chiefly in the elevated regions of Tennessee, Kentucky, Alabama, and Mississippi, with a monthly mean strength of 40,273 during a period of twelve months, 226,721 cases of disease and wounds were entered upon the field reports (some of the hospital reports appear to have been lost), and of this number, pneumonia constituted 6974; that is, on an average during this period, extending from the 1st of June, 1862, to the 31st of May, 1863, 17.31 per cent. of the mean strength were attacked by pneumonia, and this disease constituted 3.07 per cent. of all cases entered upon the field reports; during the period of twelve months (April 1st to October 31st; May 1st to July 31st), in the hospitals of the West, located in Tennessee, Upper Georgia, and Alabama, 54,672 sick and wounded were entered upon the reports, and of this number 2957, or 5.43 per cent., were recorded as pneumonia. Cases in the army of the West.

The proportion of cases of pneumonia appears, therefore, to have been greater in the elevated regions of the West, than in Virginia. It is probable that the modifying effects of the ocean upon the climate of Virginia, was the chief cause of this difference. On the other hand, in an army of 25,670 men (average monthly strength), serving along the low hot coast of South Carolina, Georgia, and Florida, during a period of nineteen months, only 8.25 per cent. of the entire command (mean strength) were attacked by pneumonia; and this disease constituted only 1.35 per cent. of the total number of diseases and wounds entered upon the field reports. Cases more numerous in the West than in Virginia.

The percentage of the mean strength attacked upon the Gulf coast, was somewhat higher even than in the army of Tennessee; the ratio of the cases of pneumonia being 17.22 per cent. of the monthly mean strength. It is to be observed, Cases on the Gulf coast.

however, that the force serving in and around Mobile, on the Gulf coast, was comparatively small, being only 6752 officers and men, and the statistics embrace both the field and hospital reports. This confusion, therefore, of the field and general hospital reports renders it impossible to institute a just comparison with the armies of Virginia, Tennessee, and South Carolina and Georgia. It appears, also, that the troops on the Gulf coast were subjected to a more moist and malarious climate than the mass of the troops serving in South Carolina, Georgia, and Florida. A large portion of the troops serving along the Atlantic coast, in the latter department, were encamped in dry, sandy, pine-barren, healthy locations, which, although elevated but a few feet above the level of the ocean, are, nevertheless, remarkably free from diseases of the pulmonary organs of a serious character.

It appears, therefore, from these statistics, that pneumonia prevailed to the greatest extent in the more elevated and northern regions of the Southern Confederacy, and in the armies which were subjected to the severest labors, privations, and exposures.

Pneumonia the most fatal of diseases.

Pneumonia not only prevailed to a considerable extent amongst the Confederate troops, but it was also one of the most fatal of diseases.

Fatality in South Carolina, Georgia, and Florida.

Thus in a command with a monthly mean strength of 25,670 men, serving in the department of South Carolina, Georgia, and Florida, during a period of nineteen months (January, 1862–July, 1863), 2220 cases of pneumonia, with 127 deaths, were entered upon the field reports, and 1786 cases, with 370 deaths upon the hospital reports. As the cases were, in most instances, first entered upon the field reports, and then transferred to the general hospitals, we will approximate more nearly to the truth, by assuming that the 2220 cases of pneumonia, entered upon the field reports, include those also transferred to the general hospitals, and the mortality of the cases treated in general hospitals, should be added to the mortality of the cases treated in the field; thus giving a mortality of 497 in 2220 cases of pneumonia. According to this calculation, 22.3 per cent. of the cases of pneumonia terminated fatally, or one death occurred in 4.4 cases.

Fatality on the Gulf of Mexico.

In the Confederate army serving on the Gulf of Mexico, in and around Mobile, with a mean monthly strength of 6752, the cases of pneumonia numbered 1161, and the deaths from this disease 151, during a period of eighteen months; or one death in 7.6 cases of pneumonia.

In the army of Tennessee, during a period of fourteen months,

827 cases of pneumonia were recorded, with 1291 deaths; the ratio of deaths, from this disease, being 15.5 per cent., or one death in 6.4 cases. The hospital reports gave a still higher mortality, namely, 18.2 per cent., or one death in 5.4 cases.

Fatality in Tennessee.

Upon the field reports of General T. J. (Stonewall) Jackson's army, serving in the Valley of Virginia, during a period of ten months, with an average monthly mean strength of 15,562 officers and men, 1034 cases of pneumonia were reported. During this short period, 6.6 per cent. of the mean strength were affected with this disease. The number of deaths entered upon the field reports of General "Stonewall" Jackson's army, was only 50, or 4.8 per cent. of the cases. The returns of deaths were incomplete; it was also true, that the cases of pneumonia in this active and fighting army were in most cases transferred to the general hospitals, and chiefly to the large general hospital at Staunton. The statistics of the Staunton General Hospital furnish the most correct data for an estimate of the mortality of pneumonia amongst the forces serving in the Valley of Virginia, throughout the war, under Generals Jackson and Early. During a period of forty-four months (July, 1861–February, 1865), in the General Hospital at Staunton, Virginia, 833 cases of pneumonia were treated, with 191 deaths. In this large and well-conducted hospital 22.9 per cent. (or one death in 4.3 cases) of the cases of pneumonia terminated fatally. A portion of this mortality, as well as of the mortality in typhoid fever and gunshot wounds, was attributable to the previous exposures and fatigue of the sick in transportation from a distance, during the active operations of the Confederate forces.

Cases in the Valley of Virginia.

The statistics of the general hospitals of Virginia, exclusive of the hospitals in and around Richmond, possess great interest, as furnishing the most reliable data for the determination of the rate of mortality in pneumonia. During a period of fourteen months 4864 cases of pneumonia were entered upon these hospital reports, with a mortality of 1261; the ratio of deaths amongst this large number of cases of pneumonia, treated in some of the largest and best conducted hospitals in the Southern Confederacy, was 25.9 per cent., or one death in 3.8 cases.

Statistics of the Virginia general hospitals.

The following statistics will serve to illustrate the relative mortality from pneumonia, and several of the more important diseases in Confederate hospitals.

Fatality from pneumonia, typhoid fever, and other diseases in Confederate hospitals.

CASES AND DEATHS FROM PNEUMONIA, TYPHOID FEVER, AND OTHER DISEASES, IN THE GENERAL HOSPITALS OF THE ARMY OF THE POTOMAC AND NORTHERN VIRGINIA, FORMERLY UNDER THE SUPERVISION OF SURGEON J. H. WILLIAMS, MEDICAL DIRECTOR, INCLUDING THE CONFEDERATE HOSPITALS AT MANASSAS JUNCTION, FRONT ROYAL, WARRENTON, WARM SPRINGS, MD., JACKSON, LEESBURG, CULPEPPER COURT-HOUSE, ORANGE COURT-HOUSE, GORDONSVILLE, CHARLOTTESVILLE, CHARLOTTE, DANVILLE, FARMVILLE, LIBERTY, STANDARDSVILLE, PETERSBURG, AND STAUNTON, DURING A PERIOD OF FIFTEEN MONTHS, JANUARY, 1862, TO MARCH, 1863, CONSOLIDATED FROM ORIGINAL REPORTS ON FILE IN THE SURGEON-GENERAL'S OFFICE IN RICHMOND, VA., BY JOSEPH JONES, M. D., ETC.

Month and Year.	Typhoid Fever.		Common Continued Fever.		Remittent Fever.		Congestive Fever.		Intermittent Fever.		Measles.		Diarrhœa and Dysentery.		Pneumonia.		Gunshot Wounds.		Total from all Diseases and Causes during month.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1862.																				
January . . .	168	70	45	–	88	2	2	1	40	–	19	1	130	7	367	127	19	6	4,011*	244
February . . .	168	34	11	–	49	–	–	–	47	–	2	–	250	6	220	79	17	1	1,508	144
March	89	40	10	–	26	–	–	–	47	–	4	–	263	1	187	59	30	–	1,302	122
April	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
May	239	93	83	–	84	–	–	–	228	–	453	24	994	26	376	128	157	2	6,048	326
June	369	109	125	–	279	3	2	2	384	–	593	36	1,919	59	310	74	795	26	8,811	405
July	693	256	190	–	797	–	1	–	410	–	183	7	1,769	75	177	48	966	24	9,446	556
August . . .	852	332	184	–	1,296	29	5	–	1,440	–	167	4	2,304	66	231	17	1,431	59	17,318	635
September . .	461	136	196	–	399	6	3	–	474	–	186	11	1,692	65	69	10	956	238	18,055	560
October . . .	407	102	123	–	198	9	6	–	360	–	89	5	906	68	68	16	1,880	84	8,255	378
November . .	376	156	96	–	220	2	6	–	988	–	113	3	1,808	57	816	153	840	23	14,131	510
December . .	159	80	54	–	114	–	3	–	325	–	57	–	707	45	581	156	1,400	21	8,113	451
1863.																				
January . . .	218	93	106	–	92	3	1	–	247	–	50	2	596	40	438	182	511	14	5,557	479
February . . .	244	60	144	–	87	2	2	–	243	–	40	3	450	49	419	113	345	4	4,792	380
March	306	58	129	–	91	–	17	4	179	–	60	6	692	23	515	99	449	14	5,567	326
Totals . . .	4,749	1,619	1,496	–	3,820	56				–			14,470	587	4,774	1,261	9,796	516	113,914	5,516

* This number (4011) represents the aggregate number of cases treated in the hospitals during this month. The number received during January, was 1691, and the number remaining from December, 1861, 2320.

From the preceding table we gather that during this period of fifteen months, one hundred and thirteen thousand nine hundred and fourteen (113,914) cases of various diseases and gunshot wounds were treated in the hospitals of Virginia, exclusive of the hospitals in and around Richmond; out of this number of cases, five thousand five hundred and sixteen (5516) proved fatal. Analysis of foregoing table.

The ratio of deaths from all causes to the entire number of cases treated was 4.85 per cent., or one death in every 20.65 cases.

The deaths from common continued fever are here included under the head of typhoid fever. After a careful examination of many cases registered as common continued fever, and after conferences upon this subject with numerous surgeons in Virginia, I have been convinced that the great majority of the cases reported as common continued fever are nothing more than cases of typhoid fever. As the cases recorded as common continued fever amount to near one third the number of typhoid fever, and as the vast majority of the former should have been classed as the latter, the most accurate calculation is that which combines the two classes together. The ratio of deaths to the cases of typhoid fever and common continued fever was 25.92 per cent., or one death from typhoid and common continued fever in 3.85 cases. The ratio of deaths from typhoid and common continued fever, to the entire number of deaths from all causes, is 29.35 per cent., or one death from these diseases in 3.4 deaths from all causes. Whilst on the other hand the ratio of cases of typhoid and common continued fever to the entire number of cases treated is 5.48 per cent., or one case of these diseases in 18.25 cases of all diseases. Common continued and typhoid fever identical.

A fraction more than one fourth the cases of pneumonia terminated fatally, or more exactly 22.86 per cent., or one death in 3.78 cases of pneumonia. The ratio of the deaths from pneumonia, to the deaths from all causes, was 22.86 per cent., or one death from pneumonia in every 4.37 deaths from all causes; whilst on the other hand the cases of pneumonia amounted to only 4.16 per cent. of the entire number of cases. Percentage of deaths from pneumonia.

Typhoid fever, common continued fever, and pneumonia together, caused two thousand eight hundred and eighty deaths, out of five thousand five hundred and sixteen deaths from all diseases; that is, a little more than one half the deaths from all causes were due to typhoid fever and pneumonia, or more exactly 52.39 per cent. Fatality from pneumonia and typhoid fever.

Fatality from other diseases.

12.7 per cent. of the cases were classed under the head of chronic and acute diarrhœa and dysentery, whilst the mortality from these diseases was 4.05 per cent. of the cases of diarrhœa and dysentery, and 10.51 per cent. of the entire number of deaths from all causes.

Only one case out of 11.6 of all diseases was due directly to the casualties of war; that is, the cases of gunshot wounds were only 8.59 per cent. of the entire number of cases. The mortality from gunshot wounds was a little less than one tenth of the entire number of deaths from all causes, or more exactly 9.35 per cent., or one death from gunshot wounds in every 10.69 deaths.

Analysis of table on opposite page.

The ratio of deaths from all causes to the entire number of cases treated in the hospitals in and around Richmond, Va., during a period of seven months, September, 1862, to March, 1863, was 4.11 per cent., or one death in 24.37 cases.

The record of the deaths, during several months, was incomplete. In this table, as in the preceding and succeeding tables, I determined the number of deaths from various diseases from the long rolls in which the name of the deceased soldier, together with the disease causing death, was recorded, without any classification as to the disease. In several of the monthly reports, large portions of these rolls were absent from the consolidated medical directors' reports. The labor necessary to the classification of the diseases causing several thousand deaths was very great. In this table, as in the previous one, the deaths from common continued fever are included under the head of typhoid fever. During six months, September, October, November, 1862, January, February, and March, 1863, two thousand seven hundred and forty-eight (2748) cases were recorded of typhoid and common continued fever, and during the same period seven hundred and twenty-three deaths from these diseases. Therefore more than one fourth, or 26.31 per cent. of the cases of typhoid fever, terminated fatally; that is, one case of typhoid and common continued fever proved fatal in 3.8 cases. During this period of six months the deaths from these diseases constituted 24.94 per cent. of the deaths from all causes; that is, one eighth of the entire deaths were caused by typhoid and common continued fever (one death from typhoid and common continued fever in eight deaths from all causes).

During four months, September, 1862, January, February, and March, 1863, one thousand five hundred and twenty-seven cases of pneumonia were entered, with four hundred and five deaths.

CASES AND DEATHS FROM TYPHOID FEVER, PNEUMONIA, AND SOME OTHER DISEASES, IN THE GENERAL HOSPITALS IN AND AROUND RICHMOND, VIRGINIA, SEPTEMBER, 1862, TO MARCH, 1863, A PERIOD OF SEVEN MONTHS. CONSOLIDATED FROM ORIGINAL REPORTS IN OFFICE OF SURGEON-GENERAL S. P. MOORE, RICHMOND, VIRGINIA, BY JOSEPH JONES, M. D., ETC.

Month and Year.	Typhoid Fever.		Common Continued Fever.		Remittent Fever.		Congestive Fever.		Intermittent Fever.		Measles.		Diarrhœa and Dysentery.		Pneumonia.		Gunshot Wounds.		Total from all Diseases and Causes entered during month.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1862.																				
September . . .	775	240	105	–	299	–	7	–	601	–	234	–	2,501	–	89	20	773	†	24,771*	535
October	674	127	111	–	261	–	–	–	759	–	274	–	2,419	–	172	†	2,924	†	20,199	340
November . . .	380	123	83	–	183	–	4	–	469	–	230	–	1,361	–	457	†	845	†	14,990	448
December . . .	330	†	56	–	150	–	3	–	240	–	80	–	853	–	869	†	3,110	†	15,546	954
1863.																				
January	203	77	26	–	48	2	3	–	96	–	88	3	327	19	552	248	632	27	5,585	787
February . . .	161	57	61	–	46	–	1	–	156	–	52	3	652	23	461	91	480	14	7,177	390
March	101	99	68	–	54	1	2	3	168	–	76	4	624	32	425	46	224	10	5,484	395
Totals . . .	2,624	733	510	–	1,041	3	20	3	2,489	–	1,034	10	8,737		3,025	405	8,988		93,852	3,849

* This number represents the aggregate for September; number received during the month, 13,113; number remaining from August, 11,658.

† Record of deaths incomplete.

During this period the ratio of deaths from pneumonia to the entire number of deaths from all causes was 19.22 per cent., or one death from pneumonia in 5.42 deaths from all causes; whilst on the other hand, the cases of pneumonia during these four months were only 3.54 per cent. of the entire number of cases treated during this period.

During four months, September, 1862, January, February, and March, 1863, typhoid fever, common continued fever, and pneumonia caused 41.67 per cent. of all the deaths from all causes.

It is important to note that the hospitals in and around Richmond were, to a considerable extent, supplied with convalescent patients.

Analysis of table on opposite page.

During four months, April, May, June, and July, 1863, one hundred and eight thousand one hundred and sixty-five (108,165) cases were treated in the general hospitals in Virginia, including those in and around Richmond; and the number of deaths during this period was two thousand seven hundred and five (2705). The ratio of deaths from all causes, to the entire number of cases treated, was 2.5 per cent.; that is, one death in 39.98 cases.

The ratio of deaths from typhoid and common continued fever to the entire number of cases of these diseases, was 17.77 per cent., or one death from these diseases in 5.62 cases. The deaths from typhoid and common continued fever constituted 18.82 per cent. of the entire number of deaths from all causes; whilst the cases of typhoid and common continued fever formed only 2.64 per cent. of the entire number of cases of all diseases.

24.14 per cent. of the cases of pneumonia terminated fatally, or one death in 4.05 cases of pneumonia.

21.29 per cent. of the deaths from all causes were due to pneumonia; whilst, on the other hand, this disease formed only 2.16 per cent. of the entire number of cases of all diseases.

Pneumonia and typhoid fever, and common continued fever, together, caused 40.11 per cent. of the entire number of deaths from all causes, these diseases included; or one death from these diseases occurred in 2.49 deaths from all causes; whilst, on the other hand, the cases of pneumonia, typhoid, and common continued fever, constituted only 4.81 per cent. of the entire number of cases treated.

If the statistics of individual hospitals be examined, similar results will be obtained. We have selected the records of the Gen-

CASES OF, AND DEATHS FROM, PNEUMONIA, TYPHOID FEVER, AND SEVERAL OTHER DISEASES, IN THE GENERAL HOSPITALS IN VIRGINIA, INCLUDING THOSE IN AND AROUND RICHMOND, VA., UNDER THE SUPERVISION OF SURGEON WILLIAM A. CARRINGTON, MEDICAL DIRECTOR. CLASSIFIED AND CONSOLIDATED FROM MONTHLY REPORTS, BY JOSEPH JONES, M. D. ETC.

Month and Year.	Typhoid Fever.		Common Continued Fever.		Remittent Fever.		Congestive Fever.		Intermittent Fever.		Measles.		Diarrhœa and Dysentery.		Pneumonia.		Gunshot Wounds.		Total from all Diseases and Causes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1863.																				
April	350	110	71	–	248	–	4	–	382	–	80	–	1,261	–	951	264	1,096	–	20,784*	694
May	589	134	221	–	350	–	6	–	804	–	132	–	3,488	–	767	180	9,722	–	32,112	890
June	471	200	418	–	910	–	–	–	1,223	–	91	–	4,990	–	406	104	2,660	–	23,217	692
July	522	65	221	–	458	–	8	–	834	–	48	–	4,019	–	220	28	11,334	–	32,052	429
Totals . . .	1,932	509	931	–	1,966	–	18	–	3,143	–		–		–	2,344	576		–	108,165	2,705

* This number represents the aggregate for April, and includes the number received during this month, 10,870, and the number remaining from last report, 9918.

eral Hospital at Charlottesville, because they date from an early period of the war, and have been accumulated under the able administration of intelligent surgeons, and has drawn its patients directly from the largest army in the Confederacy.

Analysis of table on opposite page.

In the General Hospital of Charlottesville, Va., a small fraction less than one fourth the cases of typhoid fever, or one in 4.15 cases (24.05 per cent.), terminated fatally. The ratio of the cases of typhoid fever, to the entire number of cases from all causes, was 8.66 per cent., or one case of typhoid fever in 11.54 cases of all diseases; whilst the deaths from typhoid fever were more than one third of the entire number from all causes, or, more exactly, one death from typhoid fever in 2.78 deaths, thus giving a ratio of 35.94 per cent. of deaths from typhoid fever. On the other hand, the ratio of deaths from all causes to the entire number of cases treated, was 5.79 per cent., or one death in 17.24 cases of all diseases treated.

Nearly one third, or, more exactly, 31.9 per cent. of the cases of pneumonia terminated fatally, that is, one death occurred in every 3.12 cases of pneumonia. The ratio of deaths from pneumonia, to the entire number of deaths from all causes, was 23.84 per cent., or one death from pneumonia in 4.17 deaths from all causes, pneumonia included. On the other hand, the cases of pneumonia were less than one twenty-third of the entire number of cases (4.32 per cent.), or, more plainly, one case of pneumonia in 23.13 cases of all diseases, pneumonia included.

Typhoid fever and pneumonia, together, caused 519 deaths out of 868 deaths from all causes, these diseases included. That is, typhoid fever and pneumonia caused more than one half, or 59.9 per cent. of the deaths from all causes, gunshot wounds included; or, one death from pneumonia and typhoid fever occurred in every 1.67 deaths. On the other hand, the cases of pneumonia and typhoid fever, were only 12.98 per cent. of the entire cases. And the ratio of deaths from all causes, to the entire number of cases, was 5.79 per cent., or one death in 17.24 cases of all diseases treated.

Typhoid fever most prevalent in summer and autumn.

The largest number of cases of typhoid fever occurred in July, August, September, and October, 1861, and during the first thirteen months (July, 1861–July, 1863, inclusive), 1094 cases of typhoid fever entered the hospital, whilst during the last thirteen months (August, 1862–August, 1863, inclusive), only about one fifth the number of cases of typhoid fever

CASES OF, AND DEATHS FROM, PNEUMONIA, TYPHOID FEVER, AND SOME OTHER DISEASES, IN THE GENERAL HOSPITAL, CHARLOTTESVILLE, VA., DURING TWENTY-SIX MONTHS, JULY, 1861, TO AUGUST, 1863. CONSOLIDATED FROM THE OFFICIAL MONTHLY REPORTS, BY JOSEPH JONES, M. D., ETC.

Month and Year.	Typhoid Fever.		Common Continued Fever.		Remittent Fever.		Congestive Fever.		Intermittent Fever.		Measles.		Diarrhœa and Dysentery.		Pneumonia.		Gunshot Wounds.		Total Diseases and Wounds entered during Month.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1861.																				
July	284	75	–	–	35	–	1	–	53	–	656	8	178	6	48	18	300	35	2,608	147
August	74	46	–	–	7	–	–	–	–	–	116	4	16	3	6	10	6	21	329	87
September	150	24	–	–	18	–	1	–	27	–	104	–	43	–	12	2	9	6	511	32
October	195	27	–	–	21	–	–	–	31	–	51	–	31	–	14	2	15	–	556	33
November	100	15	–	–	14	–	–	–	12	–	22	2	31	–	41	7	–	–	448	31
December	63	6	–	–	8	–	1	–	9	–	7	–	19	1	22	3	7	–	329	12
1862.																				
January	30	4	–	–	3	–	–	–	5	–	–	–	18	1	24	15	2	–	226	21
February	34	5	–	–	6	–	–	–	2	–	1	–	66	–	21	–	1	–	300	6
March	14	1	–	–	3	–	–	–	13	–	1	–	56	–	21	4	2	–	290	9
April	60	8	–	–	4	–	–	–	22	–	48	1	61	2	80	25	3	–	539	44
May	32	20	1	1	1	–	–	–	12	–	20	–	67	3	35	36	16	–	429	67
June	23	13	–	–	6	–	–	–	13	–	14	–	95	–	20	12	266	12	754	53
July	33	11	–	–	10	–	–	–	6	–	–	–	73	–	9	3	41	7	337	26
August	19	10	–	–	4	–	–	–	6	–	–	–	45	2	2	–	380	21	682	35
September	7	2	–	–	2	–	–	–	–	–	1	–	9	–	1	–	764	18	886	23
October	5	3	–	–	3	–	–	–	4	–	1	–	12	1	1	1	56	3	340	11
November	21	7	–	–	2	–	–	–	46	–	8	–	54	2	38	15	46	2	916	32
December	21	7	1	–	6	–	–	–	8	–	2	–	45	3	118	27	158	8	993	54
1863.																				
January	16	4	–	–	3	–	–	–	10	–	1	–	42	4	49	11	42	7	601	41
February	12	5	1	–	2	–	–	–	8	–	2	–	35	3	23	7	24	3	312	26
March	6	2	2	–	–	–	–	–	4	–	–	–	27	1	15	6	31	4	198	17
April	3	3	1	–	–	–	–	–	4	–	–	–	21	–	6	8	14	1	124	14
May	15	5	1	–	11	–	–	–	18	–	1	–	115	1	14	2	66	1	572	11
June	14	3	–	–	11	–	–	–	14	–	2	–	100	1	13	2	77	1	417	8
July	11	1	3	–	8	–	–	–	13	–	–	–	49	2	6	–	444	4	821	7
August	55	5	5	–	30	–	–	–	13	–	2	–	51	4	8	1	93	1	449	11
Totals	1,297	312	15	1	118	–	3	–	–	–	1,060	15	–	–	647	207	2,843	153	14,966	868

entered, or, more exactly, 203 cases. During the first thirteen months, 253 deaths from typhoid fever occurred; whilst during the last thirteen months only 60 deaths, or not quite one fourth the number of the first thirteen months. During the first thirteen months, 1040 cases of measles were entered; whilst during the last thirteen months, only 20 cases of measles were recorded. This disease, therefore, like typhoid fever, decreased as the war advanced. As a general rule, mankind are afflicted with these diseases but once during a lifetime, and during this war both diseases appear to have been intimately connected in their origin and spread with the crowding together of the soldiers; whilst they are, without doubt, due to distinct and wholly different poisons, still they have in this war been associated, to a certain extent, in the time and circumstances of their origin and diffusion. We observe no such law governing pneumonia. This disease was most abundant during the cold, wet, and changeable weather of winter and spring, and there was no marked diminution of the disease as the war progressed, beyond that incident to the hardening and strengthening of the troops under exposure and fatigue.

The cases of gunshot wounds were 18.99 per cent. of the entire number of cases; and the deaths from gunshot wounds were 17.62 per cent. of the entire number of deaths, or, 5.44 per cent. of the entire number of cases of gunshot wounds treated.

Size and character of hospital at Charlottesville.

In instituting comparison between the statistics of the General Hospital of Charlottesville, and those of other portions of the Confederate States, it should be borne in mind, that the General Hospital of Charlottesville was one of the nearest hospitals to the largest and most active army in the Southern Confederacy. The severest cases of disease were, as a general rule, left at this and other hospitals nearest to the scene of active service; whilst the mildest cases were forwarded to the more distant hospitals. It results from these facts, that, all things being equal, as to treatment, nourishment, and hygiene, the mortality in a hospital thus situated and supplied with patients must necessarily be heavier than in hospitals connected with armies much smaller and comparatively at rest, where large numbers of the severe cases were treated in the field hospitals.

Fatality in hospitals at Savannah, of pneumonia and typhoid fever.

As high as the preceding rates of mortality in pneumonia and typhoid fever may appear, they are not as high as in some others of the Confederate hospitals. Thus, in the two general hospitals of Savannah, Ga., Nos. 1 and 2, the ratio of mortality in these diseases was extraordi-

narily high. And we are at a loss to account for this high death-rate, from the fact that these hospitals were connected with a comparatively small and inactive army. As the troops serving in and around Savannah were greatly exposed to the influence of malaria, this depressing agent may have influenced, to a certain extent, the death-rate.

In General Hospital No. 1, Savannah, Ga., during a period of twenty-five months (December, 1861—December, 1863, inclusive), 178 cases of typhoid fever were recorded, with 91 deaths. In this hospital, therefore, more than one half proved fatal. The percentage of deaths in the cases of typhoid fever was 51.12; that is, one death occurred in 1.95 cases. Between one third and one fourth of the entire deaths from all causes were from typhoid fever, or, more exactly, one death from typhoid fever occurred in every 3.65 deaths; the deaths from typhoid fever were 27 per cent. of the entire deaths from all causes. On the other hand, the cases of typhoid fever were a little less than two and a half per cent. of the entire number of cases of all diseases; or, more exactly, 2.48 per cent. of the entire number; or, the ratio of cases of typhoid fever was as 1 to 40.

In the cases of pneumonia, a little over one third, or one in 3.18, or 31.35 per cent. proved fatal. More than one third of the entire deaths, from all diseases, were caused by pneumonia; or, one death from pneumonia occurred in every 2.87 deaths, giving 34.83 per cent. of deaths from pneumonia. On the other hand, only a little over five per cent. (5.17 per cent.) of the cases entered upon the sick reports were recorded as pneumonia, giving a ratio of one case of pneumonia to 19.32 cases.

Pneumonia and typhoid fever, together, caused 207 deaths out of 333, the entire number; that is, these two diseases alone occasioned nearly two thirds of the entire number of deaths from all causes; or, more exactly, one death in every 1.6 deaths, or 62 per cent. of deaths. Whilst on the other hand, these diseases constituted only 7.65 per cent. of the entire number of cases.

Fewer cases of typhoid fever were received in 1863 than in 1862; thus in the former year, 74 were entered, whilst in the latter, the sum was about one third greater, or 100.

In General Hospital No. 2, Savannah, Ga., during nineteen months (June, 1862 — December, 1863), a small fraction over one fourth of the cases of typhoid fever proved fatal; that is, one death occurred in every 3.918 cases, giving 25.5 as the percentage of deaths in the cases of typhoid fever. Of the total number of

deaths, between one third and one fourth were from typhoid fever, or, more exactly, one death from typhoid fever in 3.378 deaths from all causes; thus yielding a ratio of deaths from typhoid fever, to the deaths from all causes, of 29.6 per cent. On the other hand, the ratio of cases of typhoid fever to the entire number of cases treated of all diseases was only 4.26 per cent., or between one twenty-third and one twenty-fourth of the entire number of cases (one case of typhoid fever occurred in every 23.4 cases of all diseases); and the ratio of deaths from all causes, to the entire number of cases, was 3.67 per cent.

A little less than one fourth the cases of pneumonia (or one in 4.32 cases, 23.14 per cent.) terminated fatally. One fifth of the deaths from all causes, were due to pneumonia, whilst the ratio of cases of pneumonia to the entire number from all diseases was only 3.174 per cent.

Pneumonia and typhoid fever together, caused 62 deaths out of 125, or very nearly one half the entire number of deaths from all causes; whilst the ratio of cases of pneumonia and typhoid fever to the entire number of cases of all diseases was only 4.49 per cent.

Twenty-nine deaths, or nearly one fourth of the entire number of deaths, were attributed to remittent and congestive fever, in Hospital No. 2, Savannah, Ga. From June, 1862, to December, 1862 (six months), 13 deaths from remittent fever were recorded, out of only 141 cases treated; that is, nearly one tenth of the cases of remittent fever during this period proved fatal. In view of the present enlightened and successful mode of treatment in this disease, this is certainly a remarkable ratio of mortality.

The statistics might be greatly extended, but they are sufficient for comparative purposes. The following tables will furnish the necessary data for comparison with the records of other hospitals: —

TABLES SHOWING THE NUMERICAL RELATIONS OF THE CASES AND DEATHS BY TYPHOID AND COMMON CONTINUED FEVER AND PNEUMONIA, IN THE GENERAL HOSPITALS IN VIRGINIA, AND IN SEVERAL HOSPITALS IN GEORGIA, DURING A PORTION OF THE WAR OF 1861–1865. CONSOLIDATED AND CALCULATED FROM THE OFFICIAL RECORDS ON FILE IN THE OFFICE OF SURGEON-GENERAL S. P. MOORE. BY JOSEPH JONES, M. D., ETC.

TABLE I.

CASES AND DEATHS FROM ALL DISEASES AND CAUSES.

NAME OF HOSPITAL.	DATES AND LENGTH OF TIME OF STATISTICS.	Total Sick and Wounded treated during this period.	Total Deaths from all Causes.	Per cent. of Deaths in Cases.	One death in —— Cases of all Diseases and Wounds.
General Hospitals in Virginia, out of Richmond	Jan. 1862—Feb. 1863, (15 months)	113,914	5,516	4.84	20.65
General Hospitals in Virginia, in Richmond	Sept. 1862—April, 1863, (7 months)	93,852	3,849	4.11	24.37
General Hospitals in Virginia	April, 1863—Aug. 1863, (4 months)	108,165	2,705	2.5	39.98
General Hospital of Charlottesville, Va.	July, 1861—Sept. 1863, (26 months)	14,966	868	5.7	17.19
General Hospital No. 1, Savannah, Ga.	Dec. 1861—Jan. 1864, (25 months)	7,149	333	4.65	21.46
General Hospital No. 2, Savannah, Ga.	June, 1862—Jan. 1864, (18 months)	3,402	125	3.67	27.21
Guyton Hospital, near Savannah, Ga.	May, 1862—Jan. 1864, (20 months)	2,695	46	1.70	58.58

TABLE II.

CASES AND DEATHS FROM TYPHOID FEVER AND COMMON CONTINUED FEVER.

NAME OF HOSPITAL.	DATES AND LENGTH OF TIME OF STATISTICS.	Total Cases of Typhoid and Common Continued Fever.	Total Deaths from Typhoid and Common Continued Fever.	Per cent. of Deaths in Cases of Typhoid and Common Continued Fever.	One Death in —— Cases of Typhoid and Common Continued Fever.	Per cent. of Cases of Typhoid and C. C. Fever in Total Cases.	One Case of Typhoid and C. C. Fever in —— Cases of all Diseases and Wounds.	Per cent. of Deaths from Typhoid and C. C. Fever in —— Deaths from all Causes.	One Death from Typhoid and C. C. Fever in —— Deaths from all Causes.
General Hospitals in Virginia, out of Richmond	January, 1862—February, 1863, (15 months)	6,245	1,619	25.92	3.85	5.48	18.25	29.35	3.4
General Hospitals in Virginia, in Richmond	September, 1862—April, 1863, (7 months)	–	–	26.31	3.8	3.50	27.27	24.94	8.
General Hospitals in Virginia	April, 1863 — August, 1863, (4 months)	2,863	509	17.77	5.62	2.64	37.9	18.82	5.31
General Hospital of Charlottesville, Va.	July, 1861—September, 1863, (26 months)	1,312	313	23.8	4.19	8.77	11.4	36.05	2.77
General Hospital No. 1, Savannah, Ga.	December, 1861—January, 1864, (25 months)	204	93	45.58	2.19	2.85	35.0	27.62	3.57
General Hospital No. 2, Savannah, Ga.	June, 1862—January, 1864, (18 months)	239	42	17.57	5.66	7.02	14.23	33.6	2.97
Guyton Hospital, near Savannah, Ga.	May, 1862—January, 1864, (20 months)	105	11	10.47	9.54	3.89	25.66	23.69	4.18

TABLE III.

CASES AND DEATHS FROM PNEUMONIA

NAME OF HOSPITAL.	DATES AND LENGTH OF TIME OF STATISTICS.	Total Cases of Pneumonia.	Total Deaths from Pneumonia.	Per cent. of Deaths in Cases of Pneumonia.	One Death from Pneumonia in — Cases of Pneumonia.	Per cent. of Cases of Pneumonia in entire number of Cases.	One Case of Pneumonia in — Cases of all Diseases.	Per cent. of Deaths from Pneumonia in Deaths from all Causes.	One Death from Pneumonia in — Deaths from all Causes.
General Hospitals in Virginia, out of Richmond . .	January, 1862—February, 1863, (15 months) . .	4,774	1,261	26.41	3.78	4.16	23.86	22.86	4.37
General Hospitals in Virginia, in Richmond . .	September, 1862—April, 1863. (7 months) . . .	–	–	26.56	3.76	3.54	28.29	19.22	5.42
General Hospitals in Virginia . .	April, 1863 — August, 1863, (4 months) . . .	2,344	578	24.14	4.05	2.16	45.9	21.29	4.71
General Hospital of Charlottesville, Va.	July, 1861—September, 1863, (26 months) . .	647	207	31.9	3.12	4.32	23.13	23.84	4.17
General Hospital No. 1, Savannah, Ga.	December, 1861—January, 1864, (25 months) . .	370	116	31.35	3.18	5.17	19.32	34.83	2.87
General Hospital No. 2, Savannah, Ga.	June, 1862—January, 1864, (18 months) . . .	108	25	23.04	4.32	3.174	31.5	20.00	5.00
Guyton Hospital, near Savannah, Ga.	May, 1862—January, 1864, (20 months) . . .	78	7	8.98	11.14	2.88	34.68	15.21	6.57

In the large number of cases (344,063) treated in these hospitals, 13,542 deaths are recorded, and of this number typhoid fever and pneumonia caused very nearly one half.

Progressive diminution of the prevalence of typhoid fever during the war.

The last observation which we shall sustain by statistics, is that typhoid fever progressively diminished during the progress of the war, and disappeared almost entirely from the veteran armies; whilst, on the other hand, pneumonia continued to prevail, and appeared to be chiefly dependent upon the vicissitudes of the climate.

This statement is clearly sustained by the preceding statistics of the General Hospitals in Virginia.

The statistics which we consolidated from all the returns on file in the Surgeon-General's Office, do not extend over nineteen months, but even during this comparatively short period we observe a verification of the preceding observation, as will be shown by the following table: —

TABLE ILLUSTRATING THE NUMERICAL RELATIONS OF PNEUMONIA AND TYPHOID FEVER IN THE CONFEDERATE ARMIES DURING NINETEEN MONTHS, FROM JANUARY, 1862, TO JULY, 1863. CALCULATED FROM OFFICIAL REPORTS, BY JOSEPH JONES, M. D., ETC.

Month and Year.	Field Reports.				Hospital Reports.	
	Pneumonia.		Typhoid Fever.		Pneumonia.	Typhoid Fever.
	Per Cent. of Cases of Pneumonia in Mean Strength.	Per Cent. of Cases of Pneumonia in Total Sick and Wounded.	Per Cent. of Cases of Typhoid Fever in Mean Strength.	Per Cent. of Cases of Typhoid Fever in Total Sick and Wounded.	Per Cent. of Cases of Pneumonia in Total Sick and Wounded.	Per Cent. of Cases of Typhoid Fever in Total Sick and Wounded.
1862.						
January . .	1.70	4.35	1.38	4.36	10.24	9.6
February . .	0.93	2.84	1.17	3.59	10.72	10.8
March . . .	1.12	3.67	1.16	3.79	17.00	8.1
April . . .	1.06	3.83	1.44	3.63	21.23	14.5
May	0.61	1.38	1.37	3.09	6.76	7.1
June	0.65	1.12	3.02	5.25	4 89	8.6
July	1.03	1 98	2.78	5.30	2.59	10.2
August . . .	0.379	0.84	1.83	4.07	1.46	6.1
September .	0.142	0.421	0.85	2.50	1.01	5.5
October . .	0.245	0.79	0.82	2.65	1.18	4.8
November . .	0.84	3.20	0.64	2.46	5.76	3.9
December . .	1.72	4.42	1.07	2.74	6.23	2.9
1863.						
January . .	1.38	3.49	0.89	2 27	8.90	4.7
February . .	0.92	3.32	0.61	2.19	7.19	4.9
March . . .	0.89	3.03	0.81	2.75	8.48	5 7
April . . .	0.93	2.94	1.10	3.47	8.41	4.9
May	0.97	3.20	0.90	3.06	2.69	2.6
June	0.249	0.79	0.64	2.04	1.76	4.4
July	0.106	0.37	0.99	3.46	0.98	2.8

The following tables illustrate, still more clearly, the progressive decrease of typhoid fever, and the connection of pneumonia with the seasons: —

CASES AND DEATHS FROM ALL CAUSES, AND CASES AND DEATHS FROM PNEUMONIA AND TYPHOID FEVER IN THE GENERAL HOSPITALS OF CHARLOTTESVILLE AND STAUNTON, VA., FROM OFFICIAL REPORTS, BY JOSEPH JONES, M. D., ETC.

Month and Year.	General Hospital, Charlottesville, Virginia.						General Hospital, Staunton, Virginia.					
	Total Cases Disease and Wounds entered during Month.	Total Deaths from all Causes.	Total Cases Pneumonia.	Total Deaths from Pneumonia.	Total Cases Typhoid Fever.	Total Deaths Typhoid Fever.	Total Cases Disease and Wounds entered during Month.	Total Deaths from all Causes.	Total Cases Pneumonia.	Total Deaths from Pneumonia.	Total Cases Typhoid Fever.	Total Deaths Typhoid Fever.
January, 1861	–	–	–	–	–	–	–	–	–	–	–	–
February	–	–	–	–	–	–	–	–	–	–	–	–
March	–	–	–	–	–	–	–	–	–	–	–	–
April	–	–	–	–	–	–	–	–	–	–	–	–
May	–	–	–	–	–	–	–	–	–	–	–	–
June	–	–	–	–	–	–	–	–	–	–	–	–
July	2,608	147	48	18	284	75						
August	329	87	6	10	74	46	1,430	30	17	3	151	20
September	511	32	12	2	150	24						
October	556	33	14	2	195	27	938	19	3	–	255	6
November	448	31	41	7	100	15	615	11	19	–	269	7
December	329	12	22	3	63	6	734	59	37	22	193	14
Totals, 1861	4,781	342	143	42	866	193	2,417	119	76	25	868	47
January, 1862	226	21	24	15	30	4	126	17	4	8	30	1
February	300	6	21	–	34	5	254	5	12	2	64	1
March	290	9	21	4	14	1	614	10	68	2	56	3
April	539	44	80	25	60	8	705	27	65	7	45	7
May	429	67	35	36	32	20	2,272	83	53	28	48	26
June	754	53	20	12	23	13	1,229	36	23	5	34	8
July	337	26	9	3	33	11	892	42	–	5	56	25
August	682	35	2	–	19	10	805	78	3	3	103	39
September	886	23	1	–	7	2	1,435	29	–	3	20	6
October	340	11	1	1	5	3	4,549	95	27	4	222	42
November	916	32	38	15	21	7	3,923	151	180	24	96	66
December	993	54	118	27	21	7	361	69	19	12	5	15
Totals, 1862	6,692	381	370	138	299	91	17,165	642	454	103	779	239
Totals, 1861-62	11,473	723	513	180	1,165	284	19,582	761	530	128	1,647	286
January, 1863	601	41	49	11	16	4	102	15	1	5	5	1
February	312	26	23	7	12	5	96	8	5	4	6	1
March	198	17	15	6	6	2	483	13	75	4	32	2
April	124	14	6	8	3	3	155	37	14	20	5	5
May	572	11	14	2	15	5	639	15	23	8	24	3
June	417	8	13	2	14	3	1,542	14	16	4	48	6
July	821	7	6	–	11	1	8,428	25	25	1	123	11
August	449	11	8	1	55	5	1,209	37	12	1	65	18
September	271	10	2	–	20	7	406	16	3	–	21	3
October	397	7	9	1	18	2	308	12	4	1	23	3
November	301	10	16	2	5	3	127	12	3	2	10	5
December	469	27	29	6	15	3	228	1	6	1	6	0
Totals, 1863	4,932	189	190	46	190	43	13,723	205	167	51	368	58
January, 1864	401	35	30	8	22	13	225	3	10	1	4	1
February	145	9	11	3	2	1	108	3	16	1	3	–
March	249	6	13	2	2	1	177	1	9	–	5	1
April	481	11	30	3	7	2	138	4	7	1	3	1
May	1,152	68	27	6	4	3	1,475	47	7	–	18	–
June	1,344	50	8	2	15	5	826	29	3	–	14	–
July	–	–	–	–	–	–	1,598	19	9	3	41	8
August	–	–	–	–	–	–	1,304	21	2	–	21	7
September	–	–	–	–	–	–	1,693	13	1	–	30	2
October	490	13	3	1	6	3	1,531	30	4	–	24	5
November	321	7	11	2	10	2	511	25	10	1	11	3
December	267	9	10	1	3	–	505	14	30	4	18	1
Totals, 1864	4,850	208	143	28	71	30	10,091	209	103	11	192	29
Totals, 1863-64	9,782	497	333	74	161	73	23,814	414	270	72	560	87
Totals, 1861-64	21,265	1,120	846	254	1,426	357	41,396	1,175	800	190	2,207	393

In the preceding tables we observe a progressive and marked diminution of the cases of typhoid fever, whilst the yearly fluctuations of pneumonia are not referable to any such law. Analysis of foregoing tables.

Thus, in the General Hospital of Charlottesville, during the year 1861, the cases of disease and wounds numbered 4781, with 342 deaths; of this number pneumonia constituted 143 cases and 42 deaths, and typhoid fever 866 cases and 193 deaths. During the year 1862, the total cases entered upon the hospital records numbered 6692, with 381 deaths; of these, there were of pneumonia, 370 cases and 138 deaths; typhoid fever, 299 cases and 91 deaths. During 1863, total cases, 4932, and deaths, 189; pneumonia, 190 cases, 46 deaths; typhoid fever, 190 cases, 43 deaths. During 1864, total cases, 4850, deaths, 208; pneumonia, 143 cases, 28 deaths; typhoid fever, 71 cases and 30 deaths.

In the General Hospital of Charlottesville, during the first twenty-six months, the largest number of cases of typhoid fever occurred in July, August, September, and October, 1861; and during the first thirteen months (July, 1861 — July, 1862, both months inclusive) 1094 cases of typhoid fever entered the hospital; whilst during the last thirteen months (August, 1862 — August, 1863, inclusive) only about one fifth the number of cases of typhoid fever entered, or, more exactly, 203 cases. During the first period of thirteen months, 253 deaths from typhoid fever occurred; whilst during the last thirteen months there were only 60 deaths, or not quite one fifth the number of the first thirteen months.

In the General Hospital of Staunton the cases of typhoid fever decreased in the following manner: In 1861, 868 cases and 47 deaths; in 1862, 779 cases and 239 deaths; in 1863, 365 cases and 58 deaths; in 1864, 192 cases and 29 deaths. The sum total of cases of typhoid fever during both the years 1863 and 1864 was far less than during either 1861 and 1862, notwithstanding that the total cases of diseases registered was greater in 1863 and 1864.

CHAPTER TENTH.

OBSERVATION ON THE DISEASES OF THE HEART NOTICED AMONG SOLDIERS, PARTICULARLY THE ORGANIC DISEASES.

BY J. M. DA COSTA, M. D.,

PHYSICIAN TO THE PENNSYLVANIA HOSPITAL, ETC.

The Clinical Material for this Chapter. — Valvular Diseases. — Table of Valvular Diseases. — Cases of Valvular Disease following Rheumatism. — Cases of Valvular Diseases not preceded by Rheumatism. — Absence of Bright's Disease or any Diathetic Affection. — Cases of Valvular Disease attributed to Protracted and Violent Exertion. — Case of Insufficiency of the Pulmonary Valves. — Cases in which Valvular Disease did not prevent the Performance of Military Duty. — Infrequency of Diseases of the Pericardium. — Enlargement of the Heart independent of Endocarditis or Pericarditis. — Hypertrophy of Heart from persistent Functional Disorder and after Fevers. — Enlargement due to a Rheumatic Diathesis, or existing prior to Enlistment. — Cases of Hypertrophy without Valvular Lesions amenable to Treatment. — Treatment employed in these Cases. — Cases of Enlargement with predominant dilatation infrequent. — Of Irritable Heart. — Conclusions.

The clinical material for this chapter.

In this paper I shall discuss some points connected with the affections of the heart noticed among troops. During the war I held for a time the post of visiting physician to one of the largest military hospitals, and subsequently had in other hospitals wards allotted to me, to which soldiers affected with thoracic, particularly with cardiac disease, were sent. Some of the forms of these diseases were constantly recurring, and presented features of so much interest that they were carefully noted and studied. Notes of upwards of four hundred cases are thus in my possession; and while taking them as the basis of some of the deductions here made, I retain for analysis and publication elsewhere several groups of them, which, minutely analyzed, would require a more extended discussion than it is either desirable or convenient here to enter into. But an examination, especially of organic affections, inquiring into their cause, their disqualifying effect for doing duty, and the possibility of averting or remedying them, will, I trust, furnish a contribution not out of place in this volume, and in keeping with its general spirit.

Valvular diseases.

First let me say a few words about valvular diseases. They were not on the whole very common, that is, the mass of those presenting cardiac disorders did not present signs of valvular disease. But when this was detected it was

ordinarily found to be due to the same causes which are known usually to generate it. To analyze thirty cases, taken indiscriminately from my note-books : —

TABLE OF VALVULAR DISEASES.

Case.	Seat and Character of Disease.	Supposed Cause.
I.	Aortic Insufficiency.	Acute Rheumatism.
II.	Mitral Constriction.	Pneumonia (Endocarditis).
III.	Mitral Insufficiency.	Acute Rheumatism.
IV.	Mitral Insufficiency.	Acute Rheumatism.
V.	Mitral Insufficiency.	Rheumatism.
VI.	Aortic Insufficiency.	Acute Rheumatism.
VII.	Mitral Insufficiency.	Before enlisting.
VIII.	Aortic Insufficiency.	Before enlisting ; rheumatism.
IX.	Aortic Insufficiency.	Endocarditis ; Pneumonia.
X.	Mitral Insufficiency.	Rheumatism.
XI.	Mitral Insufficiency and Chronic Pericarditis.	Acute Rheumatism.
XII.	Aortic Constriction.	Pleuro-pneumonia (Endocarditis).
XIII.	Aortic Insufficiency.	Acute Rheumatism.
XIV.	Mitral Insufficiency.	Noticed after heavy marching.
XV.	Aortic Insufficiency and Constriction.	Acute Rheumatism.
XVI.	Aortic Insufficiency and Chronic Pericarditis.	Acute Rheumatism.
XVII.	Mitral Insufficiency.	Measles.
XVIII.	Aortic Constriction.	Diarrhœa ; rheumatism in hips.
XIX.	Mitral Insufficiency.	Rheumatism.
XX.	Mitral Insufficiency and Chronic Pericarditis.	Acute Rheumatism.
XXI.	Mitral Insufficiency.	Pneumonia (Endocarditis).
XXII.	Mitral Insufficiency.	Before enlisting.
XXIII.	Mitral Insufficiency.	Acute Rheumatism.
XXIV.	Aortic Constriction and Insufficiency.	Before enlisting.
XXV.	Aortic Constriction.	After heavy marching.
XXVI.	Mitral Insufficiency.	Rheumatism.
XXVII.	Aortic Insufficiency.	Uncertain.
XXVIII.	Aortic Insufficiency.	Before enlisting.
XXIX.	Aortic Insufficiency.	Before enlisting.
XXX.	Insufficiency of pulmonary valves.	No distinct cause.

Looking over this table, we find these results: Of the thirty cases, fifteen had rheumatism for the first time while in service, and ten of these had acute articular rheumatism, produced for the most part by exposure. In the remaining five, the attacks had been more subacute or muscular, and they are marked in the table simply as rheumatism. Five cases presented the history of cardiac disease prior to enlisting, and several of these again had had articular rheumatism. One of them had a slight attack of rheumatism prior to the war, but also stated that he inherited disease of the heart from his mother. Two patients first noticed the cardiac disturbance after heavy marching, to which they attributed it, though it might be thought more likely that it had existed before. With greater certainty may this be said of one patient (Case XVIII.), who asserted that it was only after a severe attack of diarrhœa that his heart at all annoyed him. Four of the cases mentioned in the table believed that they had been seized with pneumonia, being previously in excellent health, and that since the acute malady the cardiac symptoms had developed themselves.

Cases of valvular disease following rheumatism.

The first of these patients (Case II.) stated that he had flying rheumatic pains, particularly in the shoulder joints, prior to enlisting, and occasionally fluttering of the heart when lifting heavy timbers. But he was able to serve with his regiment throughout the spring and summer campaign of 1864, doing much marching; and as it was only after a severe attack of inflammation within the chest, called pneumonia, that he became troubled with shortness of breath and expectorated pure blood, it may well be questioned if there existed any previous disease of the heart. It should be added that before being sent to the hospital in September he contracted fever, and had chills and night sweats. While under my observation he presented the physical signs of mitral constriction with some regurgitation, and excessive irregularity of the action of the heart, attended with great shortness of breath, and at times with giddiness. Either, it is evident, a valvular affection had developed itself subsequent to the acute seizure, or a slight preëxisting disorder had been greatly aggravated by this and the heavy marching.

Cases not preceded by rheumatism.

In the second instance of disease of the valves following an acute attack (Case IX.), no such doubtful point can be adduced. The man, a private in Company B, 187th Pennsylvania Volunteers, had been an active farmer before enlisting in January, 1864. He never had had a severe disease, never acute rheumatism; had had

occasionally pain in the left shoulder, but was a vigorous man in fine health when he joined his regiment. He did hard duty with it until the 28th of August, 1864, participating in all the marches south of the Rapidan, and was in most of the battles and skirmishes which occurred. He was found to possess aortic insufficiency marked to a high degree, and though he attributed the cardiac complaint chiefly to heavy marching and to the weight of the cartridges, he also mentioned having had something like an acute seizure; stating, that while on a march he was attacked with severe pain in the left side, which persisted and was soon accompanied by spells of faintness on exertion. In spite of this, he did more or less duty for two or three months, until he was sent to the Cuyler Hospital, and he was thence transferred for special treatment to my wards in Philadelphia.

In the third case (Case XII.), also, aortic disease existed. But the signs were those of constriction rather than of insufficiency. The patient was a private in the 22d New York Cavalry, forty years of age, and had been a blacksmith before joining the army. He was in excellent health when he enlisted in January, 1864, and had almost constantly enjoyed good health, though he stated that on two occasions prior to enlisting he had pneumonia, and that years before the war he had rheumatic pains in the hips and knees, but not severe, nor had he ever an attack of acute rheumatism. He was in several fights, and in one of these, in May, 1864, was dismounted, after which he was obliged to march on foot, which he did, from Port Royal, Va., to City Point. About the 15th of June he was seized with an acute thoracic affection, which he says was pronounced pneumonia. He recovered from this with some pain in the cardiac region, and with shortness of breath; the least exertion wearied him. He was ordered to Washington, and remounted in July, 1864; and soon afterwards did service in the Valley of the Shenandoah, but most of the time as blacksmith. The difficulty of breathing, however, increased so much, that after August 24th he was unable to do duty any longer. He was sent to several hospitals, and transferred to my wards September 29th; his main symptom was shortness of breath on exertion. The murmur was systolic, and very rough, of greatest intensity to the right of the sternum, and unattended by receding pulse, or throbbing of carotids, or very forcible impulse. The percussion-dullness in the cardiac region was not that of a decidedly enlarged heart, measuring only two inches and three quarters transversely, three and one quarter perpendicularly, and three

and a half obliquely. The chest was thirty-five and a half inches in circumference.

The fourth case (Case XXI.) was that of a private in the 109th New York Volunteers. Before enlisting, in December 22, 1863, he was a carpenter, and in admirable health ; never had had rheumatism, or any sign of cardiac disturbance. He was taken sick February 15th, 1864, the day after arriving in Washington, with pain in the left side, etc., and was thought to have pneumonia of the left lung. He recovered slowly, but had pain about the heart, which he distinctly remembered to have annoyed him in March. His recovery was about that time considered sufficient to enable him to do light duty ; and when his regiment was ordered to join the 9th Corps he accompanied it, going for the first time into the field. He was much troubled with palpitations while on the march, and on arriving at Warrenton Junction was attacked with a malarial fever, for which, May 2d, he was sent back from the front. He had thus, if the march to the front be excepted, never done any active duty. He remained four months under observation, presenting the signs of mitral regurgitation, with forcible action of the heart, though with but slight increase in its size. His general appearance was good, even when first seen, and he never showed the least signs of anæmia.

Absence of antecedent Bright's disease or any diathetic affection in the preceding cases.

I have given the histories of these cases somewhat in detail, because they bear on a very interesting point of cardiac pathology — the occurrence of endocardial inflammation, and subsequent valvular disease, without antecedent rheumatism, or Bright's disease, or any diathetic affection. It is true that rheumatic pains had preëxisted in two of the cases, but in the last-mentioned of these, at least, not in such a manner as to be looked upon as a causing element. The supposition of pneumonia having given rise to the valvular lesion is of course not to be entertained. If pneumonia really happened at any time, — and only one of the cases (the first) presented any signs which rendered the previous occurrence of either pneumonia or pleuro-pneumonia a likelihood, — it happened as a complication of the endocarditis, the presence of which might very readily have been overlooked, or not communicated to the patients. Moreover, one of them did not say scarcely any thing on the subject of the supposed pulmonary inflammation ; but attributed the disease, more persistently, to the heavy marching. Thus, then, we have cases of endocarditis, contrary to the supposed opinion, of idiopathic origin, and it is quite possible that violent efforts in several of them

may have acted as predisposing causes, and have had just as much to do with the development of the inflammation as any exposure to which the men were subjected.

This may have happened in the case just alluded to (Case IX.), which, indeed, has only, on account of some of the statements of the man, been classed with those that were thought to have presented marked symptoms of an acute thoracic affection. In two other cases placed in the tabular view for analysis, heavy marching and over-exertion were looked upon alone and decidedly as the cause of the cardiac trouble. In one of these (Case XIV.), no disorder of the heart whatever existed before enlistment, so far as could be ascertained, and the first symptom noticed was strong beating of the organ after a great deal of marching and exertion. In the second (Case XXV.), much the same history was given. In both, the heart was considerably enlarged; in one indeed, out of proportion to the amount of valvular lesion, and it seems likely that here the affection of the valves was the indirect consequence of the enlargement. But though this may be said of the instance of mitral insufficiency (Case XIV.), it can scarcely be stated of that of aortic constriction (Case XXV.). We find, then, cases of valvular disease originating after heavy marching and violent exertion. Some of these may be due to latent idiopathic endocarditis, others are probably the consequence of preceding enlargement.

Cases of valvular disease attributed to protracted and violent exertion.

Fevers are not mentioned in the tabular statement as giving rise to valvular disease. Yet many of the patients attributed the disorder of the heart to them, particularly to typhoid fever. But on analysis it was almost invariably found that these patients had had acute rheumatism previously, or signs of cardiac disturbance, and that these had become much aggravated after the fever, rather than made their appearance with it.

Concerning the signs and symptoms of the abnormal condition of the valves, it is needless to go into detail. However interesting to the student of physical diagnosis, it would not serve a useful purpose here to examine them, and to see in how far they correspond with those considered by observers generally, as characteristic. But as regards Case XXX., an exception may well be made, on account of the rarity of the lesion presented.

Case XXX. *Insufficiency of the Pulmonary Valves.* — Henry F. L——, sergeant Company L, 9th New York Heavy Artillery, was sent to my ward in April, 1865. He was a fine, healthy looking man, who complained of nothing excepting shortness of breath, and some pain

in the cardiac region. The shortness of breath was only markedly developed on exertion of any kind; the pain was not severe, but from its persistency, by constantly reminding the patient of the cardiac malady, may have been the chief cause of the frequent depression of spirits from which he suffered. His digestion was excellent; there was no dropsy. He was unable to trace the disease of the heart to any exciting cause. He had been in service almost from the beginning of the war, never had had rheumatism; had typhoid fever in 1861, not very long after enlisting, and on his recovery from it until he reënlisted, saw much active service. Indeed, he was almost constantly on duty until three months before his admission into the Filbert Street Hospital, until, indeed, a swelled testicle caused him to be placed under medical care. Since that time, and when returning to duty, after being relieved from the affection mentioned, he noticed palpitation. The pulse was 72, full, rather abrupt; respirations 24; the impulse of the heart was extended and forcible; the cardiac percussion-dullness increased, though not to an extreme degree. On auscultating the heart a loud murmur was heard, loudest at the left edge of the sternum, near the fourth costal cartilage, and at the fourth interspace, and transmitted thence to the left edge of the heart and upwards as far as the clavicle on the left side. At the apex it was only faintly perceived, and it was scarcely audible, at times wholly inaudible, at or near the aortic cartilage, where a well-marked normal second sound was heard. At the pulmonary cartilage, and in the second interspace on the left side, the murmur was very much more distinct than to the right of the sternum, but in the positions indicated on the left side, not a trace of a second sound could be discerned. There was no murmur in either carotid. On closely analyzing the murmur, at its place of greatest intensity, it was found to consist in reality of two: the first short, comparatively indistinct, systolic, and soon lost as the stethoscope was removed to other parts of the cardiac region; the second long, loud, distinct, and completely taking the place of the normal second sound of the valves of the pulmonary artery.

It may be a matter of astonishment that a person with so serious a valvular trouble should have suffered on the whole so little from it, and should have been able to discharge his duties as a soldier for so long a time without any particular inconvenience arising from the disease of the heart. For it cannot be supposed that the cardiac malady dated merely from the attack of swelled testicle; but it must have existed prior to his reënlisting, and perhaps even prior to his entrance into the service. He was an ardent soldier, anxious not to be away from his regiment, and nearly always with it. Yet, if we except the attack of fever at the outset of his military career, his history did not show that he had had any of the diseases inci-

dent to troops, or that he had been obliged to be careful of himself, or relinquish any of his duties, until he went to the hospital for the complaint mentioned. But while suffering from the irritation of this, and on returning with his health not in the usually good condition, he began to be annoyed, or rather, to have his attention directed to his heart, and was shortly afterwards sent from camp to be treated for the cardiac complaint. This is, indeed, the history of very many, I may say of the majority, of these patients. I could adduce case upon case that came under my observation during the war, of men who did not notice the affection of the heart until some acute malady reduced their strength. Sometimes it was a severe attack of diarrhœa, but oftener a fever, particularly a typhoid fever, or measles. But whatever the disease, the sequence ran thus: little, if any, disturbance previously; an acute attack; symptoms of cardiac derangement noticed then, or during convalescence, or soon after return to duty.

This statement may seem to invalidate the remarks above made as to the presumable origin of some cases of valvular disease in acute idiopathic endocarditis with or without active thoracic symptoms, or happening during over exertion. Yet, though this objection to the view of the matter cannot be positively set aside, I do not think it applies to the cases there cited. They were admitted as such only after the most careful sifting of the evidence they furnished. The attack was in all of comparatively recent date; the valvular affection was not attended with marked cardiac enlargement; moreover, the men had enlisted at a late period in the war, and passed the inspection of the surgeon at a time when much greater care was taken with the examination of the recruit, and when valvular diseases were not apt to be overlooked.

Cases in which valvular disease did not prevent the performance of military duty.

But how did it happen that men with valvular affections could perform military service at all — could bear the marching, the exposure, the excitement of a soldier's life? For, even deducting all doubtful cases, there were numbers whose histories clearly indicated that they had had cardiac disease long prior to its being observed, who had yet performed faithfully their duty. For instance, Case XXII. presented a clear history of disease of the heart, dating from inflammatory rheumatism in 1861. He enlisted January 7th, 1863, for three years, did continuous duty up to the 30th of April, 1864, when he caught measles, followed by some rheumatic pains. About this period, and during his convalescence, he was noticed to have enlargement of the heart, with valvular disease. He came

under my charge August 1st, 1864, had no dropsy, suffered occasionally from palpitation, complained of pain about the heart, and of inability to lie on his left side. The impulse was forcible, and extended, and there was a mitral murmur. The pulse was ninety-six, not particularly irregular. He was a cavalryman, and it may be a question whether his being mounted was not a cause of his ability to do duty so long. But even in those serving in other arms of the service, the power to perform duty for a considerable period was remarked.

Now, in the explanation of these cases, we must look closely to the amount of disturbance of the organ and the extent of the coexisting enlargement. When the heart is greatly disturbed in its function, or there is much increase in its size, active service becomes, for any length of time, an impossibility. Otherwise, it is quite possible. I met with an instance of aortic regurgitation in a soldier, the type of excellent physical health, who, for a short distance at least, was a good runner. And I may, in concluding this part of the inquiry, allude to the case of a gentleman whom, from repeated examinations before the war, I knew to have an affection of the mitral valves, and who served creditably during a long campaign on the staff of a general high in command, where the officers had little rest, and who had, particularly, the reputation of not sparing them. The valvular affection was not then, and is not now, attended with much discomfort, or evidence of disorder of the circulation.

I insist thus upon comparative latency of the symptoms, or rather upon absence of marked functional disturbance and considerable enlargement, as essential elements in allowing a valvular disease to remain inactive; and it has been made apparent how, if the circulatory function be deranged in consequence of a fever or other acute malady, or of any departure from the previous standard of general health, the affection of the heart begins to show itself, and become troublesome. Yet, let it not be understood that cases of tolerance of the cardiac disease, if I may so express myself, bore more than a certain — though an unexpectedly large — proportion to those in which fatigue and exposure rapidly led to the manifestations of the symptoms of a disordered heart. For a number of my patients with valvular disease told me that almost from the first they were unable to keep up with the regiment on the march, in consequence of choking sensations, shortness of breath, and giddiness (Cases VII. and XI. were particular illustrations); or were unable to bear the weight of their knapsacks and equipments; and,

so as not to lag too far behind, were obliged to throw them away. It is quite likely that some of these cases of valvular disease died sudden deaths, and were grouped among those who, from fatigue, had sunk exhausted at the wayside, or had had a sun-stroke. But this is a mere surmise, for I have no data for determining the point.

Pericardial disorders were not, on the whole, frequently encountered. Indeed, considering the hundreds of cases of cardiac affections that I examined, I was struck with their rarity. When found, they presented, generally, coexisting endocardial trouble, and were rather the remnants of a pericarditis with friction indicative of roughening of the membrane, or with what could be regarded as presumable signs of adhesion, than chronic pericarditis with effusion. In the following case, however, there was effusion which disappeared under treatment.

Infrequency of diseases of pericardium.

Case XXXI. *Chronic Pericarditis; Recovery under Iodide of Potassium, etc.* (Case-Book IV., p. 130). — John W. M——, private, Company D, 14th New York Artillery, aged nineteen, formerly a farmer; enlisted July 4th, 1863, for three years. He stated that he had felt pain over the heart, and had occasional palpitation, before enlisting; but that the examining surgeon, after investigation, pronounced this not to be due to a disease of the heart. The battalion to which M. was attached was sent to Sandy Hook, N. J., and while there he had a severe attack of what he says was regarded as inflammation of the lungs, and was under medical treatment for two months. After this seizure he had more pain about the heart, with shortness of breath and, at times, palpitation. He was transferred with his regiment to the army of the Potomac, in March, 1864, and did duty until June 17th, 1864; when, in consequence of diarrhœa, succeeded by rheumatism, and by an increase of the signs of the heart trouble, he was, after having been in a camp hospital, sent to a general hospital in July, and to my wards September 14th. He had at that time recovered from the diarrhœa, but still had, off and on, rheumatic pains in his limbs. He had much difficulty of breathing, and complained of the pain in the cardiac region, which constantly grew worse toward evening, and was then attended with palpitation. His nights were restless; he could not lie on the left side. After he had been under observation for a day or two, it was observed that he had, occasionally, a slight swelling of the lower limbs, and, more constantly, of the hands. He was a man of very temperate habits, never smoked, chewed, or drank.

The physical examination showed an impulse extended and very deficient in force; an increased percussion-dullness in the cardiac region, with soreness to the touch; and great indistinctness of the sounds of the heart, which, however, were very much more distinct at the base than at the apex. He was directed to take iodide of potassium, five

grains three times daily, while tincture of iodine was painted over the front of the left side of the chest; and on the 26th, a solution of bitartrate of potassa was also ordered as a daily drink. Under this treatment he steadily improved. October 12th it was noted that both sounds had become quite distinct, and that the percussion-dullness had decreased. This was still more marked by the 27th, and as his symptoms had at the same time greatly ameliorated, he was allowed to go home on furlough. November the 18th he returned, looking well, and nothing particularly abnormal could be found upon auscultating the heart. Soon afterwards he returned to his regiment.

From this record, it is difficult to fix the exact period at which the pericarditis happened. It either occurred as a complication with, and at the time of, the supposed pneumonia, in which case the man had the pericardial affection for eight months or upwards, before I saw him, and did duty in the field, with his pericardium probably filled with fluid; or the disorder dated from the rheumatism shortly following the diarrhœa, and was then of nearly three months' duration. Though the former view appears the less probable, the details of the history favor it.

Enlargement of heart independent of endocarditis or pericarditis.

Let us now turn to other forms of organic disease of the heart, to enlargements of the heart unconnected with endocarditis or pericarditis. And here I will first describe *hypertrophy*. It was very commonly met with, and presented the usual physical signs: increased percussion-dullness, forcible, extended impulse, dull, heavy, first sound. This case will illustrate them, as well as some of the attending symptoms.

Case XXXII. *Symptoms of Cardiac Disorder appearing during a March; Hypertrophy of Heart* (Case-Book IV., p. 236).—Paul S——, private, Company H, 8th New York Artillery, aged twenty-one years, a blacksmith prior to enlisting, joined the army August 12th, 1862, for three years. He said, — and repeated examinations failed to elicit any contradictory statements, — that before enlisting he had always enjoyed excellent health, and had been capable of undergoing much exertion and fatigue without any disturbance of the heart. In February, 1864, he had an attack of small-pox; and, on recovering from this, rejoined his regiment. On the marches in May, 1864, he had, for the first time, pain in the region of the heart, with palpitation, shortness of breath, and attacks of faintness, which rendered him unable to keep up with his comrades. He nevertheless continued on duty, coming up with his regiment at night after it had halted; and was with it in several engagements of the spring campaign. June 22d he was injured by being struck on the right shoulder by the limb of a tree cut off by a shell; and was sent to a general hospital for treatment, whence he was trans-

ferred, October 11th, 1864. After the injury, and while at the General Hospital, his heart difficulty grew worse.

Examined in October, he was found to have severe palpitations, attended at times with much shortness of breath, and always worse at night, the violent beating interfering with his sleep. He also complained of pain over the heart following any exercise, and of occasional dizziness with faintness. The pain in the cardiac region only existed on exertion. His appetite was good; the bowels regular. The impulse of the heart was extended, very heavy, and forcible; the first sound dull, prolonged, heavy; the second indistinct, even at the base. The percussion-dullness of the heart measured five inches transversely; four and seven-eighths perpendicularly, and five and a half obliquely, from its right upper edge to the apex. Though the impulse was very strong, it was not so strong as this great extent of percussion-dullness might imply. The pulse did not beat above seventy-eight, and was for a time reduced by aconite to between sixty and fifty-two. The man was made much more comfortable by treatment; but, being unfit for active service, was finally placed in the Veteran Reserve Corps, Second Battalion.

This case illustrates the physical signs of an hypertrophied heart, as well as the inconveniences it entails on the soldier, and in fact its common clinical history. Some further symptoms may be found in this and the succeeding record.

Case XXXIII. *Hypertrophy of the Heart, much Cardiac Pain, Bleeding from the Gums and Lungs* (Case-Book III., p. 138). — George W. F——, private, Company B, 7th Michigan Volunteers, twenty-one years of age, a farmer before enlisting; enlisted October 22d, 1863, for three years, being well and strong at the time. Had an attack of inflammatory rheumatism three years prior to entering the service. Was on duty until January 1st, 1864, when he caught a severe cold, and on recovering from this the heart trouble supervened, manifesting itself chiefly by shortness of breath on exertion, and spitting of blood. After being transferred to various hospitals, he was sent to my wards, May 26th, 1864. He was a healthy-looking man, five feet nine inches in height, of excellent habits, using neither tobacco nor spirituous liquors. His appetite was good; the bowels regular; the gums were spongy — occasionally they bled. The respiratory organs were healthy; a trifling bronchitis forming the only exception to this statement. He had not then, nor had he had, any pains of a rheumatic character since enlisting, but was frequently annoyed by a sharp pain, strictly limited to the region of the heart. While quiet he had no palpitation; had dyspnœa on exertion, and found it difficult to breathe in the recumbent posture. Exercise still caused bleeding from the lungs, either of pure blood, or, more generally, of blood mixed with mucus. The impulse was extended and strong, and had in addition somewhat of a jerking stroke —

a character which the pulse, beating ninety-four to the minute, and forcible, did not share. The cardiac percussion-dullness was increased; the first sound long, murmurish over left ventricle, but without real murmur; the second sound distinct, yet not unnaturally so. The force and frequency of the impulse were considerably influenced both by aconite and aconitia, one thirtieth of a grain twice daily. And even the first sound became gradually less dull. The cardiac pain, however, persisted, and was at times noted to have been attended with soreness in the cardiac region. There was, however, no perceptible decrease in the cardiac diameters; and after several months of treatment, particular attention being paid to his diet, after a return home on furlough, and a cessation of the bleeding for some time, the man was, in a much improved condition, placed in the Veteran Reserve, Battalion I.

This patient presented as one of his symptoms spitting of blood; and this phenomenon, scarcely encountered in hypertrophy of the heart seen in civil life, I have found to be not at all infrequent among soldiers. Now it occurs under various circumstances. In the majority it first makes its appearance after excessive exercise, especially after the fatigue and excitement of a hard contested battle, or after a forced march. In some, as in the case just reported, it is associated with marked signs of cardiac distress, and though often produced by exertion, did not originally set in as the immediate consequence of this. In either instance it may not or may be combined, as it was in Case XXXIII., with evidences of a scorbutic state of system. Nor would I wish the inference drawn that its occurrence is invariably linked to the existence of an enlarged heart. I have encountered it under circumstances similar to those mentioned, in soldiers who merely presented an irritable state of the organ. In some cases, though not in many, it was a mere coincidence with the noticing of cardiac symptoms, being really due to a blow, or to a fall from or with the horse — the latter the more common. Again, the hæmoptysis may happen without any connection with a persistent cardiac disorder, either organic or functional. For I met with instances in which soldiers had spat blood more or less profusely after a battle, or much exertion, in whom, when examined a few weeks afterwards, perfect regularity of the heart's action existed, and not a trace of disease of the lungs. The simple pulmonary congestion, probably associated with the temporarily excited circulation, had passed away. These hemorrhages do not recur, excepting it may be when the cause recurs. I may add that I had a number of cases of these various forms of hæmoptysis for a long

time under observation, and not in one did any pulmonary trouble develop itself. Thus, then, hemorrhage from the lungs in soldiers happens often under circumstances unlike those in civil life, and has, with its dissimilar causes, both different consequences and a different meaning.

Hypertrophy from persistent functional disorder, and after fevers.

But to return to the study of hypertrophy. What were observed to be its causes? The most frequent was persistent functional disorder, especially that disorder which I have described as irritable heart. But I shall have to refer for the evidence of this to my paper on the subject. Very many cases originated after fevers; at all events I could not discover, on the closest investigation, that they had had any cardiac symptoms whatever prior to the fever. But, not long after going back to duty, they were troubled with shortness of breath and palpitation, and presented, when examined by me — which, it is true, did not, as a rule, happen for some months subsequent to the development of the cardiac symptoms — the signs of hypertrophy. The explanation of this is not difficult. It is well known how often, in typhoid fevers — and it was particularly with reference to them that the observations were made — the cardiac structure undergoes changes. If a man with a heart in this condition, or rather not fully restored from this condition, be sent to duty, as not uncommonly happened; if he take then much exercise, and keep up an excited action of the weakened organ, it is easy to see how hypertrophy, with more or less dilatation, will follow. It is true this explanation implies, as one of the causing elements, that continued functional disturbance will result in enlargement. But, as already stated, my experience on this point is so positive as to leave no doubt.

In a certain sense also due to continued functional excitement were those cases which originated during or after heavy marching.[1] They were by no means rare, and whether this be their true explanation or not, gave very distinctive histories.

Case XXXIV. *Hypertrophy of the Heart subsequent to Heavy Marching; No Fever or preceding Derangement of Health* (Case-

[1] I use the term marching not simply of the marching of infantry — which then would imply excessive exercise as pedestrians as the acting cause — but also of the marching of cavalry and artillery, in which branches of the service the upper extremities come more into play. I have met, indeed, with the kind of hypertrophy under discussion in all arms of the service; it is true, more frequently in infantry. But, considering their greater number, this might well happen, without there being a greater absolute frequency. To determine this point positively, would, however, require an investigation on the largest scale, on which, at the same time, the number of troops of each arm engaged in a campaign were accurately known. Data of this kind are not in my possession.

Book V., p. 39). — Nath. C——, private, Company G, 1st Regiment Rhode Island Artillery, enlisted in August, 1862, and was very constantly on service for two years, doing much marching. He was a perfectly healthy man before enlisting. He first noticed shortness of breath and pain in the side in April, 1864, and subsequently marched with his regiment from Brandy Station to Petersburg, and then to the Valley, part of the time accompanying the 6th Cavalry. In August he had an attack of diarrhœa, found his shortness of breath much increased, and so great that he could not march; in consequence was sent to a hospital. He never had a fever. When he came under my charge some months afterwards, he was observed to have dilated hypertrophy. The impulse was one hundred and twenty-four, extended, moderately forcible; first sound dull, rather heavy; second sound not much altered, slightly increased. The transverse diameter of the heart was four inches; the longitudinal three and a half; the oblique four and seven eighths. The man was five feet nine inches in height, and had a well developed chest. He did not suffer much excepting on exertion.

Enlargement due to a rheumatic diathesis, or existing prior to enlistment.

In some cases the enlargement of the heart, though unconnected with valvular disease, appeared to have its origin in a rheumatic diathesis. Again, in others it had existed clearly before enlisting.

Case XXXIII. *Affection of the Heart, probably Hypertrophy, existing prior to enlisting; Aggravation of Symptoms subsequent to a Wound, strictly limited Soreness in Cardiac Region* (Case-Book IV., p. 240). — Wm. H. L——, private, Company I, 112th Pennsylvania Volunteers, aged twenty-nine, enlisted August 3d, 1863, for three years. Was, while in civil life, a harness-maker, and had been much troubled with restlessness, shortness of breath, and with occasional fainting spells, for a year before entering the service. He never could bear the double quick, being always obliged to fall out; but he did duty regularly until June 3d, 1864, when he was wounded in the hand in an engagement at Cold Harbor, Virginia, having marched there from Front Royal without noticing palpitation, or being much annoyed by shortness of breath. While his wound was being treated at the hospital, marked attacks of palpitation occurred, accompanied by choking sensations, and at times by what appeared to him like a cessation of the impulse of the heart, when he felt as if without life enough to move or to make the least exertion. These symptoms still existed when he was sent into my wards October 11th. He was also very restless, complaining much of nervousness. Any noise excited palpitation, likewise exertion of any kind, such as going up-stairs. Generally slept well, excepting when disturbed by fits of violent beating of the heart. Appetite was good; bowels regular; used tobacco, but no ardent spirits; never had had rheu-

matism. The impulse was ninety-six, extended, rather forcible; the first sound dull, the second not increased. Diameters of percussion-dullness were: Transverse, three and a half inches; perpendicular, three and five eighths inches; oblique, four and one eighth inches. Height, five feet nine inches; circular width of chest, thirty-four and a quarter inches. Respirations, thirty-two in the minute. There was no constant cardiac pain, but he felt pain when the heart's action was much excited. Soreness, however, in the cardiac region was noted on several occasions; was probably constant; and corresponded to limits of dullness on percussion. At the upper limit of the dullness, it agreed precisely with the line which was drawn.

In this case there was no doubt of a previous cardiac disorder, yet the man did not suffer much from it, and appears to have done considerable duty until he was wounded and lost blood. In other cases there was comparatively slight trouble or even inconvenience, until the strength was much reduced by diarrhœa, or some other source of exhaustion. In other words, we have here a repetition of what was noticed when discussing valvular affections. The same explanation might be advanced to account even for the cases of enlargement originating seemingly in fevers. Yet I do not think, on analyzing my series carefully, that it holds good except for a limited number.

In thus examining into the causes of hypertrophy of the heart in soldiers, I have not mentioned the cases originating in connection with valvular or pericardial diseases, or in consequence of affections of the lungs or kidneys, because, though they were met with, they presented nothing different from what is constantly encountered, and from what every observer is familiar with. Yet it may be stated that, excepting enlargements associated with valvular diseases, illustrations of the causations mentioned were very rare.

Cases of hypertrophy without valvular lesions amenable to treatment.

What becomes of cases of hypertrophy such as I have described in detail? Do they recover; or do they get rapidly worse, and finally die, in consequence of secondary affections, which hypertrophy of the heart may induce? I did not see a death from it, either directly or indirectly; but, on the other hand, I never saw an instance in which the disease had reached a very marked point, in which a cure was accomplished. Yet I think I have seen enlarged hearts decrease. I found the complaint amenable to treatment to a very high degree, and excellent health was enjoyed by those who, after the force of the action was reduced by means of treatment, lived regularly and

did no laborious work. The following cases, which I had an opportunity of examining at long intervals, will confirm the opinion advanced.

Case XXXVI. *Hypertrophy of the Heart, probably succeeding to Fever; Quieting of the Action of the Heart under Treatment; Persistence of the Hypertrophy when seen Twenty Months after Discharge, but Lessening of Signs of Enlargement.* — Charles W. P——, private, Company F, 2d Pennsylvania Artillery, aged nineteen, a farmer before entering the service, enlisted February 2d, 1864, for three years. Stated that he suffered occasionally from palpitation and pain for about five years prior to enlistment; otherwise was perfectly healthy. Had typhoid fever in March; by May 15th was sent to rejoin his regiment, with which he remained until July 18th, but was on duty only part of the time, and could not keep up on the marches. Was sent to Division Hospital in July, and came into my wards, in Philadelphia, September 3d. The palpitations only became marked subsequently to the fever, which was followed by diarrhœa after rejoining his regiment. Indeed, though he said that he had occasional palpitation prior to enlisting, it was very doubtful if by this he meant any thing more than that his heart beat more strongly on very active exertion; for he was able to run without being put out of breath, and kept up well with the others when drilling on the double quick on first enlisting, and even until he had the fever.

He was a temperate man, using neither ardent spirits nor tobacco; of fine physique; gums healthy; digestive functions in excellent order; much pain in cardiac region, almost constant, but subject to marked exacerbations. Impulse one hundred, extended and forcible; first sound heavy, long, muffled; second, distinct, but not sharp. Transverse diameter of percussion-dullness, four inches.

After a treatment of seven months — the man having been recommended for the Veteran Reserve, 1st Battalion, but not mustered in — the impulse was reduced to seventy-eight; still, however, forcible, and still felt in several intercostal spaces. The first sound, though yet rather heavy, was decidedly less lengthened than formerly, and there was far less palpitation.

The man was discharged May 29th, 1865, having kept up his treatment — for the main part by aconite — more or less actively. He went home, and did little or no work, and I found him, December 12th, 1866, as a conductor on one of our city railroad cars. He told me that he had held this situation for eight months, and that he had not any steady pain in the cardiac region, though occasionally a pain there annoys him for a day or two. He can even exercise freely without shortness of breath, though not so well as before enlisting. Examining his heart, I perceived that the impulse was still rather forcible;

but it was regular, and only seventy-six in the minute. Both sounds were well marked; the first was heavy. The transverse diameter of the heart was three and five eighths, the perpendicular three inches.

In this case, then, a marked amelioration in both symptoms and signs took place, and continued for about twenty months after the treatment had been stopped. Nay, it appeared as if the enlarged organ had been absolutely reduced in size. Without, however, mooting this point, it is very certain that the patient's heart did not increase, and that he became more and more comfortable. It may be even argued, as just mentioned, that the heart diminished in size. But the evidence is, I admit, not wholly free from doubt; for I am aware that an engorgement of the cavities of the heart, such as is often found in instances of hypertrophy in which the action is very forcible, may cause the percussion-dullness to be greater than when the action is much quieted. Though I do not think that so considerable a difference as was here found, can be thus explained.

In another case (Case-Book V., p. 50), in which, however, the hypertrophy was much more decided, and which was, in fact, a most marked example of dilated hypertrophy — the percussion-dullness, in May, 1865, measured, in a transverse direction, four and one eighth inches; in a perpendicular direction, three and seven eighths. The impulse was very extended and forcible, and when uncontrolled by medicine, one hundred and twenty. The man had no dropsy. He was but a short time under treatment; since soon after he was admitted, the military hospital was broken up. In January, 1866, I came across him, and found him, though looking very well, still suffering from shortness of breath and palpitation, at times very violent. He had been unable to do any thing save the lightest work. The impulse was very strong; the first sound dull and heavy, and the cardiac percussion-dullness augmented; transverse diameter four and three eighths, perpendicular, four inches.

Now, in this case, it is evident that the hypertrophy of the heart did not lessen, but increased, though the action of the heart became, perhaps, quieter; and the general health of the patient, which, when he was first seen, was not very good, had become much better. The increase in the enlargement was probably due to the absence of treatment; for the man, as already stated, was only for a brief period with us before he was discharged.

In another case (Luther R——, Case-Book I., p. 125), in which the history indicated that the cardiac enlargement followed an

attack of so-called typho-malarial fever contracted on the Chickahominy, the patient, when he came into my hands, in June, 1863, while presenting the appearance of good health, showed, with the usual symptoms and signs of hypertrophy, a cardiac percussion-dullness of four and a half inches, transversely; three and seven-eighths perpendicularly; and four and seven-eighths obliquely to apex. The impulse was eighty-eight, and quite forcible: respirations twenty-four. This patient having lost nearly all of his upper teeth subsequently to the fever, and being unfit for duty in the field, was, after he had been treated for a few months, detailed to do light duty as nurse, and acting as such, remained under observation for one year. The treatment, which consisted of various sedatives, but, towards the last, exclusively of aconite, was kept up with considerable regularity nearly this whole time; and with the result that all sensitiveness in the cardiac region, at one time great, disappeared; that he no longer had any palpitation except on active exertion; and that, while the first sound remained heavy and prolonged, and the impulse strong, accurate percussion of the heart indicated that the transverse diameter had decreased by one inch, the oblique by three eighths of an inch, while the perpendicular remained the same. I have heard from the man since his discharge; he is unable to do any thing but light work on a farm, and still has strong beating of the heart. I received this report about one year after his discharge. Clearly he had hypertrophy of the heart; clearly it persists; but clearly, also, it was much benefited by treatment.

The treatment employed in these cases.

As so great stress is laid on proper treatment, and as the results show that so much can be done for these cases of hypertrophy, it is right that the means employed should be more fully mentioned. Of course, in every case, abstinence from all agents, and avoidance of all causes, which excite the heart, was insisted upon, and as faithfully as can be done with soldiers, enforced. Where diarrhœa, or any digestive disturbances existed, or anæmia was present, these were, as far as possible, removed; in other words, every thing was done to prevent the heart's movements from being, or remaining frequent. And in each instance, attempts were made to control the further increase of the organ by agents which reduce its action. With this view, I tried digitalis, veratrum viride, aconite, gelseminum, belladonna, both internally and externally, and, in addition, many other articles. Nothing answered as well, as universally well, as aconite. But I had to learn that, to be successful with it,

it must be given in a very different manner from what it has hitherto been, and still usually is. It must be persevered in for months. My general plan was to administer one or two drops of a good tincture twice or three times daily, and to go on without decreasing or increasing the dose until the impulse of the heart had become decidedly softer; at the same time, usually, the pulse was lessened in frequency. Then the medicine was kept up in varying doses, always watching whether or not it produced the desired effect, or acted too much. It did not interfere with digestion, nor impair in the least the general health. And what, fearing its activity as a sedative, I commenced hesitatingly and doubtingly, I soon was taught to use fearlessly and sanguinely. I am certain that in a large number of cases, thus employed, the remedy prevented the further growth of the heart. Nay, I think that in some — and I have given the details of a few — it lessened the already increased bulk of the organ. But the last point is one to a great extent of opinion, for the differences in the physical signs may, as above mentioned be, perhaps, explained in a different manner; and, as I cannot prove my supposition by absolute demonstration, I shall not here further discuss it. But, as regards beginning cases of hypertrophy, cases with already slight increase, cases standing as it were on, or just having passed the border line between functional disturbance and organic change, the influence of the drug is such as not, I think, to admit of doubt.

Case XXXVII. *Signs of beginning Hypertrophy following Functional Disturbance of the Heart; their Disappearance under the use of Aconite; Hæmoptysis, with Temporary Blowing Sound in Pulmonary Artery* (Case-Book III., p. 100). —Henry B——, private, Company B, 146th New York Volunteers, age 22 years, by occupation when enlisted a clerk. Enlisted August 13th, 1862, for three years, being at that time in perfect health. Did duty with his regiment up to June 1st, 1863, when he was first affected with palpitation. After that could not drill or undergo any active exertion or do hard work, and was detailed as clerk for his captain. While on the march with his regiment, moving with the army toward Maryland and Pennsylvania, in the month of June, 1863, he fell in the ranks with a severe attack of palpitation. Unable afterwards to keep up with his regiment, he was always obliged to come up as a straggler after it had encamped. Yet he did not leave it until April 30th, 1864, when, after being sent to various hospitals, he was directed to my ward in Philadelphia May 11th, 1864. He had at that time frequent palpitation and a sharp pain in the cardiac region; an impulse forcible and extended; a comparatively large area of percussion-dullness over the heart, though not one showing a very decided increase of the organ; and a dull first sound. Pulse eighty.

He took for a week tincture of hyoscyamus ℥ij twice daily, without any perceptible effect, and was then placed on a drop of a strong tincture of aconite (two and a half times the strength of that officinal in the Pharmacopœia) twice daily.

May 20th. Impulse seventy-two; not so many palpitations. Aconite three times daily.

June 17th. Has had several small hemorrhages from the lungs within the last two weeks, for which, while continuing the aconite, he has been taking aromatic sulphuric acid. A distinct, systolic blowing is perceptible in the second interspace on the left side. The impulse of the heart appears less extensive, and is markedly decreased in force; seventy-two. Temporarily stops aconite, continues acid.

June 30th. Had one slight attack of hæmoptysis since last note. Blowing sound in pulmonary artery has almost disappeared, being no longer distinctly audible. Has had more palpitation. Impulse eighty. Resumes the strong tincture of aconite, two drops at night; continues acid twice daily.

July 6th. Impulse seventy-six; still has occasionally palpitations; acid stopped; aconite given twice daily some days.

July 25th. Impulse seventy-eight; seems absolutely feeble — so much has its force been reduced. Treatment suspended.

August 4th. Impulse eighty; but has not resumed its excessive force. Only seldom, and then at night, active beating of the heart. Does now light duty as clerk.

August 22d. Impulse seventy-two, not in the least forcible, nor is there any abnormal character of sounds. Man looks and feels well; and, some time after this examination, returned to his regiment.

Cases of enlargement with predominant dilatation infrequent.

The cases of hypertrophy that I have brought forward in this discussion of the subject, and all, indeed, which have been embraced here in any general remarks, were either simple, or with more or less dilatation; but all cases in which the increase in the size of the walls predominated over that of the cavities. As a rule, too, it may be mentioned that in most of them the left ventricle rather than the right seemed to be particularly implicated. Pure, or almost pure, instances of *dilatation* were very infrequent. I met with only a few, among upwards of a hundred examples of enlargement of the heart, uncomplicated with valvular disease. When encountered, they presented the usual symptoms of enfeebled action of the organ, with the well-known accompanying physical signs.

Of irritable hearts.

In the foregoing pages I have described the organic affections of the heart met with among soldiers; and it is not my purpose to examine the functional ones particularly.

Yet the mass of cardiac disorders is not organic, but functional. And of these again a very large proportion belong to the group which I have designated "irritable hearts." Elsewhere (*Medical Diagnosis*) I have endeavored to depict the outlines of this curious malady; and I intend to publish a fuller narrative. To complete, however, this essay, and furnish a means of comparison, I will indicate very briefly the characters of the ailment. They are: great frequency of the action of the heart, constantly recurring attacks of palpitation, and pain in the præcordial region. The very rapid action of the heart is associated with an extended, not forcible, but an abrupt or jerky impulse, sometimes of irregular rhythm, and with a short first sound, and a very distinct second sound. The disorder is an extremely obstinate one, and much exercise is impossible; the malady often exists when the general health is perfect. When present to a marked degree, it totally unfits the soldier for active duty — as much so as the worst organic disease.

Conclusions.

On bringing this inquiry into cardiac affections to an end, it is scarcely worth while to dwell on the lessons it inculcates. The cases speak for themselves. It has become apparent how underlying the development and aggravation of cardiac maladies are certain general laws, the recognition of which is of the deepest practical importance to the physician; how the signs of merely disordered function are not to be slighted, since it may lead to organic disease; how the amount of suffering and the inability to exertion are often more in proportion to the extent of the disturbed function than of the structural change; how little the cardiac malady may show itself or become a source of inconvenience as long as the general health remains good; how quickly all deterioration of health reacts on the heart; and how, after exhausting diseases, especially fevers, we should be careful not to permit over-exercise or sustained exertion.

These points are alike important to the student of cardiac pathology in civil and in military life. But there are some further questions here mooted which concern the latter alone. Ought an affection of the heart to be a disqualifying element for enlisting? Ought it to become a cause for discharge? Obviously it cannot be recommended to receive into the ranks men with any defect of the circulation. But the mere fact of a disorder of the heart existing ought not to be a cause for discharge. Some cases are curable, and others can do much military duty, though it may not be the most active field service. If a nation engaged in war

has a population flocking to its standard; if the ranks can be readily recruited with able-bodied men; if it does not care for the military efficiency of those who have been long enough in the army to attain military efficiency, unless this be combined with perfect physique — then, of course, it had best at once restore to the field and workshops those whose frames are no longer free from disorder. But under other circumstances many cases even of organic disease of the heart may be retained for service in garrison and the like, and a skillful medical officer should be chosen to select them — the principle of selection involving the extent and nature of the complaint, and taking as a guide the coexisting evidences of disturbed function, rather than the mere name, or label, it bears.

CHAPTER ELEVENTH.

ON CEREBRO-SPINAL MENINGITIS.

By SANFORD B. HUNT, M. D., Etc.

Historical and Geographical Sketch. — Prevalence in America and during the War. — The Disease favored by Cold and Overcrowding. — Age and Constitution of those attacked. — Symptoms. — Premonitions. — Period of Invasion. — The Intellect. — Muscular Contraction. — Pain. — Decubitus. — Petechiæ. — Temperature. — Pulse, etc. — Phenomena of Vision. — Deafness. — Phenomena preceding Death. — General Summary of Symptoms. — Duration and Mortality. — *Post-mortem* Appearances. — Case reported by Surgeon Joseph Jones. — Note by the Compiler. — Commentary by Dr. Jones. — Commentary by the Compiler. — Dr. Webber's Division into three Orders. — Surgeon Russell's Observations. — Dr. Upham's Observations. — Dr. Sanderson's Report of Autopsies. — Petechiæ. — Further Autopsies. — Treatment. — Surgeon Russell's Report. — Dr. J. Baxter Upham's Account. — Dr. Webber's Views. — Dr. Sanderson's Report. — Comments by the Compiler. — Ætiology. — Climate. — Exposure. — Prisons and Barracks. — Epidemic Constitution. — Sex and Age. — Summary. — Is Cerebro-Spinal Meningitis Contagious?

HISTORICAL AND GEOGRAPHICAL SKETCH.

It is within the last thirty years that the disease under notice has, for the first time, been scientifically described. Under the various names of "cerebro-spinal meningitis," "spotted fever," "typhus syncopatis," "winter epidemic," "catarrhal fever," "peripneumonia notha," "fièvre cérébrale," and "céphalalgie épidémique," it has been more or less known for a longer period. Each of these various titles is in some sense descriptive; but the first is the only one which can be considered classical, or based upon a true appreciation of the pathology. History.

Says Mr. Simon: "In 1837, when its importance first began to be recognized in France, few previous epidemics of the disease were on record." Yet it had been more or less known before that time. In Geneva, in 1805, it killed thirty-three persons, and from that time on it has been occasionally described. Yet there can be no doubt that, as an epidemic, — and in that respect to be distinguished from ordinary meningeal inflammations, — it has existed from the earliest periods of medical record. Dr. S. G. Webber, of Boston, in the erudite essay to which was awarded the Boylston Prize for the year 1866, very clearly establishes its identity with epidemics chronicled in Europe as far back as 1480; while an epidemic occurring in 1503 can be readily recognized as the

same from the descriptions given of the symptoms. "Fièvre cérébrale" was the name then assigned to it; and, under that and similar designations, it has made frequent appearances upon the records of epidemics. In some descriptions of jail or hospital fever, such as that by Sir John Pringle, in 1752, it is pretty clear that this enemy to life was the real subject of study.

With the increase of medical publications, we find this disease, or something which does not much vary from it in the prominent symptoms, recorded frequently; and it would encroach too much upon our space to specify the particular epidemics. In all of them we find no contradiction to the continuous statement of a disease distinctly, but not extensively, epidemic; suddenly appearing, and as suddenly passing away; having its habitat in malarial localities, or where crowd-poison was present; attracting attention and exciting profound alarm by the violence of its cerebral symptoms; and, finally, presenting at all times — and not less now than in former years — a frightful percentage of mortality.

Geography.

No country in Europe or in North America, open to intelligent medical observation, has escaped this infliction. The localities that have been distinguished by its most severe invasions, during the present century, are Geneva in 1805; among the Spanish prisoners at Briançon in 1807; in the sick of the French army at Grenoble in 1814, after the hardships of crossing the Alps in winter; and in the Parisian hospitals at the same time; during the winters of several years (1813, 1814, and 1815) in Ireland; in Millbank Penitentiary, near London, in 1823; among the galley slaves at Toulon in the winter of 1829–30; in numerous barracks in France in 1837, and continuing for several years to be mostly confined to the military; extending its ravages to civil life at Strasbourg in 1841; from which time its appearances are too numerous to quote, it having become a well recognized disease, although by far the best study of it that has met our eye is that made in 1865 by Dr. John Burdon Sanderson on the Lower Vistula, in Northern Germany, whither he was despatched on a tour of investigation by Dr. John Simon, the distinguished medical officer of the Privy Council of Great Britain.

Prevalence in America, and during the war.

In America it has occurred, mostly in the winter season, in the ordinary fever haunts of cities, and in isolated country districts, especially those which present the ordinary causative influences of typhus and typhoid, or are distinctly malarial. It has also happened on shipboard in association with hardships and confinement between decks. With reference

to our present purpose of study — to learn how far this disease may be connected with military hygiene — we find it developing itself, especially in the winter of 1863–64, in the army, and also in the succeeding winter. Its most frequent habitat was in overcrowded military hospitals, in cantonments for recruits, and in military prisons. Epidemics occurred especially at Benton Barracks, Missouri, at Newbern, N. C., and at the Penitentiary at Little Rock, Ark.; while at numerous other posts we find records of its occasional prevalence.

In the Confederate army it was witnessed in the army of Northern Virginia, near Fredericksburg, in April, 1863; in Kentucky in the winter of 1861–62; and near Mobile in the closing winter of the war.

The frequent mention of prisons in the above statement will at once attract attention. The observation of our army surgeons, North and South, will confirm the proposition that cerebro-spinal meningitis is not peculiarly a disease of the camp or the campaign. It sometimes occurred in tents, but most frequently in permanent cantonments, and where masses of troops were aggregated, or in the various prisons.

At Little Rock, Ark., the writer saw it in the winter of 1864–65. Some cases occurred in the camp of a Missouri regiment which was living in stockaded tents, many of which were damp, ill-ventilated, and, from long occupancy, surcharged with organic matter in process of decay. At the same time a considerable number of deaths occurred in the Penitentiary, two miles distant from the camp mentioned. This penitentiary was overcrowded with Confederate prisoners. Surrounded by a high stone wall, and itself built of solid masonry, it had very insufficient latrines, and was damp and chilly throughout. All forms of zymotic disease prevailed there, including typhoid fever and small-pox. The cerebro-spinal meningitis showed itself in the form of a small, compact epidemic, and disappeared after about twelve deaths occurred. All cases were fatal.

Occurrence at Little Rock, Arkansas.

At Benton Barracks, near St. Louis, Mo., fifty cases were observed by Surgeon Ira Russell during the winter of 1863–64. Dr. Russell says: "At that time the weather was extremely cold; the men were huddled together in overcrowded barracks, and subjected to all the moral and physical influences incident to a change from a life of servitude to one of freedom and military service." In another report Surgeon Russell details at length the conditions to which these unfortunate

Occurrence at Benton Barracks.

men (escaped or emancipated slaves) were subjected. The barracks occupied by them were inferior to the cavalry stables near by, and were most imperfectly heated; while the commissariat and clothing supply was deficient. As in the epidemic at Little Rock, zymotic diseases were very prevalent, coincident and frequently complicated with the meningeal disease.

Occurrence at Newbern, North Carolina.

In the winter of 1862–63, a severe epidemic occurred at Newbern, N. C., which has been ably described by Surgeon J. Baxter Upham. It was confined mostly to the 44th, 45th, and 51st Massachusetts, and the 10th Connecticut, regiments, all of which occupied barracks. The epidemic tendency extended, however, to troops living in tents to a small degree. The regiments most afflicted occupied barracks located on a "sandy and sterile plain, elevated perhaps five or six feet above the level of the river. The 44th, which suffered most, was nearest the bank; quite near the camp lay a couple of marshy bogs, small in extent, through which flowed a sluggish stream to the river." Of the barracks, Dr. Upham says: "They were made of green stuff — hard pine mostly — the logs being taken newly cut from the forest or drawn out from the water, where they had been lying for a few weeks, sawn into joists and boards, and used in the fabrication of all parts of the building. . . . . Thus constructed, they were necessarily cold and damp." They were also much overcrowded, with imperfect ventilation and scanty heating apparatus.

Occurrence near Fredericksburg, Va.

In April, 1863, four cases occurred in a single tent of the 22d North Carolina regiment (Confederate), near Fredericksburg, Va. They were reported by Surgeon P. Gervais Robinson. Three of these cases died, all being from one family of conscripts. The fourth tent-mate, an old soldier, recovered. Dr. Robinson says, that "it is difficult to define any special circumstances affecting this tent in preference to others."

In February, 1863, eight cases, of which six were fatal, occurred in the 3d Alabama (Confederate). We are not informed of the character of the camp, but suppose it to have been one of considerable exposure. The season was severely cold.

Sanderson's report of epidemic on the Lower Vistula.

Turning to the epidemic on the Lower Vistula (Northern Germany), in 1865, we find Dr. Sanderson reporting a very insufficient ventilation in the cottages where it prevailed; and he adds: —

"The want of house drainage and of any appliance for the collection and deposit of excreta, is another condition which (especially in a

marshy district) must, no doubt, exercise a deteriorating effect upon all the inhabitants; but as the evil is universal, as every peasant defecates in the open air in the immediate neighborhood of his cottage, it would be absurd to attribute any special significance to the fact."

The disease favored by cold and over crowding.

These statements, which are not contradicted by any other facts within our knowledge, go to show that cerebro-spinal meningitis has its favored habitat in cold, damp, and overcrowded tenements; preferring prisons and barracks, and being most fatal in those localities. The winter is the season in which these anti-sanitary conditions are most easily developed; but there seems to be another element of causation in a low temperature. It is especially a disease of the winter season. We have observed it (in civil life) in the summer, but our records confine us almost entirely to the winter months.

Age and constitution of those attacked.

Dr. Sanderson's record of the epidemic on the Lower Vistula, shows that of three hundred and forty-seven deaths, three hundred and eighteen were of children under fourteen years of age. As to sex, one hundred and sixty-four were males, and one hundred and fifty-four females. The sex of those over fourteen is not mentioned. We quote these statistics as far more valuable for generalization than any that can be furnished by an army; inasmuch as military life excludes the questions of sex and of childhood. Our statistics do not enable us to give accurate tables of the age and condition of those who were attacked in the army during the rebellion; but we feel safe to assert that cerebro-spinal meningitis, both in military and in civil practice, selects its victims from the young and the vigorous, preferring the strongest and most robust constitutions to the feeble and broken.

Dr. Upham says of the Newbern epidemic: "The subjects of this disease, in most cases, were those previously in the fullness of robust health, — between the ages of eighteen and twenty-four, — who had endured hardships and exposures with impunity."

SYMPTOMS.

Premonitions.

Usually, the premonitions of cerebro-spinal meningitis are brief and uncertain. The patient has been usually found in good health up to the moment of attack. In some few cases, which remind us of idiopathic meningitis, there is a prelude of nausea or causeless vomiting, and in some rare cases there is headache for some days previously. On this point, Dr. Upham says: "The disease was commonly sudden and without premonition, the patient, for the most part, continuing on duty and making no complaints till the very day of his seizure."

Dr. Russell says of the Benton Barracks epidemic: "The first patients brought to the hospital were in a dying state; those bringing them reporting that a few hours previously they were well, and insisting that they had been poisoned. Dr. Russell, however, found, on close investigation, that the onset of serious symptoms had usually been preceded by a period of malaise, lasting from three to eight days. It is, nevertheless, a prominent fact that there is usually nothing diagnostic in whatever prelude there may be, and that sudden, violent, and uncontrollable attack is one of the characteristics of the onset. The premonitory symptoms are very rarely, if ever, sufficient to provoke a call for medical assistance.

Period of invasion.

Vomiting is a characteristic symptom of the period of invasion. It is usually violent and obstinate to treatment, and continues for several hours. Severe headache is synchronous with the vomiting; the pain, at first, being usually referred to the whole head. Not unfrequently a chill ushers in the grave symptoms. It may be slight, but is sometimes profound, assuming the appearance of the congestive chill of pernicious intermittent. In these cases the chill merges at once into delirium or coma.

As a rule the nausea and vomiting are the first prominent signs, and they are very speedily followed by a peculiar stiffness in the muscles of the back and neck, or by intense localized pains somewhere in the same region, or, perhaps, referred to the shoulder or arm. In some cases the initiatory symptom has been paralysis of the tongue or muscles of the face. The headache and pain are attended by great restlessness, and delirium speedily follows. Fever sets in, the face is usually flushed, the heat of the body is augmented as shown by the thermometer, though the sensations may still remain chilly; the conjunctiva is red and injected, the pupils of the eyes are most frequently dilated though sometimes contracted, and the muscles of the nucha are contracted. From this point on it will be more convenient to study the leading symptoms individually.

The Intellect.

From the period of invasion the intellect becomes affected. The delirium may be either active or passive. Sometimes the condition is that of partial coma, the patient being capable of being roused and of comprehending questions. In other cases the delirium is violent, and the patient needs coercive control; but the general rule will be a condition of muttering, talkative delirium, without much physical exertion. The violent form of delirium is usually rapidly fatal, and may continue until the moribund condition, when it is succeeded by a brief period of coma, which is a part of the process of death.

Again, the delirium often merges into a state of apathy or complete indifference to external impressions. Dr. Sanderson remarks, that in several children whom he saw, the general state of the patient was very similar to that of tubercular meningitis, and that it was impossible to distinguish them from cases of that disease. The order of the succession of the intellectual disturbances, is first the tendency to mutter in a dreamy way, and following that a coma, usually not profound, which deepens into dissolution by death, or may gradually give way to recovery.

The delirium, whether violent or muttering, is accompanied, and often preceded, by that characteristic symptom, a contraction of the muscles of the neck. In Germany, this feature has given the popular name to the disease (Nackenstarre), and it may be considered as pathognomonic when associated with disturbance of the intellect. Dr. Sanderson attributes this contraction to pain, and not to spasm. He says: "The muscles of the back of the neck become the seat of exquisite pain, and in consequence the patient, by a half voluntary effort, throws back his head, in the same way as a person affected with other forms of myalgia." This does not agree with American, and especially with army observation, which almost uniformly speaks of "spasm" and "opisthotonos" being present. Dr. Webber says of this, that even under the influence of chloroform it is impossible to straighten the body. Again, numerous allied symptoms are exhibited which prove to us, conclusively, that the muscular contraction is a true tonic spasm. Strabismus, occasionally trismus without any other tetanic symptom, paralytic deglutition, and inward curvature of the thumbs and great toes — some or all of these are so frequently present, usually followed by opisthotonos, that all questions as to whether this is spasm or a voluntary posture seem decided.

Muscular contraction.

Pain, however, is a symptom of great importance. It is often localized, usually at first in the nape of the neck, but frequently in the spine. Sometimes it assumes the form of colic, or of intense rheumatic twinges in the muscles, perhaps of the abdomen, or of the extremities. This pain is rarely dull. It is agonizing. Closely connected with it is a hyperæsthesia, large portions of the surface becoming exquisitively sensitive, so that when touched or handled the patient screams. All motion is intolerable, and even when the patient seems plunged in a profound insensibility, the attempt to move him calls out the most painful semi-articulate cries of suffering. At the same time, and without regard to the pain of motion, we find restlessness a constant and

Pain.

prominent symptom. Early in the disease, his constant search for a new position exhausts himself and his attendants, and the restlessness continues even after he has become incapable of turning in bed. In convalescence, we find hyperæsthesia still present, and only disappearing with the other evidences of cerebral disturbance.

Decubitus.

This, like the other symptoms, is peculiar. From the time the nape-pain commences, the head is thrown back, and the patient lies upon his side, with the face upturned toward the head-board. As opisthotonos increases, or as, perhaps, the thighs become flexed upon the abdomen, the lateral posture is the only one possible, the sufferer constantly returning to it from his frequent efforts to find relief elsewhere.

Petechiæ.

Great importance has been attached to the petechial eruption; so much that, in the northern and eastern States, the disease bears the popular name of "spotted fever," and many observers see in it only a peculiarly malignant form of typhus. At another stage of this argument, we shall further allude to this symptom, with a view to determine whether cerebro-spinal meningitis is a fever or a phlegmasia, a contagious or a non-contagious disease — a point of great hygienic importance.

For the present it will suffice to say that petechiæ are not constant, the body frequently assuming a uniform dusky or livid hue of capillary congestion. When present they appear early — in the majority of cases on the first day — and vary in size from a mere red point to a diameter of an inch. Lying even with the surface, they are permanent on pressure, occurring most frequently on the legs and body, but often found on the arms. In American statistics they are mentioned as present in about one third of the cases which are tolerably well recorded. As a negative fact, it is important to mention that Dr. Sanderson makes no allusion whatever to petechiæ in his report from the Lower Vistula, a paper otherwise remarkable for accurate study. It is to be inferred that he does not consider them a symptom of the disease.

Temperature, pulse, etc.

The febrile condition is not marked, though there is a uniform increase of the natural temperature, attended by exacerbations during the periods of pain.

The pulse is accelerated most in the early stage of the disease. As a guide to judge the severity of the disease it has little value. It varies in the same case from hour to hour. It is generally over ninety, but may suddenly fall much below, and alternately rise above, that number, without apparent relation to the progress of the disease. In *character* it uniformly gives evidence of deficient

arterial tension. Intermission or irregularity is not often observed.

The respiration partakes of the same uncertainty as the pulse, being rapid or slow without reference to other symptoms. But it is always embarrassed in strict relation to the gravity of the case, and we find the inspiration laborious and prolonged. It is the same form that we notice in typhoid patients who are tending toward coma.

The tongue is sometimes covered with a white, creamy coat, but is more often dry, and assumes toward the last a brown fur. Herpetic eruptions occur about the lips.

The bowels are commonly sluggish, and there is nothing characteristic in the stools. Dr. Upham remarks that diarrhœa setting in late in the disease often points to a fatal termination.

Swellings and *abscesses* occasionally appear in the progress of the disease or during convalescence.

Strabismus, usually internal, is often present. The conjunctivæ are injected, and in some instances small ecchymoses occur in them. The iris follows the same law as in other forms of meningitis, being either natural or contracted during the acute stage, and dilated and fixed after the period of effusions. In some recorded instances of recovery, total blindness was found to have been produced by inflammatory action in the posterior chamber of the eye, resulting in opalescence of the lens and atrophy of the eyeball. Iritis has also been observed, resulting in suppuration and loss of sight. Phenomena of vision.

In like manner, deafness is sometimes present from the onset, or may be developed during the progress of the disease. It is sometimes permanent. Deafness.

The phenomena of dissolution are those connected with the failure of the respiratory function. Coma having become profound, the respiration becomes hurried and difficult, while the pulse is proportionately accelerated. The temperature at the same time is augmented, the record being in the neighborhood of 102° or 103° Fahrenheit immediately before death. As the breathing becomes a mere exhausted flutter, the pulse will be found to be as high as 140. The heart continues to beat for a few moments after the last expiration. Phenomena preceding death.

The above analysis of symptoms will be incomplete without some attempt to give a *coup d'œil* of this terrible disease. Much as it varies in the details of its career, it always presents two stages or conditions. The first is a period of General summary of symptoms.

wretchedness, in which the tortured organs of sense and consciousness express the keenest forms of pain and restlessness, and of mental hallucination and delirium, rapidly plunging the miserable man into the horrors of convulsion or tetanus, until we find him with eyes fixed or squinting, with the head thrown back, the body in opisthotonos, and the thighs flexed upon the belly, panting, sweating, moaning, or shrieking with pain.

The second stage is more merciful. The organs of the brain have succumbed under the pressure of effusion, and the exhausted body lies comatose and paralyzed. The pain, the muscular contraction, the restlessness, the extreme debility — these are the fixed quantities of the disease. All other phenomena are comparatively non-essential in the diagnosis.

DURATION AND MORTALITY.

Duration.

Of several hundred fatal cases, the records as to the period of death are so imperfect that we are only able to speak with positiveness in one hundred and sixty cases. Of this number twelve, or one in thirteen, died within the first twenty-four hours; ninety-two, or more than half, died before the close of the fifth day; fourteen, or one in eleven, died before the close of the tenth day; four, or one in forty, before the close of the fifteenth day; and eighteen survived for various periods thereafter. The deaths on the second, third, fourth, and fifth days are pretty equally distributed. It will be seen that sixty-five per cent. of the deaths occur within the first five days. That period past, the chances of the patient improve.

Of the duration of the cases of recovery it is unnecessary to speak. The attempts made to establish a probable period of convalescence have only resulted in proving that recoveries are slow as a general thing, and that there is no law other than the very uncertain periods that may be required for the removal of whatever deposits of exudation may have been made upon the meninges. The result is, that the epoch of convalescence is at any point of time from three days to three months.

Dr. Webber, from a smaller number of cases, reaches the same conclusions. He says: "If a patient lives beyond the sixth day, there is some chance of recovery, less than one sixth having died after that time. The most fatal period is from the second to the fifth day, more than half dying then."

Of seven hundred and thirteen cases which we have collated with some degree of accuracy, we exclude three hundred and forty-

seven as being records of deaths only, and not capable of comparison. We have left three hundred and sixty-six cases, which present all the data necessary to deduce the average rate of mortality in cases attacked. Most of them are from military life, and include all the recoveries as well as the deaths. The following is the result: — Mortality.

Cases.	Deaths	Recoveries.	Per Cent. of Deaths.
366	243	123	70.

It will be seen that this ranks as one of the most uncontrollably fatal diseases, and that the resources of modern science save no more cases than recovered three centuries ago.

POST-MORTEM APPEARANCES.

The vast importance of a clear comprehension of the essential pathology of a disease of such fatality, is sufficiently evident. Fortunately, the *post-mortem* records to which we have access are so harmonious in their agreement upon the appearances presented after death, that there seems to be but little need for argument. It is, however, necessary to premise that we exclude from our research two cases reported by Dr. Upham at Newbern, which seem to us to have been deaths from other disease. They are cases numbers two and twelve, in his able monograph, published in Boston in 1863. A reference to the bijou in question will, we think, excuse their omission.

Of sixty-eight autopsies, the records of which we have examined, all present positive evidence, not only that the meninges of the brain and spinal cord were the localities of inflammatory disease, but that the sufferers died from that inflammation, and not from any intercurrent or other disease which might cloud the discussion of the essential cause of death. The appearances in other organs were mostly negative. As most of the patients had been healthy up to the hour when headache and nape-pain appeared, so we find their organs after death exhibiting trivial signs of disease. A few typical autopsies will sufficiently exhibit this; and we shall then proceed to analyze them all with reference to other lesions which otherwise might be regarded as an integral part of the disease.

Surgeon Joseph Jones, Confederate Army, observed several cases of cerebro-spinal meningitis at Augusta, Georgia, just before the close of the civil war. One of these, presenting the usual phenomena during the progress of the disease, furnishes the following careful *post-mortem* examination. The duration of the

disease was eleven days — long enough to fully develop the pathological conditions.

Autopsy, Eight Hours after Death. — After the removal of the skull-cap, the dura mater of the brain presented a normal appearance; there were no marks of inflammation or effusion between this membrane and the arachnoid. The arachnoid presented an opalescent appearance where it passed over the sulci of the cerebrum and cerebellum.

Case of Private Goosby, Co. J, Third Georgia militia — reported by Surgeon Joseph Jones.

The pia mater was greatly congested; and the larger veins and many of the arteries were greatly distended with dark blood.

The pons varolii, medulla oblongata, and spinal cord, were coated with a firm, light greenish-yellow, wax-like, fibrinous exudation; large tracts of the cerebrum and cerebellum were also thinly coated with this effusion, which also surrounded the cauda equina and most of the roots of the spinal nerves, up to their entrance into the dura mater of the spinal cord.

This exudation possessed various degrees of consistency, from that of a serous fluid to a newly-formed membrane, and differed in thickness in different portions of the spinal axis. The exudation at the base of the brain, where it covered the pons varolii and medulla oblongata, was of considerable thickness and firmness, and extended laterally, gradually diminishing in thickness, to the convolutions of the cerebrum and cerebellum. Over these organs the deposit was much thinner and less consistent.

When a section of the brain was made, so as to expose the ventricles, the third and lateral ventricles were found filled, and even distended, with a light greenish-yellow, semi-fluid exudation, resembling, to the naked eye, pus. The optic thalami and striated bodies, with the walls generally of the ventricles, were coated with a layer of semi-organized plastic lymph. This deposit was subjected to a careful microscopic examination, resulting as follows: —

Under the microscope, the exudation presented different stages of organization and development, from the simple granule to the perfected fibre, and even fibrous tissue. Although resembling pus to the naked eye, the exudation possessed a higher organization, and the more solid portions were rapidly passing into fibrous tissue.

These facts struck me as of importance, in that they connected this disease with other forms of inflammation, as pleuritis and peritonitis; and also explained the great difficulties that lie in the way of recovery from an inflammation of the nutritive membranes of organs essential to life, surrounded by a bony case. The present case had persisted for two weeks, and the results of the autopsy

indicated that the intensity of the inflammatory process had ceased, and much of the effused material was becoming organized. The mere presence of this material, from the very structure of the organs involved, and their bony envelope, must give rise to various morbid nervous phenomena, and, by pressure upon the nervous centres, give rise to irremediable disturbances in the muscles and organs to which their nerves are distributed.

[Dr. Jones proceeds to give at length the *post-mortem* appearances in the other organs. Their evidence is negative. He says: "The liver contained grape sugar, which I have shown to be absent from the liver of malarial fever." The organs of the thorax and abdomen may be said to have been healthy, or so nearly so as to present no evidence that they had shared in producing the fatal result. The liver and spleen were microscopically examined.] Note by the compiler.

The following points are established by the investigations in this case of cerebro-spinal meningitis: — Commentary by Dr. Jones.

1. There was no complication with malarious disease.

2. The products of the inflammatory action resemble in all respects those of pleuritis and peritonitis.

3. The inflammatory action appeared to be confined chiefly to the pia mater, involving, to a certain extent, also, the arachnoid.

4. The nervous elements of the brain, spinal cord, and cervical nerves, (ganglionic cells, commissures, nerve tubes, and nervous connective tissue,) appeared to be free from inflammatory action.

5. If the nervous elements were primarily involved in cerebro-spinal meningitis, it would be impossible to explain the suddenness and violence of the symptoms, and the rapid fatal result in the absence of all lesions recognizable to microscopic investigation. On the other hand, it can be readily conceived that the inflammation of the nutritive membrane, and the coating of the most delicate organs confined in a bony case, with a dense exudation tending to organize itself progressively into more firm and resisting structure, might give rise to all the phenomena of cerebro-spinal meningitis.

6. This case furnishes an explanation of the very fatal character of this disease, as well as of the tedious nature of its recoveries. Even after the subsidence of inflammatory action in the meninges, the most serious consequences may follow, and all the dangers of the essential functions of life may be kept up by the mere mechanical action of the fibrous effusion. The period of convalescence from this disease would depend not only on the amount of effu-

sion, but also on the character and rapidity of the subsequent changes.

7. The disease appeared to have been produced in this patient by the same causes which are active in the production of other inflammatory affections, as peritonitis, pleuritis, pneumonia, and acute rheumatism; namely, exposure, cold, damp weather, and the hardships of camp life.

8. In its essential nature this case differed from a contagious malignant fever. There was not a single fact developed by the *post-mortem* examination that would justify the classification of this disease with the Pyrexiæ. If cerebro-spinal meningitis belongs to the class of the febrile diseases, then pneumonia, pleuritis, and acute peritonitis should, in like manner, be stricken from the list of the Phlegmasiæ.

Comments by the compiler.

In commenting on the preceding extended and exhaustive report (and we have been compelled to somewhat curtail its minuteness of detail), we see, first, that this was a typical case of cerebro-spinal meningitis; that it was epidemic in character, being one of a number of simultaneous cases; that the period of death was deferred until all the phenomena had time for development; that the autopsy was thorough and conscientious; and, finally, that its subsequent study and illustration are worthy of full confidence.

Accepting this, then, as a type of the epidemic form of cerebro-spinal meningitis, it is only necessary to inquire in how much other records in our possession may be contradictory of this case.

The theory which Dr. Jones seeks to establish is, briefly, that cerebro-spinal meningitis is not a fever, but a local inflammation; that it is not contagious; that therefore we may allow it contact in hospital wards with other patients; and, finally, that all our hygienic efforts may be directed to its original and not its secondary causation — because the latter does not exist. We turn, therefore, to other records of autopsies to find whether those diseases which have been considered allied to epidemic cerebro-spinal meningitis, such as typhus, typhoid, and "peripneumonia notha," appear in the *post-mortem* examinations.

Dr. Webber's division into three orders.

Dr. Webber, in his Boylston Prize Essay of 1866, divides cerebro-spinal meningitis into three orders. In the first the cerebro-spinal system is affected; in the other two it is not. Without reminding this able essayist, to whom we are much indebted, that he may be accused of a classification on the *lucus a non lucendo* principle, we quote his statement of the conditions of the two latter varieties: —

"II. In the second, or pneumonic form, there is less disturbance of the cerebral functions; *delirium is wanting*, though headache *may* exist. With great debility are found the symptoms, rational and physical, of pneumonia. Petechiæ occur. Opisthotonos is not unusually met with. Only two cases of this form occurred among those recorded; both recovered; both exhibited petechiæ."

Two cases of petechial pneumonia, in which delirium was wanting, and headache is the only recorded cerebral symptom, while both recovered, can hardly be considered as within the range of this essay. As to the third variety he says: —

"III. The third variety is marked by an absence of all the peculiar local symptoms; having the debility, the petechiæ, and complications. Two cases occurred: one with suppuration of both parotids, the other with great swelling, and excessive tenderness of the right knee; *both were without cerebral symptoms;* both recovered."

We must again conclude, that two cases, in which no cerebral symptoms appeared, were not cerebro-spinal meningitis, and this refinement of classification is due to an original error in the material from which the essay was compiled. Excepting these four, the two hundred and forty-nine cases included in the tables of Dr. Webber, seem to have been genuine. The four mistakes do not affect his records of autopsies. Of these he says: "In the lungs, the only lesion which is at all general, is a congested state," which he ascribes to hypostasis. "Sometimes there is a thick deposit of lymph upon the pericardium, and sometimes the same substance is to be found in one of the cavities," — a fact important as a possible metastasis. The other appearances he enumerates are in no manner logically connected with the disease in question, unless we except his mention of petechiæ upon the peritoneum.

Dr. Russell's observations.

Surgeon Ira Russell, U. S. Volunteers, who had, and improved, excellent opportunities for observing this disease in Benton Barracks, St. Louis, Mo., gives seven *post-mortem* examinations. In one of these he mentions splenic enlargement and fatty liver; in a second, softened mucous membrane of the stomach and congestion of both lungs; in a third, slight pleuritis and slight inflammation of the left lung; in a fourth, lymph covered the left pleura, and the left lung was in gray hepatization with the liver engorged; and, in a fifth case, the whole intestinal mucous membrane was softened. In two cases lumbrici were found, a reminder of the French records of early epidemics, when this parasite was considered a cause of the disease.

The cases coming under Dr. Russell's observations, were pecul-

iarly malarial; yet we find in two of his cases that no complication was present. Those complications that were exhibited are phlegmasiæ, or else chronic disease, and none of them indicate any of the known forms of febrile disease.

Dr. Upham's observations.

Among nineteen autopsies reported by Surgeon Upham as occurring at Newbern, N. C., we find the following noteworthy conditions existing in the thoracic and abdominal viscera. In one case, apoplectic points in the lung, the spleen double the usual size, and Peyer's patches more prominent than usual, with ulcerative points in one gland; "not having, however, the legitimate appearance recognized in typhoid fever." In a second case, the lungs were tubercular, with apoplectic spots, the liver enlarged, and the spleen twice the usual size. In a third case, which lived nearly a month, Peyer's patches were very much thickened, and, in one or two instances, ulcerated. In a fourth case (Case XII.), there is no evidence of cerebro-spinal meningitis. The patient died suddenly, comatose. The brain was found softened, and the liver in fatty degeneration.

Comments by the compiler.

Thus, in nineteen autopsies, we have only three which presented appearances at all justifying the inclusion of pneumonic or abdominal disease as a part of the cause of death; and in these the prudent observer will see only accidents and not essentials.

Dr. Sanderson's report of autopsies.

The same remark is true of the autopsies reported by Dr. Sanderson in the cases occurring in Northern Germany.

We are inclined, therefore, to believe that the only essential pathological condition of epidemic cerebro-spinal meningitis is that which its name indicates — an inflammation of the meninges, especially of the pia mater, and that it does not differ in its character or tendencies from ordinary phlegmasiæ of serous membranes. Its locality gives it a fatal tendency not seen in pleuritis, but not much exceeding that of peritoneal inflammation.

The only phenomenon that strongly supports the febrile theory in this disease, is the occurrence of petechiæ, and to them we now turn our attention.

Petechiæ.

Among the numerous cases reported, we find petechiæ, or purpuric spots, reported so infrequently that, taking into consideration the many instances in which the reports are obviously deficient in some respect, no numerical analysis of value can be made. The general statements of reporters seem to us, for once, more reliable than the statistics. Dr. Webber says, they are "not always present." Dr. Upham says: "Petechiæ

were not an unfrequent manifestation — in appearance almost identical with the true typhus eruption, and like that seen upon every part of the body except the face; persistent on pressure; varying in hue from the darkest aspect of measles to that of the true petechial spots imbedded in the skin. Purpural spots, abundant and of large size, were sometimes present, and were always a grave symptom."

Dr. Russell, whose patients were mostly negroes, saw no petechiæ at all, and does not mention them or apoplectic spots in the lungs, or ecchymoses on the peritoneum as present.

Dr. Simon, medical officer of the Privy Council of Great Britain, in concluding his graphic description of this disease, says: "And now, frequently, the patient has eruptions upon his skin, — sometimes petechial, sometimes more or less exhibiting the characteristic exanthema of typhoid fever, measles, or other eruptive fever, but oftenest of all in the form of herpetic vesicles about the lips."

Dr. Sanderson, who reports three hundred and forty-seven deaths in Northern Germany from this disease, many of which he witnessed, incidentally mentions, in the few autopsies he witnessed, that "in one of the rapid cases the discoloration was excessive, and there were, moreover, petechiæ of various sizes scattered on the trunk and inferior extremities." This is the only mention he makes of their occurrence.

The cases furnished to us by Confederate surgeons rarely, if ever, mention petechiæ as among the signs before or after death. Dr. Jones discusses their value at length, and we make from his records the following extract: —

"Writers have been led into error by attributing the mottled appearance of the surface, and the changes of the secretions, as well as the marked disturbances of the circulatory and respiratory systems in cerebro-spinal meningitis, to the action of a poison disorganizing the blood. It is entirely pertinent to ask: If the blood is so disorganized in this disease, as to allow of the effusion of disorganized blood in the skin, why should all such effusions be absent from the structures most inflamed and diseased, the meninges of the brain and spinal cord? The fact is that these discolorations of the skin, in most cases of the disease, are not due to actual effusions of disorganized blood; but merely to irregular capillary action and congestion, dependent upon deranged nervous action and circulation. It is unnecessary to do more in this connection than allude to the effects of pressure upon the medulla oblongata, upon the functions of circulation and respiration. And even if it be true that the blood is disorganized in certain cases of cerebro-

spinal meningitis, such disorganization may be entirely explained by the derangements of circulation and respiration, induced by the disturbance and perversion of the functions of the cerebro-spinal system."

The facts in the discussion seem to be, that the immediate effect of the disturbance of the nervous centres is to produce capillary congestion; that the skin becomes flushed and livid; that sometimes hemorrhagic spots appear beneath its surface, and in the conjunctivæ or lungs; and that in one case the stomach, and in another, the peritoneum presented hemorrhagic effusions, or petechiæ, to a small extent. That these constitute a hemorrhagic effusion, dependent upon disorganized blood, which itself is dependent upon a specific poison is, thus far, not proven, nor does the evidence yet adduced assign to these occasional blood-spots any higher importance than may be conceded to the much more common herpetic eruptions about the lips.

Further autopsies.

With the view of illustrating the *post-mortem* appearances that attend the rapidly fatal as well as the matured cases of this disease, we append, with comments, a few cases covering the various periods of duration, from the initial chill until death: —

Case. Death eighteen hours after admission, reported by Ira Russell, surgeon U. S. V.

Wm. O'Brien, Company D, 7th Missouri Infantry, age 35. Admitted January 7th. Died January 8th, 1864. Brought to the hospital in a state of collapse, insensible and pulseless, unable to swallow. Surface cold. All efforts to produce reaction proved unavailing, and death occurred eighteen hours after admission.

Autopsy. — Dura mater injected. Arachnoid contained ʒiss of serum. Pia mater injected. Gray and white substance of brain highly congested. Right and left lateral ventricles each contained ʒij of serum. Choroid plexus highly injected. Cerebellum, pons, and medulla, congested and flabby. The spinal cord presented similar appearances.

Thorax. — ʒij of serum in pericardium. Whole left lung highly congested and softened. Bronchial tubes injected. Inferior lobe of right lung highly congested and softened. Spleen weighed thirteen ounces, of a light gray color, and a consistence like jelly. [We have omitted all negative facts, and thus much abbreviated the account, which is minute. The splenic disease must have existed prior to the attack. The congestion of the lungs is characteristic of the embarrassment of the respiratory tract of the spinal cord.]

Case. Death forty-eight hours after attack, reported by Dr. J. Baxter Upham.

J. M., a private, aged 19, was admitted to hospital on the evening of January 16, in a moribund condition. No previous history of his case could be obtained, further than that he had been attacked the night before, suddenly and violently. When admitted, he was unconscious, having frequent epileptic spasms;

frothing at the mouth; pupils insensible to light. Tonics and stimulants, in large doses, were prescribed, and stimulating injections were ordered; these last were not retained, but brought away immediately large quantities of hardened fæces. Sinapisms were applied over various parts of the body and limbs.

17th. — No improvement; skin moist and moderately warm, pulse one hundred and sixty, irregular, soft, and very compressible; spasms growing worse; stimulants assiduously employed. Died at four P. M.

Autopsy, Twenty Hours after Death. Head. — Investing membranes of the brain were found much congested; the substance of the brain itself slightly so, with a deposit of thick, pus-colored fluid within the ventricles and at the base of the brain, and upon the lobes of the cerebellum. *Chest.* — Lungs greatly congested; more posteriorly than anteriorly. Heart normal in size, with a deposit of lymph in both ventricles. Stomach healthy. Liver normal. Spleen of natural size, and highly congested. Kidneys and Peyer's glands healthy.

Case. Death on the fifth day. Reported by Dr. J. B. Upham.

E. F. W., a private, aged 18 years, was admitted January 30th, 1863. Had a slight chill yesterday afternoon, and became suddenly and violently delirious in the evening. Died February 3d, at six A. M. *Post-mortem* exhibited extensive engorgement of blood-vessels of the brain, and a deposit of lymph over upper surface of hemispheres of cerebrum and cerebellum. Some effusion in the ventricles; thoracic and abdominal viscera healthy.

Remarks.

These cases are typical. In all, even in those that died at a very early stage of the disease, some evidence of meningeal inflammation was present. In some of them, it was only an opalescence of the arachnoid with small effusion, but in nearly all the *post-mortem* appearances within the encephalon account for death. The morbid conditions of other viscera, sometimes present, appear to have been previously existing, accidental, metastatic, or due to the phenomena of death. We have endeavored to convey an intelligible idea of all the facts before us, and find it only necessary to call attention to the rapidity of effusion as closely allied to the effusion of caco-plastic lymph in acute peritonitis, which is frequently fully established within a few hours after the exciting cause is applied, as, for instance, in perforation of the bowels.

TREATMENT.

In all peculiarly fatal diseases, the modes of treatment recommended are numerous and contradictory. Not only do they vary with the theories that practitioners may entertain of the pathology of the disease, but with that feeling of irresolution or desperation

which prompts strange remedies in a strange disease. Accordingly, we find an almost endless, certainly an absurd catalogue of remedies recommended by writers. Numerical analyses of results of treatment are notoriously faulty. Each such result must necessarily partake of all the errors of diagnosis, prognosis, and ætiology which may have existed in the mind of the practitioner.

A Confederate surgeon at Grenada, Miss., saw thirty-five cases of cerebro-spinal meningitis, of which *all* died. He expresses the opinion that mercurials were the more *successful* remedies. He means that cases treated with mercurials lived longer than those under another treatment, and perhaps his use of the word "successful" is justifiable. We propose to quote somewhat freely from the reports in our hands, as to treatment, and leave the matter with the reader without extended comment. In a disease of which seventy in a hundred die, no therapeutics are a matter for boasting.

Surgeon Ira Russell's report.

Dr. Russell[1] reports the case of J. T., 1st Iowa Infantry, who was admitted in the second stage, comatose, pulseless, and muscles contracted. Supposed to be moribund, nothing was done for him at first. On the second day sinapisms were ordered to the surface; capsicum, quinine, and stimulants were given internally; blisters were applied to the spine, and stimulating enemata were administered. The quinine was given in very large doses. This treatment, with a supporting diet, was continued, and the patient finally recovered.

Dr. Russell says in conclusion (and it should be recollected that he speaks of the disease as a fever of the congestive variety): —

"The disease has been unquestionably of an asthenic type. At first surgeons were inclined to adopt an opposite theory, and to resort to active antiphlogistic remedies. But lack of success in treatment, and more mature reflection induced them to abandon such remedies, and to depend upon a stimulant and tonic treatment. I have been led to believe that quinine, freely given in the early stages of the disease, prior to the period of collapse,[2] exercises a controlling influence, and such is the opinion of the regimental surgeons who have treated cases before they were sent to the hospital. During the congestive chill and collapse, alcoholic stimulants, capsicum and quinine, mustard emetics and sinapisms to the surface, and cups, wet and dry, to spine, seem to exert a good influence, and hasten the period of reaction. Opium has invariably been found to be a successful remedy, especially in controlling delirium and promoting reaction.

"After reaction has been fairly established, blue mass and saline cathartics have been followed by good results. Cups and blisters to

[1] Epidemic at St. Louis.

[2] Coma.

the spine, with a general tonic plan of treatment, with iodide of potassium, has manifestly been the best plan of treatment; while a nourishing diet has been found indispensable."

Dr. Russell's statements of treatment are not tabulated. He says, that "more than one half died," — a ratio that compares favorably with the average success.

Dr. Upham[1] says: —

Dr. J. Baxter Upham's account.

"In regard to treatment, when we consider the mortality, as shown in the preceding record (fifty-four deaths and seventeen recoveries), but little that is satisfactory can be said. In the onset of the epidemic, it was naturally taken to be of malarious origin, and the usual means of combating such an affection were assiduously employed — quinine, in some instances, to the extent of sixty and even eighty grains, being given within ten or twelve hours from the first attack, but without effect; conjoined with this, stimulants and purgatives of calomel were freely used. Antiphlogistic measures were also tried — cupping, wet and dry, to the back of the head and nucha; saline purgatives, epispastics, frictions along the spine, blisters to the inside of thighs, calves, and ankles, with enemata of turpentine and brandy. When there was marked cerebral excitement, venesection was freely employed; but its powerlessness to avert, or even mitigate the symptoms, is seen in Dr. Cowgill's account of a case at Academy Green Hospital, in which the remedy was faithfully tried. The patient was a strong, robust young man, — attacked suddenly and with great violence, — with urgent cerebral symptoms, great restlessness and jactitation, perfect unconsciousness, and with a full pulse. He was bled to the amount of twenty-four ounces; his pulse became stronger under the operation — no symptoms of faintness. He was quiet for twenty minutes, when the jactitation became as violent as before. At evening, there was violent muscular action, pulse eighty-six, strong and full; the bandages were loosened, and sixteen ounces more of blood allowed to flow, the patient, in the mean time, being held upright in bed. There was no evidence of syncope, and no lessening of muscular action. The excitement continued the whole night, and the patient died the next day.

"Calomel in combination with ipecac, in doses of two grains of the former and half a grain of the latter, given every two hours, — in conjunction with frictions or sinapisms along the course of the spine, as reported by Dr. Cowgill, seemed, in several instances, to have a good effect. Dr. Haddock suggested the use of ergot, in accordance with the recommendations of Dr. Brown Sequard, in certain affections of the spinal cord, unaccompanied with active inflammation. It was given in the form of the fluid extract in doses of from ten to fifteen minims, repeated every four hours. Several of the cases thus treated by Dr. Haddock recovered. Oftentimes a beneficial effect attended the exhibition

[1] Epidemic at Newbern.

of camphor water, in combination with the carbonate of ammonia. Dover's powder and the solution of sulphate of morphia were given, to induce sleep at night."

Dr. Webber says : —

Dr. S. G. Webber's views—Boylston Prize Essay

"The natural tendency seems to be toward death. Treatment to be effectual must be early ; in nearly every case when delayed long, the result was death. It is generally agreed that all debilitating measures should be avoided ; general bleeding is rather injurious than otherwise, though in the first and fifth cases recorded by Dr. Robert Burns, of Philadelphia, in the 'American Journal of Medical Sciences,' for April, 1865, bleeding seemed to be beneficial. . . . . Local bleeding, especially by means of leeches, to the back of the neck, or to the temples, and wherever inflammatory action has appeared, is beneficial."

Dr. Webber recommends emetics at the onset, deprecates violent cathartics, approves support and stimulation, counter-irritation, friction, sinapisms, dry cuppings, and blisters, and says : —

"Cold to the head by means of ice-bags or cloths wrung out in cold water ; stimulating enemata ; gentle cathartics ; quinine ; opium to quiet restlessness and procure sleep ; stimulants and nourishment in the shape of milk-punch, beef tea, strong broths, etc., have been generally adopted as the best means at our command to control this disease. Quinine and stimulants must be given freely and largely ; opium is considered one of the most valuable remedies by many, and apparently with good reason, but it must be given in large doses frequently repeated."

Dr. Webber also quotes the use of a strict antiphlogistic treatment by Dr. Burns, of Philadelphia ; of opium, strychnia, and arsenic, by Dr. McVey, of Illinois ; of aconite, bisulphite of soda, and ergot, for each of which favorable results are claimed.

Dr. Sanderson says : —

Dr. John Burdon Sanderson's report to the medical officer of the Privy Council of England on the cerebro-spinal meningitis of the Lower Vistula.

"In almost every case, the practice during the acute stage consisted in the application of leeches, or cupping-glasses behind the ears or temples, in the application of cold to the head, and in the internal administration of calomel in repeated doses of one or two grains.

"As local abstraction of blood was invariably combined with the application of cold (ice or snow whenever they could be obtained), its effects could only be judged of in combination. It was the opinion of all who had had most experience of the disease in its severest forms, that no advantage could be hoped for from this remedy, unless it were adopted while the initial symptoms still lasted, and that if the patient had already lapsed into the state of indifference, and especially if the breathing had the peculiar

character of slow inspiration, quick expiration, and prolonged pause, even though the face might still be flushed, and the skin feel warm, it was already too late to apply leeches. On the other hand, it appeared to be the general result of the experience of those who had seen the disease in its severest aspects, that even in cases in which the onset was most violent, free local bleeding during the first few hours, while the patient was still vomiting, might be expected to be attended with benefit, and occasionally produced the most striking results. . . . . My own opportunities were, of course, far too limited to enable me to form an opinion on the question, but I think that the complete concurrence of opinion among practitioners is sufficient to warrant the statement that, notwithstanding the generally negative results that are observed, leeching and the application of ice cold to the spinal cord, is the only mode of treatment by which the progress of the disease is likely to be arrested, and that its utility is confined to the first day, and, in some instances, to the few hours after the patient has begun to vomit.

"The employment of calomel in frequently repeated doses, varying from one to three grains, was as universal as that of local bleeding. It was given partly as a purgative, partly with a view to its so-called constitutional effects. Its purgative effect was increased by combining it with jalap, or by injections, or by administering, at the same time, infusion of senna with sulphate of magnesia, or either of these remedies separately.

"In cases in which there were periodical exacerbations of pain, especially if they were accompanied or preceded by febrile accessions, it was the habit to give quinine. Although some practitioners thought this remedy useful, and employed it in large doses, others were of opinion that the results were negative.

"The advantage obtained by the administration of morphia after the initial symptoms had subsided, as a means of calming the restlessness of the patient, of relieving the violent pain experienced in the neck and back, and thus inducing sleep, appeared to be unequivocal, nor did it seem to be attended with any unfavorable effects afterwards. It was given either by the mouth (in doses of one eighth to one fourth of a grain), or by subcutaneous injection. Of the two methods the latter seemed preferable.

"In the later stages of the disease, various vegetable tonics were employed, with which it was usual to combine iodide of potassium, especially in cases in which there was impairment of vision or hearing, persistent muscular pains or contraction, or other indications that the disease had left behind alteration of structure of important organs."

Comments by the compiler.

It will be seen that the methods of treatment enumerated above are contradictory, principally because the pathology is clouded and obscure. The disposition on the part of some

observers to recognize, in cerebro-spinal meningitis, something as mysterious as it is fatal, has led to the suggestion of quaint and unusual therapeutics. Reducing this disease to its simplest formula, the mystery is resolved. Whatever its causation, whatever its relation to zymotic poison, we find at last that it is the mechanical pressure of effused lymph and serum, products of inflammation, within a bony case, that kills the patient. All treatment, therefore, should be directed to the prevention of effusion, and its removal when present.

In the present stage of our knowledge, we are compelled to assume that this disease is a simple inflammation of a serous membrane, which is fatal because of its locality rather than from any intrinsic power of harm that it possesses. If the epidemic agency, whatever it may be, were directed to the pericardium, the pleura, or the peritoneum, we should have *mutatis mutandis*, the same pathological conditions, and a measure of fatality proportioned to the importance of the part attacked.

We are therefore called upon to treat this disease at two separate stages. If we meet it in the dry stage, when the inflammation is still gathering force, an antiphlogistic treatment — always with a view to the effusion that must follow — is demanded. The dry stage is brief; and the patient can rarely be placed under treatment before the second stage — that of effusion — is upon us. From that time the treatment changes, and all the means with which we are familiar, to check effusion and promote absorption, are to be employed.

ÆTIOLOGY.

Climate.

Climate evidently exercises a controlling influence on the causation of cerebro-spinal meningitis. The American epidemics we have studied all occurred in the winter or early spring, and Dr. John Simon informs us that of one hundred and eighty-two epidemics occurring in Europe, ten were in August and September, twenty-four in October and November, forty-six in December and January, forty-eight in February and March, thirty in April and May, and, again, twenty-four in June and July. We believe, also, that a more rigid analysis would show that the epidemics in winter months have been far more extended and fatal than those which have occurred during the heats of summer.

Exposure.

Exposure to the inclemencies of weather — to the same causes that produce acute rheumatism, pleuritis, and pericarditis — must also be reckoned among the more frequent causes of the disease. The French army of the Alps, in

1814, after camping in the snow and suffering severely, developed an epidemic of cerebro-spinal meningitis. So, too, in the Confederate army at Fredericksburg, Va., in the winter of 1862–63, it appeared as an epidemic under circumstances of exposure. At Mobile, Ala., and Grenada, Miss., it also appeared among troops in the field, and the greater portion of the mortality at Benton Barracks may be fairly ascribed to the great hardships endured by the negroes in their escape from their masters, and the insufficient care bestowed upon them by the United States authorities before their muster-in as soldiers. In this latter instance, the weather was bitterly cold, and the exposure of the men in transportation was excessive.

A reference to our remarks upon the history of this disease will show that it has its favorite habitat in prisons and barracks. The four or five years following 1837, it invaded nearly all the crowded barracks of France. It has appeared frequently among the galley-slaves at Toulon, and has taken the name of "jail fever" in England. The epidemic occurring at Newbern, N. C., was certainly connected with the bad material and construction of the barracks occupied by the three or four regiments that suffered — their habitations being damp, cold, and poorly ventilated. The prison at Little Rock, Ark., is another and striking example of this source of causation. The winter was severe, the weather alternating between snow and rain. The prison was shut in by high walls of masonry, and the premises, though well policed, were excessively damp and chilly. The deaths occurred as well among the guard as the prisoners, but only in one section of the prison.

Prisons and barracks.

Upon this point Dr. John Simon remarks that —

"Epidemics have seemed particularly apt to occur in establishments where masses of special population have been living in common domicile — as in work-houses, convict prisons, schools, and (above all) barracks. And in several such cases the epidemic has seemed to confine itself to one section of the establishment — to one block of building, to one floor, or to one room. It is asserted here that, as a general rule, the affected segment of population has been in overcrowded and ill-ventilated quarters. And when the disease has spread from such centres, or has independently arisen among common populations, this, almost always, has been said to have been under similar unwholesomeness of circumstances. Where the epidemic has been among soldiers, officers have enjoyed almost entire immunity; and where common populations have been suffering, the disease has shown great, if not exclusive, preference for the worst-lodged classes of the community. Reviewing the evidence which exists on these points, I am strongly of the

opinion that the best sanitary precaution which in the present state of knowledge can be taken against this disease, must consist in care for the ventilation of dwellings. But in stating this, I must add that in some cases, according to local reports, the distribution of an epidemic has very decidedly not been governed by conditions of overcrowding and ventilation."

Epidemic constitution.

Nearly all observers concur, and none adduce any reasoning to the contrary, that the epidemic constitution of cerebro-spinal meningitis is felt by very many in the vicinity, who do not finally develop the full phenomena of the disease. Headaches, neuralgias, slight stiffness of the muscles, and soreness of the cutaneous surface, are common among those who are classed as well, but are subjected to the same atmospheric influence. This fact is sufficiently evident to prove the existence of a controlling atmospheric cause; while the simultaneous development in the same community of other acute inflammatory diseases much simplifies our quest as to the causation, by removing it from the mystery of a special cause, and justifying us in assigning to this disease a place among the phlegmasiæ.

Sex and age.

The army records of cerebro-spinal meningitis, of course, are negative as to the preference of this disease for either sex. Other sources supply us with the proof that it has no sexual preferences — the statistics of Dr. Sanderson showing one hundred and sixty-four cases among males, and one hundred and fifty-four among females. As to age, we need only refer to his tables to show how preëminently this is a disease of youth; and to the army records for the other fact, that it attacks the robust and healthy.

Summary.

We arrive, therefore, at the conclusion that cerebro-spinal meningitis has no special causation different from those general atmospheric conditions of cold, exposure, bad ventilation, etc., that provoke the common phlegmasiæ of fibrous and serous membranes, which, in all their laws as to season and modes of attack, and especially in the pathological conditions they develop to the anatomist of disease, seem to seek the same localities and attack the same classes of persons. The difference in the fatality of the several diseases alluded to, may be fairly stated as a difference in the relative importance to the functions of life of the locality attacked. A given morbific influence may attack the pleura, with only the result of recovery after a brief illness. The same influence assaulting the nutritive membranes of the nervous centres, must produce death if it goes on long enough to establish the usual exudations of organizable lymph.

IS CEREBRO-SPINAL MENINGITIS CONTAGIOUS?

We have omitted contagion from the ætiological argument. We are well aware that it has been often spoken of as a contagious disease, but are at a loss to discover the evidence upon which that theory rests. The peculiar character of the symptoms, especially those of the second stage, bear a strong resemblance, in many cases, to the phenomena that occur in diseases which are certainly capable of being propagated by contagion. But these phenomena themselves occur in a different manner. To use a popular phrase, the disease, after completing its deterioration of the blood, "goes to the brain." In cerebro-spinal meningitis, it begins at the brain and remains there — the affections of other organs, as we have shown, being intercurrent, metastatic, or existing prior to the attack. There is no disorganization of the blood, except that which can be rationally ascribed to the failing power of the lungs to aerate the blood, dependent upon the mechanical pressure on the respiratory tract.

It may be urged that petechiæ may be classed as evidence of blood-poison. But they, or something like them, are only recorded in one third of the cases in which any mention of them could be expected, while so good an observer as Dr. Sanderson excludes or omits them altogether from his carefully drawn catalogue of signs and symptoms. Dr. Jones, of the Confederate service, asserts that the ecchymotic spots sometimes seen are not petechial; that they are merely a part of that general capillary congestion which depends upon the disturbance of the nervous centres; and it seems to us altogether probable that the ecchymoses which occur in the conjunctiva, the occasional, but rare, apoplectic spots in the lung, and the half-described similar spots, only once or twice mentioned, in the peritoneum, are mere "blood-shot" effusions dependent upon capillary stasis.

The exudation uniformly found in the meninges of the brain and cord, is not of the character that attends putrid or contagious diseases. Microscopically examined, it is found to be an organizable lymph, of a far higher grade of cell-formation than we find in the blood poisons. The cases of recovery evidence this; and we find patients recovering slowly or rapidly, in proportion to the probable amount of exudation, or suffering from sequelæ, such as blindness and deafness, which are occasioned by the deposits of inflammation destroying the delicate apparatus of the eye or ear.

But the most positive evidence of the non-contagiousness of cere-

bro-spinal meningitis is in the bald fact that no well-proven case of contagious origin has met our eye, either in books or in our personal observation. In looking over the various reports before us, we find a valuable internal evidence in the constant statement that the patient was admitted to hospital with the disease; and in no single instance do we find that a case has originated within a hospital. It is well known that patients with this disease were not isolated in the army hospitals during the recent war. Whatever contagious elements they had were freely distributed among other patients and the attendants; yet we find no instance in which the disease seems to have been propagated from man to man.

Dr. Sanderson remarks, with reference to the epidemic in Northern Germany: —

"No facts were met with in the course of the inquiry which afforded ground for believing that epidemic meningitis was capable of being communicated by personal intercourse. The following considerations tend toward a contrary inference: —

1. "No single instance occurred to me in which there was the slightest reason to believe that any communication had taken place between the family in which the first case occurred in any district and one previously infected.

2. "The disease broke out in the two districts of the department of Dantzig, which were eventually most severely visited, so far as can be ascertained, at the same time, viz., about the 15th of January, although these places are at a distance of at least thirty miles from each other."

3. [Dr. Sanderson remarks that in Dantzig no two cases occurred in any one house, and that there was no transmission of the disease in the hospitals.]

4. "In those families in which more than two children were attacked about the same time, the intervals between the attacks were so short, that it could scarcely be supposed there had been communication from one child to another."

In the absence of any positive proof of contagion, it is hardly worth the while to prolong the negative argument. Yet the grand law which governs the coming and going of this terrible malady may be mentioned as a part of the history. It is most fortunate that cerebro-spinal meningitis, a disease so fatal, and which yields so little to the skill of the physician, occurs always in "small, compact epidemics." We find it developing only fifty cases out of the many thousands congregated at Benton Barracks; only forty at Newbern, N. C.; only a dozen at Little Rock, in a body of perhaps ten thousand troops in winter cantonments; thirty cases occurred at Grenada, Miss.; and in the vast army of Northern

Virginia we find record of only fourteen cases occurring in two distinct epidemics.

Contagious diseases do not thus limit and terminate themselves. They propagate by fomites; and so long as the latter exist, the disease will be developed. But cerebro-spinal meningitis never accompanies the march of a column; never follows the great highways of travel. It comes unheralded to a single locality, taking one and leaving another by laws of its own, and departs with the first change of weather, or the first removal of its prospective victims from the scene of its ravages.

CHAPTER TWELFTH.

ON THE DISEASES OF NERVES, RESULTING FROM INJURIES.

By S. WEIR MITCHELL, M. D.,

MEMBER OF THE NATIONAL ACADEMY OF SCIENCES, FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA, ETC., ETC.

Purpose of this Chapter. — Previous Publications. — Primary Symptoms of Wounds or other Injuries of Nerve Trunks. — Case of Choreal Affection of Right Fore-arm and Shoulder after Amputation at the Wrist.—Classification of Modes in which Nerves are Injured. — Case of Injury by Contusion. —Crutch Palsy, and Palsy from other Modes of Pressure. — Case of Crutch Palsy. — Injury by Contusion. — Cicatricial Changes producing Nerve Injury. — Propagated Disease of Nerves. — Case. — Classification of Local Symptoms. — An Imaginary Case. — Changes in the Nutrition of Parts, the Nerves of which have been Injured. — Muscular Atrophy. — Muscular Contractions. — Tonic Spasms. — Distinct Nutrient Nerve Fibres.—Certain Diseases of the Skin belong among the Nervous.—Case of Herpes. — Effect of Wounds on the Nutrition of the Skin and its Appendages. — Glossy Skin. — Case of Intense Neuralgia, with Motor Palsy, etc. — Hypertrophy of Areolar Tissue of the Hand from Wound of Nerve. — Case. — Inflammation of Joints. — Effect on Secretions. — Lesions of Sensation. — Classification of these Lesions. — Hyperæsthesia. — Anæsthesia and Analgesia. — Delay in Transmission of Sensations and Volitions. — Slow Passage of Neural Impressions in Injuries of the Medulla Spinalis. — Retardation of Electrical Current. — Burning Pain. — Defects of Motion from Wounds of Nerves. — Different Ways in which Nerve Lesions affect Motion. — Paralysis. — Shortening of Opponent Muscles. — Spasm. — Prognosis of Wounds of Nerves. — Palsy of Nerves at a Distance from the Seat of Injury. — Case. — Treatment as regards Pain. — Case. — Treatment of Nutritive Changes, and of the Paralysis. — Blisters. — Active and Passive Motion. — Shampooing. — Hot and Cold Douches. — Electricity. — Electro-Muscular Contractility. — Electro-Muscular Sensibility. — The Interrupted Current and Electro-Galvanic Machines. — Direct Galvanism. — Electrization of the Skin. — Electrization of the Muscles. — Application of Electricity to Diagnosis and Prognosis. — Mode of employing Electricity as a Therapeutical Agent. — Constitutional Treatment of Wounds of Nerves. — Illustrative Cases.

The knowledge upon which the views of the present essay are founded, was obtained in the U. S. Army Hospital for Injuries and Diseases of the Nervous System, and from numerous cases since then observed by me in private practice. In 1864 I published a small volume on this subject in conjunction with my colleagues, Drs. Morehouse and Keen. In a second paper — Circular No. 6, 1864, U. S. Army Medical Bureau — we related instances of paralysis of one or more limbs, produced by

Previous publications.

injuries of remote regions of the body; and, more recently,[1] I again reported these cases, with additions and corrections, and with a full critical review of all the former relations of similar histories. Besides the practical information which these papers contained, we recorded at length our experience in the use of hypodermic injections in neuralgic cases, in the "American Journal of Medical Sciences," July, 1865; and in the number for October, 1864, of the same journal, we discussed the subject of malingering — chiefly with reference to simulation of nervous maladies.

Having, therefore, already considered the most important points in gunshot and other injuries of nerves, I shall dwell in these pages upon such matters as have not been so amply discussed; and shall draw my illustrations chiefly from records of cases which have not as yet been published.

It is needless to add that I can only give here a condensed statement of my present opinions, and that for minute details the reader must refer to the papers above enumerated.

PRIMARY SYMPTOMS OF WOUNDS OR OTHER INJURIES OF NERVE TRUNKS.

Sensation felt directly after a sudden injury.

When a person receives a sudden injury of a nerve of importance, he usually feels as though he had been struck with a stick or a stone. In a very few instances, no pain is experienced; and, in still fewer, the pain is referred to some remote part of the body. In one case, a wound of the right brachial plexus was felt as a violent pain in both elbows. Several similar wounds caused sudden pain at the insertion of the deltoid muscle. I have been told by some of my patients, that the burning neuralgia first described by my colleagues and myself began instantly upon the occurrence of the wound. Of this, however, I have some doubt.

Loss or impairment of motion and sensation.

Loss or diminution of motor power and of sensation, of course follow instantly upon a wound of a nerve. I shall discuss them more fully in future. It is sufficient here to say, that, as a rule, motion is more often and more permanently impaired than sensation; and that, except in absolute division of a nerve, motion is apt to improve considerably within the first week. Thus, if we suppose a case where a ball passes over a nerve, and very near to it, we may have immediate loss of motion, partial of sensation; entire and rapid restoration of the latter;

[1] *New York Medical Journal*, February and April, 1866.

slower return of motility; and, finally, prolonged or even permanent want of power in some single group of muscles. I remember one very striking instance in the spring of 1864.

Case.

"A sergeant, wounded in the left lower neck, was placed in our wards within four days from the date of his wound, which seemed to have directly implicated the brachial plexus of that side. His arm was totally palsied as to motion and sensation at the moment he was hit. Sensation returned within five days. Motor power was restored in all the flexor muscles of the hand within ten days; and, under three applications of electricity, it reappeared also in all the other muscles except the deltoid and triceps extensor, which never perfectly regained their functions."

Explanation of the speedy recovery of sensation.

The remarkable manner in which the sensory nerves recover their function has been elsewhere explained by us as being due to the constant automatic exercise of the sense of tact, whereas the function of motion demands a distinct volition. If this accounts for the early return of sensibility in wounded limbs—and I am not fully satisfied that it does—it will not explain why it sometimes happens that, a nerve being wounded, only motion is lost, or only sensation. I suspect that, in most nerves, the fibres of motion and sensation are, more or less, kept together in bundles, so to speak; and that, in some of the cases above described, the facts may be explained by this arrangement.

The question here raised is one of great anatomical, and of some practical interest, but I can find no authority which attempts to answer it. The popular medical opinion supposes that, after the sensitive and motor roots of a spinal nerve unite, their respective filaments become uniformly distributed throughout the area of the nerve trunk; to be again re-collected into bundles having separate functions, near to the points where the skin, or muscle-supplies respectively, are given off from the parent stem. Such an arrangement would involve, to my mind, a lack of economy in Nature, without, as it would seem, any sufficient reason; while the results of nerve wounds, on the other hand, plainly indicate the probability that the two sets of nerve fibres remain, for the most part, grouped in distinct fasciculæ throughout the track of the main nerve. It would not be difficult to settle the question by experiment.

The immediate and remote phenomena following wounds.

The general phenomena which follow nerve wounds, are immediate or remote. As to the first class, it contains nothing peculiar to these wounds; since shock may be an incident of any wound. It is quite sure to occur in severe injuries of nerve trunks; and for this reason, was treated of

at length in the papers above referred to. We considered it then, as I still do now, a condition of temporary paralysis from peripheral lesion. In fact, there may be every variety as to persistence, severity, and extent of loss of function; so that from one wound may be witnessed a brief general loss of power, with that of the heart; from another, defect of power in one limb, or more, for a few hours or days; and in a third, a like result of permanent character. These latter cases are very rare, and have been described as reflex paralyses. Thus, the same mechanism which occasions these graver maladies, is competent, as I think, to abolish for a time the irritability of the nerve centres in general; in some cases touching the heart most; in others, acting with greatest severity on the organs of intelligence; and, in rare instances, so disturbing the central ganglia as to occasion death.

The secondary phenomena of a general nature, or, at least, not of necessity involving the part wounded, are paralyses such as I have just now described, and tetanus.

Tetanus.

I have never met with a case of tetanus in a patient affected with a wound of a nerve trunk. This would be the more remarkable, as I have personally treated several hundred cases of nerve wounds, were it not that most of them reached our wards after the first few weeks of treatment had gone by, when, in no small proportion, the wounds had long been healed, and the period of danger was over.

Tremor.

Choreal affections must be very uncommon consequences of nerve wounds. Simple tremor of muscles, or of groups of muscles, was more frequent, and was readily relieved. Two of the most interesting choreal maladies I have seen, were the results of amputation of the thumb and fore-arm respectively, and were induced during the cicatrization of the stumps.

The following history is a good illustration of this malady: —

Case I. *Gunshot Wound of Right Wrist: Immediate Amputation; Choreal Affection of Muscles of Right Fore-arm (stump) and Shoulder.* — Col. J. G. P., age 41, 139th Pennsylvania Volunteers, an officer of high character, in good health up to the date of wound, was shot, June 3d, 1864, through the right wrist with a slug. He became at once singularly excited, and felt as if he was crazed. Under the sudden influence of these sensations, he ran along the line of his regiment, only half conscious, until he fell senseless, having gone about fifty feet. Within a few minutes he revived, and was assisted to a hospital near by, where Dr. Chapin, surgeon of the regiment, amputated his fore-arm at the junction of the lower and middle third.

Col. P. never remained in bed, but continued in active service while the wound healed. This process was over about September 20th, 1864. At this date, some one remarked to him that his stump shook a good deal. This first attracted his attention. Within a month the quivering extended to all the muscles of the fore-arm, except the extensor group, and at the close of the second month it attacked the biceps, triceps, and deltoid. In November a seton was carried through the skin of the stump. For a day or two the limb was much more quiet, but again became worse. Tincture of aconite was used locally without relief. A firm bandage applied to the whole limb, produced no good result, the movements getting constantly worse. At length a large part of the cicatrix of the stump was dissected out. For a few days he did better, and then relapsed as after the use of other remedies.

March 1, 1865. — The fore-arm is incessantly in motion, the muscles quivering in a singular manner, night and day, whether asleep or awake. Every twenty seconds, or oftener, the fore-arm is suddenly flexed, and more rarely the arm is thrown across the chest by the pectoral group, or upwards and outwards by the deltoid. These movements are beginning to involve the trunk and neck muscles of the right side. They are increased if attention be drawn to them, but they allow him to make voluntary movements with the aid of the muscles in question, and do not seem to interfere with or disturb this volitional control, as happens in the chorea of children. The moment his will ceases to act, the spasms recur, but he does not feel any fatigue from this endless muscular action. All the muscles move readily under induced electric currents. The stump is not unusually tender, and there is no soreness in the nerve tracks when tested by heat or pressure.

Col. P.'s general health is suffering somewhat, but at no time except during the few days of leave, which he sought in order to consult me, has he failed to do full duty in the field. On one occasion only is he aware that the arm ceased to move. This occurred at the battle of Cedar Mountain, when, his regiment having been cut off, he was in grave danger of capture. He fought his way out and saved his command. During the two or three hours of suspense, and while constantly under fire, his men observed that his arm ceased to move, and hung limber at his side.

I felt strongly disposed to consider these motions as caused by some nerve lesion originally confined to the stump, and occasioning an excitation of the centres which gave rise reflectively to the spasms. To test this, I proposed to inject a paralyzing agent into the neighborhood of the main nerve trunks, and failing thus to check the conveyance of irritations to the centres, I should have wished to divide the chief nerves in the arm, removing half an inch. This, of course, would have paralyzed the muscles below. If, then, it were still found that the deltoid and pectoralis twitched, I should have concluded that the nerves were diseased above

the point of section. Of this, some judgment could have been formed by examining with the microscope the section of nerve removed by the knife. After this there would have been no surgical remedy, excepting section of the brachial plexus in the neck, an operation which, I presume, might offer some embarrassments.

As Colonel P. was obliged to return to duty at once, I contented myself with ordering him to have two setons through the stump, and to take ten grains of bromide of potassium thrice daily. April 17th, I heard from him. He had been again severely wounded in the side, March 25th, and lay insensible for some time, although the limb all the while twitched as usual. He recovered readily, and at the date of April 17, wrote "that the limb had ceased to jump as it did, but is never still. It quivers all the time."

I saw Colonel P. September 29, 1865. The arm, at this time, rarely executed any violent or wide movements; but the fore-arm was much as his letter described it to have been in April. A greater gain was visible in the chest, neck, and trunk, the muscles of which no longer twitched. His general health was better, and he had become robust and well. I desired him to renew the treatment as soon as he was at rest in any one place, and hoped to persuade him, at a future period, to allow of some such operation as I have alluded to above.

Neuralgia of parts distant from that injured by the wound was rare. The very remarkable case of Lieutenant G——,[1] affords proof that such a result may follow a gunshot wound. The purpose of this present paper limits me to the discussion of gunshot and other injuries of nerves, and does not allow of the introduction of wounds of the centres. I shall therefore omit this subject, which was, in part, studied in our book on gunshot wounds of nerves, and pass on to consider the matters more immediately within our present scope.

Neuralgia.

In the book above referred to (p. 54) the modes in which nerves may be injured, were thus classified: —

Classification of modes in which nerves are injured.

1. Direct injury by contusion, or by a missile, resulting in partial or complete division, — Pressure.

2. Commotion, owing to the passage of a missile close to a nerve.

3. Injury from dislocations of bones, and attempts at their reduction.

4. Cicatricial changes affecting nerves.

5. Extension of diseased processes from injured nerves to nerves previously healthy.

Class 1st. — I do not think it always easy to make sure that a

[1] *N. Y. Medical and Surgical Journal*, February and April, 1866.

nerve trunk has been actually hit by a ball. The amount of loss of function does not determine it; for commotion or contusion equally occasions the result, and may give rise to symptoms quite as lasting. It is sometimes easy to determine this question by anatomical knowledge.

Direct injury. Contusion. Pressure.

Injuries to nerves from contusion presented themselves occasionally in our special hospital, but most of my own experience in this class of cases, has been derived from private practice.

Contusion.

As a rule, contusions of nerves, unless very severe, do not cause entire loss of function early in the case, but they are apt to originate morbid processes which finally occasion results almost as severe and permanent as those which arise from division of the nerve by a missile.

The following history is a fair example of injury by contusion: —

"Mrs. K., aged fifty-two, fell and struck her right neck against one of the round knobs of a brass fender. There was swelling and also a good deal of pain felt in the right arm for a few minutes, owing, as I supposed, to violence done to the brachial plexus. In a few weeks, the blood extravasated at the spot struck was absorbed. Slight pain was felt in the fore-arm and hand at intervals, until the twelfth week, when it became extreme around the shoulder joint. Next came loss of motion and wasting in the deltoid, with increase of tenderness at the site of the blow. Leeches were freely used every third day at this point until the soreness was lessened, when I blistered the part twice. The shoulder pains were now diminishing, and at the fourteenth week I began to use hypodermic injections of one eighth grain sulph. morphia with one fiftieth grain sulph. atropia. Under this treatment, employed daily, she lost all pain except when the arm was moved. I made two efforts to faradize the deltoid, but each time caused increase of pain. At the fifth month I was able to resort to the battery, under which the muscle gained bulk and power very rapidly. After twenty sittings she could raise the arm outwards to an angle of 45°.

Case of injury by contusion.

"A year afterwards, Mrs. K. had an attack of inflammatory rheumatism, which left her with distressing neuralgia of the ulnar distribution chiefly, and with some weakness of the fore-arm.

"This attack was treated by leeching, blistering tender points in the nerve, and absolute rest of the member — a measure which I have sometimes found of the utmost value. The arm finally remained feeble, and the pain is now, a year later, so rare and so slight as to give but little annoyance."

Pressure.

Injury to a nerve from pressure is rarely observed in military hospitals, if we except the very numerous and interesting cases of what was known in our own hospital as "crutch palsy."

Crutch palsy.

This malady comes on in the following manner: A man wounded in the leg, and more or less emaciated, gets on crutches. In a few days he feels a numbness or tingling in the little finger of one hand — and it is commonly the right — with sometimes a loss of feeling. Next his grasp becomes feeble, and he can no longer hold the crutch. Thus the evil brings its own remedy; but, for a time, the loss of power may even increase after the crutch has been abandoned; and this fact has in certain cases misled physicians as to the true causation.

In some of these patients there is axillary soreness; in others there is none. The prognosis is always favorable. We found that rest and the use of electricity brought about rapid cures, which were permanent if the patient employed in future a cane or a crutch provided with an elastic cushion. This was most needed in men of large frame, but so reduced in flesh as to have lost the perfect natural padding which in health would have protected the nerves from pressure.

I have myself met with this form of disease in civil practice. I have also seen nerve injury caused by the pressure on the arm made by the handle of a heavy basket.

Pressure of the snaffle rein.

My friend, Dr. John H. Brinton, late surgeon U. S. Volunteers, has seen cases of local weakness in the ulnar distribution produced by the pressure of the snaffle rein on the radial side of the third finger during long cavalry marches. In rare instances this amounts to partial palsy of the finger first affected, and is apt to be felt after a time in other terminal branches supplied by the ulnar nerve.

Palsy from form of restraint used by the Philadelphia police.

Dr. Brinton has also encountered two cases of local palsy which proved very tedious, and were brought about by the use of a form of restraint employed by the police in Philadelphia, and perhaps elsewhere. It consists of a cord attached at the ends to two small handles. This rope is passed around the arm of a prisoner, and is sometimes twisted. The two handles are held in the grasp of the officer, who may make the pressure as light or as severe as suits his own views. It is easily conceivable that injudicious use of such a formidable means of restraint may occasion the mischief which Dr. Brinton has seen it produce.

A very strange collection of cases of palsy from pressure is to be met with in the "Recueil de Mémoires de Médecine de Chirurgie et de Pharmacie Militaires," etc., T. 11th (3d série) quatrième fascicule; No. 52; Avril, 1864. In this paper M. Bachon describes a number of cases of palsy of the radial nerve, caused in the following way: —

Palsy from pressure by carrying huge jars of water.

"In the town of Rennes the supplies of water are brought to the houses in huge jars. The bellies of these enormous vessels are supported on the antero-lateral part of the thorax. Each jar has a large handle, through which the carrier thrusts his arm, so as then to embrace the circumference of the vessel, which he presses against his chest. At the same time the humerus is thrown upwards and outwards to give to the handle a solid point of support. It is a grotesque and painful sight to see a man, or even sometimes a woman, embracing, full-armed, two of these enormous spheroids, of a total weight of about seventy-six pounds, the body thrown backwards to keep an equilibrium, the arms spread apart, the elbows up, the bearer slowly toiling up the narrow staircase of a house in Rennes.

"In this position the pressure of the handle falls obliquely across the radial nerve, which is thus compressed, bruised, and irritated. As a consequence, we have paralysis of the extensor muscles of the hand and fingers."

The same author relates a case of palsy of the radial nerve from the use of a crutch, in which sensibility was not impaired. In the cases observed by my colleagues and myself, there was always some affection of sensitive nerves before motility was at all disordered. I append a single case which illustrates the whole class. In it, as in all I have seen, the ulnar nerve was first affected.

Case of crutch palsy.

"Q. C. Meaning, aged forty, porter, Company B, 1st Massachusetts Cavalry, enlisted September, 1861. Previously well. In January, 1863, he fell and broke both bones of right leg. Union took place with deformity and unusual difficulty in locomotion. From April 25th to June 20th, he walked on two common wooden crutches, and then, until July 11th, on one which he used on the right side, leaning heavily upon it. On the last named day he walked a great deal more than usual, and immediately after found that the third and fourth fingers were benumbed. The following night he lost partially the use of his arm. The axilla felt sore, but there was no evidence of any central lesion, and no syphilitic or rheumatic antecedents. Since then his biceps has regained power, but no other muscle has improved.

"*July* 21*st*, 1863. — Present state: Shoulder muscles act well, except the deltoid, which is feeble. The other muscles of the arm act well. Biceps feeble; pronation and supination good; flexion and extension

of wrist nearly absent; finger motions all excessively weak. Sensation absent in ulnar side of palm, wrist, and fore-arm; nearly absent in fore-finger. The fore-arm muscles have their electric contractility lessened; and the abductor min. digit. has very little. The axillary nerves are not tender on pressure.

"*Treatment.* — To use a cane in left hand; to have a starch bandage as a support for the broken leg; douche and faradization daily to fore-arm. The relief was rapid and complete — so much so that within two months he recovered the full use of all the weakened muscles. Sensation returned more slowly, but finally was aided by dry galvanism. He was put on guard duty after four months' treatment, but had then, I believe, some slight numbness in the fourth finger and ulnar palm."

Injury by commotion.

Class II. — When a ball passes through a part, it not only destroys what lies in its track, but it disturbs the surrounding tissues for a distance whose radius is as yet undetermined. The effects which result are known to the French authors as "local shock." They consist, I presume, in a molecular dislocation of the atoms of parts, such as, in the case of a nerve, would, at least for a time, be fatal to its function. I suppose that this local impression is in reality a physical shock — a shaking of the parts. It is best illustrated in those spinal injuries in which a ball has passed over the spine without breaking the bones, and yet has given rise to palsy of the parts below its track.[1]

I am disposed to think that, despite the apparent gravity of these spinal injuries, they do better, on the whole, than cases where the local shock has fallen upon a simple nerve trunk in a limb. Why this should be, I cannot say. I am sure that I have seen very permanent palsy in a case where the ball could not have passed nearer to the nerve than a full inch. As yet, however, despite the opportunities of frequent wars, we do not know how far the destructive influence of a ball may be radiated around its actual track, nor, indeed, how great, relatively, is this effect in balls at high and low rates of speed.

Injuries from dislocation, or from attempt at reduction.

Class III. — In the volume so often quoted, we related several instances of loss of nerve function following upon dislocation of the head of the humerus. Case XIII., op. cit., afforded a remarkable history of a local palsy so produced.

Class IV. — Neuralgia, distinctly due to cicatrix changes affecting nerves, is a very rare incident, if we except the cicatrices which follow amputations. A few instances of the former class

[1] Op. cit., p. 31, *et seq.* Cases III., V., and VI.

have fallen under my care, but in most of them relief was easily obtained by frictions, and by changing the position of the limb.

Cicatricial changes inducing nerve injury.

The cicatrices of stumps may give occasion to terrible and permanent maladies, such as neuralgia and chorea.[1] A singular case of the first is related by Dr. Nott.[2] It is a good illustration of the alterations which a nerve may undergo, and aptly illustrates the necessity for early and bold treatment. Cicatrices are rarely so placed as to cause loss of motion. In one instance this seemed to us to be the case.[3] There was want of power in certain positions; but it is possible that the great pain which arose may have been the true agent in producing the sudden feebleness then observed.

Class V. — In close relation to the changes in nerves which follow amputations are those interesting cases in which, as it seemed to us, an injury of a nerve causes inflammatory changes which are propagated inwards, and thus finally affect one or more of the cords constituting the parent plexus. We gave[4] examples of this result, and were inclined to reject the belief that the implication of other nerves than that first wounded was due to reflex irritation.

Propagated disease of nerves.

An able critic of our paper is of opinion that we had insufficient grounds for this conclusion. Our decision was influenced by the following considerations: —

The nerves secondarily affected were those which arose most immediately from that part of the parent plexus in connection with the wounded nerve. The affection of the nerves was commonly indicated by soreness upon pressure; and this soreness was very marked in the nerves finally attacked. Of these changes I give a very excellent illustration in the following case: —

Case.

C. P., clerk, aged 22, while fencing, was struck by the button of his opponent's foil upon the middle and outside of the right arm. The shirt-sleeve was torn, and the flesh bruised severely. He felt a sharp pain, which subsided into a tingling in the thumb and outside of fore-arm. This continued for several days, and on the tenth day became distressing. Upon examining his arm I found that the motions of the index finger were feeble, and that the wrist was extended with difficulty. The track of the radial nerve was sore, and the point on which the blow fell exceedingly tender. Notwithstanding the deep situation of the musculo-spiral nerve, it was also tender upon

[1] It is very deeply to be regretted that the vast mass of amputations, which were collected at one time in Philadelphia, was not made use of for a scientific study of the diseases of stumps. This was one of the many lost opportunities of the late rebellion.

[2] *Contributions to Bone and Nerve Surgery*, by J. C. Nott, M. D.: Phil. 1866; p 91.

[3] Op. cit., Case XV.

[4] Op. cit., p. 62.

pressure, and continued to be so for many weeks. I had the nerve tracks leeched twice a week, and used, on the same days, an injection of morphia and atropia over the radial nerve. These means partially relieved the hand; but the pain along the outer aspect of the arm became worse, and assumed an intermittent type, appearing every day after twelve o'clock. I used quinine, but to no purpose; and finally I placed him upon arsenic, giving six drops of Fowler's solution thrice a day. Once a week four leeches were applied over the injured part of the musculo-spiral nerve. The injections were only used when excess of pain demanded them, but an opium plaster was placed over the outside of the arm and fore-arm. These means proved successful, and the pain slowly subsided, after having lasted unchanged for four months. Exactly five months after the injury, his condition was as follows:— Extensor power nearly perfect; no pain in hand; skin on outside of fore-arm a little sore to the touch, and subject to slight daily pain, increased by fatigue and damp weather. The nerve tracks were still sore, but not excessively so. At this time he began to have pain in the shoulder, tenderness below it, and distinct loss of power in the deltoid muscle. These new symptoms followed great exposure to bad weather, and were synchronous with a fresh attack of neuralgia. As he was now well and strong, as to general health, I put cut cups about his shoulder, and followed their use by a blister dressed with morphia. At the same time I confined him rigorously to his bed. These measures relieved the pain, but the feebleness of the deltoid increased, and the muscle lost bulk, so that, at the close of a month from this fresh attack, he could raise the arm but six inches outwards from the side. Two weeks later, these changes ceased, and he began to improve so rapidly that, except the exhibition of small doses of arsenic and local frictions, there was no occasion for more active treatment. I believe that this rapid relief was largely due to the coming on of warm spring weather. When last I saw him, early in the summer of 1865, he was suffering trifling pain in the arm at rare intervals. There was no pain in the shoulder, but the deltoid was still a little flattened, and the extended arm could be raised only to the level of the shoulder.

Looking at the anatomical relations of the musculo-spiral to the circumflex nerve, it seems fair to infer that the disease which first involved the former came finally by direct propagation to affect the latter. So far as the mere symptoms can inform us, such would seem to be, in this case at least, the true explanation of the secondary affection which fell upon the shoulder.

No opportunity has been afforded me of studying the morbid anatomy of nerves supposed to be thus altered; but I think the evidence in favor of directly propagated nerve change quite sufficient to render this view a probable one, while, for the idea of its being a reflex affection, there is simply no evidence at all.

LOCAL SYMPTOMS OF WOUNDS OF NERVES.

These I have classified in the following table: —

- **Early symptoms.**
  - Defects of motility:
    - From local or general shock.
    - From direct nerve wound.
  - Defects of sensibility:
    - From shock.
    - From direct nerve wound.
- **Later symptoms.**
  - Alterations of mobility due to
    - Tonic spasm.
    - Tremor.
    - Paralysis.
    - Joint diseases.
    - Nutritive affections of muscles.
  - Alterations in sensibility:
    - Anæsthesia.
    - Analgesia.
    - Hyperæsthesia.
    - Causalgia.
    - Neuralgia.
- **Remote nutritive changes.**
  - Atrophic change in the skin and its appendages, and in the muscles; eczema; subacute inflammation of joints causing stiffness and subluxations; muscular contractions; altered secretions.

Perhaps I shall make more clear what is to follow if I state here an imaginary case of nerve wound, in which the various phenomena are related in the order in which they are usually found to occur: —

An imaginary case of wound of a nerve.

"A ball wound of the left brachial plexus. Constitutional shock. Recovery in an hour. Total absence of motion in the left arm, and nearly complete of sensation. Return of latter in a few hours, except in median nerve distribution. Slower return of motor power, and, within ten days, limitation of loss to median supply. Wound heals in six weeks, and at this time burning pain is felt in parts supplied by the nerve above named. Slight neuralgic pains in fore-arm. Gradual atrophy of certain muscles, with more or less contraction, and accompanying joint lesions further limiting mobility. Increase of burning pain with defective nutrition of nails and skin. After three or four months the pain decreases, the muscular changes increase, the joints are no better, and we have finally as much difficulty from these secondary troubles as from absolute loss of neural supply, because, even if the latter be good, we must relieve the joints, stimulate nutrition in the thinned muscles, and

elongate some of them, before the return of nerve power can be made useful."

Such is a brief sketch of what may take place after a wound of an important nerve. Of course, this schedule may be variously modified, as sensation, motion, or nutrition are more or less deranged, but it will suffice to point out the most important facts, and to indicate what was practically unknown before our own researches; namely, *that loss of motor power, in a vast majority of cases, is finally due less to neural defects than to those obstinate consequences in the range of nutrition which result from the loss of nerve power, and which may continue long after the motor power has been partially or completely regained.*

I shall now proceed to study in detail the various phenomena already alluded to, illustrating them by cases which have not hitherto appeared in print.

CHANGES IN THE NUTRITION OF PARTS THE NERVES OF WHICH HAVE BEEN INJURED.

These affect the muscles and areolar tissue, the skin, the nails, and the hair.

The most complete instances of general muscular atrophy of a member are presented in cases where entire and permanent division of a nerve has occurred. Some strange illustrations of this alteration are to be found among the casts made at the hospital for injuries, etc., of the nervous system, and now deposited in the army medical museum. The alteration is best seen, however, in cases where a single group of muscles has suffered, as those of the thenar eminence, or the interosseal muscles, or the deltoid. Nothing more grotesque can be conceived of than some of the results thus produced. One in particular was most remarkable, the man having atrophy of the rhomboid, trapezius, latissimus dorsi, and pectoral muscles on both sides. The arms continued strong, and when, by the aid of the deltoids and arm-muscles, these members were elevated, the shoulder blades, uncontrolled by the action of the back-muscles, stood out at nearly a right angle from their usual plane of repose. This odd appearance gained for the man the soubriquet of the angel. I should add that it was not due to a wound, but was said to have followed a severe attack of measles. It has been often asked whether mere disuse may not account for muscular atrophy. I do not think it will. The most entire disuse in muscles palsied by apoplexy will not suffice to give rise to any thing more than slight thinning of

Muscular atrophy.

the part, and sometimes not even to this. In fact, traumatic palsy does not always produce atrophy even when the loss of power is complete, although this combination is certainly a rare event.

The first effect of a nerve lesion is to occasion in the muscle a soft and flabby state of its tissue. Soon or late, in most instances, wasting follows, and, finally, shortening ensues. It is the latter condition which is the parent of most of the deformities seen after nerve wounds.

Muscular contractions.

It will not be out of place at this point to add a few words as to other forms of morbid muscular contractions which are met with more or less frequently.

When one group of muscles has lost motor power, its opponent group, not being paralyzed, may undergo a shortening due to want of antagonism. This is well seen in the partial palsies of childhood. Of course, under these circumstances, the muscles originally paralyzed become lengthened. In some cases this elongation remains; in others the muscles shorten as their atrophy proceeds, and the healthy group is thus restored again to its usual length. I have seen this series of changes occur; but sometimes when the healthy group is vigorous, and especially if it be a set of flexors, the atrophic contraction of the palsied muscles fails to restore the balance.

Tonic spasms.

In very rare cases a nerve wound gives rise to tonic spasm of a muscle or muscles. Inhalation of anæsthetics temporarily relaxes this spasm; but, after it has lasted some time, organic changes occur in the muscular tissues, the forms of the joints alter, and then no agent will fully relax the part. It was in the early stage of certain of these cases that we found benefit from the subdermal injection of atropia.

The reader will easily comprehend the practical embarrassments in treatment which may arise out of the various forms of muscular changes. In a large proportion of patients they constitute the chief barrier to a perfect cure, and in many instances forbid the use of prothetic apparatus such as would otherwise enable the sufferer to make fair use of the injured member.

Distinct nutrient nerve fibres.

In the little volume so often referred to, we pointed out the conclusion to which the above described phenomena led us. It still appears clear to me, in the light of a larger experience, that these facts support the modern idea of the existence of a distinct set of nutrient nerve fibres, whose implication in the wound occasions the alterations in question. This theory receives further support from the effect of wounds upon the nutrition of the skin and its appendages.

Bed-sores, the result of pressure upon palsied parts, have long been recognized, but, if we except Mr. Paget's brief statements, no previous author has described the changes which some nerve wounds bring about in the extremities, — changes, I should add, which are not due to pressure, but originate spontaneously, no matter how carefully the part has been guarded. Complete division of all the nerves of a limb is apt to occasion, first, a slight œdema, and, more remotely, a ragged or patchy skin, with dry surface, and sometimes a yellow or brownish tint. The nails also become curved; but none of these alterations are so curious as those which arise from partial nerve injuries.

In Mr. Paget's cases, two in number, the symptoms of which I am about to speak coexisted with ordinary neuralgic pains of great obstinacy. In our cases the neuralgia was not constant, but burning pains (causalgia) were always present. I quote below the account which we gave of this extraordinary and hitherto undescribed group of symptoms. It constitutes, in fact, a malady by itself, and since our publication has been everywhere recognized as a novel form of disease.

"*Effect of Wounds on the Nutrition of the Skin and its Appendages.* — So far as we are aware, only one author has spoken of the singular influence of nerve wounds upon the skin. Many have described the bed-sores which arise in paralysis, especially in spinal cases, from pressure on the sacrum, elbows, and other prominent parts.

"The changes in the skin which follow wounds of nerve trunks differ from these in an essential respect. They are of spontaneous origin, and are not brought about by pressure. Two distinct varieties are observable.

"The first is the result of entire division of the nerves of a part, and is best exhibited in cases of total palsy of a whole limb. Early in the case it is found associated in most instances with œdema, and is one of the remotest effects of the loss of nervous influence. The skin becomes thickened and dry, the epithelium hangs in patches here and there, and is yellow or even pale brown in tint. These peculiarities are in part owing to mere disuse, but this in no way applies to the changed form of the nails, which become curved as in tubercular disease, although to a less degree than in the other form of cutaneous affection, which is caused by partial injuries of the nerves. In fact, it may be stated as a rule, that the skin and subcuticular tissues are less strikingly altered in entire paralysis than in cases of a lighter nature.

"The second form of pathological change in the skin and its appendages is that which has heretofore escaped attention, if we except the slight notice of that most able pathologist, Mr. Paget.

"In a recent paper, ("Medical Times and Gazette," London, March 26, 1864), Mr. Paget speaks as follows: 'Glossy fingers appear to be a sign of peculiarly impaired nutrition and circulation due to injury of the nerves. They are not observed in all cases of injured nerves, and I cannot tell what are the peculiar conditions of the cases in which they are found; but they are a very notable sign, and are always associated, I think, with distressing and hardly manageable pain and disability. In well-marked cases, the fingers which are affected (for this appearance may be confined to one or two of them) are usually tapering, smooth, hairless, almost void of wrinkles, glossy, pink or ruddy, or blotched as if with permanent chilblains. They are commonly also very painful, especially on motion, and pain often extends from them up the arm. In most of the cases this condition of the fingers is attended with very distinct neuralgia both in them and in the whole arm, and its relation to disturbance of the nervous condition of the part is, morever, indicated by its occasional occurrence in cases where neuralgia continues after an attack of shingles affecting the arm. In two such cases I have seen this same condition of the fingers well marked, and only very slowly subsiding, and seeming unaffected by the ordinary treatment of neuralgia.'

"That the author quoted regards these conditions as rare and of interest, is the best reason why we should minutely describe them. How very common they are as results of gunshot wounds, may be gathered from the fact, that in fifty partial nerve lesions they existed in different degrees in nineteen cases.

"No particular time can be named as the period at which these changes in nutrition first show themselves. This alone can be said, they do not belong to cases of complete destruction of the nerves. They occur in such as have received slight or severe nerve wounds, provided always that these latter do not separate the part entirely from its nerve centres. They may begin within a few days, or at any later date; but usually they arise while the wound is healing, and are in many instances distinctly related to the occurrence of inflammatory accidents in or about the wound.

"The duration of this condition is various. It may be slight and disappear in a few weeks, or more rarely it may last for many months, and be very rebellious.

"In a large part of the cases now under study the palm of the hand was the part most affected, but in others quite as severe, the fingers suffered. The feet were also liable, but never so remarkably as the hands.

"*Glossy Skin.* — The skin affected in these cases was deep-red or mottled, or red and pale in patches. The epithelium appeared to have been partially lost, so that the cutis was exposed in places. The subcuticular tissues were nearly always shrunken, and where the palm

alone was attacked, the part so diseased seemed to be a little depressed and firmer, and less elastic than common. In the fingers there were often cracks in the altered skin, and the integuments presented the appearance of being tightly drawn over the subjacent tissues. The surface of all the affected part was glossy, and shining as though it had been skillfully varnished. Nothing more curious than these red and shining tissues can be conceived of. In most of them the part was devoid of wrinkles and perfectly free from hair. Mr. Paget's comparison of chilblains, is one which we often used to describe these appearances; but in some instances we have been more strikingly reminded of the characters of certain large, thin, and highly polished scars.

"Where a single nerve, as the ulnar, had been attacked, the described state of skin was seen only in its ultimate distribution; but in other instances of more extensive nerve injury, the central palm suffered, or a single finger, or the pulps of all of them. In others the palm or fingers were dotted with islets of thin and red and glossy skin. The dorsum of the hand, as a rule, was in that member the part least subject to the alteration, while the dorsum of the foot was in that region the part most liable to suffer. Do the greater functional endowments of the palm of the hand, as compared to the sole of the foot, account for this preference?

"*Eczema.* — A very constant feature of this state of skin was the occurrence of eczematous eruptions, which appeared as minute vesicles thickly scattered over the thin and tender cutis, or else showed themselves in successive crops of larger vesicles on the skin about the altered parts, with usually a preference for the portions which lay nearer the trunk.

"In some patients this symptom was absent, in others it was never wholly lost, but varied in amount; while in a small number it came and went, being absent for weeks at a time, and then returning. It was also remarkable in these latter, that recurrence of the eruption gave ease to certain painful symptoms to be presently described, or, to speak more cautiously, when the eczema came back the pain declined.

"We have spoken of this eruption as eczematous; but it is difficult to describe accurately, in ordinary terms, an appearance which presents itself on surfaces so diseased. The reader will certainly have recalled to mind by our statements, the herpetic and other forms of skin disease which are sometimes seen to accompany neuralgic affections.

"At the close of this section of our subject will be found a number of cases illustrating the various phenomena which we have described. Among these is the case of Schively, No. 18. It is an admirable example of the presence of eruptions associated with depraved nutrition. We mention it here only to call attention to the fact that the right hand was the injured member, and that eczema appeared secondarily in the left palm, and was relieved by the treatment which was addressed to the right limb. Was this a case of reflex influence?

"*The Nails and Hair.* — When the depraved nutritive state has lasted for some months, the hair commonly disappears from the fingers affected, and the nails undergo remarkable alterations. They suffer only in the fingers the neural supply of which has been interfered with, so that the nails in the median distribution may be contorted, and those in the little finger be unaffected. The alteration in the nail consists of a curve in its long axis, an extreme lateral arching, and sometimes a thickening of the cutis beneath its extremity. In other instances a change takes place which is quite peculiar, and which to us at least was new. The skin at that end of the nail next to the third finger-joint becomes retracted, leaving the sensitive matrix partly exposed. At the same time the upper line of union of skin and nail retreats into or under the latter part, and, in place of a smooth edge, is seen through the nail as a ragged and notched border. The patient who presented these changes in the most striking form had also lateral arching of the nail, but no longitudinal curving. It was a case of the most terrible suffering, from a combination of burning pain in the hand, and neuralgic pain in the fore-arm.

" No deformity of the nails in tubercle at all approaches that which nerve wounds occasion. Indeed, we think it would be possible for one familiar with these cases to diagnose the existence of a nerve lesion from the form of these protuberant and oddly curved nails.

" When the nails of the toes have been attacked, and they are very rarely so, the curving is less marked, but a distressing ulceration is apt to occur at their angles, and to break out again and again, despite of every care and attention.

" The best remedy then is excision of the outer edges of the nail, matrix and all. This has given permanent relief in a number of our patients.

" Before passing to the discussion of other parts of the same subject, we must confess that it is almost impossible, without a colored plate, to convey any clear idea of the worst cases of these cutaneous lesions. To see them is sufficient to impress one with the idea that their very peculiar appearances have no exact likenesses anywhere else in the pathological states to which the skin is subject. In the cases of glossy skin where there was no marked hyperæsthesia as to pain, the patient seemed to have healthy power of tact throughout the altered tissues. In others, though rarely, there was partial tactile paralysis. We may therefore infer that the change in the skin arises from agencies which may or may not be associated with conditions which disturb the nerves of touch." [1]

[1] *Gunshot Wounds and other Injuries of Nerves*, by S. Weir Mitchell, M. D., George R. Morehouse, M. D., and William W. Keen, M. D., Acting Assistant-Surgeons U. S. Army, in charge of U. S. Army Wards for Diseases of the Nervous System, Turner's Lane Hospital, Philadelphia: — Philadelphia, J. B. Lippincott & Co , 1864.

The facts above related possess extreme interest in connection with the pathological opinion which looks upon certain skin diseases as belonging to the class of neuroses. Herpes Zoster is certainly entitled to this distinction, being essentially a neuralgia, with a cutaneous eruption. M. Charcot[1] has reported other instances of eruptions supervening on neuralgia, and one resembling pemphigus, which resulted from an abscess of the fore-arm. Other cases are related by Notta[2] and Parratt.[3]

Certain diseases of the skin belong among the neuroses.

The most illustrative case of herpes known to me occurred in the practice of my friend Dr. Keating, who has kindly placed it at my disposal: —

Case of Herpes.

"C. B——, aged forty-three, banker, in good health, was attacked with a copious eruption of herpes, which covered the left arm and shoulder, and was accompanied with intense darting neuralgia of these parts, as well as the hand. The herpes disappeared in three weeks, but the pain continuing at the close of the fourth week, he began to complain of feebleness of the limb. This increased to such an extent as to result in almost total paralysis, which included the fore-arm and the pectoral group of muscles. Meanwhile the pain diminished, and during the second and third month the muscles underwent very marked atrophy, which was most notable in the shoulder group, and in the biceps. The neuralgia finally disappeared altogether, although the motor palsy lasted at least four to five months, being relieved, and at last cured, by the aid of faradization."

We have thus a case of herpes with not merely neuralgia, but also with paralysis of quite an obstinate character. I do not know of any other history which presented this peculiar association of symptoms.

Since my experience in connection with defective nutrition caused by nerve wounds, I have paid more attention to this subject in cases of paralyses from central organic disease. Without entering fully into the matter, I shall venture to relate a very interesting case which has fallen under my notice.

Intense Neuralgia and Motor Palsy of Legs, with Contracted Toes and Ankles; No loss of Sensation; Neuralgia of Arms and Hands; Contraction of Fingers; No Palsy of Upper Limbs; Hyperæsthesia of Palms, Causalgia, and Glazed Redness of Ulnar Side of Palms.

October 19th, 1865. — Mrs. S., aged fifty-two, twice married, has had no children, and never was pregnant. During the latter years of her last marriage, and after her husband's death, she had a good deal of

[1] *Journal de la Phys.*, tom, ii., p. 108.
[2] *Arch. Gen. de Méd.*, September, 1854, p. 318.
[3] I. Parrat, *Union Méd.*, Mars, 1856.

distress and annoyances of various kinds. In 1859, Mrs. S. had a fall, in which she struck the back of her neck. Two weeks later she felt suddenly a dull but severe pain between her shoulders. Within a few days this extended into the arms, with dragging and tearing pains down to the wrists. A few months later the pains attacked the legs, and were accompanied by violent cramps. About this time she had indistinct articulation; but this did not endure. The intellect was clear throughout the case. The next symptom was feebleness in the legs, which increased until she ceased to walk. She has since remained on a couch or in bed. After a year, as well as can be recalled, her feet and hands became contracted. The toes were flexed, the feet extended. The fingers became slowly flexed to a right angle with the palm, the index finger remaining extended. The thumb was drawn tightly into the palm, and the fingers were extended on themselves. Sensation is said to have been normal at all times. It is now entire everywhere. On the ulnar half of the palm, in both hands, the skin is dark-red, shining, and glazed. It is in these parts exquisitely tender to the touch, and is the seat of a constant causalgia or burning pain. The soles also burn, but are not red nor shining. All the motions are limited by the contractions, but there does not seem to be any distinct paralysis. The flexors of the toes are somewhat atrophied, but still have voluntary motion. Bowels always costive, never being moved without enema. Urine passed with difficulty, and for some years requiring now and then the use of a catheter; urine cloudy, from deposits of urates; very rarely uric acid sediment; it is always acid; the specific gravity average of four specimens of mixed urine of whole day, 1025; no albumen or sugar. Tubercle in left lung, cough, and hectic. These are symptoms only of the last five months. *Nutrition* — general wasting. The great toes were subject to occasional ulcers at their angles during the first two years of her malady. The three external fingers on each hand have a disease of the matrix of the nails, resulting in a thinning and irregular growth of the nails. No incurvation.

The affection of the teeth is very curious. They were formerly regular, white, of even length, and touching one another. They are now very unequal in length, and diverge from one another, so that the space of four lines exists between the two anterior upper incisors. They also seem to be turned on their long axes and all are of a deep yellow, despite the most assiduous care. I should add that none are loose. I do not know that I can fully describe the curious appearance presented by this patient's mouth. It strongly impressed me with the idea that there had been disease of the alveolar sockets, something akin to that which is met with in the matrices of certain diseased nails.

My patient died in November, 1865. To my regret, no *post-mortem* examination could be had.

It appears to me that this case is a good example of causalgia, shining palms, and depraved nutrition of teeth and nails, probably originating in central spinal disease. I do not think that these changes have hitherto been noted except in connection with injuries or disease of extra-central nerve branches. In some respects it resembles a set of cases reported by a very able observer, M. Charcot, in the "Union Médicale," 1866.

Hypertrophy of areolar tissues of hand from wound of nerve.

I have encountered an exceptional case, in which a nerve wound appeared to have occasioned a very curious hypertrophic state of the areolar tissues of the hand. This patient was seen by my friend, Dr. Morehouse, after I had ceased to attend at the hospital. Dr. M. was so struck with the singularity of the affection, that he sent the man to my house, where he was also seen by Dr. Packard, who pointed out the resemblance between the condition of his hand and that of a person afflicted with elephantiasis. I have met with no other case in the least degree like this one, and I am altogether at a loss to explain the true cause of his disease. Like most of his fellows, he passed from under our care long before he became well, therefore I can give only an unfinished history of his case.

"*Hypertrophy caused by Nerve Wound.* — John Graham, Company E, 116th New York. Wounded in left arm, October 19, 1864. Entry, three inches below axilla on posterior face; exit, two inches below axilla anteriorly. Arm dropped. He fell bleeding freely and very faint. Very early in the case his first and second finger and thumb slowly enlarged without other inflammatory signs, and with slight, darting pains. After the wound healed, these parts increased still more, and became firm and dark-purple in tint. At the same time the darting pains increased. For several months he had causalgia, but not severely. Two months after the wound, the skin of the affected parts peeled off *en masse*.

"When I saw him, seven months after the injury, there was no feeling in the first, second, and half of the third finger, and in the front of the thumb. The first and second finger were moveless, chiefly from their size and stiffness. The thumb could be slightly stirred. There was a good deal of neuralgia in these parts, and their skin was dry, scaly, and yellow. The enlargement above alluded to was chiefly confined to the thumb and first two fingers, but it also involved the dorsum of the hand, being most developed on the radial half. Perhaps it was most striking in the thumb. There was a little œdema of the ulnar palm and dorsum, but elsewhere the parts were hard and unimpressible by the finger. The skin itself appeared to be thickened, and was very dark throughout the extent of the affected portions of the member."

Another very interesting peculiarity of nerve lesions, and one of no rare occurrence, is subacute inflammation of the joints. At first I supposed it to be due to general œdema of the limb, or to be a relic of the early traumatic inflammation. These ideas were abandoned, however, as soon as the presence of a number of cases in our wards enabled us to study them with greater success.

Inflammation of joints.

Since the publication of our essay on nerve lesions, nearly all of our statements in regard to the nutritive changes in the skin, nails, hair, and joints, have been amply confirmed by the recent experience of many European observers. Perhaps the most remarkable of the lately published cases is No. 35 of the series given by Dr. Annandale.[1] Other confirmatory statements may be met with in Tillaux.[2]

Very early, or at any time after the first few days, the joints of a wounded limb may become swollen and painful to the touch or on movement. After a time, the pain and tenderness lessen, but the joints remain stiff and enlarged for months or years. As to their final fate, I have no information, since in every case the patient passed from under our care.

I have vainly sought to find any single point as to which these joints differ in appearance from those affected by subacute rheumatism. Nor, indeed, as has elsewhere been urged, are we even now sure that rheumatism is not of neural origin. Dr. Gull has lately pointed out some interesting facts in this connection; but, as is well known to American physicians, he was long ago anticipated by the late Prof. J. K. Mitchell.[3]

As regards the effect of nerve injuries upon the secretions, but little was added by us to the stock of existing knowledge.

Effect on secretions.

We observed that with complete loss of innervation the skin was dry, so that, in some cases, the boundary lines of healthy innervation could be defined by the limits of the cutaneous moisture. In some instances of partial nerve injury, there were copious sweats which were intensely acid, so that the man smelled of vinegar. In a single instance the odor was disgustingly heavy, like the stench from a foul drain.

I have recently encountered a case of an officer in whom a ball wound had injured severely the nerves of the left shoulder. The

[1] *Malformations, Diseases, and Injuries of the Fingers and Toes.* 1866. Philadelphia: J. B. Lippincott & Co.

[2] *Des Affections Chirurgicales des Nerfs.* Paris, 1866.

[3] *Am. Journal of Medical Sciences*, vol. viii., p. 55.

axilla was insensible to the touch, and, as he observed, had none of the usual odor of that part.

For cases illustrative of the nutritive changes which I have here dwelt upon, I refer the reader to the close of the paper.

LESIONS OF SENSATION.

I do not remember to have met with a single case of wound of the nerves of a limb where there was loss of motion without some alteration of the sense of tact or that of pain. This is only curious when we see how slight is sometimes the sensory lesion as compared to that of motion, and how much less enduring than the latter.

We may study this subject under the following heads: —

Hyperæsthetic Conditions;
Anæsthetic Conditions;
Neuralgia — inclusive of
Causalgia (Burning pain).

Classification of lesions of sensation.

Hyperæsthesia of the sense of tact is not to be met with in cases of nerve wounds. It is also uncommon to encounter exaggerated sense of pain, apart from inflammation, or from that strange form of skin disease described by us, and to be presently more fully dwelt upon. While cutaneous hyperæsthesia is so infrequent, it is common enough to see instances of muscular hyperæsthesia, a condition upon which Briquet has insisted as a symptom of hysteria. Elsewhere it has usually escaped recognition. It is found very often in nerve wounds, and is almost the sole symptom in some cases of spinal shock. In the latter association it was most amenable to the long-continued use of bromide of potassium in large doses. When occurring in connection with nerve wounds, it needs no special treatment, as it disappears with the lapse of time, and even when present offers no important obstacle to treatment.

Hyperæsthesia.

It is, however, a point of some interest to determine the existence of the symptom in question. We may detect it by pinching the muscles, or by deep pressure, so as to elicit an unusual feeling of soreness which, in some cases, is very acute. At the same time, if we pinch the skin, or the skin and subcuticular tissues in the same locality, no such pain is complained of.

Anæsthetic Conditions. — Defective sense of touch or of pain are found to exist in most nerve wounds. In a large number it was observed that both senses alike suffered, but in rare cases the one was injured and the other unimpaired. It was

Anæsthesia and analgesia.

further noted that, as I have already pointed out, sensation is apt to return long before motility is restored. I quote from *op. cit.*, p. 97, the following as the only explanation of this remarkable fact which I can offer: —

"When a function is partially paralyzed, its continued exercise is one of the conditions of its ultimate return to full activity so soon as the neural injury has become repaired. Now, the sense of touch is in constant automatic use, so to speak; every contact is a new stimulus, and the very fact of deficient feeling subjects the part to rough and unusual irritations. It does not seem incredible that this may explain, in part at least, the early disappearance of sensory paralysis in cases where the function of sensation appears to be quite as much affected at the outset as that of motility.

"In regard to voluntary movement the case is quite different. When muscles are paralyzed partially, an effort of will, and a greater one than common, is demanded to call them into action. The early inflammatory conditions make motion painful. The effort is unusually wearisome, and there is no inevitable and constant stimulus, such as exists in regard to touch. Hence, perhaps, it is that motility is regained less easily than sensibility, although beyond all this there are also certain mechanical obstacles in the way of a return of voluntary movement, which vary greatly, and constitute every single case a special object of study. We may sum up the matter in this brief shape. The skin is all the time stimulated, whether we will or not. The muscles which volition has ceased to move with ease have no such incidental stimulus. Accident and position do for the skin what artificial medical agencies must do for the muscles, if we desire to sustain their nutrition and restore their power."

In determining the amount of loss of sensation in the early stages of a wounded limb, it is important to bear in mind how rapid and complete may sometimes be the disappearance of this symptom, and it is also unsafe to conclude that there is perfect anæsthesia or analgesia until the skin has been thoroughly examined with the aid of the induced electric current and the wire brush. I have again and again detected by this means in wounded limbs, or in those otherwise palsied, some relics of sensibility. And while the electric wire brush is of diagnostic value, it is also capable, in many instances, of recalling sensation to affected parts in a way which is so striking as to have often excited my astonishment.

Where lesser lesions of sensation exist, they should be studied with the aid of the æsthesiometer, and the amount and extent of defective feeling recorded for future comparison.

There is yet another point of interest in connection with injuries of sensation which in time may possibly come to have value as regards the differential diagnosis of paralysis.

Delay in transmission of sensations and volition.

It has occurred to me, as to others, to observe that in some partial paralyses depending upon certain pathological states of the spinal cord an impression made on the skin of the affected limb requires some seconds to elapse before it is felt by the brain. I have carefully measured with a metronome the time thus required, and found it to be in the worst case I have seen eight seconds. In another, an instance of spinal shock from fall, it was five seconds. In like manner, the mandates of the will were equally retarded in their passage to the paralyzed muscles. I incline to the belief that in cerebral paralysis this phenomenon is less distinctly marked, and at all events it will be well to examine the subject with a larger range of cases than has fallen under my eye since I suspected this difference to exist.

In the few instances of lesion of nerve trunks which I have recently encountered, I have examined this point with great care. Of course such observations are possible only in cases of partial loss of sensation. In these I have found but a very slight retardation in the time required for a sensory impression to reach the brain — so slight a time indeed as to be measurable with difficulty, or not at all. At all events there was nothing comparable to the retardation which I have found in spinal paralysis. I am naturally led to suspect that in order to produce this effect there must be an injury of some of the ganglionic layers through which excitations of a distal nerve must pass in the spine before they can ascend to the brain itself.

I state these very interesting facts, and my deduction therefrom, with just that amount of doubt which ought rightly to exist where the range of observation has been necessarily limited. I am confident, however, that in the partial anæsthesias from injury of nerve trunks which I have lately seen, there was no such delaying of the passage of impressions as occurred in the cases of spinal paralysis which have fallen under my care, so that in any case this discrepancy would remain to be accounted for, even should future experience exhibit instances of distal lesions in which there may exist such a loss of time in transmitting sensations.

Slow passage of neural impressions in injuries of the medulla spinalis.

I am tempted here to make one remark in regard to the slow passage of neural impressions in injuries of the medulla spinalis. It appears to me to be of great importance, and to have escaped the notice of physiologists.

Retardation of electrical currents.

So far as I am aware, the retardation of electrical impressions by defects of conduction, even in wires of great length, is measurable only by fractions of seconds. But in the case of certain spinal lesions affecting the integrity of neural conduction we have a delay of from five to eight seconds, on conductors not over four or five feet long. Does not this fact separate nerve force from electric force by a boundary wider than has yet been supposed to exist.

Experiments are yet needed, however, as to the possible amount of retardation in electricity of low tension traversing conductors of such feeble power of transmission as the nerve fibres present.

If the difference which I have described between nerve lesion and ganglionic lesions be substantiated, it is possible that we may thus obtain a novel method of differentially diagnosing diseases of the centres from those of the conducting cords.

At the risk of theorizing, beyond what the facts admit of, I am tempted to state one fact in electricity which may help a little to clear up our ideas as to the mode in which ganglionic injury may lessen the power of neural transmission, and by enfeebling the current make it impossible to impress the sensorium so as to record an impression until some little time shall have elapsed.

When a current of electricity is made to pass across or through a second battery of a number of cells, and when one or more of these has its elements, as zinc and copper, reversed, the current is singularly enfeebled.

Now, it is not impossible that in cases of spinal commotion or disease some such dislocation of ganglion cells may take place as to cause a like weakening of the current. I do not wish to express myself as discerning any absolute identity between the two sets of conditions here stated, but it does seem to me as though the one might aid us at least to understand how the other could occur.

As a general rule, when a great nerve has been injured by a ball, the sense of pain, of touch, and of temperature, as well as the power to move, all suffer loss in varying degrees, and usually are most affected at the outset. In cases of injury to a nerve from contusion, or from gradual pressure, or even from disease, it is usually sensation which is first and alone attacked. Loss of motility, if it come at all, comes much later, and commonly without any previous display of convulsive movements in the muscles whose nerves have been altered. Interesting examples of this sequence are to be met with in the "crutch palsy," previously described, and which must often have been seen by our hospital sur-

geons. In this malady, numbness and loss of sensation precede the paralysis, and are sufficient to warn us of the danger which is sure to follow if the case be neglected.

Neuralgic and other pains are among the most common symptoms of nerve wounds, and are, perhaps, of all others, the most permanent. They assume every possible variety of type, and differ so little from ordinary neuralgia as to need but little notice here.

Causalgia. — There is, however, one species of pain arising out of nerve wounds which had never been described except by my colleagues and myself, although the state of skin which is usually found with it had been spoken of by Mr. Paget, who seems to have seen it only in association with common neuralgic pains. In writing of this peculiar kind of suffering, I felt that it would be well to give it some more convenient name than merely "burning pain," and, in accordance with the suggestion of my friend, Professor Robley Dunglison, I have therefore adopted the term *Causalgia* as being both descriptive and convenient. The following extract from the volume on gunshot wounds, etc., by Drs. Morehouse, Keen, and myself, delineates this disease so fully as to make it unnecessary to add to it: — Burning pain.

"In an early experience of nerve wounds we met with a small number of men who were suffering from a pain which they described as a 'burning,' or as 'mustard red-hot,' or as 'a red-hot file rasping the skin.' In all of these patients, and in many later cases, this pain was an associate of the glossy skin previously described. In fact, this state of skin never existed without burning pain.

"Recently we have seen numbers of men who had burning pain without glossy skin, and in some we have seen this latter condition commencing. The burning comes first, the skin changes afterward; but in no case of great depravity in the nutrient condition of the skin have we failed to meet with it, and that in its forms of almost unendurable anguish. The terms here used may seem strong to those who have not encountered these cases; but no one who has seen them will think that, as regards some of them, it would be possible to overstate their most wretched condition.

"We have some doubt as to whether this form of pain ever originates at the moment of the wounding; but we have been so informed as regards two or three cases. (See case 22.) Certain it is that, as a rule, the burning arises later, but almost always during the healing of the wound. Of the special cause which provokes it, we know nothing, except that it has sometimes followed the transfer of pathological changes from a wounded nerve to unwounded nerves, and has then been felt in

their distribution, so that we do not need a direct wound to bring it about.

"The seat of burning pain is very various, but it never attacks the trunk, rarely the arm or thigh, and not often the fore-arm or leg. Its favorite site is the foot or hand. In these parts it is to be found most often where the nutritive skin changes are met with; that is to say, on the palm of the hand, or palmar face of the fingers, and on the dorsum of the foot; scarcely ever on the sole of the foot, or the back of the hand. Where it first existed in the whole foot or hand, it always remained last in the parts above referred to, as its favorite seats.

"The great mass of sufferers described this pain as superficial, but others said it was also in the joints, and deep in the palm. If it lasted long, it was referred finally to the skin alone.

"Its intensity varies from the most trivial burning to a state of torture which can hardly be credited, but which reacts on the whole economy, until the general health is seriously affected.

"The part itself is not alone subject to an intense burning sensation, but becomes exquisitely hyperæsthetic, so that a touch or a tap of the finger increases the pain. Exposure to the air is avoided by the patient with a care which seems absurd, and most of the bad cases keep the hand constantly wet, finding relief in the moisture rather than in the coolness of the application. Two of these sufferers carried a bottle of water and a sponge, and never permitted the part to become dry for a moment.

"As the pain increases, the general sympathy becomes more marked. The temper changes, and grows irritable; the face becomes anxious, and has a look of uneasiness and suffering. The sleep is restless, and the constitutional condition, reacting on the wounded limb, exasperates the hyperæsthetic state, so that the rattling of a newspaper, a breath of air, another's step across the ward, the vibrations caused by a military band, or the shock of the feet in walking, give rise to increase of pain. At last, the patient grows hysterical, if we may use the only term which covers the facts. He walks carefully, carries the limb tenderly with the sound hand, is tremulous, nervous, and has all kinds of expedients for lessening the pain. In two cases, at least, the skin of the entire body became hyperæsthetic when dry, and the men found some ease from pouring water into their boots. They said, when questioned, that it made walking hurt less; but how or why, unless by diminishing vibration, we cannot explain. One of these men went so far as to wet the sound hand when he was obliged to touch the other, and insisted that the observer should also wet his hand before touching him, complaining that dry touch always exasperated his pain.

"Cold weather usually eased these pains; heat, and the hanging down of the limb, made them worse. Motion of the part was unendurable in some of the very worst cases; but, for the most part, it did no harm, unless so excessive as to flush the injured region.

"The relations of burning pain to altered nutrition have already received attention from us. It appears quite certain that in cases of glossy skin, burning always exists. It is also certain that it may exist without association with diseased skin; but that in these instances the evidence of depraved nutrient states will be very likely to follow upon the pain, should that symptom last very long.

"The temperature of the burning part we have always found to be higher than that of surrounding parts, or than that of corresponding points on the other half of the body."

I have met but one case in which burning pain and shining skin coexisted with complete anæsthesia of the part affected. In every other instance there was at least partial sense of tact, and hyperæsthesia as to pain. We found also, that remedies addressed to the diseased skin alleviated the pain, while treatment of the distant wound or cicatrix gave no good results. Nor have I met with any person who, after having suffered amputation, complained of burning pain. I infer, therefore, that the pain is caused by some nerve change which occasions alterations in the distal circulation and nutrition, and that these, in turn, produce a state of the cutaneous nerves which gives rise to pain of a peculiar character. It appears to me, in some way, therefore, to be related to the depraved nutrition of the skin. If, in any case, we had been obliged to amputate a limb thus affected, the question would have been easily settled, since, if the burning were merely a referred sensation, like the pains caused by diseased nerves in a stump, the causalgia would have continued; whilst, if it were the product of altered nutrition in distal parts, it would have disappeared with the loss of the member. Illustrative cases will be found at the close of this paper, and at page 431 the reader will meet with an instance of glossy skin and burning apparently due to disease of the spinal centres.

Burning pain with anæsthesia.

DEFECTS OF MOTION FROM WOUNDS OF NERVES.

Nerve lesions affect the power to move a part in the following ways: —

1. *By occasioning muscular paralysis;*
2. *By producing contractions organic or functional;*
3. *By causing diseases of joints;*
4. *By giving rise to long disuse.*

Different ways in which nerve lesions affect motion.

Class I. — A wound of a nerve occurs, and a number of muscles are paralyzed. Some of them recover rapidly; others remain dead to volitional control for unlimited

Paralyses.

periods of time, and undergo secondary changes very injurious to the motility of the limb. If the will has any, even the faintest, control over a muscle, it is likely to improve; but if the muscle grows flabby, becomes atrophied, and finally shortens, the prognosis is bad. Early in the case, a thorough electric examination affords prognostic indications of value, as I shall elsewhere point out more at length.

Class II. — *Results of Paralysis.* — The first of these is shortening of the opponent group, if this be still within the power of the will. With this comes a certain abruptness of motion, which occasions much awkwardness. If these changes be not provided against, the joints become altered; and if at the same time they should be inflamed, as often happens, the final result is some deformity utterly intractable to treatment. The joint lesions occasion mischief in another way. Whether from pain or neglect, it is only too often found that a limb has been kept in some one position during several weeks after a wound, or even for a longer time. The result is a state of false anchylosis which is far worse than any which follows the prolonged use of splints and the absence of passive motion.

Shortening of opponent muscles.

Organic shortening, the frequent sequence of atrophy, when it prevents contraction of the opponent muscles, would do less harm — indeed it might seem desirable if it could be checked at a given limit; but, unfortunately, it is apt to go on until it deforms the member, and gives rise to difficulties of a very interesting nature.

When, for instance, as we have seen, the wrist flexors were greatly contracted, the hand was so drawn down that the flexors of the fingers could not shorten sufficiently to bend these parts at all. The moment we forcibly overcame the flexion of the wrist, the fingers could at once be bent, so that there was really no paralysis of these parts.

Spasmodic affections are so rare as to be of little practical moment. I have seen but few cases of tonic spasm. In those which presented themselves at the U. S. Army Hospital for Injuries of Nerves, etc., we observed that the affected muscle was always firm and plump; that it remained sensitive to electricity, perhaps was even abnormally so; and that in one case at least it did not relax during sleep. Every attempt to extend it forcibly caused pain and more violent spasm. Indeed, in many instances of nerve wounds, there was a certain irritability of the muscles, which betrayed itself by pain and spastic contraction, when we moved the limb so as to elongate the muscle. Thus, if a

Spasm.

flexor muscle was so affected, passive extension of the limb produced in it a spasm, and even volitional attempts at extension occasioned this result. Tremor was a common phenomenon in muscles which were partially palsied, or had been long disused.

Diagnosis of wounds of nerves.

As regards the diagnosis of wounds of nerves, it may seem needless to say any thing. The points to determine are, Whether there be loss of motility or sensibility, and the extent and probable duration of such loss — points most readily settled a few days after the date of the wound. Total and permanent abolition of both functions may commonly be taken as evidence of actual division of the nerve, although I am sure that local shock may give occasion to great though less enduring results. While it is easy, therefore, to be sure that a nerve has been injured, we may often be at a loss to determine at once the extent of the lesion; and it is always necessary to bear in mind the various accidents or incidents of nerve wounds which lessen movement, without being directly dependent upon nerve injury. Of these I shall speak hereafter.

Prognosis of wounds of nerves.

As concerns prognosis, it is above all things important to delay the formation of an opinion for many months after the wound has been received. For, even in a case of direct, though partial, section of great nerves, the accompanying local shock is often transient; and besides this, no one can predict the extent to which nerve repair may proceed. So true is this, that it is not right to despair of a case until, at long intervals of months or years, repeated efforts have been made with electricity to recall the muscles into functional activity, and thus to utilize any favorable changes in their nerves which may have been effected during these intervals. Increasing experience has taught me, indeed, that the most unfavorable cases are those in which slight wounds of nerve trunks have occasioned atrophic shortening of muscles, or, worst of all, the peculiar joint disease first described by my colleagues and myself. Many of these cases are quite hopeless, and are certainly far more difficult to treat than simple loss of motility and feeling. I ought to add that I have followed none of these histories over more than three or four years, and therefore I cannot feel sure that they may not improve after longer periods of time have elapsed.

Wounds of nerves produced by splinters of a bone shattered by a ball are apt to be intractable for obvious reasons. I have met with several instances of this form of injury in which every remedial agent failed to be of use.

Palsy of nerves at a distance from the seat of injury.

In making either a diagnosis or prognosis, it is proper to remember that nerve injuries may give rise to palsy of sound parts, either in the limb struck, or in remote regions. It is well to be certain, in these cases, that no fragment of bone or ball has been driven against the more distant nerves which appear to be secondarily affected. The following case is not only a good instance of the possibility of such an occurrence, but is in other respects a most instructive history : —

Case.

Wm. Seymour, aged twenty, sailor. On May 5th, 1865, in the Wilderness, while ramming a load, he was shot from the branches of a tree on his left. The ball entered one and a half inches immediately below the left auditory meatus, touching the lower lobe of the ear ; it slightly splintered the posterior angle of the lower jaw-bone, and passed across the throat much below the level of the tongue, though, as to its exact path, little is known. It made exit on the right side of the neck at a level with the lower edge of the thyroid cartilage, through the sterno-cleido-mastoid muscle, about one and a half inches above the clavicle, and two and a quarter inches from the middle line. He fell senseless, lay thus about an hour, and then, awakening, crept half a mile, as he thinks, both wounds bleeding in jets. He now filled the wounds with dust, and so checked the bleeding. He thinks both arms were at this time equally strong. The third night his wounds were dressed. Up to this time he had taken no food, and most of the water which he drank ran out of the right wound in the neck. He was taken to the Douglas Hospital on the 10th May. Up to this date he ate nothing, and spoke in feeble whispers.

At this point I insert the letter which Seymour brought with him from the distinguished surgeon in charge of the Douglas Hospital, Dr. Wm. Thompson, U. S. Army, at whose request the patient was transferred to the U. S. Army Hospital for Diseases and Injuries of the Nervous System.

After describing the wound, Dr. Thompson adds : —

" For a number of days he was nourished by injections of beef-tea, and by small quantities of milk introduced into the stomach through a catheter. He had had a severe hemorrhage on his way to the hospital. His wounds were dressed with cold water.

"*May 19th.* — He had a secondary hemorrhage, and lost eight ounces of blood. This was checked by compression.

"*May 26th.* — Lost four ounces of arterial blood from the wound of exit and from the mouth. The wound of entry was closed. Small bleedings occurred each day upon the least exertion, until May 30th, when it became evident that some operation would be needed to save his life. The external compression had caused an accumulation of blood about the trachea and neck generally, which with other causes

connected with the wound, made suffocation appear imminent. He was anæsthetized, and an incision made for ligature of the right primitive carotid. I should add that at this time there was good pulsation in the right temporal artery. After patient and thorough search, no trace of the right carotid, the internal jugular vein, or the pneumogastric nerve, could be found. The incision was extended downwards, and the sternal attachment of the sterno-cleido-mastoid muscle divided. The opening in the neck was finally carried up to the parotid gland, and the region thus exposed was submitted to the closest scrutiny, but still without discovery of any large vessel. As the oozing continued, I made fruitless search for any thing large enough to tie, and at length filled the wound of exit with charpie, and left the patient to his fate. No further bleeding took place, and recovery was henceforward rapid.

"For a long time there was complete aphonia, and after the operation he lost power in the right arm."

Admitted at Turner's Lane Hospital, September 11th, 1864.

The following particulars were elicited: —

Wounds closed. Right arm: Sensation and motion feeble throughout the limb. I believe this to have been due to changes in the brachial plexus in the neck, consequent upon the operation. The neck has, from stiffness, only one quarter range of movement. Face: Touch is lost on *right* side of face, cheek, skin of lips, from half an inch in front of ear to line of external angle of right eye. Worst on edge of chin, fair on red part of lips, limited by middle line. Touch lessened on upper neck. Analgesia more or less complete, in all these parts. The nose is unaffected. Tongue: On the right side there is absolute loss of gustation, touch, pain, and sense of temperature. This defect is limited by the middle line. Very far back there seems to be considerable sensation. On the right side motion seems good — some of us thought entire; and the right side of the tongue is firm, red, and well nourished. The left side of the tongue is paralyzed as to motion almost entirely. It is soft, flabby, wrinkled, and atrophied, rolling helplessly with the movement of the right muscles. The whole tongue, when at rest, lies straight in the mouth, but it cannot now be projected. When, early in the case, this was possible, it turned distinctly to the left side. Deglutition is imperfect; he has to take moistened food only, and coughs and chokes very frequently while eating. He is liable to fits of gaping when tired or over-heated. Voice nearly perfect. The eyes are healthy. There is no pain anywhere. The heart and lungs are sound. Appetite and digestion good.

Comments on the foregoing case.

It is clear from the facts before us that the ball probably cut the left lingual nerve, and also the right lingual branches of the glosso-pharyngeal nerve. The former accident suf-

ficed to palsy the left side of the tongue. The latter may be assumed to have had some share in the destruction of gustatory sensation on the right side of that organ; but these accidents account neither for the accompanying total loss of tact and pain in the right side of the tongue, and still less for that of the external right side of the face. To paralyze sensation in the latter regions, there must have been either a secondary affection through induced disease of the centres, or else some wound of the nerve in question; and if the latter took place far enough back, it would involve some of the branches of the fifth nerve, which go to the tongue, and some which supply the face. The question is answered, I think, by the following facts: Early in the case, Seymour felt a pricking in the right throat far back. At the fourteenth day a piece of bone, half an inch wide and very thin, escaped into the throat from the part mentioned, and was coughed out. Unfortunately it was not preserved. I suppose that this splinter was broken off of the left jaw, and driven across the throat so as to wound the third branch of the fifth nerve.

Seymour's recovery was rapid, although I used no treatment at all. *October 10th.* — The face has recovered sensation. Taste was restored to the tongue, although not perfectly. Tact and pain were still absent. *October 20th.* — There is some feeling in the tongue, but no motion on the left side, and no change in the nutrition.

Returned to duty October 20th, 1864.

Treatment. — Pain exists in almost every nerve wound, and is so terrible in some as to tax all our resources, and, too often, to defy them all.

Treatment as regards pain.

The most frequent cases are those of partial nerve lesions. Here we have several points to determine before treating the disease. The scar should be inspected to see if it presses on any nerve. If it does, — and this is not often the case, — gradually increased passive, and, at last, active motion, with frictions, and the use of an ointment of iod. plumb., will be of use. If the nerve track be tender on pressure, it should be freely leeched twice a week; and, finally, after the tenderness has been lessened, it may be proper to blister the whole length of the nerve trunk repeatedly, and also to administer internally iodide of potassium. The free use of leeches gave us often most happy results. More severe measures, such as the actual cautery, impressed us unfavorably. I have used every form of electric agency to relieve these cases, but, neither in my private practice nor in the hospital were these

means successful, except in mild cases, where as the general nutrition of the limb improved the pains also lessened.

While using the methods above described, it is necessary to have some means of temporarily quieting the patient, and easing his sufferings. For these purposes nothing is better than the hypodermic injections of morphia. I am now in the habit of using, in such cases, the fourth of a grain of sulphate of morphia, and the fiftieth of a grain of sulphate of atropia, or larger doses in like proportions. I think that this combination does not produce as much general disturbance as the morphia alone, while, as was elsewhere shown, the atropia does not lessen materially the pain-destroying powers of the former drug.[1] I ought to add that, in some persons, even this dose of atropia is too much, and that, in certain patients, it always occasions headache.

I have no confidence in atropia itself, nor in hyoscyamia, daturia, or conia as anæsthetic agents; but I am satisfied that morphia, thus used, is invaluable, and that it not only relieves the pain, but in some way tends to give permanent aid. I should not think it worth while to urge this point if it were not that the profession is still too little in the habit of resorting to hypodermal injections. With us, in our hospital wards, they were employed with the utmost freedom, so that, day after day, from forty to fifty injections were used. In very many cases we were thus enabled to soothe pain until more active agents, or the slower changes due to time, had brought about permanent ease. It would not be too much to say that many patients, whose tortures would otherwise have justified amputation, have found in hypodermal injections the power to bridge over, so to speak, the long intervals required to ameliorate their sufferings. As regards the point at which this remedy should be employed, I have little to say, except that in causalgia the patients insisted that it gave most relief when used at the spot of greatest suffering. In common aching or darting neuralgias, there seems to be no great choice, and it is only necessary to select a spot where the areolar tissue is loose and abundant.

Burning Pain. — I believe that I can do no better here than to transcribe our remarks upon the treatment of this singular affection, giving the first formidable instance which fell under our care.

Case XXXI. *Gunshot Wound of the Left Brachial Plexus; Paralysis of Motion and Sensation; Muscular Hyperæsthesia; Intense Burning in Hand and Arm; Nutritive Changes; Atrophy; Contracted Extensors; Re-*

[1] "Antagonism of Atropia and Morphia," *Am. Journal of Medical Sciences*, July, 1865. Mitchell, Keen, and Morehouse.

lief; Discharged. — A. D. Marks, sergeant, Company C, 3d Maryland Volunteers, aged 43, enlisted August, 1861. Previously healthy. May 3d, 1863, at Chancellorsville, he received two wounds; one in the neck and one in the chest. The first ball passed in below the anterior boundary of the left armpit, through the margin of the great pectoral muscle, the arm being raised at the moment. The missile glanced on the neck of the humerus and made its escape anterior to the coracoid process, apparently wounding the plexus. As he turned to leave the field, a second ball entered the right side of the back, to the right of the eighth dorsal vertebra, and, crossing behind the spine, entered the left chest. The first wound caused palsy of motion and feeling in the left arm. The second gave rise to cough, spitting of blood, dysphagia, etc. It finally caused pleurisy, and large escape of pus during breathing. The wound is now closed, July 4, 1863, but the lower half of the lung is consolidated. The second wound brought him to the ground. He was taken prisoner, exposed a good deal to weather, and finally exchanged, and sent to West Philadelphia, Satterlee General Hospital, June 10, 1863.

During the first week, the arm, though palsied, was painless. Then he began to feel a knife-like pain from the wound down the inside of the limb, and also on its front, and on the ulnar side, half way to the wrist. With these pains came a tingling and burning sensation, as when the blood returns into a limb said to have been asleep, but more severe. Soon afterward this extended to the hand also, and he began to be able to feel the touch of foreign bodies.

Present State, July 5, 1863. — He lies on his back, anxious-looking, and pain-worn. The left arm rests on a pillow. It is cold, mottled, and swollen. The skin of the hand is thin, and dark-red, but presents no eruption. Tactility, nowhere absent, is dull on the dorsum of the hand and fingers. Except in these parts, localizing sensation is good. The whole arm and hand, except its back part, is, as he says, alive with burning pain, which warmth and dependence of the limb increase, and which cold and wetting ease considerably. It is subject to daily exacerbations about midday.

Motion. — The shoulder muscles act well. The deltoid is feeble. There is no motion below the elbow. The fingers are half flexed, and their joints swollen, sore, and congested. The deltoid is atrophied one half. The extensors in the fore-arm are flabby, but the general œdema prevents us from telling whether the fore-arm muscles are wasted or not. Pressure on the cicatrix gives no pain.

While at Satterlee Hospital, Dr. Walter F. Atlee used ice to the arm, and on the shoulder a blister dressed with morphia. These measures relieved the arm for the time without aiding the hand.

July 5. — Ordered hypodermic injections of the fourth of a grain of sulphate of morphia, near the scar, twice a day. This relieved the arm;

the hand growing daily worse, so that even ice ceased to afford ease, and he constantly prayed us to amputate the arm.

July 7. — Erysipelas set in about the seat of the injections, and they were discontinued for a time, morphia being used internally, and lead-water locally.

On the 9th, the disease had left him, and two drops of conia were injected into the shoulder. This was thrice repeated, but gave no relief. Atropia, one twenty-fifth of a grain, was next essayed, three times successively, at intervals of two hours. It caused dilatation of the pupils, flushed face, giddiness, and dry tongue. The only valuable result was a relaxation of the flexors of the fingers, which had become contracted, but which never afterward became so rigid as they had been. The patient himself called attention to this singular effect. Again morphia, one third of a grain, was injected into the arm without aiding the hand.

July 15 *to July* 20. — Injections of morphia were made into the hand twice a day. They gave so much ease that the ice was temporarily abandoned.

July 21. — For the first time we were able to examine the limb with electricity.

Tactile sensation was good in the arm and absent in the ulnar distribution. In all other parts of the hand tactile sensation existed. In the portions insensitive to touch, deep pressure and pinching caused pain, which was very severe, but was indistinctly localized by the patient.

Electro-muscular contractility was absent in the whole hand and fore-arm. The currents caused everywhere great pain, so that we could not tell if it were muscular or not. Probably the muscles still had sensation, since pressure on them was agonizing. Every electric examination necessitated the immediate subsequent use of morphia injections.

August 14. — The recent warm weather has increased the pain, so that he moans and weeps incessantly.

Up to September 9, various means were employed. The injections have been so numerous that the part is dotted with punctures, and their irritation has aggravated his sufferings to such a degree that they have been permanently laid aside for the internal use of narcotics. As local agents, we have had recourse to laudanum, lead-water, ice, oil, poultices with and without soda, and poultices of carbonate of soda, with vinegar to release carbonic acid. Of these, the soda poultice did best; but in this, as in every instance, the ease lasted but for a day or two. In despair, leeches were placed about the cicatrix, and blisters were applied over it and kept open, and also over the nerves which were tender on pressure; neither aided him.

Meanwhile the pain increased, but became limited to the palm and fingers and lower fore-arm, with darting pains up the arm. The tactility improved, and the muscular tenderness lessened. The general œdema disappeared, and the atrophy was seen to be extreme, while the finger

joints remained sore and swollen. Every motion or vibration caused pain.

October 18. — A blister on the palm failed to draw, but a blister on the dorsum of the hand acted well, and gave very marked relief. It was followed up with ammonia blisters on the palm and arm. These were repeated with, finally, cantharidal blisters. And now for the first time the ease was complete. Incessant blisters gradually ameliorated the pain. They were continued every few days for two months, until every trace of burning left him. He was so sure of the relief from this application that he was unwilling to allow the hand to heal before using a new one.

December 1. — Slight pneumonia of right lung.

December 10. — Electricity ordered. Immediate return of pain. Ceased its use.

Up to January 6th, his arm and hand were shampooed daily, passive motion was employed, and he began to sit up, and move about.

January 6, 1864. — Careful reëxamination. Arm gaining flesh. Cicatrix shrinking. Atrophy general; worst in the extensor group, in the fore-arm. (See specimens, casts Nos. 18 and 19, Army Medical Museum.) Sensation good throughout, but not quite perfect.

Voluntary Movements. — Shoulder abductions, one third; other actions perfect. Elbow extension complete. Flexion, by biceps alone, two thirds. Supination effected only by biceps. Pronation one third. Wrist extension and flexion about one sixth of usual range. Passive extension to line of fore-arm, where the flexors, which are contracted, limit the motion. Thumb everted, and flattened like that of a monkey. Slight flexion and adduction. Muscles utterly wasted. The finger-joints are no longer swelled, but are excessively rigid, and have no movement.

Electric Test. — Below the shoulder no muscle has any electric contractility, and the sensibility to induced currents is also diminished. Again the electricity brought on the burning and was abandoned.

Ordered daily etherization, and the fingers to be then freely moved. Shampooing to be continued, and the douche twice a day, with occasional blisters.

January 29, 1864. — Electricity no longer renews the burning, and is to be daily employed. The gain was now rapid. Flexor power over the fingers came back, but no extension, and no thumb motion.

February 23. — Supination and pronation improving. Atrophy lessening. Ordered a roll of bandage to be placed on the palm, the fingers to be bound down over it, to overcome the extensors, which, within a month, have been contracting.

On April 10, 1864, he was discharged, free of pain, and having only three fourths flexion of the fingers, without power to extend them. All the other motions were improving, and the thumb-muscles began to respond to the will. Sensation perfect.

Besides the agents above mentioned, we employed in other cases local vapor baths, alternate douches of hot and cold water, lotions or ointments of iodine, iodide of lead, iodide of potassium, sulphur, tar, cyanide of potassium, glycerine, bandaging, and various positions calculated to affect the local circulation; one and all failed to answer our purpose, and, as I have already stated, blistering in some shape became, with morphia and local use of water, our most reliable method of treatment.

TREATMENT OF NUTRITIVE CHANGES, AND OF THE PARALYSIS.

The blister has often appeared to me to have acted favorably upon the nutrition of the skin, as well as on the pain; but, excepting this agent, nothing else, save time, seemed to improve the condition of the thin and red and shining cuticle. The loss of power in the muscles and the atrophy are both reached by the same therapeutic means. First, by active motion, where it was at all possible, and by passive motion where this alone was available; second, by shampooing the part. I was once of opinion that we could scarcely give a patient too much either of passive motion, or of kneading (shampooing) the muscles. I have since learned by larger experience that, when the nutrition of a part is inactive, the amount of stimulus applied to it must bear to this a certain relation. I prefer to have the limb well shampooed, twice a day, for not over ten minutes. In children who are partially palsied, I have several times seen injury produced by excessive shampooing, and in them, as well as in excitable and feeble adults, it sometimes causes nausea, which is just what is apt to follow the over-use of induction currents, as I have elsewhere stated.

Blisters.

Active and passive motion. Shampooing.

Hot and cold douches, used alternately, seemed to us of use in flushing the limb or part whose nutrition was impaired. In the U. S. Army Hospital for Nervous Diseases, etc., we had in each ward pipes so arranged as to give a douche of fifteen feet fall; but even the simple application of hot and cold water will often answer an excellent purpose.

Hot and cold douches.

The last and, perhaps, the best of all the means of exciting the tissues, and increasing the flow of blood through the part, is the judicious employment of electricity in some form. In our volume upon "Injuries of Nerves," we discussed this portion of the treatment in a separate chapter, and drew conclusions which I have found little reason to modify. Since, however, the agent in question is of all means the most important in nerve wounds, I will

Electricity.

endeavor, in as brief space as possible, to indicate my views as to its employment.

When an induced interrupted electric current of some power is made to pass through a muscle, contraction ensues and a deep pain is felt, referred to the belly of the muscle. M. Duchenne (de Boulogne) terms the former electro-muscular contractility, the latter electro-muscular sensibility.

Electro-muscular contractility.

M. Duchenne has observed that, in certain cases, the will regains power over a muscle which yet remains unsusceptible to motion by the stimulus of induced currents. In common with my colleagues, I have often witnessed this condition of muscles. Indeed, I have now a patient whose biceps is fully under volitional command, but cannot be stirred by a strong induced current. In certain cases I have noticed that these very muscles would contract readily when sharply struck with the finger ends, so that it was not alone the will which could rouse them into action. Something akin to this is noticeable always in the anterior thigh muscles, which rarely respond at once to electrization, but, when aroused, are as sensitive as others. The same temporary inertness under strong induction currents is often met with in other muscles of the leg, and it is not uncommon to find a muscle very excitable to-day, and to-morrow far less so. It is also quite common to notice that a muscle temporarily inactive under the currents may be aroused by the electrization of a neighboring muscle or group of muscles. The statements here made must be borne in mind during every electric examination, since otherwise a person unaccustomed to these strange variations in the responsive power of the muscles may readily be misled. As a rule, when examining muscles for diagnostic or prognostic purposes, it is best to compare the part with a symmetrically-placed portion of the body.

Electro-muscular sensibility.

Electro-muscular sensibility, like electro-muscular contractility, is a somewhat unfortunate term. A muscle has a certain sensibility to painful impressions, and, when excited by electro-magnetic currents, feels a pain which is merely indicative of the continued existence in the muscle of the special susceptibility in question.

This power of the muscle to feel pain when galvanized has, however, certain relations to the functional life of the muscle, which make it important in the prognosis of nerve wounds. In most cases of intelligent adults, it is easy to ascertain if it be present or not in any given group of muscles; but in very sensitive persons, in hysterical women, in children, or in those of small in-

telligence, I have often found it difficult to make them discriminate between the pain in the skin, occasioned by powerful currents, and that which belongs to the muscular tissues.

Besides causing muscular contraction and muscular pain, electricity occasions pain in the nerves of the skin, flushes the part more or less, and almost certainly stimulates all the organic processes of the region.

The interrupted current. Electro-galvanic machine.

For these various purposes we commonly employed electro-magnetic interrupted currents. Most of the ordinary instruments will answer for curative uses; but in certain rare cases, and for diagnosis and prognosis, nearly all of them are too feeble. Duchenne's large battery is excellent, but altogether too costly. I prefer, on the whole, the rotating machines made by Neff & Sons, Philadelphia. The electro-galvanic instruments, more convenient on account of being automatic, are apt to get out of order from corrosion of the connecting wires, although, if Bunsen's cells be employed with bisulphate of mercury, this difficulty is much lessened. The neatest and most portable are made by Chester of New York. The same maker, under the direction of Dr. Hammond, has constructed a very portable galvanic battery of copper wire gauze and perforated zinc, which is put in action by vinegar, and is powerful enough for all ordinary uses where this peculiar agent is required.

Direct galvanism.

Direct galvanism should be used with care about the face, as it is said to possess the power to excite the retina most remarkably, and even dangerously. I have found it capable of flushing and heating the skin far better than induced currents, and I suspect that, in some cases, its ability to awaken the nutrition of the muscles is superior to any such result which can be attained through the means of electro-magnetism alone.

Electrization of the skin.

To electrize or galvanize the skin, it should be dried and sprinkled with flour. The conductors employed by M. Duchenne are bundles of thin wires, with which the skin is to be swept rapidly. A flat brass plate, roughened by cross-filing, answers very well. We need only to have in some way numerous points of contact. This application is very severe. It is a local excitant of the most intensely painful nature, but still having the advantage of causing no lesion. In cases of anæsthesia it is invaluable, and it has also its uses as a violent counter-irritant, which may be used in many neuralgic affections.

Electrization of the muscles may be effected directly or through the nerves. The former mode is preferable; but in some cases

of causalgia of the palm, I have found it less painful to faradize the hand muscles through their nerve than by acting upon them more immediately. Direct faradization is made by applying conductors armed with wet buckskin, cloth, or sponge, over the bellies of the muscles. In this manner but little pain is occasioned; and, if the operator be a good anatomist, he may readily pick out, so to speak, almost any single muscle, and call it into isolated action.

Electrization of the muscles.

It will be proper at this point briefly to consider the mode of using electricity in the diagnosis and prognosis of nerve injuries, and, lastly, in their treatment.

Application of electricity to diagnosis and prognosis.

After a nerve has been injured, the skin, in its range of distribution, has its sensibility more or less impaired. The muscles undergo, in various degrees of completeness, paralysis as to volition, loss of tone, loss of excitability by electricity, and loss of sensibility to the pain occasioned by electricity. Of course, if the nerves have been cut across, the palsy is total; the anæsthesia absolute. If, however, the injuries be partial, or have been in part repaired, we desire to ascertain what muscles have suffered, and to what extent. To effect this, we faradize them in turn. Those muscles which respond at all to the current are likely to recover in time; the better the response, the sooner the recovery. Those which have lost contractility alone run some chance of restoration; and those in which both this property and sensibility have departed are, of all others, the least likely to get well.

The limb should now be faradized daily for about fifteen minutes. At one time I shared Duchenne's opinion, that it was useless to electrize the muscles until time had been allowed for the nerves to undergo repair. I am now satisfied that it is wise to begin as soon as possible, and by this means, with passive motions, to keep up the nutrition of the part, as I am sure can *in some degree* be effected by steady use of these agencies. When the nerve connection becomes reconstructed, the muscles will then be in a far better state than they would have been were they to be left to themselves. Moreover, we should thus avoid much of the stiffening and shortening of muscles which disuse permits to occur. Under favorable circumstances, the electrized limb flushes and gets warm, the muscles grow, and the atrophy disappears.

Mode of employing electricity as a therapeutic agent.

This involves a long and industrious treatment, most of which, however, may be confided to the well-instructed care of the patient, and his friends or attendants. In many cases, months, or

even a year or two, must pass before the fortunate period at which, the nerve being restored more or less, we may hope to observe satisfactory changes in the regions supplied by it. In but too many instances we never arrive at this result.

In these unhappy patients it is rarely the case that all the muscles are paralyzed. In some, one or more are lost to use; and in others a single functional group is inactive. In many such instances good may be done by dividing the tendons of muscles so shortened as to interfere with the motions of their antagonists; and we have, finally, a means of relief in the employment of prothetic apparatus, designed to imitate, by elastic bands or springs, the movements of certain muscles. The character of these means, and the indications for their use, may safely be left to the judgment of individual practitioners.

Anæsthesia is often treated with success by the electric brush, used in the manner which I have elsewhere pointed out.

I have dwelt upon the employment of electricity, because I believe it to be an invaluable mode of treatment. Further details may be found in connection with the cases which I have appended to this essay.

Constitutional treatment of wounds of nerves.

The constitutional treatment of wounds of nerves is of the utmost importance. It has several times happened to me to observe that success in the local means was delayed until the general system had been invigorated by the use of tonics and stimulants.

Malaria and scorbutic disease were with us the principal enemies; but, even in civil practice, I have found that much good could be done by attention to the constitutional conditions.

Illustrative cases.

The following cases illustrate most of the various complications which occur in nerve wounds, as well as the methods of treatment described in this paper. It would have been easy to multiply them, but I have thought it enough to select a few typical cases. Two — those of Gervaise and Schiveley — are quoted from the work "On Nerve Wounds," etc., in order to append a statement of their present condition.

Case I. *Wound of Fore-arm; Partial Loss of Sensation; Immobility of Fingers and Wrist owing to Disease and Adhesions; Recovery.* — J. Albaugh, aged 19, 83d Pennsylvania Volunteers, Company G.

May 5th, 1863, at Chancellorsville, while drawing ramrod, a ball passed through the interosseal space of the right fore-arm, on the inner face of arm, at junction of middle and lower thirds, emerging through

posterior face two inches lower. Hand fell. Hemorrhage free. He walked to rear. Sent to Falmouth, and thence, May 9th, to Washington. Wound healed in six weeks. Fingers contracted until relieved by passive motion at Satterlee Hospital. Entered our wards June 23d, 1863. The wrist motions are limited, and the fingers lie in partial flexion, owing to stiffness from neglect and disuse. The index and second fingers are insensible, especially so on their posterior aspects. As he cannot move the fingers at all, and has loss of tact from nerve wound, we cannot say how much of the defect of motion may be due to neural injury.

Treatment. — Electro-magnetism, with dry conductors to insensitive parts. Passive motion and faradization of fore-arm. Douche and tincture of iodine to joints. Frictions with iodine ointment over cicatrix.

October 20th. — Gradual return of sensibility. Soreness lessened. Increasing ability to move wrist and fingers by will. Continue treatment.

November 1st, 1863. — Movements and sensation nearly normal. Ordered to guard duty.

Case II. *Wound of Brachial Plexus : Paralysis, Atrophy, and Contraction of numerous Muscles ; Burning Pain until Wound healed ; Motions limited by General Stiffening of the Joints.* — Christian Behr, aged twenty-six, turner, German, enlisted April, 1861, in Company K, 1st Minnesota Volunteers. Previous health good. At Gettysburg, July 2d, while charging, a ball struck his left hand between the thumb and forefinger, and entered finally half an inch below clavicle, three and a quarter inches from its sternal end, to emerge through the scapula, three quarters of an inch below its spine, three and a half inches from vertebral centre. The ball traversed the lung. He fell, feeling pain only in the first wound. Loss of arm motions total. Is sure that he could feel the touch of the other hand when he sustained with it the wounded limb. He rose at once, and, constantly spitting blood, walked half a mile, and for twenty-four hours wandered about in search of aid. Sharp pain came on in front of the shoulder, within a minute or two after the wound, and before next day was felt in the hand as a burning pain, which remained unaltered until the wound healed. Motion improved up to fifth week. A splint was used during first two weeks.

December 20th. — Admitted. Wounds healed. Palm red and slightly eczematous. Great wasting of teres major and minor. Deltoid slightly atrophied.

Sensation. — Loss of tact on dorsum of thumb only.

Motion. — The fingers were flexed spasmodically two weeks after wounding, and were straitened by a splint. They have remained straight and stiff. At date of wound, the pronators were in a state of spasm, which has now relaxed. Abducts arm 35° only, owing to stiffening of chest muscles. For the same reason, the backward motions of the arm are limited. Extension of arm feeble. Owing to stiff joint, the arm

can be flexed from a state of full extension only two thirds of usual range, where also passive motion ends. Has voluntary pronation, but no voluntary supination. Voluntary extension of wrist lost. Wrist flexion good.

Fingers stiff. No voluntary extension of first joints, slight of second and third, but limited by stiffening. Flexion of first joints good; that of second and third limited by rigidity.

Thumb, no extension; flexion good. Electric test. Deltoid, no electro-muscular contractility; electro-muscular sensibility, fair. The pectoralis major, supinator longus, infra and supra spinatus, and teres muscles, have no movement when faradized, but feel the current sen sibly, though not perfectly. Contractility lessened a little in biceps, triceps extensor; lessened also in extensor indicis, and extensor of thumb; no loss in other extensors. Thumb muscles have no contractility, except the abductor, and there is none in the little finger muscles, nor in the interosseal group.

The chief final difficulty in this case arose from the remarkable stiffening in all of the joints, and from the atrophied and contracted state of so many muscles. The joints were again and again treated by breaking up the adhesions, and using passive motion. This process always caused great suffering, swelling, and inflammation. Nor was it efficient. Next, we tried slow and gradual flexion, but this also became intolerable, even when accompanied by repeated subdermal injections of morphia. It is needless to detail the several means in turn resorted to. All of them failed, and the patient was at length discharged, but little better, March 25th, 1864.

Case III. *Gunshot Wound of Axillary Nerves; Extensive Paralysis of Fore-arm and Hand; Loss of Sensation; Great Improvement under Treatment; Continued Gain afterwards; Final Condition Three Years after Wound.* — George T. Barnes, aged 25, sail-maker, Company D, 68th Pennsylvania Volunteers. Healthy until wounded at Gettysburg, July 2, 1863, while carrying an officer upon a stretcher. Ball entered at the antero-superior angle of the left axilla. Exit in arm one third of an inch below apex of posterior axillary fold. He felt stung, as he says, but did not fall until he fainted from loss of blood. Is sure all motion was lost, but cannot speak as to sensation. Was taken to the rear, and was insensible for some hours. On awakening he had intense, sharp, shooting pains, but no burning. About November 1st, the pains lessened, and are now much better. Sensation was found to be absent in the front of the arm the day after he was wounded. It has changed very little. Motion has slowly improved.

December 6th. — Admitted. Wounds healed. General health good.

Nutrition. — Hand swollen, bluish, and red in spots; always cold to touch. Palm dry; never sweats except on thenar eminence, the limit

marking the lines of separate nerve supply. No atrophy above elbow. Flexors and pronator radii teres much wasted. Elsewhere no atrophy. The ulnar side of the flexor group in fore-arm, as well as the biceps, is slightly contracted.

Motion. — Voluntary movement good in arm and shoulder. Elbow a little stiffened; has about two thirds range. Pronation and supination nearly absent. Wrist, no flexion. Extension good. Fingers and thumb, no flexion. Extends third and fourth fingers by extensor communis alone. The first and second have no extension. No lateral finger motions. Slight power to extend thumb.

Sensation. — Absent over lower half of fore-arm, anteriorly and in the palm up to the radial half of the thenar eminence. The thumb and back of arm and hand are normal. Touch is lost in the first and second fingers only in second and third phalanges. In the third in all the phalanges. In the fourth, in all three, and over metacarpal bone. Loss of sense of pain and temperature accompany loss of touch.

Electric Test. — Electro-muscular contractility and sensibility lessened in left biceps, triceps, and extensors. The electric properties are good in the supinator longus, but deficient in the extensor group, except the extensor indicis and extensor communis of third and fourth fingers, which react very well under faradization. Contractility lessened somewhat in the extensor carpi ulnaris and extensor ossi metacarpi pollicis. None in the other thumb extensors, pronator teres, short thumb muscles, and interossei. Good in pronator quadratus.

Treatment. — Electricity, douches, active and passive motion.

January 1st. — Improving. Acts as orderly. *February 12th.* — Wrist motions much better. Fingers extend better, and are less sore and less stiff. Cannot flex or extend second and third phalanges more than when first seen. Can now supinate the arm well, and slightly pronate it. Discharged, April, 1864.

I saw this man again, May 16th, 1866. He is much better. The arm has grown considerably, as shown by comparison of measurements made December, 1863, and at this date, May, 1866. The hollow formerly so marked in the fore-arm, owing to atrophy of the flexor group, is now much less marked. The palm is still thin and flat, wanting the natural arching from side to side. The thumb muscles also exhibit notable atrophy.

He has regained all the natural movements, as flexion and extension of wrist, pronation, and supination. He has flexion and extension of the first phalanges of the fingers. The second and third phalanges are bent at right angles, and are nearly fixed in this position, presenting a good specimen of the claw hand. The interosseal group of muscles in the hand is paralyzed; hence, loss of power to extend second and third phalanges. The common extensor acts on the first phalanges, and, being still active, confers its usual movement. The flexion of the second

and third joints depends on the common flexor. Its palsy originally destroyed this motion, and its subsequent contraction flexed these joints, their diseased condition fixing them firmly in the posture so acquired. But we know that the interossei in health flex the first phalanges. In the present case, these muscles are palsied, and still the flexion is well performed. A little care in examination showed that the contracted common flexor has still some power, or rather, has regained power. It cannot pull on the second and third phalanges, for these are already flexed, but it acts secondarily to draw the first phalanx toward the palm. He has good tactile power in the arm, and in most of the hand. In fact, everywhere he feels a touch, but always it is felt as a slight stinging sensation. When the finger ends are touched, the impression is referred to the centre of the palm.

Case III. *Gunshot Injury of Musculo-spiral Nerve; Loss of Sensation and Motion; more Rapid Return of Sensation, with Persistence of Motor Palsy in all the Lower Muscles fed by this Nerve; Final Recovery of Motion; Examination after Three Years.*—Jeremiah Crowley, aged 25, iron-moulder, Pennsylvania, Company G, 68th Pennsylvania Volunteers, enlisted August, 1862. In good health, until wounded at Gettysburg, July 2, 1863. A ball entered right arm, on outside, one and a quarter inches in front of a line drawn perpendicularly upwards from the external condyle, five inches above that point. Exit inside of arm, on a line drawn perpendicularly upwards from the internal condyle, three and five eighths inches above it. The ball broke the bone, passing behind the artery and nerves, probably damaging with bone-splinters the musculo-spiral nerve. He thought his arm was shot off, dropped his gun, but did not himself fall until hit three times elsewhere. Is sure that all motion and sensation were lost in the arm and hand. Limb dressed next day, on rectangular splint, with the fingers left free to move. On fourth day came pain in wound, which lessened until it ceased about October 20th, when the wounds healed. Some splinters escaped in the mean while. Sensation began to return at third week, and motion very slowly after two months. Not improving.

Present State, January 10th, 1864. *Nutrition.* — Measurements: Bicipital, left, nine and three quarter inches; right, eight and seven eighths. Fore-arm, left, ten and one eighth inches; right, nine and five eighths. Arm slightly wasted throughout. Hand of normal color, a little swollen. The right hand sweats the most, and smells acid.

Sensation. — No pain of any kind. Extensors of hand and supinator group a little sore on pressure. Localization perfect. Tact perfect, except a spot on back of thumb between the metacarpal bone and that of the forefinger.

Voluntary Motion. — Partial paralysis of biceps, and complete of triceps and supinator longus. No flexion of fore-arm can be made, and but

very feeble extension. These difficulties are increased by slight stiffening of elbow-joint. Pronation good. Supination two thirds range and feeble. Wrist: Good flexion; no extension. Thumb: Feeble flexion; no extension. Has other motions. Fingers: Good abduction and adduction of first joints; flexion and extension good, except that the latter is absent in the first joints.

Electric Tests. — Supinator longus: No contractility; sensibility lessened. Extensors, same condition. Biceps: Contractility feeble.

Treatment. — Douches; daily faradization and movements. Rapid gain. The stiffness of the elbow has been overcome. Has acquired voluntary flexion of two thirds range. Supination by biceps only. Pronation and supination nearly entire. Flexion good throughout. Measurements: Bicipital, left, eight and seven eighths inches; right, ten. Fore-arm, left, nine and one eighth inches; right, ten and a half. It thus appears that he has lost somewhat in general muscular size, but gained out of proportion in the wounded arm. Continue treatment.

February 18th, 1864.

May, 1864. — Still better. Has regained full flexion of fore-arm, but has no extension of wrist. Acted as ward-master until discharged, April 10, 1865.

April 23, 1866. — I reëxamined Crowley. He has still loss of sensibility in a limited region of back of hand, between the metacarpus of thumb and first finger. Can now extend the fingers a little, and the wrist has one half range of motion. Violent voluntary efforts to straighten the fingers cause them to flex. No thumb extension. Slight contraction of flexor group in fore-arm.

Remarks. — We are here struck with the rapid return of sensation, and with the comparatively slight sensory lesions, as compared to the defects of muscular function.

Case IV. *Gunshot Wound of Right Axillary Plexus; Slight Final Loss of Sensation; General Loss of Motion; Nutrition but little Affected; No Contractions or Special Atrophy; Muscles Firm.*—S. M. Deal, aged 22, New York, farmer. Enlisted August, 1862, Company G, 140th New York Volunteers. Wounded July 2d, 1863, at Gettysburg, kneeling, arm bent, gun in left hand. Entry one half inch below clavicle, three inches from sterno-clavicular articulation. Exit through and below scapular spine, two inches external to posterior edge of scapula. Stinging at wound. Lay down conscious, but weak; fainted in half an hour. Carried away. Dressed at fourth day. No secondary hemorrhage. In an hour the stinging extended to the fingers, and has so continued, being more or less severe.

March 9th, 1864. — States that the motions became worse about second week, and have improved but very slowly since.

March 9th, 1864. Admitted. *Nutrition.* — Measurements: Bicip-

ital, right, nine and a half inches; left, eleven. Fore-arm, right nine and a quarter inches; left, eleven and a quarter. Some general thinning, but no special loss. Muscles firm. No contractions. The passive motion of elbow limited by stiffness to three fourths range. No swollen joints nor disease of nails. Hands look alike. Sensation not quite perfect in cushions of finger ends, but nowhere absent; it is good above elbow, and lessened on radial side of fore-arm.

Motion. — The shoulder is moved only by the trapezius, all the other muscles being paralyzed. The elbow is moveless also, and the pronators and supinators are without power to stir. The wrist flexion is preserved as well as the extension. The interosseal group moves partially and with feebleness, but the fourth finger is paralyzed, and the third is weak. There is slight power in the common extensor of the fingers.

Electric Conditions. — Contractility of trapezius the same as on left side. None in deltoid. In pectoralis-major, one third. In biceps and triceps extensor, none. A trace in extensor of fingers. Extensor pollicis, one fourth. Flexor group, none. Pronators, none. Interossei, the first is the best, decreases toward ulnar side.

Treatment. — Passive motion; daily faradization.

April 1st. — There has been no gain. The track of the nerves has become painful, and there are shooting pains in the hand. For these linear cautery was thrice used over the nerves involved, and iodide of potassium given. These means produced no satisfactory change, and at this period our patient was discharged under a general order.

This case presents no interest as regards treatment. Its negative points are valuable. It was curious to see such complete palsy with so little atrophy, and with so slight an affection of sensation, as well as with so remarkable an absence of pain.

Case V. *Gunshot Wound of Axillary Nerves; Total Loss of Motion; Extensive Atrophy; Gradual Gain; Partial Loss of Sensation; Slight Causalgia and Neuralgia; Relief of both; Tremors; Great General Gain.* — R. C. Phillips, aged 20, farmer, New York. Enlisted August, 1862, in Company C, 4th New York Volunteers. Healthy until wounded, July 2d, 1863. He was slightly injured by a ball which cut the skin over the sternum. A little later, a ball entered the left chest, over the second rib, three fourths of an inch to left of middle line, and lodged in the left arm, on a level with the posterior border of the armpit, two inches external to it. It was cut out a few hours later. Its track was downward and outward in front of the chest, but finally behind the humerus, damaging the axillary nerves, but not the artery. When hit he was lying down, loading, but cannot say in what position his arms might have been. He felt weak at once. Did not lose consciousness. Thought his arm was off. Total loss of arm motions. As to feeling, cannot say, but had sharp pain very soon in the thumb, and in the first and second

fingers. Wound dressed that night, and again in three days. No splint used then, or later. Motion improved gradually. The pains became worse. Sensation was finally found to be diminished in the radial distribution.

December 9th, 1863. — Wounds healed about four weeks ago. Left hand cold and blue. Radial palm looks as though frosted. The following muscles are atrophied to a greater or less extent: Infra spinatus has lost about one third its size. Deltoid, loss one half; biceps two thirds; teres muscles, three quarters or more. Fore-arm generally wasted; flexor group most so. The interossei are much atrophied. Contracted muscles: Biceps slightly, no others.

Measurements. — Left acromio-deltoid, fifteen and a quarter inches; right acromio-deltoid, seventeen inches. Bicipital, left, eight and three quarter inches; right, ten. Fore-arm, three inches below olecranon process, left, nine and a quarter inches; right, ten and a quarter.

Voluntary Motion of shoulder imperfect. Triceps acts well. Biceps, no power. The supinator longus alone produces flexion. Pronation and supination feeble and slow, but complete. Wrist has two thirds flexion and the like extension. Thumb muscles act well, except short flexor. Fingers: First has flexion of first phalanx, and imperfect of second and third. Extension good, except in second and third phalanges, which have this movement incompletely. Second finger, all movements much better. Third and fourth have all motions perfect. No abduction or adduction of first finger. No abduction of second.

Abnormal Movements. — Incessant quivering of the deltoid during rest, ceasing when the arm is abducted so as to relax this muscle.

Sensation. — Touch is felt throughout, but is badly felt on the left half of radial side of fore-arm, thumb, first finger, and radial side of second finger, where also there seems to be more analgesia than elsewhere.

Pain. — Some little burning in anterior parts of thumb, first finger, and radial side of second. None in the arm. The darting pains have long been absent, but reappear if the arm be kept too warm. Pressure over the median nerve causes pain in the parts above named as having diminution of tactile sensation. No muscular hyperæsthesia. Treatment of pain by four blisters. Entire relief by February 19th, 1864. Faradized daily from date of admission. Great gain in motion. Tremor has disappeared.

February 29th. — Movements all rapidly improving; more complete and stronger. Promoted to lieutenancy.

The two cases which follow are extracted from the book on gunshot wounds of nerves so often referred to, and are given in order to complete these histories up to a more recent date. For these additions I am indebted to my friend and former colleague, Dr. William W. Keen: —

Case VI. *Gunshot Wound of Axillary Nerves; Paralysis of Motion; Slight of Sensation; Burning on Tenth Day; Great Atrophy and Contracted Muscles; Subluxation of Fingers; Nutritive Changes; Eczema in both Palms; Great Improvement; Discharged.* — David Schiveley, aged 17 no trade, Pennsylvania, enlisted August, 1862, in Company E, 114th Pennsylvania Volunteers. Healthy before and after enlisting, except a slight attack of typhoid fever.

At Gettysburg, July 2d, 1863, while aiming, a ball entered one inch to the left of the middle line, and one inch above the sternal end of the clavicle. Exit on the posterior part of the right arm, at the middle line, two inches below the axilla. The ball passed in front of the trachea, broke the inner half of the right clavicle, went in front of the vessels of the neck and the subclavian artery, in front of the axillary artery, and below the humerus — speaking of that bone as raised and abducted at the time. When hit, he thought his arm was shot off. It dropped, the gun fell, and, screaming that he was murdered, he staggered, bleeding freely, and soon fell unconscious. When a little later he revived and raised his head, a second ball struck him in the right temporal fossa and emerged through the right eye. He jumped up, ran a little way, and fell once more. When hit, he lost all motion in the limb, which became numbed, but felt no pain. Two weeks later, feeble power to move returned gradually in the elbow, shoulder, and arm; and, after two months, in the wrist and hand.

Treatment, cold-water dressings and means to relieve burning, but all ineffectual.

The joints became swollen early, and the arm bent at a right angle. The hand, dependent, lay across his chest during a long period. He made some attempts at passive motion as he found the hand becoming stiff, but no great good was thus gained; and, as the contractions took place and the joints grew worse, the wrist became moulded to the curve of the chest on which it lay.

About the tenth day, burning pain began in the palm and fingers, especially in the cushions of the fingers and the knuckles. It was at its worst a month later, and remained thus another month, after which it grew less. When at its height, he suffered from loud sounds, vibrations, and dry contact. The rubbing of his boots on the floor was the greatest annoyance, and this he relieved by wetting his stockings. Since October, four months after he was wounded, it has been unaltered. Sensation, little affected at the outset, has undergone no change of moment. Voluntary motion, which grew better for a while, suffered anew and increasingly, as the nutritive changes developed themselves. When they first arose, we have been unable to determine.

Present State, December 17th, 1863. — *Nutrition.* — The wounded arm is shrunken generally, with well-marked atrophy of the supra and infra spinatus, deltoid, and biceps, the loss in the last two being fully one half.

Triceps, no wasting of moment. Supinator longus and radial extensors, two thirds loss. Flexors and extensors in fore-arm, one half loss. Thumb muscles almost absent. Little finger and interosseal group, no loss.

Contractions. — The flexor carpi ulnaris, palmaris longus, and flexor carpi radialis being strongly contracted, the wrist is bent at a right angle to the arm and drawn to the ulnar side; the extensor group is in like manner contracted, and the first phalanges, having thus been violently extended while the wrist was flexed, have undergone subluxation.

The color of the back of the arm and hand is natural as far as the knuckles. Thence to the finger tips the skin is tense, shining, hairless, mottled red and blue, abraded in spots; the nails curved, and the joints swollen, and very tender. Palmar surface normal to wrist. The whole palmar face of the hand and fingers is polished, deep scarlet, abraded in points, and eczematous all over to a remarkable degree. The eruption followed the burning in about six weeks. The palm of the left hand is nearly equally eczematous. If his account may be trusted, it began to be so nearly a month before any eczema appeared in the wounded member.

There is slight soreness on pressure in the infra spinatus, biceps, and flexors of the fingers.

Voluntary Motion. — Entire in the shoulder, though weak. The elbow possesses the middle third of its normal range of motion, but cannot be fully flexed or extended. The wrist, lying at a right angle to the arm, has only about forty-five degrees of extension. The thumb, nearly fixed in adduction, has slight and very feeble motion in all its joints. The fingers, bent back in extension, can be flexed to make a straight line with the dorsum of the hand. The flexors move the second and third phalanges through one fourth of their usual range. They perform abduction and adduction well.

Sensibility. — Tactility nearly normal. Localization of touch not quite perfect on the radial distribution in the hand.

Pain. — The burning in the right hand is intense and constant. It is made worse by heat, exposure, drying of the skin, and dependent positions. He has kept it wet and wrapped up since October, 1863, which we believed might have made the skin troubles worse, until we saw this and other cases improve under treatment without any cessation in the application of the water.

The left hand, which, it will be remembered, was also eczematous, is painful on pressure or touch, especially in the palm. He is positive that there is pain in that hand, and that it is a burning pain. Both hands are kept covered with loose cotton gloves, which he wets at brief intervals. He is especially fearful of having the right hand touched, and is nervous and hysterical to such a degree that his relatives suppose him to be partially insane. It is difficult even to examine him properly on account of his timidity, and his whole appearance exhibits the effects

of pain, want of rest, and defective hæmatosis. His treatment was constitutional and local. It answered admirably so far as gain in health and loss of pain were concerned. The after-means employed to cure the deformities and restore motion were partially successful.

Remarks. — The electric tests satisfied us that in time the muscles could be restored, and assured us that the nerve communications were entire. The sensibility was practically perfect. Motion, though feeble from atrophy in some parts, was present in every group of muscles. *It was limited by the contracted muscles and by the nutritive lesions in the joints.* These two combined have damaged the power of movement, and left worse effects than usually result from partial paralysis affecting directly the motor nerves. Had proper passive motion been early used, there can be little doubt that the hand would now be far better than it is. Specimen No. 15, in the Army Medical Museum, is a cast of the limb.

January 25th, 1867. — Health and strength very good; is attending school. Eyesight in right eye lost, of course; the lids are now constantly in contact, and do not look so unseemly as before; they can be somewhat separated, showing the shrunken ball, the sclerotic only being visible.

Motion. — Perfect as to range in shoulder and elbow; would be perfect in wrist, but is limited to three eighths range by contraction of flexors. Power is somewhat diminished. Thumb perfect, but lies adducted. He can abduct it well. It is also everted so as to form the "monkey hand."

The first phalanges are constantly at an angle of 45° in extension. They can be extended to 90° voluntarily, and flexed to a line with dorsum of hand. The second phalanges have about the middle third of their range of motion, but not much force. The third phalanges cannot be moved voluntarily, but can be moved passively well. The joints appear to be normal, save the subluxation of the knuckles. Abduction and adduction good.

Sensation. — Good.

Contractions. — The flexors are contracted so as to limit extension of wrist; the extensors are not, I think, contracted, but by the constant flexion of the wrist at 90° they extend the fingers as above.

Pain. — In August, 1864, he began to lose the violent pain. It was not gradual, but one day he noticed suddenly that his glove was dry, and yet he could use his hand well and without pain. It was not entirely gone, and he yet wet his hand for some months, but it grew much better. Even now he feels dry rubbing in the palm of the hand to the finger tips, and a loud noise, such as a wagon making a great noise in passing, or a sudden emotion, as seeing a person fall, etc., makes the same impression.

In the left hand there is no pain. It left about the same time.

Appearance of Hands. — Left hand perfectly normal. The eczema he is pretty sure passed away before he ceased wetting the hand.

Right hand, color normal; no eczema. It continued longer than on the left hand, but also disappeared before he ceased wetting it. It sweats a great deal; gets cold very easily; has no constant pain in it. The hair has been reproduced on the dorsum, even to that of the fingers. Nails normal; second and third phalanges a good deal wasted; muscles of thumb a good deal wasted (say two thirds), except flexor brevis, which is of nearly normal size. Hypothenar muscles of about normal size.

Nutrition. — Right biceps, eight and five eighths inches; left, nine and one eighth. Right fore-arm, three inches below olecranon, eight and five eighths inches; left, nine and one quarter.

His nervousness is entirely gone, and he is perfectly well mentally.

Electro-Muscular Sensibility is greater in right than in left arm throughout.

Electro-Muscular Contractility very markedly diminished in right arm from shoulder down to hand. It is not more than one half.

He can use his hand so as to handle a fork. Could use a knife, but was always left-handed; holds a book well, *e. g.*, "Gray's Anatomy;" cannot write with it; can touch every finger tip with thumb.

The temperature taken April 20th, 1867, was as follows: —

Fold between palm and thenar eminence, the only place where the thermometer bulb could be held and covered equally well by either hand, — Right, paralyzed side, 97½° Fahr.; Left, paralyzed side, 97⅙° Fahr.

Case VII. *Gunshot Wound of Left Arm, Ulnar, and Median Nerves; Paralysis of Motion; Slight of Sensation; Contraction of Flexors; Relaxation under Treatment; Atrophy; Claw-hand from Paralysis of Interossei; Stinging Pain in Hand; Great Gain; Interosseal Paralysis alone remains; Discharge with Prothetic Apparatus.* — Henry Gervaise, aged 20, Canadian, blacksmith, enlisted February, 1862, in Company F, 1st Vermont Cavalry. Healthy, until shot, July 7th, 1863, in the left arm. Probably the wound of entry was the one over the artery, at the edge of the biceps, six inches above the internal condyle of the humerus. Exit on postero-internal face of arm, half an inch above, and three and a quarter inches behind the other wound. He felt pain in the arm, but dismounted, the artery jetting blood. After walking a little way, he fainted, and, awakening after some hours, found that the bleeding had ceased, but that he had no motion from the shoulder to the finger tips, and that sensation was lessened below the elbow. The pain in the hand grew worse gradually, and was neuralgic in character. On the second day, he could move the elbow, and during the first week could stir the

thumb. About December, 1863, he began to move the fingers voluntarily, and this control has continued to improve.

In January, 1864, electricity was used in the hospital where he then was, but he says it was applied only on the fingers.

Present State. February 18, 1864. — Hand congested; palm purplish; nails curved. Measurements: Biceps, right, eleven and three eighths inches; left, ten and one eighth. Fore-arm, right, eleven and one half inches; left, ten.

Flexors in fore-arm wasted considerably. Thumb muscles wasted, and all the interossei much atrophied. No stiffness in the joints. The short flexor of the thumb, and the flexor group in the fore-arm, are moderately contracted. The former defect has allowed the extensors of the thumb to act on it so as to bring its metacarpal bone level with those of the fingers, and to turn the nail upward.

Sensation. — Anæsthesia and analgesia in palm and palmar face of all the fingers; but only in the dorsum of the hand, and not on the dorsal aspect of the fingers.

Motion. — Good above elbow. Supination and pronation normal. The wrist flexion is incomplete from want of power. Extension limited by flexor contraction.

Thumb. — Flexion partly lost from want of power, and extension limited by contraction of short flexor. He has no abduction nor adduction of the fingers, and cannot flex the first phalanges, or extend the last two. Hence there is paralysis of the interosseal group.

It is not necessary to speak in detail as to the electric properties, which were wholly absent in the interosseal muscles, and defective in some others.

Treatment. — Electricity, douches; splint to correct flexions. Under this treatment, with energetic use of passive motion, the flexions were corrected, and every motion regained, except that of the interosseal muscles. To have a prothetic apparatus, and be discharged.

April 9, 1864. — The hand is now healthy in color, the neuralgia nearly entirely well.

April 22, 1867. *Visible Condition of Hands.* — Nails of left hand slightly incurvated; palm slightly mottled, almost normal.

Measurements. — Biceps, right, ten and three eighths inches; left, ten and one eighth. Fore-arm, right, ten and five eighths; left, ten and a quarter. The loss in the right arm is probably due to a change in his occupation, he being now a stationer. The left arm has gained relatively.

Nutrition. — Flexors of left fore-arm, thumb muscles, and interossei, all slightly wasted. Flexors of fingers the only contracted muscles. Thumb has very nearly regained its normal position.

Sensation perfectly normal on dorsum of hand, perfectly localized but a little dulled on palm; dulled and imperfectly localized on palmar surface of fingers, but only slightly so.

Motion. — Flexion and extension of wrist perfect when the fingers are flexed, as they always are except when passively extended. When so extended, extension is limited by the contracted finger flexors. Pronation and supination perfect. Abduction of thumb lost; flexion weak; extension good. No abduction or adduction of fingers; no extension of last two phalanges, save by violent extension of the first phalanx; but there is some flexion of the first, so that with great effort by flexing the first and extending the last two phalanges, he can grasp an object placed at the middle of the palm. It is doubtful whether this flexion is not wholly a secondary effect of the flexion of the last two phalanges rolled into the palm. The claw-hand is only manifest on extension of the fingers, the first phalanges being extended, the last two flexed one half.

Electrical Test. — Electro-muscular sensibility in left arm and fore-arm the same as in the right; in the hand diminished nearly one half. Electro-muscular contractility not now absent in a single muscle. In the left arm and fore-arm it is very slightly if at all diminished. In the left hand all the muscles respond, the general loss being about one half, but in the first and fourth dorsal interosseal about three quarters or more.[1]

Ordered galvanism daily to the hand. Temperature (the thermometer being placed in the metacarpo-phalangeal fold where both hands could close on it about equally well), after being tested for half an hour in each hand, was right, 95½°, left, 96° Fahr.

I have alluded in the text to the fact that the temperature in parts partially paralyzed by wounds was in some cases higher than upon the healthy side. This was especially noticeable in the instances of causalgia described by my colleagues and myself. As the facts here referred to have excited some little doubt, I have appended to the cases of Schiveley and Gervaise the record of their present thermal state. To my surprise I found that despite the great changes made by time, the temperature of the injured hand is still slightly higher in both cases than that of the other member. Schiveley had severe burning pain. Gervaise suffered only from neuralgia of the ordinary type.

[1] By the battery he is enabled to make a good fist, being able to bring the thumb into opposition to the fingers perfectly.

SECTION THIRD.

INVESTIGATIONS

UPON

THE DISEASES OF THE FEDERAL PRISONERS CONFINED IN CAMP SUMPTER, ANDERSONVILLE, GA.,

INSTITUTED

WITH A VIEW TO ILLUSTRATE CHIEFLY THE ORIGIN AND CAUSES OF HOSPITAL GANGRENE, THE RELATIONS OF CONTINUED AND MALARIAL FEVERS, AND THE PATHOLOGY OF CAMP DIARRHŒA AND DYSENTERY.

BY

JOSEPH JONES, M. D.,

PROFESSOR OF PHYSIOLOGY AND PATHOLOGY IN THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF NASHVILLE, TENN., AND FORMERLY SURGEON IN THE PROVISIONAL ARMY OF THE CONFEDERATE STATES.

THE third and concluding Section of this volume is devoted to a Report by Professor Joseph Jones, M. D., of investigations relating to the diseases, mortality, etc., at the military prison in Andersonville, Ga. These investigations, undertaken at the instance of Professor Jones, were prosecuted under the authority of the Surgeon-General of the Confederate Army. As an Official Report, by a Confederate medical officer, this Section will have interest for all classes of readers. For the medical reader it will be valuable as a record of facts showing the relations between the prevailing diseases and the mortality at the Andersonville prison, and the morbific influences to which the prisoners were exposed. Moreover, the Report embraces elaborate investigations relating to the diseases which prevailed among the Confederate troops during the war.

A due regard to the size of this volume rendered necessary some abridgment of Professor Jones's Report. Two of the chapters of the Report have been omitted. The subject of one of the omitted chapters is Hospital Gangrene. This subject will be treated of fully in the surgical volume to be published by the Sanitary Commission. The other omitted chapter gives an account of *post-mortem* examinations in cases of diarrhœa, dysentery, scurvy, and hospital gangrene. Exclusive of these chapters, all the portions of the Report which are omitted are referred to in notes, either on the pages where the omissions occur, or at the end of the chapter. The omitted portions consist mainly of tables which may be spared without detriment to the Report, and extracts from various medical writers. In making the necessary abridgment nothing has been excluded of importance as affecting either the investigations or the conclusions deduced therefrom by Professor Jones. The greater part of the Report is retained, and is printed from the Author's manuscript without alteration, and with no additions except the marginal notes.

PREFACE.

THE facts recorded in the following pages are of such a nature that justice to my distressed and afflicted countrymen, as well as to myself, demands a correct history of these investigations upon the diseases of the Federal prisoners confined at Andersonville, Ga.

Hearing of the unusual mortality amongst the Federal prisoners confined at Andersonville, I expressed, during an official visit to Richmond, Va., in the month of August, 1864, to the Surgeon-General, S. P. Moore, C. S. A., a desire to visit Camp Sumpter, with the design of instituting a series of inquiries upon the nature and causes of the prevailing diseases. Small-pox had appeared amongst the prisoners, and I believed that this would prove an admirable field for the establishment of its characteristic lesions. The condition of Peyer's glands in this disease was considered as worthy of minute investigation.

Proposal of the writer to engage in these investigations.

It was believed that a large body of men from the northern portion of the United States, suddenly transported to a warm southern climate, and confined upon a small portion of land, would furnish an excellent field for the investigation of the relations of typhus, typhoid, and malarial fevers.

The Surgeon-General furnished me with the following letter to the surgeon in charge of the Confederate States military prison hospital at Andersonville: —

CONFEDERATE STATES OF AMERICA.
SURGEON-GENERAL'S OFFICE, RICHMOND, VA., *August 6th*, 1864.

SURGEON ISAIAH H. WHITE,
IN CHARGE OF HOSPITAL FOR FEDERAL PRISONERS, ANDERSONVILLE, GA.: —

SIR, — The field for pathological investigations afforded by the large collection of Federal prisoners in Georgia is of great extent and importance, and it is believed that results of value to the profession may be obtained by a careful investigation of the effects of disease upon this large body of men subjected to a decided change of climate, and to the circumstances peculiar to prison life.

Letter of Surgeon-General Moore.

The surgeon in charge of the hospital for the Federal prisoners, to-

gether with his assistants, will afford every facility to Surgeon Joseph Jones in the prosecution of the labors ordered by the Surgeon-General.

Efficient assistance must be rendered Surgeon Jones by the medical officers, not only in his examinations into the causes and symptoms of the various diseases, but especially in the arduous labors of *post-mortem* examinations.

The medical officers will assist in the performance of such *post-mortems* as Surgeon Jones may indicate, in order that this great field for pathological investigation may be explored for the benefit of the medical department of the Confederate army.

S. P. MOORE, *Surgeon-General, C. S. A.*

Circumstances under which the investigations were entered upon.

As soon as the necessary preparations[1] could be made, I repaired to Andersonville, and examined carefully the condition and diseases of the sick and wounded Federal prisoners in the Confederate States military prison hospital, and instituted a series of *post-mortem* examinations, with the design of elucidating the pathology of the prevailing diseases. The weather was intensely hot, and the small structure surrounded at the sides with old tent cloth, and covered with boards, erected extemporaneously for the occasion, by the surgeon in charge, in the open space just outside of the limits of the hospital, afforded but indifferent facilities for the pursuit of pathological studies. In this confined, unventilated room, exposed to the burning autumnal sun, *post-mortem* examinations of the thoroughly poisoned and rapidly decomposing bodies of those who had died from hospital gangrene, diarrhœa, dysentery, and scurvy, were not unattended with discomfort, and with even some danger; and I felt unwilling to do more than to invite the coöperation of the surgeons and assistant-surgeons. Consequently I did not feel disposed to criticize harshly the apparent indisposition on the part of the medical officers to engage in such unpleasant, and, to a certain extent, hazardous labors.[2]

[1] During the recent disastrous civil war, I was compelled to prepare the test fluids, and even certain of the mineral acids, for the analysis of the animal fluids. At the time of my last visit to the Confederate capital (August, 1864), I had just completed a long series of investigations upon typhoid and malarial fevers, and it was necessary to replenish my exhausted stock of test-fluids and re-agents before commencing the labors at Andersonville, and in the general hospitals attached to the army of Tennessee.

[2] At the time of the prosecution of these investigations, my own system was somewhat scorbutic, as manifested by the spongy and bleeding gums consequent upon the prolonged use of salt meat, with but scant supplies of vegetables. The Confederate currency had depreciated to such an extent, that officers were not much better off than the privates of the Confederate army, and were in most cases confined to the ordinary ration of corn-meal and salt pork or bacon, with occasional small issues of fresh beef, rice, pease, and molasses; and the tendency of this diet without change was to induce a scorbutic state of the system.

It might possibly be of some interest to those who may in future attempt similar investigations to know the precautions which I adopted to protect myself against poisoning in such

In consequence of the refusal on the part of the commandant of the interior of the prison to admit me into the stockade on the order of the Surgeon-General C. S. A., the following communication was addressed to the commandant of the post: —

Admission into the stockade refused.

CAMP SUMPTER, ANDERSONVILLE, GA., *September 16th*, 1864.

BRIGADIER-GENERAL JOHN H. WINDER, COMMANDANT POST, ANDERSONVILLE: —

GENERAL, — I respectfully request the Commandant of the post of Andersonville to grant me permission, and to furnish the necessary pass, to visit the sick and medical officers within the stockade of the Confederate States prison.

Letter to General Winder.

I desire to institute certain inquiries ordered by the Surgeon-General.

Surgeon Isaiah H. White, chief surgeon of this post, and Surgeon R. R. Stevenson, in charge of prison hospital, have afforded me every facility for the prosecution of my labors amongst the sick outside of the stockade.

My secretary, Mr. Manigault, will exhibit to you the originals of the orders under which I am now acting, and in accordance with which the present request is respectfully made.

Respectfully your obedient servant,

JOSEPH JONES, *Surgeon, P. A. C. S.*

The following reply was received through Captain A. S. Winder, A. A. G.: —

CAMP SUMPTER, ANDERSONVILLE, GA., *September 17th*, 1864.

CAPTAIN, — You will permit Surgeon Joseph Jones, who has orders from the Surgeon-General, to visit the sick within the stockade that are under medical treatment.

Letter from General Winder.

Surgeon Jones is ordered to make certain investigations, which may prove useful to his profession.

Very respectfully,

By direction of General Winder,

A. S. WINDER, *A. A. G.*

Captain H. WIRTZ, Commanding Prison.

After the conclusion of the labors amongst the Federal prisoners in the stockade and in the prison hospital, the field of labor was changed to the army of Tennessee operating in Northwestern Georgia, and a series of inquiries

Field of labor changed to the army of Tennessee.

a state of the system, and in this hot climate. Before commencing any *post-mortem*, or handling diseased structures and fluids, the hands were immersed in a strong solution of alum, which was allowed to dry upon the surface. After the completion of the autopsies, the hands were carefully washed in a solution of chlorinated soda, and then immersed in a strong solution of alum, and finally washed in tincture of camphor, which was allowed to dry upon the surface, and all cuts or abrasions were touched with tincture of iodine.

were instituted upon hospital gangrene, which was committing extensive ravages upon the wounded in the general hospitals.

The following communication was addressed to the Surgeon-General from Macon, the centre of my labors: —

MACON, GA., 19*th October*, 1864.

SURGEON-GENERAL S. P. MOORE, C. S. A.,
WAR DEPARTMENT, RICHMOND, VA.,

SIR, — I have the honor to give the following brief outline of my labors conducted in accordance with the orders of the Surgeon-General.

Communication to Surgeon-General Moore.

Immediately after the brief report upon hospital gangrene had been forwarded to the Surgeon-General, I repaired to Camp Sumpter, Andersonville, Georgia, and instituted a series of investigations upon the diseases of the Federal prisoners.

The field was of great extent and of extraordinary interest. There were more than five thousand (5000) seriously sick in the hospital and stockade, and the deaths ranged from ninety to one hundred and thirty each day. Since the establishment of this prison, on the 24th of February, 1864, to the present time, over ten thousand Federal prisoners have died: that is, near one third of the entire number have perished in less than seven months. I instituted careful investigations into the condition of the sick and well, and performed numerous *post-mortem* examinations, and executed drawings of the diseased structures. The medical topography of Andersonville and the surrounding country was examined, and the waters of the streams, springs, and wells around and within the stockade and hospital carefully analyzed.

Extent of the field of investigations at Camp Sumpter.

Diarrhœa, dysentery, scurvy, and hospital gangrene were the diseases which have been the main causes of the extraordinary mortality. The origin and characters of the hospital gangrene which prevailed to so remarkable a degree, and with such fatal effects, amongst the Federal prisoners, engaged my most serious and earnest consideration. More than *thirty thousand* men crowded upon *twenty-seven* acres of land, with little or no shelter from the intense heat of a southern summer, or from the rain and dew; with coarse corn bread, from which the husk had not been removed; with scant supplies of fresh meat and vegetables; with little or no attention to hygiene; with festering masses of filth at the very doors of their rude dens and huts; with the greater portion of the banks of the stream flowing through the stockade a filthy quagmire of human excrements alive with working maggots, generated by their own filthy exhalations and excretions an atmosphere that so deteriorated and contaminated their solids and fluids that the slightest scratch of the surface, even the bites of small insects, were frequently followed by such rapid and extensive gangrene, as to destroy extremities, and even life itself. A large

The diseases causing the extraordinary mortality.

number of operations have been performed in the hospital on account of gangrene following slight injuries and mere abrasions of the surface. In almost every case of amputation for gangrene, the disease returned, and a large proportion of the cases have terminated fatally. I recorded careful observations upon the origin and progress of these cases of gangrene, and examined the bodies after death, and noted the pathological changes of the organs and tissues. All these observations, together with the drawings, will be forwarded to the Surgeon-General at the earliest practicable moment.

Investigations upon hospital gangrene in the army of Tennessee.

After concluding my labors amongst the Federal prisoners, I moved to Macon, and instituted a series of inquiries and investigations upon the hospital gangrene which has prevailed to so great an extent in the army of Tennessee, during the recent disastrous campaign, and especially since the evacuation of Atlanta. The doubtful, if not dangerous and disastrous, policy of collecting the cases of hospital gangrene into one hospital devoted exclusively to its treatment, was inaugurated amongst the general hospitals of the army of Tennessee, and about three hundred cases of hospital gangrene were collected at the Empire Hospital at Vineville, near Macon. I am at the present time engaged in investigating the disease in all its various stages at this Gangrene Hospital, and have made numerous analyses of the blood and excretions, and executed life-size drawings of the gangrenous parts, illustrating not only the appearance of the wound at different stages of the disease, but also the permanent disability which gangrene produces by the contraction of the injured muscles. I am also, at the same time, investigating the origin and causes of this disease in the army of Tennessee, examining the hospital records, as well as all cases of interest, and addressing numerous inquiries to the various medical officers. As soon as my labors with the Macon hospitals are completed, I will institute similar investigations in the Confederate hospitals of Columbus, Georgia. These active labors in the field will engage my attention for at least one or two months longer; and, immediately after their completion, my full report upon hospital gangrene will be prepared, embodying the results of my investigations upon this disease in various parts of the Confederacy, in the general hospitals in Virginia, South Carolina, and Georgia, and embracing also the more recent investigations at Andersonville, Macon, Vineville, and Columbus, Georgia. If I am favored, I hope to be able to place this report in the hands of the Surgeon-General about the 1st of May or June, 1865.

Very respectfully,

Your obedient servant,

JOSEPH JONES,
Surgeon, P. A. C. S.

Advance of General Hood on Atlanta.

On the 28th of September, General Hood advanced upon the rear of Atlanta and of the Federal army, and was so far successful, that thirty miles of the railroad supplying General Sherman's army, between Marietta and Tunnel Hill, were destroyed, and the garrison at Dalton captured. These movements necessitated new plans and combinations on the part of the commander of the Federal forces in Georgia. After sending a portion of his army to confront General Hood in Tennessee, General Sherman burnt Atlanta, abandoned his lines of communication with the North, and, on the 14th of November, commenced his march for the coast of Georgia. To resist the sudden invasion of this powerful army of seventy thousand veteran troops, which marched at the rate of from ten to fifteen miles a day, the State of Georgia had less than four thousand militia, and the old men over fifty, and the boys under sixteen years of age. In the march through the heart of Georgia, from Atlanta to Savannah, the United States forces occupied a belt of country from thirty to sixty miles in width, and destroyed the entire railroad system of the State, burning rolling stock, depots, and bridges, and tearing up the rails for scores of miles on the Western, Atlantic, Georgia, Central, and Gulf Railroads. The line of march was marked by burning barns, cotton-gins and presses; the destruction of agricultural implements and of numerous dwellings; the loss of horses, mules, cows, hogs, and stock of all kinds; and by the utter impoverishment of the inhabitants.[1]

Return of the writer to Augusta.

The active labors amongst the sick and wounded of the army of Tennessee did not cease until the middle of November, and I returned to Augusta from Columbus on the 15th,

[1] Major-General W. T. Sherman, in his *Official Report of the Georgia Campaign*, gives the following estimate of his operations: —

"I was thereby left with a well-appointed army to sever the enemy's remaining railroad communications eastward and westward, for over one hundred miles, namely, the Georgia State Railroad, which is broken up from Fairburn Station to Madison and the Oconee; and the Central Railroad, from Gordon clear to Savannah, with numerous breaks on the latter road from Gordon to Eatonton, and from Millen to Augusta; and the Savannah and Gulf Railroad.

"We have also consumed the corn and fodder in the region of country thirty miles on either side of a line from Atlanta to Savannah, as also the sweet potatoes, cattle, hogs, sheep, and poultry; and have carried away more than ten thousand horses and mules, as well as a countless number of their slaves. I estimate the damage done the State of Georgia and its military resources at one hundred millions of dollars, at least twenty millions of which has enured to our advantage, and the remainder is simple waste and destruction. This may seem a hard species of warfare; but it brings the sad realities of war home to those who have directly or indirectly been instrumental in involving us in its attendant calamities."

In complimenting the conduct of the rank and file, General Sherman says, in the same Report: —

"*A little loose in foraging*, they 'did some things they ought not to have done'; yet on the whole they have supplied the wants of the army, with as little violence as could be expected, and as little loss as I calculated."

thus escaping either capture or isolation in a distant part of the State. The elaboration of the results of the investigations into a report to the Surgeon-General of the Confederate army, was immediately commenced, and steadily continued throughout the winter; and, by the close of February, the work was so far completed, that the greater portion was placed in the hands of my clerks to copy. Obtaining "leave of absence," I went on horseback to Liberty County, on the sea-coast of Georgia, with the design of transferring to a place of safety, secure from the constant depredations of the forces in and around Savannah, and the liberated blacks, my mother and sister, with her little ones. Upon my return to Augusta, after a journey of over five hundred miles on horseback, in the early part of April, 1865, arrangements were being made to carry my report in person, on horseback, to Richmond — all railroad communication having been broken up by the desolating march of General Sherman's army through the Carolinas.

Termination of labors on the surrender of General Johnston.

The surrender by General Joseph E. Johnston to General Sherman, on the 26th of April, 1865, of all the Confederate forces east of the Chattahoochee River, necessarily terminated these labors.

After the disastrous close of a struggle which had enlisted all my sympathies and engaged all my energies, broken in health, fortune, and spirits, I desired only peace and rest; and, filing away the investigations amongst the Confederate sick and wounded, turned my attention wholly to the pressing necessities of the times.

The desire of the writer not to publish the report on the Federal prisoners at Andersonville.

I desired especially that the report on the Federal prisoners at Andersonville should never see the light of day, because it was prepared solely for the eye of the Surgeon-General of the Confederate States Army; and the frank manner in which all the subjects had been discussed, would only engender angry feelings, and place weapons in the hands of the victors; and also because one of the chief reasons which stimulated the preparation of this report was no longer active, namely, the rectification of such abuses in the conduct of military prison hospitals as would deprive the United States Government of all excuse in continuing retaliatory measures upon the gallant soldiers of the Confederacy, who have been or who might be so unfortunate as to become prisoners of war. By a deliberate and well calculated policy, thousands of the Southern troops were confined for months and even years in Northern

prisons, without any possibility of exchange; and I felt it to be the duty of all their fellow-soldiers and countrymen to avoid all unnecessary abuses in military prisons, and to advocate that line of policy in the treatment of prisoners of war which would tend to insure the most humane treatment of Confederate prisoners during their distressing and painful captivity.

The writer ordered by the United States authorities to deliver up all papers, etc.

Without any warning, I was suddenly summoned to Washington by the United States authorities, and ordered to deliver up "all papers, reports, records, etc., of every kind in my possession, pertaining to the Andersonville Prison." To a paroled prisoner of war there was neither option nor appeal in the matter.

The following letter was addressed to the Judge Advocate immediately upon my arrival in Washington: —

WASHINGTON, D. C., *October 3d*, 1865.

COL. CHIPMAN, JUDGE ADVOCATE, U. S. ARMY,
WASHINGTON, D. C.

SIR, — On the 23d of September I received the following order: —

OFFICE PROV. MAR. GEN., DPT. OF GA.,
AUGUSTA, GA., *September 22d*, 1865.

Order of Major-Gen. Steedman, U. S. Army.

Prof. Joseph Jones will report forthwith to Col. Chipman, Judge Advocate at Washington, D. C., as a witness in the Wirtz Case, now on trial in that city, and will take with him all papers, reports, records, etc., of every kind in his possession, pertaining to the Andersonville Prison. Quartermaster will furnish transportation.

By command of Major-General Steedman,

HERMAN W. SNOW,
Lt.-Col. and Act. Pro. Mar. Gen. Dist. Ga.

Report to General Steedman.

Immediately upon the receipt of this order, I reported to General Steedman, and informed him that I had in my possession *none* of the *original* records of Andersonville, but only the materials of a report (including *copies* of some of the records of the Confederate States Military Prison Hospital) which I had prepared, in compliance with the orders of the Surgeon-General, C. S. Army, but which had never been presented, on account of the destruction of all railroad communication with Richmond, Virginia, before the completion of the report. I asked for information whether this order related to matter which had never been formally and officially presented to the Medical Department of the Confederate States. General Steedman informed me that the order was absolute, admitting of but one construction, and related to all matter in my possession connected with the Andersonville Prison, and that my report, although incomplete and never officially presented or recognized, was nevertheless included, and must be immediately surrendered to the Judge Advocate.

In complying with the preceding order, I respectfully submit the following.

My inspection of the Confederate States Military Prison Hospital of Camp Sumpter, Andersonville, Ga., together with the accompanying pathological investigations, designed to determine the causes of the great mortality amongst the Federal prisoners, were instituted in compliance with the following order: —

CONFEDERATE STATES OF AMERICA.
SURGEON-GENERAL'S OFFICE, WAR DEPARTMENT,
RICHMOND, VA., *August 6th*, 1864.

Order of the Surgeon-General of the Confederate army.

Surgeon Joseph Jones is directed to institute an extended investigation upon the causes, pathology, and treatment of fevers, and the relations of climate and soil to disease.

Surgeon Joseph Jones will visit those parts of the Confederate States, and prosecute his investigations in those cities, armies, and regimental and general hospitals which he may deem necessary, as affording suitable fields for the establishment of the results indicated in this order.

Medical directors of the field and hospital, and chief surgeons of corps, divisions, districts, and brigades, and surgeons and assistant-surgeons of regiments and general hospitals, will afford every facility to Surgeon Jones to carry out these instructions, and will respond as far as possible to his inquiries by letter and circular, and will furnish him with copies of all field and hospital reports which he may deem necessary for the illustration of the subjects of inquiry indicated in this order.

Surgeon Jones will embody the results of his labors relating to the diseases of the Confederate army in substantial volumes, and will deposit them in the Surgeon-General's office, for the use of the medical department of the Confederate army.

S. P. MOORE,
Surgeon-General, C. S. Army.

Account of labors at Andersonville, etc.

After the completion, about the end of September, 1864, of these labors at Andersonville, I instituted a series of researches upon hospital gangrene, pyæmia, and small-pox, which were prevailing extensively amongst the sick and wounded of the Confederate troops of the army of Tennessee, then under the command of General Hood. My active labors in the field did not cease until the middle of November, when I returned to Augusta, and commenced the elaboration of the results of my investigations into a report to the Surgeon-General. Before the completion of this report, all communication by railroad was cut off by the armies of Generals Sherman and Grant, between Augusta and Richmond, the seat of the Confederate government.

It was my design to make a similar inspection of all the Confederate military prisons, and to draw up an extended report upon the causes of disease and death, together with observations upon the best methods of remedying existing evils.

In justice to myself, as well as to those most nearly connected with this investigation, I would respectfully call the attention of Col. Chipman, Judge Advocate, U. S. Army, to the fact, that the matter which I now place in his hands, in obedience to the demands of a power from which there is no appeal, was prepared solely for the consideration of the Surgeon-General of the Confederate army, and was designed to promote the cause of humanity, and to advance the interests of the medical profession.

The matter now published prepared for the Surgeon-General of the Confederate army.

This being granted, I feel assured that the Judge Advocate will appreciate the deep pain which the anticipation gives me, that these labors may be diverted from their original mission to be applied to the *prosecution* of *criminal cases*.

Pain of the writer at the diversion of his labors to the prosecution of criminal cases.

The same principle which led me to endeavor to deal humanely and justly by these suffering prisoners, and to make a truthful representation of their condition to the Medical Department of the Confederate army, now actuates me in recording my belief that, as far as my knowledge extends, there was no deliberate or willful design on the part of the chief executive, Jefferson Davis, and the highest authorities of the Confederate government, to injure the health and destroy the lives of these Federal prisoners.

On the 21st of May, 1861, it was enacted by the congress of the Confederate States of America: "That all prisoners of war taken, whether on land or at sea, during the pending hostilities with the United States, shall be transferred by the captors, from time to time, and as often as convenient, to the Department of War; and it shall be the duty of the Secretary of War, with the approval of the President, to issue such instructions to the Quartermaster-General, and his subordinates, as shall provide for the safe custody and sustenance of prisoners of war; and the rations furnished prisoners of war shall be the same, in quantity and quality, as those furnished to enlisted men in the army of the Confederacy." By Act of February 17th, 1864, the Quartermaster-General was relieved of this duty, and the Commissary-General of Subsistence was ordered to provide for the sustenance of prisoners of war.

Bill enacted by the Confederate congress.

According to General Orders, No. 159, Adjutant and Inspector-General's Office, C. S. A., — "Hospitals for prisoners of war are placed on the same footing as other Confederate States hospitals, in all respects and will be managed accordingly."

The Federal prisoners were removed to Southwestern Georgia in the early part of 1864, not only to secure a place of confinement more remote than Richmond and other large towns, from the operations of the United States forces, *but also to secure a more abundant and easy supply of food.*

The objects in removing the Federal prisoners to Southwestern Georgia.

As far as my experience extends, no prisoner who had been reared upon wheat bread, and who was held in captivity for any length of time,

could retain his health and escape either scurvy or diarrhœa, if confined to the Confederate ration issued to the soldiers in the field, of unbolted corn meal and bacon. The large armies of the Confederacy suffered more than once from scurvy; and, as the war progressed, secondary hemorrhage and hospital gangrene increased to a great extent, from the deteriorated condition of the blood, dependent upon the prolonged use of salt meat; and but for the extra supplies received from home and from the various benevolent State institutions, scurvy, diarrhœa, and dysentery would have committed still greater ravages.

The Confederate ration insufficient to protect against scurvy and diarrhœa.

It was believed by the citizens of the Southern States, that the Confederate authorities earnestly desired to effect a continuous and speedy exchange of prisoners of war in their hands, on the ground that the retention of these soldiers in captivity was a great calamity, not only entailing a heavy expenditure of the scant means of subsistence, already insufficient to support their suffering, half-starved, half-clad, and unpaid armies struggling in the field with overwhelming numbers, and embarrassing their imperfect and dilapidated lines of communication; but also as depriving them of the services of a veteran army fully equal to one third the numbers actively engaged in the field; and the history of subsequent events has shown, that the retention in captivity of the Confederate prisoners was one of the efficient causes of the final and complete overthrow of the Confederate government.

Belief in the Southern States that the Confederate authorities desired to effect exchange of prisoners.

Without at all attempting to justify the abuses which have been alleged against those directly engaged in keeping the Federal prisoners, it is my honest belief that, if the exhausted condition of the Confederated government, with its bankrupt currency, with its retreating and constantly diminishing armies, with the apparent impossibility of filling up the vacancies by death and desertion and sickness, and of gathering a guard of reserves of sufficient strength to allow of the proper enlargement of the military prisons, and with a country torn and bleeding along all its borders, with its starving women and children and old men fleeing from the desolating march of contending armies, crowding the dilapidated and over-burdened railroad lines, and adding to the distress and consuming the poor charities of those in the interior who were harassed by the loss of sons and brothers and husbands, and by the fearful visions of starvation and undefined misery, could be fully realized, much of the suffering of the Federal prisoners would be attributed to causes connected with the distressed condition of the Southern States.

Much of the suffering of Federal prisoners attributed to causes connected with the distressed condition of the Southern States.

Very respectfully,

Your obedient servant,

JOSEPH JONES.

In the trial of the Commandant of the Interior of the Confederate States Military Prison of Andersonville, by the United States Military Court in the Capitol at Washington, only those portions of my report were used in the prosecution by the Judge Advocate, which related to the diseases and sufferings of the Federal prisoners. In the extracts read before the court whilst I occupied the witness stand, every thing relating to the distressed condition of the Southern States, and to the difficulties under which the medical officers labored in the discharge of their duties, as well as the inspection reports appended, were suppressed.

In the trial of Wirtz the portions of the writer's report relating to the diseases and sufferings of the Federal prisoners alone used.

When upon the witness stand, after hearing the extracts read from my report, I was compelled, by a sense of justice to my suffering fellow-countrymen, to state that I had appeared before that military tribunal, in obedience to the demands of a power from which there was no appeal, and that my report contained other matter relating to the straitened condition of the Confederate government, as well as Inspection Reports, which demonstrated clearly that the medical officers in charge of the sick and wounded Federal prisoners, had made efforts to alleviate their sufferings.

Statement of the writer on the witness stand.

These reasons have led me to desire to place all the facts before the public, who have already had access to certain selected facts.

The following pages differ in no essential respect from the report in the hands of the United States authorities; the very language of all the observations upon the condition of the Confederate States, and upon the conduct of the medical officers, has been retained, just as it was in the report prepared for the Surgeon-General of the Confederate Army, and the only change consists in the division of the matter into chapters, the addition of pathological details, and the comparison of the results with the labors of other surgeons in Europe.

The following pages essentially the same as the report in the hands of the United States authorities.

JOSEPH JONES.

AUGUSTA, GEORGIA, *November*, 1865

CHAPTER FIRST.

GENERAL VIEW OF THE MEDICAL TOPOGRAPHY AND CLIMATE OF CAMP SUMPTER, ANDERSONVILLE, GA., AND OF THE COUNTRY IN THE IMMEDIATE VICINITY.

Character of Soil. — Elevation. — Geological Position. — Character of the Waters of Andersonville. — Waters of the Streams, Wells, and Springs within the Stockade (Confederate States Military Prison), and within the Military Prison Hospital. — Vegetation. — Animals. — Climate.

Before entering into an examination of the diseases which proved so fatal to the Federal prisoners in Camp Sumpter, the medical topography and climate of the surrounding country will be briefly considered, that data may thus be obtained by which to estimate more correctly the causes of the fatal diseases.

ELEVATION.

Andersonville, with the surrounding hills, including the Confederate States Military Prison, is elevated from three hundred and fifty to four hundred and thirty-five feet above the level of the ocean, and is situated in Sumpter County, Ga., between the Flint and Chattahoochee rivers, seven miles due west of the former, and forty-two miles east of the latter, in about 32° 10′ N. lat., and 85° 26′ W. long., near the commencement of the western slope of the dividing ridge between the streams flowing southwesterly into the Gulf of Mexico, and those flowing southeasterly into the Atlantic Ocean.

Elevation of Andersonville.

Fort Valley, twenty-nine miles N. E. of Andersonville, at an elevation of about five hundred and thirty feet, lies upon the crest of the ridge running between the Ocmulgee and Flint rivers; the former uniting with the Oconee, and forming the Altamaha, empties into the Atlantic Ocean, and the latter uniting with the Chattahoochee, and forming the Appalachicola River, pours its waters into the Gulf of Mexico. From this dividing ridge the country slopes toward the Atlantic on the southeast, and toward the Gulf of Mexico on the southwest.

Elevation of Fort Valley.

Andersonville is distant from the Atlantic Ocean in a straight line about one hundred and seventy miles, the configuration of the coast of Georgia being such that the distance is about the same from St. Catharine's, Sapelo, Alta-

Distance of Andersonville from the ocean.

maha, St. Simon's, and St. Andrew's sounds; and this place is distant from the Gulf of Mexico, near where the Wakulla and St. Mark's rivers entered Appalachee Bay, one hundred and forty-two miles.

Situation of the hospital.

The summit of the hill at Andersonville, upon which the Confederate States General Hospital has been located, is four hundred and thirty-five feet above the level of the sea, and, according to the railroad survey, is next to the highest point on the railroad between Oglethorpe and Albany; the highest point between these two places being about four hundred and eighty and six tenths feet. High table-land, with an average elevation of about four hundred and sixty feet, lies between Andersonville and Americus, the highest point being four hundred and eighty and six tenths feet. The following are the elevations above the level of the sea of several points about Andersonville: Railroad depot, three hundred and ninety-nine feet; hill opposite depot, four hundred and sixteen feet; north branch of Sweet Water Creek at Andersonville, three hundred and sixty feet; south branch, three hundred and fifty and five tenths feet; highest hill in stockade, about four hundred feet. The town of Americus is seventy-eight feet below the summit of the highest hill at Andersonville, and five and a half feet above the level of the south branch of Sweet Water Creek.

Surrounding hills.

The hills of this rolling country, in and around Andersonville, vary in height from forty to one hundred and eighty feet above the level of the water courses. The summit of the hill upon which the Confederate State General Hospital is located, is elevated one hundred and eight feet above the branch of Sweet Water Creek which flows at its base; and one hundred and seventy-eight feet above low-water in the Flint River opposite this place.

CHARACTER OF THE SOIL.

Surface soil.

The surface soil is sandy, with but little vegetable mould. For agricultural purposes the soil may be characterized as light, sandy, and unproductive after the first few years of cultivation. Many of the hills which have been cleared and cultivated present a barren surface, with varying admixtures of white sand and red clay. Some of the hills appear to be composed in large measure of sand, and, upon the surface, present a white, sandy, loose soil, in which the pouched rat (*Pseudostoma bursarium*, Say; Canada rat, Shaw; *Mus bursarius*, Linn.; *Mus saccatus*, Mitchell; *Geomys cinereus*, *Rafinisque cricetus bursarius*, Desm.)

burrows to a considerable depth. This singular animal burrows with great facility in the loose soil of the pine-barrens of the Southern States, and casts up mounds of loose earth which have no exterior opening, and which have been aptly compared to heaps of dry earth emptied from a flower-pot. These animals are said to form an extensive net-work of subterranean passages a foot or two beneath the surface; and the presence of the small sandy mounds which they cast up are indicative of a dry, healthy soil. Other hills present a red color, resembling the red-clay hills of Middle and Upper Georgia; they contain, however, much less clay in their structure, and are much less productive. The red color is due to the admixture with the sand and clay of the oxide of iron.

Composition of hills.

The hills are composed of alternate layers of sand and pipe-clay, called most commonly soap-stone. Both the sand and clay present various shades of color, from pure white to deep red and chocolate.

Under the microscope the pure white sand is found to consist of numerous crystalline fragments, and crystals of transparent quartz.

Micro-copical examination of the soil.

After microscopical examination I was unable to detect any siliceous casts of animalcules, or fragments of corals and shells, either in the white and variegated clays, or in the layers of sand. This, however, must be taken only as negative evidence, for the amount of matter examined, even after a prolonged microscopical examination, is necessarily so small that the inability to detect organic remains in the small portion subjected to this minute scrutiny does not at all allow of the general assertion that these strata are devoid of all organic remains.

GEOLOGICAL POSITION.

Eocene subdivision of tertiary formation.

I was unable to discover any fossils by which the geological position of this immediate locality could with certainty be determined. As far, however, as my knowledge of the country lying above and below extends, this region should be referred to the tertiary, or more exactly to the upper or buhrstone strata of the eocene formation.

It would appear that the force which elevated the Appalachian Mountains expended itself chiefly in this direction between the two systems of rivers, and toward the south and western portions of Georgia and Florida, and the southeastern parts of Alabama.

The relative elevation and geological position of Andersonville will be best comprehended by considering the preceding facts in connection with a general view of the topography and geological features of Georgia.

Topography and geological features of Georgia.

The State of Georgia is situated between 30° 22′ and 35° of north latitude, and between 80° 48′ and 85° 40′ west longitude. Upon a general view of the physical structure of Georgia, the observer is first struck by the natural division of the State into two portions, presenting marked physical, geological, botanical, zoölogical, and climatic differences. We shall for the present purpose only indicate in a general way these grand divisions.

The Atlantic slope forming one portion.

Looking inland from the Atlantic Ocean, a vast plain seems emerging from its waters, and gently rising like the shelving bottom of the ocean which washes its low shores. At first, an almost undulating level, it is imperceptibly broken into hill and dale, and gradually attains a height of from three hundred to five hundred feet above the level of the sea, when it meets the primary and metamorphic rocks, at a line passing through Augusta, Macon, and Columbus, near the heads of navigation of the Savannah, Ogeechee, Oconee, Ocmulgee, and Chattahoochee. The length of this plain, from north to south, varies from one hundred to one hundred and fifty miles, and its geological formations extend from the cretaceous to the most recent; and it forms a large part of the great Atlantic slope extending through South Carolina, North Carolina, Virginia, Maryland, Delaware, and New Jersey.

Elevated plateau and mountains forming another portion.

North of the line which we have indicated as the boundary of the tertiary plain lies the other division, composed of the primitive, metamorphic, and older fossiliferous rocks, crossing the State from northeast to southwest, with a width of one hundred and sixty miles at the northern limit, and one hundred at the southern. With an elevation of about five hundred feet upon its southern border, this belt soon swells into an elevated plateau near one thousand feet above the level of the sea, and gradually rising toward the west and north into mountains from one to three thousand feet higher. The Blue Ridge range of mountains passes near its western edge, and attaining a height of from twelve hundred to four thousand feet, forms the most elevated land of the State. From the level of the low Atlantic islands to the elevated plateau and mountains, there is an average elevation of from twelve hundred to fifteen hundred feet, which, at the lowest calculation, is equivalent to 3° of latitude; and, if we add the difference of latitude, we have near 8°, equivalent to an equal number of degrees of temperature.

Whilst the southern extremity of the low plain bordering on the

sea is a region of palms, with an almost tropical climate in summer, suited to the sugar-cane, orange, date, and lemon, the mountainous northern extremity rises into an elevation favorable to grain, apples, and the grasses. Between the sub-tropical climate of the sea-coast, and the cooler and more bracing climate of the mountains, vegetation has a wide range; cotton, rice, tobacco, wheat, and corn, and numerous fruits, as the fig, pomegranate, water-melon, plum, peach, pear, grape, and apricot, may be added to those above enumerated.

Vegetable productions in the two portions.

Whilst the variations in the distribution of the animals is not so evident, from their relative scarcity, it is none the less marked. Thus the *Amphicoma means* (Congo Snake), the *Siren tacertina*, and the *Emys senata* and *reticulata*, are confined almost entirely to the low, muddy, hot rice-fields and swamps of the southern coast; and the Gopher (*Testudo polyphemus*), and the pouched rat (*Pseudostoma bursarius*), to the loose, sandy, pine-barren regions lying above the rice lands.

Animals in the two portions.

Georgia presents the following geological divisions: —

1st. The primitive and metamorphic formations, embracing the extensive belt of country that lies between the eastern base of the Blue Ridge, and the northwestern terminations of the cretaceous and tertiary formations, embracing the counties of Rabun, Union, Lumpkin, Habersham, Franklin, Hart, Elbert, Madison, Hall, Forsyth, Gwinett, Jackson, Clarke, Oglethorpe, Wilkes, Lincoln, Columbia, Warren, Hancock, Taliaferro, Greene, Putnam, Jasper, Morgan, Walton, Newton, De Kalb, Henry, Butts, Fayette, Fulton, Cobb, Campbell, Carroll, Coweta, Heard, Troup, Meriwether, Pike, Upson, Monroe, and portions of Gilmer, Cherokee, Cass, Paulding, Talbot, Bibb, Jones, Baldwin, Richmond, and Crawford. The rocks of this region of Georgia are chiefly sedimentary, non-fossiliferous; as micaceous, feldspathic, and sienitic gneiss, hornblend schist, talcose slate, chloritic slate, elastic sandstone, and other rocks of closely related characters. In several localities, as De Kalb County, large masses of granite are found. Crystalline primitive marble exists to a limited extent in several of the counties in this region, as in Hall and Habersham; it does not exist, however, in sufficient abundance to exert any marked effects upon the waters of this region. The justly celebrated argillaceous soils of this zone, which have resulted from the decomposition of the granites and slates, are not only richly endowed with all the elements of fertility, and especially with that most valuable element, potash, which has such a control-

Primitive and metamorphic formations.

ling effect upon vegetation, and which, in these soils, has been derived from the decomposition of feldspathic rocks, but, under a proper system of culture, are capable of being maintained in their primitive state of fertility, and of yielding abundant harvests, which will correspond in luxuriance to the magnificent forests of black walnut, chestnut, hickory, elm, red cedar, short-leaf pine, black oak, red oak, and Spanish oak, which adorned this soil in its virgin fertility. With an elevation of four hundred feet upon the southern border, and of more than two thousand feet in the northern mountainous regions, it is well watered by numerous streams, which afford inexhaustible supplies of water, with the requisite falls and water-power for thousands of manufactories. The waters of no part of the world are more pure, or contain less mineral matter in solution, than those of the primitive regions of Georgia. A distinction must be made between the mineral and the suspended matters of streams and rivers. Water may present a turbid, muddy appearance, from the presence of insoluble suspended matters, and yet be very pure. It is well known to every resident of Middle and Northern Georgia, that the streams and rivers, especially in wet seasons, present a turbid reddish and brownish yellow and red appearance. This is due to the presence in the waters of the insoluble red clay, washed down by the rains.

Purity of waters contributes to health of Middle Georgia.

It is to the purity of its waters, as well as to its elevation, and the salubrity of the climate, and the freedom of the soil from accumulations of decomposing vegetable matters, that Middle Georgia owes its reputation for health. A comparison of the mortuary statistics of this part of Georgia, with the southern and northwestern regions of the State, not only establishes its preëminence in healthfulness over the cretaceous, tertiary, and older fossiliferous formations of Georgia, but also establishes the fact, that its inhabitants, both white and black, are as healthy and as long-lived as the most favored people in the world.

The transition, or older fossiliferous formations.

2d. The transition or older fossiliferous formations in the northwestern portions of the State, embracing Cass, Murray, Chattooga, Walker, Dade, and Floyd, and portions of Paulding, Cobb, Cherokee, and Gilmer counties. This elevated mountainous region affords, in many parts, a fertile soil and healthful climate. The Appalachian coal-field merely touches the extreme northwest corner of the State.

3d. The eocene lime formation, lying to the south and southwest of the primitive and cretaceous formations, embracing portions of

Richmond, Burke, Scriven, Effingham, Emanuel, Jefferson, Washington, Laurens, Pulaski, Twiggs, Houston, Bibb, Macon, Sumpter, Randolph, Lee, Baker, Decatur, Dooly, Irwin, Thomas, and Lowndes. The soil of this region contains less clay in its constitution than the soil of Middle and Northern Georgia, and in many parts rests upon the joint clay, which belongs to the upper strata or buhr-stone of the eocene formation. The joint clay, and, in fact, large tracts of this country, are underlaid by the eocene lime formation, which may generally be reached at a depth varying from ten to sixty feet beneath the surface, and which in many places is exposed, where the joint clay has been washed off by the denudations of former deluges. In addition to the inexhaustible deposits of shell limestone and marl in this section of the second zone, there are beds of superior kaolin, capable of furnishing material of the finest quality for china ware; and, also, inexhaustible quarries of buhr-stone, which, upon trial, has proved equal, in most respects, to the French buhr millstones. In this section are found what are commonly called boiling-springs. They are nothing more than streams of water issuing out of the sides of hills composed of shell limestone. The volume of these streams varies greatly; in some instances it is sufficient to turn more than a dozen mills, within three hundred yards of the orifice of the subterranean streams. In some places, as near Tennille, on the Central Railroad, where the hills are composed almost entirely of this eocene shell limestone, the streams have cut tunnels through the hills. Usually, the basins of these limestone boiling springs are formed of white sand, and particles of shells and echinoderms. As the water boils up, these particles of sand and shell are continually thrown up, producing a boiling appearance. The waters of all these boiling springs in the eocene lime formation of Georgia, which I have examined, are perfectly transparent; and, as the stranger approaches the stream, it is difficult to persuade himself that there is any water in the basin before him. They resemble in transparency the celebrated springs of Florida.

Eocene lime formation.

Boiling springs.

In the summer season, these waters are deliciously cool and inviting, but they are said to quench thirst imperfectly; and, if drank continuously, will first increase the appetite, and during this increase of appetite the patient gains flesh; after several months or a year, however, the bowels become torpid, and the complexion indicates derangement of the liver. Those plantations on which these waters are used by the negroes, are said

Effect of the water from these springs on health.

to be much more subject to climatic diseases and bowel affections, and to exhibit higher bills of mortality, especially amongst the young, than those upon which rain-water, or water which has simply percolated through the joint clay, is used. An intelligent and extensive planter of Burke County informed me that, since the abandonment of his limestone springs and wells, and the substitution of rain-water, collected in cisterns, disease had diminished at least four fifths amongst his servants and in his family.

Chemical constituents of the waters of wells in the eocene formation.

The chemical constituents held in solution in the waters of the wells in the eocene formation of Georgia, vary with their depth, and with the character of the strata from which the waters are collected. Thus, if the strata of joint clay be thick, and the well ends in this formation without passing into the shell limestone below, the water will be comparatively pure. This results from the fact that the joint clay, although resting upon the shell limestone, contains relatively but a very small proportion of carbonate of lime, and is composed almost entirely of insoluble silicates. The waters of wells sunk in the shell limestone, differ in no essential respect from the waters of the limestone springs, the proportion of carbonate of lime being about the same in both.

Injurious effects of waters from wells in shell limestone formation.

The injurious effects of the waters of those wells which penetrate the shell limestone formation, may be illustrated by a simple calculation. At least seventeen grains of carbonate of lime would be consumed by an adult laborer daily during the hot weather of summer. This lime would meet with various acids, as acetic and hydrochloric acids, in the stomach, and be converted into acetates and chlorides, etc., which, independently of their diuretic and irritant action upon the animal economy, must to a certain extent derange the chemistry of digestion and nutrition, and by these effects lay the system open to disease, and especially to hepatic and bowel affections.

Character of the waters of lakes.

The character of the waters of the lakes which abound in this region, will depend upon their origin, and upon the composition of their shores and bottoms. If the waters of the lakes rise out of the shell limestone, the waters will be impregnated with carbonate of lime, as in the case of the boiling springs. If the waters be derived from the sandy surface soil and the joint clay, and if, at the same time, the bottom and sides of the lake be formed of joint clay, or of any other clay or sand in which lime exists in no larger proportion than from one half to three per cent., then the waters will be pure and suitable for drinking (provided there be not too

much vegetable matter), and the proportion of carbonate of lime held in solution will be very small. The chemical composition of the lake and pond water, derived from the shell limestone formation, does not differ from the composition of the waters of limestone springs and wells sunk in the limestone formation. Those streams which derive their waters chiefly from the shell limestone formation, contain much carbonate of lime in their waters; while those streams which are supplied with water from the sand and clays resting upon the shell limestone formation, are remarkably pure, and do not contain a much larger proportion of carbonate of lime than the streams of the primitive region. The rivers which flow through the eocene formation do not contain as much carbonate of lime as we would suppose, for two reasons: first, their waters are derived chiefly from the highlands of the primitive belt; and second, over large tracts of the eocene formation through which they flow, the joint clay varies in thickness from ten to sixty feet, and their waters are derived chiefly from this strata, which, as we have demonstrated, contains little more carbonate of lime than the soils derived from the primitive and metamorphic rocks of Middle and Northeastern Georgia.

Character of rivers flowing through the eocene formation.

We have dwelt thus at length upon the eocene formation of Georgia, because Andersonville is situated in this region of country, and quite near to the great lime and cotton belt of this State.

4th. The cretaceous formation, lying between the primitive and the eocene, and embracing the counties of Marion, Muscogee, and portions of Talbot, Harris, Stewart, and Randolph. This formation, which comprises comparatively a small area of the western portion of the State, and lying just below the falls of the Chattahoochee, is elevated from three hundred to six hundred feet above the level of the ocean.

Cretaceous formation.

5th. That portion of the tertiary formation which extends from the south, southwestern, and western boundaries of the eocene formation to the Savannah River and Atlantic Ocean, embracing Effingham, Chatham, Bryan, Tatnall, Liberty, McIntosh, Glynn, Appling, Montgomery, Telfair, Ware, Bullock, and portions of Scriven and Emanuel.

Portion of tertiary formation.

The lower, and what may be called the sub-tropical zone, commences in a chain of islands, and rising by a very slow acclivity from the Atlantic Ocean to an elevation of from ten to thirty feet, is bounded at the distance of about thirty miles from the Atlantic Ocean by another more elevated plain, differing in the structure of its soil, and in the character of its vegetation.

Sub-tropical zone.

In the first low plane, which may well be termed the sub-tropical zone, there are numerous swamps, clothed with a most luxuriant and imposing vegetation — the tall cypress, the splendid magnolia grandiflora, the majestic live oak with its mossy boughs, the luxuriant sweet gum and deep-green tupelo, and the impenetrable canebrakes, indicate not only the fertility of the soil, but also the warmth and moisture of the climate. These swamps discharge their waters into short, deep, sluggish streams, and increasing in breadth from their junction with the rivers, and interlocking with each other, form a chain across Georgia and Carolina to the Neuse in North Carolina, and, southward again, along the Atlantic border into Florida. The soil of the river bottoms, swamps, and marshes consists of a rich deposit of vegetable matters, mixed with varying proportions of sand and clay, sometimes alternating with beds of marl and sand; this clay deposit varies in depth from five to fifty feet, and contains buried deep beneath the surface supporting the present luxuriant growth, the stumps of pines, cedars, oaks, cypress, and other trees; and in some localities, as upon Skiddaway Island, Hyner's Bridge, near Savannah, and on the Brunswick Canal, between the Altamaha and Turtle rivers, bones of the megatherium, a gigantic sloth, and of extinct varieties of the horse, and of other extinct animals similar to those found in the pampas of South America, an analogous formation along the borders of the Atlantic Ocean. The existence of these remains of ancient forests deeply buried beneath the present surface, together with the bones of these extinct animals, associated with sea-shells identical with those now inhabiting the Atlantic Ocean, prove conclusively that this portion of Georgia has not only been recently reclaimed from the sea, but has been subjected to successive elevations and depressions; and there are facts to show that the sea-coast of Georgia and Carolina is now slowly settling.

This rich soil, formed from the washings of Upper Georgia, brought down by numerous rivers and deposited in a shallow sea, with a level bottom, is not only characterized by the tropical aspect of the palmetto, Spanish bayonet, tall feathery cypress, and glorious magnolia, but to the agriculturalist it is especially characterized as the peculiar region for the successful cultivation of rice and long staple cotton.

The climate in these regions the great enemy of the white man.

The great enemy of the white man in these regions is the climate. No white man can ever work with impunity in the summer and fall in these lowlands and swamps, and no race but the African appears to be adapted to the burn-

ing heat and fatal miasmatic exhalations of the swamps and rice-lands, and some of the richer cotton fields.

This low plain, with its extensive swamps, is bounded by elevated lands, called the sand-hills. The rise from the Atlantic Ocean to the ancient sea-beach, which forms the commencement of these elevated lands, is not more than from ten to thirty feet, whilst the elevation of the sandy second plain varies from fifty to two hundred feet above tide-water. This elevated plain continues back from fifty to seventy miles, when it is in turn bounded by another escarpment or ancient sea-cliff, running nearly parallel with the lower sea-margin. Beyond this ancient sea-beach we have another extensive plain which gradually rises by a succession of hills and elevations to the primitive region; and this hilly portion embraces the region which we have previously described as the eocene lime formation of Georgia. The second great plain is covered chiefly by forests of the long-leaf pine (*Pinus australis*), and the surface soil is composed chiefly of sand, with little vegetable matter, resting upon beds of clay, and these again upon sand. The depth of the upper layer of sand varies greatly; it is deepest at the southern boundary of the plain. I have seen wells thirty to forty feet in depth which passed through nothing but sand. It is from this more elevated plain that the swamps chiefly derive their waters. Water derived from this great natural filter is remarkably pure and free from saline ingredients. We have made numerous analyses of these waters, and of those of the swamps and rivers in the lower plain, which will be considered when we treat more specially of typhoid and malarial fevers. This pine-barren region is noted for health, and forms the summer resort of the planters who live during the winter months in the lower and more unhealthy region.

The elevated lands called sand-hills.

Andersonville is situated in the western portion of Georgia, about seventeen miles due east of the western boundary of the cretaceous formation, and about forty miles south of the southern boundary of the primitive region of Middle Georgia, and in the eocene formation near its northwestern termination.

Situation of Andersonville.

CHARACTER OF THE WATERS OF ANDERSONVILLE.

I carefully analyzed the waters from various localities, and found them all remarkably pure; the waters of the wells and small streams did not differ to any extent in specific gravity from that of distilled water, and they contained only traces of the chlorides and sulphates, and of the salts of lime and

Purity of water from the wells and small streams.

magnesia and iron. The well of water upon the summit of the hill upon which the Confederate General Hospital is situated is of remarkable purity; and in fact it may be considered as equal to the purest well-water in the world. Its temperature is sufficiently cool in this hot climate during the summer and fall months to render it refreshing. The waters of the branches of Sweet Water Creek, before entering the Stockade (Confederate States Military Prison) and the Federal Hospital, are equally pure, with the exception of very minute traces of vegetable matters; these, however, do not exist in sufficient quantity to be of the slightest moment in a medical point of view. The waters of these streams are not so pleasant for drinking as the well-water, because their temperature is several degrees higher, and is subject to considerable variations, according to the volume and rapidity of the current and the degree of external heat.

No lime in the soil at Andersonville.

From this examination of the waters of Andersonville and the vicinity, we are justified in the conclusion that little or no lime exists in the soil. The chemical examination of the waters corresponds, therefore, with the results of the microscopical examination of the sands and clays composing the surface of the country.

Remarkable purity of water from streams, wells, and springs within the Stockade and Prison Hospital.

The waters of the streams, wells, and springs within the Stockade (Confederate States Military Prison) and the Military Prison Hospital (Federal) were also subjected to careful chemical examination, and were found in like manner to be of remarkable purity. The waters of the stream which enters the Stockade, as well as of the bold spring which mingles its waters with this stream, just after its entrance into the Stockade, and which are extensively used by the prisoners for drinking, washing, and cooking, are of great purity, containing only traces of the sulphates and chlorides, and of lime, magnesia, and iron. The bakery is situated near this stream, and one of the Confederate regiments is camped upon the hill above; but these sources of contamination are too far distant to sensibly affect the constantly flowing waters. The only perceptible effect was a slight increase of the chlorides.

The waters of the stream which enters the hospital inclosure, as well as of the deep well within the hospital grounds, were in like manner of remarkable purity, and contained only slight traces of the chlorides and sulphates, and the salts of lime, magnesia, and iron.

The waters of the streams issuing from the Stockade and Hos-

pital are contaminated by the excrements, filth, and offal of the Federal prisoners, and contain not only these matters and various salts resulting from their decomposition, but also numerous maggots, animalculæ, and cryptogamous plants.

Waters issuing from the Stockade and Hospital contaminated with excrements, etc.

As these waters, loaded with filth and human excrement, flow sluggishly through the swamp below, filled with trees and reeds coated with a filthy deposit, they emit an intolerable and most sickening stench. Standing as I did over these waters in the middle of a hot day in September, as they rolled sluggishly forth from the Stockade, after having received the filth and excrements of twenty thousand men, the stench was disgusting and overpowering; and if it was surpassed in unpleasantness by any thing, it was only in the disgusting appearance of the filthy, almost stagnant, waters moving slowly between the stumps and roots and fallen trunks of trees and thick branches of reeds, with innumerable long-tailed, large, white maggots, swollen pease, and fermenting excrements, and fragments of bread and meat.

VEGETATION.

The vegetation of the highlands and hills indicates the poverty of the soil.

The low grounds and swamps bordering the streams in this immediate vicinity are of no great extent, and they do not manifest by their growth any special fertility.

Poverty of the soil of the highlands.

The forest trees covering the high grounds and hills consist chiefly of the long-leaf pine (*Pinus australis*), yellow pine (*Pinus mitis*), barrens scrub oak (*Quercus catesbæi*), black jack oak (*Quercus nigra*), post oak (*Quercus obtusiloba*), upland willow oak (*Quercus cineria*), *Q. discolor*, *Q. coccinia*, *Q. rubra*, *Q. falcata*, *Q. triloba;* persimmon (*Diospyros virginiana*); chinquapin (*Castanea pumila*); black walnut (*Inglans nigra;* holly (*Ilex opaca*); wild plum (*Prunus umbellata*), *Prunus chicusa*, *Prunus virginiana;* red flowering maple (*Acer rubrum*); sweet leaf (*Hopea tinctoria*, Linn.; *Symplocos tinctoria*, Willd.); wild haw (*Viburnum*, Lentagr.; *Viburnum nitidum*); whortleberry (*Vaccinium myrsinites*, Mich.; *Vaccinium resinosum*, Ell.; *V. tenellum*, Ell.); and many other shrubs.

With the exception of the pines, the oaks and all the trees growing upon these barren hills presented a stunted and diminutive appearance.

Vegetation of the low grounds and swamps.

The low grounds and swamps bordering the streams were clothed chiefly with sweet gum (*Liquidambar styraciflora*),

tulip tree (*Linodendron tulipifera*), black gum (*Nyssa multiflora*), tupelo (*Nyssa aquatica; N. uniflora*), red flowering maple (*Acer rubrum*), lind or basswood (*Tilia pubescens; T. glabra*), white beech (*Fagus sylvatica*), small magnolia or white bay (*Magnolia glauca*), red bay (*Laurus caroliniensis*), sassafras (*Laurus sassafras*), dogwood (*Cornus florida*), myrtle (*Myrica cerifera*), common cane (*Arunda gigantia* and *tecta*, Watt.), and numerous shrubs; also several species of pine (*Pinus serotina* and *taeda*), and of oak (*Quercus aquatica* and *Q. alba*). In some parts of these swamps numerous vines, as the supple jack (*Berchimia volubilis*), and the trumpet vine (*Bignonia radicans*, Ell.), and China brier (*Smilax hastata*, Willd.; *S. quadrangularis*, Muhl.; *S. lanceolata*, Linn.; *S. taurifolia*, Linn.; *S. pumila*, Watt.; *S. pseudo-china*, Linn.), form thick and almost impenetrable jungles.

The swamps in this immediate vicinity appear to rest upon sand, and to have no great depth of vegetable mould.

No source of disease in the soil and waters of Andersonville.

From this examination, we conclude that there is no recognizable source of disease in the soil and waters of Andersonville, except perhaps to a limited extent in the immediate neighborhood of the narrow swamps, and the low grounds bordering the streams.

As far as I could ascertain from the physicians and from the citizens, the highlands of Sumpter County have proved very healthy to the inhabitants. Along the borders of the swamps, and especially along the Flint River, chills and fevers are common.

After careful examination, I was impressed with the belief that the highlands of Andersonville and of this region of country were as healthy as any region of the world, situated in the same latitude, and at the same elevation above the sea; and that this locality, chosen by the Confederate States for the confinement of the Federal prisoners, was much more salubrious than most of the region of Georgia lying to the south and southeast.

ANIMALS.

Enumeration of animals.

The higher species of vertebrate animals appear to be comparatively rare in this elevated and sandy region. The opossum (*Didelphys virginiana*, Penn.), raccoon (*Procyon lotor; Ursus lotor*, Linn.), rabbit or American hare (*Lepus Americanus*), fox-squirrel (*Sciurus vulpinus*, Gmel.), cat-squirrel (*Sciurus Cinereus*), common gray squirrel (*Sciurus carolinensis*, Gmel.), common flying squirrel (*Pteromys volucella*), shrew mole (*Scalops canadensis*), wood rat, and several species of rats and mice, are the most common. The deer (*Cervus virginiana*) is

found chiefly in the large swamps and forests; they are said to have abounded in this part of the country when first reclaimed from the Indians. The gopher (*Testudo polyphemus*) and the pouched rat (*Pseudostoma bursarium*) are found in considerable numbers in the dry and more sandy soils. As far as my information extends, these animals do not inhabit the primitive region of Middle Georgia. The falls in the rivers may be taken as the geographical limits of these most interesting and characteristic animals. The birds appear to be scarce upon the highlands and sandy hills. They abound chiefly along the watercourses. The cat-bird (*Mimus felivex*, Bonap.), red bird, or cardinal grosbeak (*Cardinalis virginianus*, Bonap.), blue bird (*Sialia Wilsonii*, Swains.), mocking-bird (*Mimus polyglottus*), ferruginous thrush or thrasher (*Mimus rufus*, Bonap.; *Turdus rufus*, Linn.), American shrike or butcher-bird (*Tanius septentrionalis*), turtle-dove (*Columba carolinensis*), American partridge or quail (*Ortyx virginiana*), golden-winged woodpecker or flicker (*Colaptes auratus*, Swains.), blue jay (*Garrulus cristatus*, And.), the raven (*Corvus coran*, Linn.), crow (*Corvus americanus*), jackdaw (*Quiscalus major*), red-winged black-bird or twopial (*Icterus phœniceus*, Dand.), and the turkey-buzzard (*Cathartes aura*), black vulture, or carrion-crow (*Cathartes jota*, Bonap.), great horned or cat owl (*Strix virginiana*), little screech-owl (*Strix nævia*, Gmel.), barred owl (*Strix nebulosa*, Linn.), red-tailed hawk, or buzzard (*Buteo borealis*), American sparrow-hawk (*Falco sparverius*, Linn.), and the American starling or meadow-lark (*Sturnella ludoviciana*, Bonap.), appear to frequent this region of country throughout the entire year. The wild turkey (*Meleagris gallopavo*) is now rare, although when the country was settled both this bird and the deer were abundant.

On the other hand, in this immediate locality, vermin and insects of certain species abound to a most unfortunate extent. In this sandy soil fleas find a most suitable and healthy habitation, and multiply with great rapidity; whilst mosquitoes swarm in untold myriads, and render life at night all but intolerable by their everlasting buzzing and their troublesome bites.

Abundance of vermin.

During the first night that I slept at this place, my face and hands were thoroughly peppered with the bites of these insects, and throughout my stay at Andersonville my face and hands appeared as if covered by an eruptive disease. Between the fleas and the mosquitoes at night, I enjoyed but little sleep during the entire period of my investigations. It was almost impossible to

sleep on account of the mosquitoes, except under tents. I observed that many of the prisoners and Confederate soldiers had been similarly treated by the mosquitoes. It is probable that the immense amount of filth generated by the prisoners may have had much to do with the development and multiplication of these insects, for they are said to have been almost unknown in this section of country, before the foundation of the prison.

CLIMATE.

Latitude of Andersonville.

Andersonville is situated in very nearly the same latitude with the following places: Savannah, 32° 4′ 53″; Beaufort, S. C., 32° 25′ 57″; Charleston, 32° 46′ 33″; Montgomery, Ala., 32° 22′; Jackson, Miss., 32° 23′; Point Toma, Cal., 32° 40′ 13″; San Diego, 32° 41′ 58″; Tuscaloosa, 33° 12′.

Incorrect to attribute formation of Peninsula of Florida to the coral insect.

It is incorrect to attribute the formation of the Peninsula of Florida in any great degree to the action of the coral insect. The slow architecture of these animals, as well as the sediment constantly deposited by the Gulf Stream, without doubt tend to add continually to this low neck or peninsula; but the *frame-work* of Florida, if the expression may be employed, was formed by the same force which upheaved the tertiary formation of Georgia from the bottom of the sea. Florida is nothing more than the prolongation of this plain; and but for this elevating force, throwing up a mass of earth directly across the channel of the Gulf Stream, there is no mode in which we can conceive the formation of the peninsula, by the slow deposition of the sediment of the Gulf Stream, and the still slower action of the coral insects. In fact the action of the Gulf Stream would be, if the land had not thus been elevated, to wear away the coast of Florida and Georgia.

A second fact is that Andersonville is one of the most elevated points in the tertiary formation of Georgia.

Thirdly, the elevation of the tertiary region of Georgia is not so great as materially to affect the climate.

Thus it would be fair to assume that all places in the same latitude in the tertiary slope of Georgia would possess the same climate.

Mean temperature of Andersonville and the isothermal line.

In the absence of direct observations, the mean temperature of Andersonville may be assumed, without any great deviation from the truth, at about 65° for the spring; 82° for the summer; 65° for the autumn; 55° for the winter and 65° for the year.

The isothermal line of Andersonville for the spring passe

through or near Charleston, S. C.; Columbus, Ga.; Montgomery; Vicksburg, Miss.; Fort Scott, Texas; and rises up along the Pacific coast nearly to the thirty-fourth degree of latitude. For the summer it commences as low down as the Bahamas, near the twenty-fifth degree of north latitude, passing through Nassau, and ascending along the coast of Florida, through Fort Dallas, St. Augustine, and along the coasts of Georgia and Carolina, through Savannah and Charleston, and then almost directly across the Continent, through Columbus, Montgomery, Jackson, Vicksburg, Miss., and Austin and Fort Dawson, Texas, thus falling below the thirtieth degree of north latitude in Texas. For the autumn it commences on the Atlantic coast as high up as the thirty-fifth degree of latitude, and passes through Beaufort and Wilmington, N. C.; Columbus, Ga.; Montgomery, Ala.; Jackson, Miss.; and in Texas falls below the thirtieth degree of latitude; and on the Pacific coast rises again above the thirty-fifth degree of latitude. For the winter, the isothermal line of Andersonville again commences on the Atlantic coast, near the thirty-fifth degree of north latitude, and passes through Fort Johnston, N. C.; Charleston, S. C.; near Savannah, Ga.; and Montgomery, Ala.; Jackson, Miss.; Natchitoches, La.; Austin, Forts Lincoln and Clarke, Texas; passing in Texas as low as the twenty-ninth degree of latitude, and then rising toward the Pacific coast, and passing through St. Angelos and San Francisco, strikes the Pacific Ocean about the thirty-seventh degree and fifty minutes north latitude. For the year the isothermal line commences on the Atlantic coast near the thirty-fourth degree of north latitude, passes through Fort Johnston, N. C.; Montgomery, Ala.; Jackson, Miss.; and descends in Texas below the thirtieth degree, and in Mexico below the twenty-fifth degree, and ascends toward the Pacific coast as high as the thirty-seventh degree of north latitude.

It is evident, therefore, from these facts, that the climate of Andersonville is similar in most respects to that of the interior basin of the Mississippi, being colder in winter and autumn and spring, and warmer in summer, than the Atlantic coast in the same latitude.

Climate of Andersonville similar to that of the interior basin of the Mississippi.

Perry, situated in Houston County, thirty miles northeast of Andersonville, in lat. 32° 30′ and long. 83° 42′, has very nearly the same elevation — rising four hundred feet above the ocean. The observations of Mr. Cooper upon the climate of this place will apply to Andersonville. According to these observations, during two years, the mean temperatures for the different months were: January, 39.8°, February, 55.1°, March, 63.2°, April, 62.9°, May,

74.1°, June, 78.2°, July, 82.3°, August, 78.8°, September, 74.8°, October, 67.6°, November, 53.3°, December, 50.9°; giving a mean for spring of 66.7°, summer, 79.8°, autumn, 65.3°, winter, 48.6°; and for the entire year, 65.1°. According to this observer, during the same period, the mean fall of rain for the different months, and for the seasons and year, in inches, was: January, inches, 1.4, February, 2.9, March, 2.5, April, 3.5, May, 4.33, June, 3.3, July, 5.1, August, 8.2, September, 1.3, October, 1.5, November, 9.2, December, 3.5; mean fall of rain for spring, 10.3, summer, 16.5, autumn, 12, winter, 7.8; for entire year, 46.7 inches.

Conclusions.

In conclusion, as far as my physical and pathological investigations extended, I was compelled to believe that the diseases which proved so fatal to the Federal prisoners confined at Andersonville, Georgia, were due to causes other than those connected with the soil, waters, and climate. The heat of this climate may have promoted the rapid decomposition of the filth which, in violation of all hygienic laws, was allowed to accumulate in the Stockade and hospital grounds; and also in itself the heat may have proved a cause of debility; but still the fearful mortality could not properly be referred to this condition of climate, or to all the other elements of climate combined.

No blame can be attached to the Confederate authorities for the collection of the Federal prisoners at this elevated and healthy locality, which was more salubrious than one half the territory of South Carolina, Georgia, Alabama, Mississippi, and Louisiana.

NOTE.

The following is a list of tables introduced by the writer in this chapter, and omitted in the publication: —

1. Table showing results of the analysis of 100,000 grains of Savannah River water, opposite the city of Augusta, and 100,000 grains of Turknett Spring water, situated two miles from Augusta.

2. Table presenting general view of the comparative purity of the waters of different springs and rivers.

3. Analysis of the springs issuing out of the shell limestone eocene formation of Georgia.

4. Analyses of waters from wells in the eocene formation.

5. Analyses to determine the relative composition of the waters of the lakes and streams, and of the deep wells which penetrate into the shell limestone.

6. Table showing the relations of the waters and strata of the eocene formation of Georgia.

7. Table of elevation above the ocean of various points in Georgia, classified according to the geological formations.

8. Table of mean temperature for each month, season, and the year; mean annual precipitation in rain and melted snow, etc., at different stations.

CHAPTER SECOND.

DESCRIPTION OF THE CONFEDERATE STATES MILITARY PRISON AT ANDERSONVILLE.

Stockade. — Number of Prisoners confined in the Stockade during the Months of March, April, May, June, July, and August, 1864.—Area of the Stockade in Square Feet at different times.—Square Feet of Ground allotted to each Prisoner. — Physical Condition, Food, Clothing, Habits, Moral Condition, Diseases, and Deaths. — Scurvy, Diarrhœa, Dysentery, and Gangrene. — Condition of Sick within Stockade. — Morning Sick Reports. — Manner of Disposing of Dead. — Character of Food.

THE STOCKADE.

The Confederate Military Prison at Andersonville, Ga., consists of a strong stockade, twenty feet in height, inclosing twenty-seven acres of land. The stockade is formed of strong pine logs firmly planted in the ground. The main stockade is surrounded by two other similar rows of pine logs, the middle stockade being sixteen feet high, and the outer twelve feet. These are intended for offense and defense. If the inner stockade should at any time be forced by the prisoners, the second forms another line of defense; whilst in case of an attempt to deliver the prisoners by a force operating upon the exterior, the outer line forms an admirable protection to the Confederate troops, and a most formidable obstacle to cavalry or infantry.

Construction of the Stockade.

The four angles of the outer line are strengthened by earthworks upon commanding eminences, from which the cannon, in case of an outbreak amongst the prisoners, may sweep the entire inclosure; and it was designed to connect these works by a line of rifle-pits, running zigzag around the outer stockade. The rifle-pits have been but partially completed.

The ground inclosed by the innermost stockade lies in the form of a parallelogram, the longer diameter running almost due north and south. This space includes the northern and southern opposing sides of two hills, between which a stream of water runs from west to east. The surface soil of these hills is composed chiefly of sand, with varying admixtures of clay and oxide of iron. The clay is sufficient to give a considerable degree of consistency to the soil. The internal structure of the hills, as revealed by the deep wells, is similar to that already described.

Character of the inclosed ground.

The alternate beds of clay and sand, as well as the oxide of iron, which forms in its various combinations a cement to the sand, allow of extensive tunneling.

Dirt huts and tunnels.

The Federal prisoners not only constructed numerous dirt huts with balls of clay and sand taken from the wells which they have excavated all over these hills, but they have also tunneled extensively in all directions from these wells. A large number of tunnels, and some of them of great length, have been discovered.

The lower portions of these hills, bordering on the stream, are wet and boggy from the constant oozing of water.

RELATIONS OF PRISONERS TO AREA OF STOCKADE.

Number of prisoners for which the Stockade was built.

The Stockade was built to accommodate only 10,000 prisoners, and included originally seventeen acres. Near the close of the month of June, the area was enlarged by the addition of ten acres. The ground added was situated upon the northern slope of the largest hill.

Density of population of the Stockade at different periods.

The following table presents a view of the density of the population of the prison at different periods.

MEAN NUMBER OF FEDERAL PRISONERS EACH MONTH, CONFINED IN THE CONFEDERATE STATES MILITARY PRISON AT ANDERSONVILLE, GA., FROM ITS ORGANIZATION, FEBRUARY 24TH, 1864, TO SEPTEMBER, 1864; SHOWING ALSO THE NUMBER OF SQUARE FEET OF GROUND TO EACH PRISONER.

Month.	Mean Strength Federal Prisoners.	Area of Stockade in Square Feet.	Average Number of Square Feet of Ground to each Prisoner.
1864.			
March . . .	7,500	740,520	98.7
April	10,000	740,520	74.
May	15,000	740,520	49.3
June	22,291	740,520	33.2
July	29,030	1,176,120	40.5
August . . .	32,899	1,176,120	35.7

Amount of space for each prisoner.

Within the circumscribed area of the Stockade, the Federal prisoners were compelled to perform all the offices of life, — cooking, washing, urinating, defecation, exercise, and sleeping. During the month of March the prison was less crowded than at any subsequent time, and then the average space of ground to each prisoner was only 98.7 feet, or less than eleven square yards. The Federal prisoners were gathered from all parts of the Confederate States east of the Mississippi, and crowded into this confined space, until, in the month of June, the

average number of square feet of ground to each prisoner was only 33.2, or less than four square yards.

These figures represent the condition of the Stockade in a better light even than it really was, for a considerable breadth of land along the stream, flowing from west to east between the hills, was low and boggy, and was covered with the excrements of the men, and thus rendered wholly uninhabitable, and in fact useless for every purpose except that of defecation.

Pines and other small trees soon consumed for firewood, or used in constructing huts.

The pines and other small trees and shrubs which originally were scattered sparsely over these hills, were in a short time cut down and consumed by the prisoners for firewood; and no shade-tree was left in the entire inclosure of the Stockade. With their characteristic ingenuity and industry, the Federals constructed for themselves small huts and caves, and attempted to shield themselves from the rain and sun, and night damps and dew. But few tents were distributed to the prisoners, and these were in most cases old, torn, and rotten. Tents had long since been almost entirely abandoned by the Confederate forces in the field, and the supply of cloth was barely sufficient to meet the demands of the Hospital Department.

No order observed in arrangement of huts.

In the location and arrangement of the tents and huts within the Stockade, no order appears to have been followed; in fact, regular streets appeared to be out of the question in so crowded an area, especially, too, as large bodies of prisoners were from time to time added suddenly without any previous preparation.

The irregular arrangement of the huts, and imperfect shelters, was very unfavorable for the maintenance of a proper system of police. The police and internal economy of the prison was left almost entirely in the hands of the prisoners themselves.

INTERNAL POLICE OF STOCKADE.

Confederate soldiers acted only as guards, outside of the Stockade.

The duties of the Confederate soldiers acting as guards are limited chiefly to the occupation of the boxes or lookouts ranged around the Stockade at regular intervals, and to the manning of the batteries at the angles of the Stockade.

Judicial matters left to the prisoners.

Even judicial matters pertaining to themselves, as the detection and punishment of such crimes as theft and murder, are abandoned to the prisoners themselves.

A striking instance of this occurred in the month of

July, when the Federals tried, condemned, and *hanged six of their own number*, who had been convicted of stealing and of robbing and murdering their fellow-prisoners.

They were all hanged upon the same day, upon gallows constructed by the Federal prisoners within the Stockade for this especial purpose. The condemned were guarded by their fellow-prisoners, armed with sharpened stakes, the points of which had been hardened in the fire, and with large clubs. Thousands of the prisoners gathered around to witness the executions which they had decreed.

The Confederate authorities did not interfere at all in these proceedings.

Stories of robbery and murder.

In this collection of men from all parts of the civilized world, every phase of human character was represented — the stronger preyed upon the weaker; and even the sick, who were unable to defend themselves, were robbed of their scanty supplies of food and clothing. Dark stories were afloat of men both sick and well, who were murdered at night, strangled to death by their comrades, for scant supplies of clothing or money. I heard a sick and wounded Federal prisoner accuse his nurse, a fellow-prisoner, of the United States army, of having stealthily, during his sleep, inoculated his wounded arm with gangrene, that he might destroy his life and fall heir to his clothing.

The excuse given for the absence of Confederate guards and police within the inclosure of the Stockade, was the insufficiency of men capable of performing military duty.

The absence of Confederate guards within the inclosure owing to want of men.

At the time of the establishment, and during the existence, of the Military Prison at Andersonville, the Confederate government was sorely pressed on every side; the best States were being overrun and desolated; and, with all the forces that could be gathered from all quarters, the main armies are still largely outnumbered, and are being steadily pressed back, leaving a desolated and ruined country. It is with difficulty that the Confederate government can spare at the present time of trouble and distress and disaster between two and three thousand reserves, composed of old men and boys (many of whom are wholly unfit to perform even guard duty), to guard this large number of prisoners, which they have ever been anxious to exchange, and which the Confederate authorities believe to be forced upon their hands by the persistent action of the United States Government.

Similar excuses are given for the crowded condition of the

Stockade. Thus it is affirmed that the gigantic operations, as well as the sudden and formidable raids of the United States forces in Virginia, around Richmond, and in Northwestern Georgia, have compelled the sudden and continuous removal of prisoners of war to a place of safety.

Difficulties connected with the subsistence of the Confederate army.

The military operations of the United States have reduced the railroad system of the Confederate States east of the Mississippi practically to one long and uncertain line. The utmost capacity of the railroads of the Southern Confederacy, which are now in a most deplorable condition, is taxed with the transportation of troops, sick and wounded soldiers, prisoners of war, munitions of war, and provisions for the armies in the field. Notwithstanding the utmost exertions of the Confederate authorities, the armies in the field are, as is well known to the Surgeon-General, but poorly fed and clothed at the best, and ofttimes are upon less than *one quarter rations*. And were it not for supplies received in foraging and through private sources, it would appear almost impossible that the Confederate army should be able to keep the field with any thing like its present numbers. The Surgeon-General is also well acquainted with the fact that, at the present time, large numbers, and it might almost be said entire armies, of Confederate troops, are suffering with symptoms of the scurvy; and hospital gangrene and pyæmia are making fearful ravages amongst the poorly fed and badly clothed and imperfectly treated wounded of the army of Tennessee, now contending for the possession of Georgia. Again the Confederate currency has depreciated almost to a nominal value, and large numbers of the citizens are refusing to take it in the purchase of provisions or lumber. In this section of Georgia the means of cutting and hauling lumber are scarce, not only from the original absence of machinery and scarcity of surplus horses and mules, but also from the extensive destruction of the saw-mills by the contending armies in the northern parts of the State, and from the natural decay of machinery during three years of war, in a country cut off from all intercourse with the surrounding world, and possessing at its best estate but few workshops for the manufacture of machinery. Axes, spades, tools, and implements of all kinds are exceedingly scarce in this section of country; and the State has been so often under the hands of the impressing officer, that it is difficult to obtain teams for hauling lumber.

Notwithstanding that my labors relate to the investigation of the causes and nature of diseases, I do not deem it improper thus

to make a simple statement to the Surgeon-General of these facts, in connection with those results of my labors which appear to reflect upon the action of certain officers.

FILTHY CONDITION OF STOCKADE. — VAST ACCUMULATION OF HUMAN EXCREMENTS IN THE LOW GROUNDS AND ALONG THE BANKS OF THE SMALL STREAM.

The large number of men confined within the comparatively small space of the Stockade, soon covered the surface of the low grounds with their excrements.

Accumulation of excrements.

The arrangements for the sinks over the lower portions of the stream, were imperfect, and the excrements were in large measure deposited so near the borders of the stream as not to be washed away, or else accumulated upon the low boggy ground. The volume of water was not sufficient to wash away the fæces, and they accumulated in such quantities in the lower portion of the stream as to form a mass of liquid excrement. Heavy rains caused the waters of the stream to rise, and, as the arrangements for the passage of the increased amounts of water out of the Stockade were insufficient, the liquid fæces overflowed the low grounds and covered them several inches, after the subsidence of the waters. The action of the hot sun upon this putrefying mass of excrements and fragments of bread and meat and bones, excited most rapid fermentation, and developed a horrible stench. Improvements were projected for the removal of this filth, and for the prevention of its accumulation, but they were only partially and imperfectly carried out.

As the health of the prisoners was reduced by confinement, want of exercise, improper diet, and by scurvy, diarrhœa, and dysentery, they were unable to evacuate their bowels within the stream or along its banks, and the excrements were deposited at the very doors of their tents.

Accommodations for the sick.

The accommodations for the sick were in keeping with those for the well.

From the organization of the prison, February 24th, to May 22d, the sick were treated within the Stockade. In the crowded condition of the Stockade, and with the tents and huts clustered thickly around the hospital, it was impossible to secure proper ventilation, or to maintain the necessary police. The Federal prisoners also made frequent forays upon the hospital stores, and stole the food and clothing of the sick.

The hospital was on the 22d of May removed to its present site without the Stockade, and five acres of ground, covered with oaks

and pines, appropriated to the use of the sick. The supply of medical officers has been insufficient. The nurses and attendants upon the sick have been in most cases Federal prisoners, who had no incentive to proper action.

From this condition of things it is not wonderful that from February 24th to September 21st, 1864, 9479 deaths (nearly one third of the entire number of prisoners) should have been recorded.

CONDITION OF THE CONFEDERATE MILITARY PRISON (STOCKADE) AT ANDERSONVILLE, DURING MY PATHOLOGICAL INVESTIGATIONS, SEPTEMBER, 1864.

Removal of many of the prisoners in anticipation of an advance by General Sherman's forces.

At the time of my visit to Andersonville, a large number of the Federal prisoners had been removed to Millen, Savannah, Charleston, and other points of the Confederacy, in anticipation of an advance by General Sherman's forces from Atlanta, with the design of liberating their captive brethren; but still about fifteen thousand persons remained confined within the limits of the Stockade and Confederate States Military Prison Hospital.

Condition of the Stockade.

In the Stockade, with the exception of the damp low lands bordering the small stream, the surface was covered with huts and small, ragged tents, and parts of blankets and fragments of oil-cloth, coats, and blankets stretched upon sticks. The tents and huts were not arranged according to any order; and there was in most parts of the inclosure scarcely room for two men to walk abreast between the tents and huts. I observed men urinating and evacuating their bowels at the very tent doors and around the little vessels in which they were cooking their food.

Small pits not more than a foot or two deep, nearly filled with soft offensive fæces, were everywhere seen, and emitted, under a hot sun, a strong and disgusting odor. Masses of corn-bread, bones, old rags, and filth of every description, were scattered around or accumulated in large piles.

Disposition of the dead.

The dead of the previous night lay in the narrow streets without any covering, and with their mouths open, their limbs and necks contorted, as they had been left in the last agonies of death, and with their open glazed eyeballs staring into the void above. In many cases no friendly hand, even amongst their own comrades and fellow-soldiers, was found to perform the last sad offices during the final struggle. Each day the dead from the Stockade were carried out and deposited upon the ground, under a bush arbor, just outside of the southwestern gate. From

thence they were carried in carts to the burying-ground, about one quarter of a mile northwest of the prison. The dead were buried without coffins, side by side, in trenches four feet deep. Each body was marked with a head-board, numbered; and the numbers were entered upon a record book, so that any body might be identified. The soil of the graveyard was composed of a mixture of sand and clay. I observed that innumerable large green flies swarmed over the red earth covering the dead, and in some places they even filled the cracks in the ground.

Appearance of the corpses.

I inspected from first to last two or three hundred corpses, and in every case they were extremely emaciated and covered with filth and vermin. During the entire period that I remained at Andersonville, I did not see a single corpse in good flesh. I was somewhat surprised at this, as I had been informed that the men would frequently die without any apparent disease.

The prevailing diseases.

The sick were almost all suffering with scurvy, diarrhœa, and dysentery. As they received but little attention from their fellow-prisoners, or from the regularly appointed nurses, they were compelled to exert themselves at all times to attend to the calls of nature, and hence they retained the power of moving about to within a comparatively short period before the close of life.

Sudden death attributable to scurvy.

Many of the sudden deaths were also referable to the effects of scurvy. In the *post-mortem* examinations of the bodies of those who had died from scurvy, or from diarrhœa, dysentery, and gangrene complicated with scurvy, I found the heart pale and soft, the blood deficient in colored corpuscles, and the pleural and pericardial cavities and the ventricles of the brain filled with serous effusion. Sudden death frequently took place upon slight exertion, and appeared to be referable mainly to failure in the muscular power of the heart and of the respiratory muscles. The softening of the muscles of the heart to which I have alluded was not a *post-mortem* change, for my examinations were made within a few hours after death, before any *post-mortem* alterations of the structures had taken place.

Sudden death from scurvy noted by various observers.

The frequency of sudden death in scorbutic patients has been noted by various observers. Thus, in the history of Lord Anson's voyage round the world, published in London in 1748, it is stated that when he came into the South Sea, where his men were afflicted with scurvy in the most terrible manner, the malady was frequently accompanied with a difficulty of breathing, which was the most striking and deadly of all the

symptoms. Many of the men, although confined to their nammocks, eat and drank heartily, were cheerful, and talked with much seeming vigor, and in a strong tone of voice; and yet on their being the least moved, although it was only from one part of the ship to another, and that in their hammocks, they have immediately expired; and others who have confided in their seeming strength, and have resolved to get out of their hammocks, have died before they could reach the deck. And it was no uncommon thing for those who could do some kind of duty, and walk the deck, to drop down in an instant in any endeavor to act with the utmost vigor.

Poupart, whose observations were published in 1699, and who appears to have performed a large number of *post-mortems* in this disease, remarks that in all those who died suddenly in scurvy, the auricles of the heart were as large as a man's fist, and were full of coagulated blood. Sydenham, in his "Work on Acute and Chronic Diseases," notices as one of the characteristic symptoms of scurvy, the difficulty of breathing, especially after exercise.

Doctor David Macbride, in his "Methodical Introduction to the Theory and Practice of Physic" (London, 1772; chap. vi. Description of Scurvy, pp. 617–618), thus describes the same symptoms in scurvy: —

"But what is very remarkable in this disease, notwithstanding the various and immense load of distress under which the patients labored, there is no sickness of the stomach, the appetite keeps up, and the senses remain entire, almost to the very last; when lying at rest they make no complaints, and feel little distress or pain; but the moment they attempt to rise or stir themselves, then the breathing becomes difficult, with a kind of shortness or catching, with great oppression, and sometimes they have been known to fall into a fatal syncope. This catching of the breath upon motion, with the loss of strength, dejection of spirit, and rotten gums, are held as the essential or distinguishing symptoms of the disease. . . . . As people far gone in the scurvy are apt to faint, and even expire, on being moved and brought out into the fresh air, the utmost care and circumspection are requisite when it is necessary to stir or remove them."

Gilbert Blane, in his "Observations on the Diseases of Seamen" (3d ed., London, 1799, p. 483), remarks: —

"The most remarkable symptom next to these, is a lassitude and depression of spirits. A small degree of exercise produces laborious breathing. This, and pains of the thorax, are some of the most distressing symptoms in the advanced stages of the disease. Debility and

lassitude increase as the disease advances; and these, together with pains of the limbs, and contractions of the hams, confine the diseased person to bed; and any rough motion, or attempt to raise himself to the erect posture, is apt to bring on syncope. In the most advanced stages of the disease, they frequently expire on occasions of this kind, or in the act of carrying them on shore for cure, upon their arrival in port. In the same stage of it, the callus of broken limbs is dissolved or absorbed, so that the part comes to be in the state of a recent fracture."

Facts recorded by Surgeon J. M. Foltz, United States Navy.

Other observers have recorded similar facts. We deem it unnecessary, however, to multiply testimony beyond that already given, and the following facts recorded by Surgeon J. M. Foltz, U. S. Navy, in his Report on Scorbutus, as it appeared on board the United States squadron blockading the ports in the Gulf of Mexico, in the summer of 1864: —

"The symptoms of the disease, as they appeared on board the *Raritan*, varied materially from such as are laid down in books. Lassitude and indisposition to muscular energy were not among the symptoms which ushered in the disease; there were generally great activity, and not unfrequently cheerfulness, good appetite, and sound sleep at night, for weeks after the teeth were loosened, the gums ulcerated, the limbs edematous and discolored. The nervous system was among the last to be invaded, and then it was not an indisposition to corporeal exertion, but an actual disability. The countenance became pale, languid, cadaverous; the respiration oppressed, irregular; and the pulse feeble, fluttering, intermittent, simultaneous with this muscular prostration. Slight efforts to turn, sit up, or move about, were followed by tremors and syncope. When this class of symptoms set in, the strides of the disease were rapid, every thing indicating, without speedy aid, an early fatal result. In every case, when the disease was so far advanced, the respiratory system was much involved. There was also a manifest reduction of the temperature of the body in every aggravated case. In two cases, well developed symptoms of angina pectoris presented, and the paroxysms were accompanied with the most distressing pains in the chest and arms. The patients themselves expressed the greatest apprehension of suffocation. But these cases recovered from this angina, on their transfer to the hospital; but when we last saw them, their emaciated and tottering frames gave the incontestible evidence of permanently impaired constitutions. There were but two classes of symptoms which made such irreparable inroads on the constitution; from all the other symptoms, the health became again perfectly restored; these were the oppressed, laborious, and difficult respiration; the other, irregular, obstructed, and imperfect action of

[1] *American Journal of the Medical Sciences*, January, 1864, p. 47.

the heart. Paroxysms of dyspnœa were frequent in these cases; the inspirations were short and rapid, and performed chiefly by the action of the intercostal muscles, and were performed with much labor by the patient, imparting to the countenance the impression of suffocation, accompanied by palpitations, which compelled the patient to sit up. The contractions and dilatations of the heart were irregular, at times intermitting and indistinct, with a great sense of anxiety at the precordia. In the midst of these symptoms, the pulse was scarcely perceptible at the wrist, the extremities were cold, and the countenance assumed a leaden hue. Auscultation, so far as practicable on board a crowded ship of war, gave but little aid in detecting the character of organic derangement. In several cases the sounds emitted were those of hypertrophy; but the number of these cases were limited, compared with the indications of atrophy and diminution of the cardiac functions."

Stench from the low grounds bordering the stream.

The low grounds bordering the stream were covered with human excrements and filth of all kinds, which in many places were alive with working maggots. An indescribable sickening stench arose from this fermenting mass of human dung and filth. The prisoners appeared to be utterly callous to this filth, and it appeared to be utterly impossible to establish and carry out the proper hygienic rules without the constant presence of a Confederate guard within the Stockade. The Confederate force, as we have before stated, was barely sufficient to act as a guard on the outside of the prison; and the internal police was left almost entirely, from necessity, to the prisoners themselves. And although the quagmire was covered by order of the commandant of the interior of the prison, at the suggestion of the medical officers, with dry sand, it was soon again covered with human excrements — the prisoners refusing or neglecting to use the privies arranged over the stream.

Five thousand prisoners seriously ill, and the deaths more than one hundred daily.

There were near five thousand seriously ill Federals in the Stockade and Confederate States Military Prison Hospital, and the deaths exceeded one hundred daily; and large numbers of the prisoners who were walking about, and who had never been entered upon the sick list, were suffering from severe and incurable diarrhœa, dysentery, and scurvy. Upon one occasion, as I was passing through the Stockade, a stout Irishman, sitting at his tent door, showed me a large molar tooth which he had just extracted with his fingers, and I found that all his teeth were loose, and the gums greatly swollen and ulcerated.

I visited two thousand sick within the Stockade, lying under four

long sheds, which had been built at the northern portion for barracks.

Deficient medical attendance.

At this time only one medical officer was in attendance, whereas at least twenty medical officers should have been employed. I was informed that several of the medical officers appointed to attend the sick within the Stockade were sick, and that the duty was so arduous, and the exhalations from the sick and filth of the prison were so deleterious, that it was impossible for the medical officers to stand the service for any length of time. Great difficulty was experienced by the surgeon in charge of the post to induce medical officers and physicians to accept positions in the Stockade or Hospital, on account of the absence of many of the facilities for the treatment of the sick, and the great and numerous depressing agencies, and the consequent unsatisfactory results of practice. So distressing was the service, and so great were the obstacles to successful and satisfactory practice amongst these men, whose constitutions had been sapped by the loss of all hope of exchange on the part of their government, and by long confinement upon an unvarying diet, that the more energetic Confederate surgeons and assistant-surgeons endeavored to get transfers to other fields of labor, preferring the hardships and exposures of service at the front. It is also to be considered that not only is there a scarcity of physicians in the Confederacy, but it is especially difficult to command the services of competent physicians in this sparsely settled country. Added to all this, the gigantic military operations in Georgia, attended with the utter destruction of her territory in the rear of the Federal forces, and with the serious wounding of thousands of Confederate troops, have absorbed the sympathies and attention, and commanded the abilities of almost every available physician in the State. The hospitals of the army of Tennessee have been in constant motion for months, following the continuous series of disasters and evacuations in Northern Georgia, and are crowded with seriously wounded, suffering in many cases with the most extensive hospital gangrene, and with fatal pyæmia. Every town and village in Georgia is filled with the sick and wounded of the army of Tennessee, and the privations and sufferings of the Confederate troops, even amongst their own countrymen, are great beyond description, and equal to those of any armies in ancient or modern times. With the whole energies of this people engaged in such a terrible and unequal struggle, it is not singular that medical talent of the highest order should be scarce, and difficult of access and control at the interior posts.

The very conditions and results of the contest also, without doubt, tend to excite such prejudices as would disincline medical officers from voluntarily seeking service amongst the captive enemies, who are the representatives of those who are seeking to conquer and desolate their native land.

Deficient records of the sick in the Stockade.

I found no record of the sick in the Stockade previous to September 14th. It appears that after the removal of the hospital, no record was kept of the diseases treated within the prison, and the following includes all the statistics which I was able to collect: —

MORNING REPORT OF ACTING ASSISTANT-SURGEON F. J. WELLS, IN CHARGE OF STOCKADE.

DATE.	Remaining last Report.	Taken Sick.	Total Sick.	Returned to Duty.	Discharged.	Sent to General Hospital.	Died.	Remaining.
1864.								
September 14	936	64	1,000	–	–	76	36	888
" 15	888	515	1,403	–	–	114	58	1,231
" 16	1,231	13	1,244	–	–	16	70	1,955
" 17	1,159	88	1,247	–	–	109	36	1,102
" 18	1,102	906	2,008	–	–	3	50	1,195
" 19	1,955	–	1,955	–	–	32	42	1,881
" 20	1,881	–	1,881	–	–	63	44	1,774

Number of deaths as great in the Stockade as in the Hospital

If this table be compared with the following one for the Military Prison Hospital during the same period, we will see that the number of deaths was as great in the Stockade as in the Hospital, notwithstanding the disparity in the number of medical officers in attendance upon the sick in both institutions, being three hundred and forty-six in the former, and three hundred and forty-four in the latter.

CONSOLIDATED MORNING REPORT OF SURGEON R. R. STEVENSON, IN CHARGE OF C. S. MILITARY PRISON HOSPITAL, ANDERSONVILLE, GA., SEPTEMBER 14–20.

DATE.	Remaining in Hospital last Report.	Received from Stockade.	Received from Attendants.	Total in Hospital.	Returned to Stockade.	Deserted.	Detailed from Stockade.	Died.	Remaining in Hospital.	Medical Officers on duty as Hospital Surgeons.	Assistant-Surgeons.	Acting Assistant-Surgeons.	Total Medical Officers on duty in Hospital.
1864.													
Sept. 14	1,609	76	–	1,685	1	–	49	37	1,598	3	11	8	22
" 15	1,598	114	–	1,712	14	–	–	47	1,651	3	11	8	22
" 16	1,651	16	–	1,667	1	–	–	49	1,617	3	11	8	22
" 17	1,617	109	4	1,730	–	–	–	40	1,690	3	11	8	22
" 18	1,690	3	–	1,693	–	–	–	58	1,635	3	11	9	23
" 19	1,635	32	1	1,668	–	2	–	55	1,611	3	11	9	23
" 20	1,611	63	2	1,676	–	–	–	48	1,628	3	11	9	23

Died in Stockade from its organization, Feb. 24th to Sept. 21st, 1864	3,254
Died in Hospital, Feb. 24th to Sept. 21st, 1864	6,225
Total deaths in Stockade and Hospital	9,479

Prevailing diseases.

Scurvy, diarrhœa, dysentery, and gangrene were the prevailing diseases.

Cases of malarial fever few.

I was surprised to find but few cases of malarial fever, and no well-marked cases of either typhus or typhoid fever. The absence of the different forms of malarial fever may be accounted for on the supposition that the artificial atmosphere of the Stockade, crowded densely with human beings and loaded with animal exhalations, was unfavorable to the existence and action of the malarial poison.

Absence of typhus and typhoid fever.

The absence of typhoid and typhus fevers, amongst all the causes which are supposed to produce these diseases, appeared to be due to the fact that the great majority of the prisoners had been in captivity in Virginia, at Belle Island, and in other parts of the Confederacy for months, and even as long as two years, and during this time they had been subjected to the same bad influences, and those who had not had these fevers before, either had them during their confinement in Confederate prisons, or else their systems from long exposure were proof against their action.

Effects of scurvy.

The effects of scurvy were manifest on every hand, and in all its various stages, from the muddy pale complexion, pale gums, feeble, languid, muscular motions, lowness of spirits, and fetid breath; to the dusky, dirty, leaden complexion, swollen features, spongy, purple, livid, fungoid, bleeding gums, loose teeth, œdematous limbs, covered with livid vibices and petechiæ, spasmodically flexed, painful and hardened extremities, spontaneous hemorrhages from mucous canals, and large, ill-conditioned spreading ulcers covered with a dark purplish fungous growth.

In some of the cases of scurvy the parotid glands were greatly swollen, and in some instances to such an extent as to preclude entirely the power of articulating. In several cases of dropsy of the abdomen and lower extremities supervening upon scurvy, the patients affirmed that previously to the appearance of the dropsy, they had suffered with profuse and obstinate diarrhœa; and that when this was checked by a change of diet from indian corn-bread, cooked with the husk, to rice, the dropsy appeared. The severe pains and livid patches were frequently associated with swellings in va-

rious parts, and especially in the lower extremities, accompanied with stiffness and contractions of the knee-joints and ankles, and often with a brawny feel of the parts, as if lymph had been effused between the integuments and aponeuroses, preventing the motion of the skin over the swollen parts.

Many of the prisoners believed that the scurvy was contagious; and I saw men guarding their wells and springs, fearing lest some man suffering with the scurvy might use the waters and thus poison them.

I observed also numerous cases of hospital gangrene, and of spreading scorbutic ulcers, which had supervened upon slight injuries. Cases of hospital gangrene.

The scorbutic ulcers presented a dark, purple, fungoid, elevated surface, with livid, swollen edges, and exuded a thin, fœtid, sanious fluid, instead of pus. Many ulcers which originated from the scorbutic condition of the system appeared to become truly gangrenous, assuming all the characteristics of hospital gangrene.

From the crowded condition, filthy habits, bad diet, dejected and depressed condition of the prisoners, their systems had become so disordered that the smallest abrasion of the skin, from the rubbing of a shoe, or from the effects of the hot sun, or from the prick of a splinter, or from scratching a mosquito's bite, in some cases took on rapid and frightful ulceration and gangrene.

The long use of salt meat, often improperly cured, as well as the almost total deprivation of vegetables and fruit, appeared to be the chief causes of the scurvy.

I carefully examined the bakery and the bread furnished to the prisoners, and found that they were supplied almost entirely with corn-bread, from which the husk had not been separated. Character of the food supplied. In this respect the meal did not differ from that issued to the Confederate soldiers in the field. The scarcity of sieves in the Confederacy was the excuse urged for the issue of unbolted corn meal to the Confederate soldiers, as well as to the prisoners of war. The husk of the indian corn appeared to act as an irritant to the alimentary canal, without adding any nutriment to the bread. As far as my examination extended, no fault could be found with the mode in which the bread was baked — the difficulty lay in the failure to separate the husk from the corn meal. I strongly urged the preparation of large quantities of soup made from the cow and calves' heads, with the brains and tongue, to which a liberal supply of sweet potatoes and vegetables might have been advantageously added. The materials existed for the preparation of such soup,

with little or no additional expense. Such aliment would have been not only highly nutritious, but it would also have acted as an efficient remedial agent for the removal of the scorbutic condition.

The sick lay on bare boards in sheds within the Stockade.

The sick within the Stockade lay under several long sheds, which were originally built for barracks. These sheds covered two floors which were open on all sides. The sick lay upon bare boards, or upon such ragged blankets as they possessed, without, as far as I observed, any bedding, or even straw.

Pits for the reception of fœces were dug within a few feet of the lower floor, and they were almost never unoccupied by those suffering with diarrhœa and dysentery.

Appearance of the prisoners, and their complaints of the United States government.

The haggard, distressed countenances of these miserable, complaining, dejected living skeletons crying for medicine and food, and cursing their government for its brutality in refusing to exchange prisoners, and the ghastly corpses with their glazed eyeballs, staring up into vacant space, with the flies swarming down their open and grinning mouths, and over their ragged clothes, infested with lice, as they lay amongst the sick and dying, formed a picture of helpless, hopeless misery, which it would be impossible to portray by words or by the brush. A feeling of disappointment and even of resentment on account of the action of the United States Government upon the subject of the exchange of prisoners, appeared to be wide-spread, and the apparent hopeless nature of the negotiations for the general exchange of prisoners appeared to be a cause of universal regret, and of deep and injurious despondency. I heard some of the prisoners go so far as to exonerate the Confederate government from any charge of intentionally subjecting them to protracted confinement, with its necessary and unavoidable suffering, in a country cut off from all intercourse with foreign nations, and sorely pressed on all sides ; whilst on the other hand, they charged their prolonged captivity upon their own government, which was attempting to make the negro equal to the white man.

That I have not misrepresented the sentiments of these prisoners is clearly demonstrated by the following resolutions passed a short time after my examination of the Stockade, by these same Andersonville prisoners who had been transferred to Savannah. These resolutions were published in the Savannah papers.

" At a mass meeting held September 28th, 1864, by the Federal prisoners confined at Savannah, Ga., it was unanimously agreed that the

following resolutions be sent to the President of the United States, in the hope that he might thereby take such steps as in his wisdom he may think necessary for our speedy exchange or parole.

Resolutions adopted by the prisoners at a mass meeting.

"*Resolved*, That while we would declare our unbounded love for the Union, for the home of our fathers, and for the graves of those we venerate, we would beg most respectfully that our situation as prisoners be diligently inquired into, and every obstacle consistent with the honor and dignity of the government at once removed.

"*Resolved*, That while allowing the Confederate authorities all due praise for the attention paid to prisoners, numbers of our men are daily consigned to early graves, in the prime of manhood, far from home and kindred, and this is not caused intentionally by the Confederate government, but by the force of circumstances; the prisoners are obliged to go without shelter, and, in a great portion of cases, without medicine.

"*Resolved*, That whereas ten thousand of our brave comrades have descended into an untimely grave within the last six months, and as we believe their death was caused by the difference of climate, the peculiar kind and insufficiency of food, and lack of proper medical treatment; and whereas those difficulties still remain, we would declare as our firm belief that, unless we are speedily exchanged, we have no other alternative but to share the lamentable fate of our comrades. Must this thing still go on? Is there no hope?

"*Resolved*, That whereas the cold and inclement season of the year is fast approaching, we hold it to be our duty as soldiers and citizens of the United States to inform our Government that the majority of our prisoners are without proper clothing, in some cases being almost naked, and are without blankets to protect us from the scorching sun by day, or the heavy dews by night, and we would most respectfully request the Government to make some arrangement whereby we can be supplied with these to us necessary articles.

"*Resolved*, That whereas the term of service of many of our comrades having expired, they, having served truly and faithfully for the terms of their several enlistments, would most respectfully ask their Government, Are they to be forgotten? Are past services to be ignored? Not having seen their wives and little ones for over three years, they would most respectfully but firmly request the Government to make some arrangements whereby they can be exchanged or paroled.

"*Resolved*, That whereas, in the fortune of war, it was our lot to become prisoners, we have suffered patiently, and are still willing to suffer, if by so doing we can benefit the country; but we must most respectfully beg to say, that we are not willing to suffer to further the ends of any party or clique to the detriment of our honor, our families, and our country, and we beg that this affair be explained to us, that we may

continue to hold the Government in that respect which is necessary to make a good citizen and soldier.

(Signed)

P. BRADLEY,
Chairman of Committee in behalf of Prisoners.

Views of the writer respecting the treatment of prisoners of war.

When soldiers surrender, our action (placing it in no higher light than that of policy, and leaving out of view entirely the higher and more noble dictates of humanity and Christianity) should be to treat them in such a manner, that surrender in battle will have no special terrors. The fear of great suffering and even of almost certain death in imprisonment only renders the enemy more stubborn and vindictive in battle. Strict justice to the gallant men of the Confederate armies who have been, or who may be, so unfortunate as to be compelled to surrender, demands that the Confederate government should adopt that course which will best secure their health and comfort in captivity, or at least leave our enemies without the shadow of an excuse for any violation of the rules of civilized warfare in the treatment of prisoners.

Several hundred prisoners released on parole.

It is worthy of note, in connection with the preceding description of the condition of the prisoners within the Stockade, that several hundred of the Federal prisoners had been released on parole, and filled all the sub-offices as clerks, carpenters, cooks, bakers, ration-dividers, nurses, ward-masters, stewards, and druggists. These men who had the liberty of the entire post were well clothed, and presented a stout, healthy appearance, and as a general rule appeared to be in better circumstances, and to enjoy much more robust health than the Confederate troops guarding the prison.

To these paroled prisoners was confided not only the preparation and cooking of the food, but also the distribution of the rations to the sick and well within the Stockade and Hospital.

CHAPTER THIRD.

CONFEDERATE MILITARY PRISON HOSPITAL AT ANDERSONVILLE, GA.

Physical and Moral Condition of Sick. — Defective Hygiene and Police of Hospital.—Accumulation of Filth. — Flies. — Mosquitoes. — Manner of Disposing of the Dead. — Defective Cooking Arrangements. — Improper Food for Sick. — Foul Air of Filthy Tents.

Situation of the hospital. Accumulation of filth.

THE Hospital is situated near the southeastern corner of the Stockade, and covers about five acres of ground.

The larger forest trees, as the pine and oak, have been left in their natural state, and furnish pleasant shade to the patients.

The ground slopes gently toward the south and east. A sluggish stream of water flows through the southern portion of the hospital grounds from west to east. The upper portion of this stream is used by the patients for washing their clothes, whilst along the borders of the lower portions logs have been ranged upon which the patients may sit and evacuate their bowels. This part of the stream was a semi-fluid mass of human excrements, offal, and filth of all kinds.

This immense cesspool, fermenting beneath the hot sun, emitted an overpowering stench.

The banks of this stream south of the hospital inclosure are bordered by a swamp which spreads out toward the southeast. This swamp is well covered by forest trees, usual in southern swamps, as the small magnolia, red bay, sweet gums, black gum, tupelo, tulip-tree, red maple, ash, and beech.

North of the hospital grounds, the stream which flows through the Stockade pursues its sluggish and filthy course. The exhalations from this swamp, which is loaded with the excrements of the prisoners confined in the Stockade, exert their deleterious influences upon the inmates of the Hospital.

The entire grounds are surrounded by a frail board fence, and are strictly guarded by Confederate soldiers, and no prisoner, except the paroled attendants, is allowed to leave the grounds except by a special permit from the commandant of the interior of the prison.

Number of patients and attendants.

The patients and attendants, near two thousand in number, are crowded into this confined space, and are but poorly supplied with old and ragged tents. Large numbers of them were without any bunks, and lay upon the ground, ofttimes without even a blanket — no beds or straw appear to have been furnished.

The tents extend to within a few yards of the small stream, the eastern portion of which, as we have before said, was used as a privy, and was loaded with excrements; and I observed a large pile of corn-bread, bones, and filth of all kinds, thirty feet in diameter and several feet in height, swarming with myriads of flies, in a vacant space near the pots used for cooking.

Great number of flies and maggots.

Millions of flies swarmed over every thing, and covered the faces of the sleeping patients, and crawled down their open mouths and deposited their maggots in the gangrenous wounds of the living and in the mouths of the dead. Myriads of mosquitoes also infested the tents, and many of the patients were so stung by these pestiferous insects that they appeared as if they were suffering from a slight attack of measles.

Police and hygiene of the hospital.

The police and hygiene of the hospital was defective in the extreme; as the attendants were selected from the prisoners, they not only robbed the sick of their clothing and rations, but also neglected their comfort and cleanliness in a most shameful manner. The sick were literally incrusted with dirt and covered with vermin.

Dressing of wounds. Maggots in wounds, etc.

When a gangrenous wound needed washing, the limb was thrust out a little from the blanket or board or rags upon which the patient was lying, and water poured over it, and all the putrescent matters allowed to soak into the ground floor of the tent.

The supply of rags for dressing wounds was said to be very scant; and I saw the most filthy rags, which had been applied several times and imperfectly washed, used in dressing recent wounds. When hospital gangrene was prevailing it was impossible for any wound to escape contagion under these circumstances.

I saw several gangrenous wounds filled with maggots. The numerous flies which swarmed around and over every ulcer, without doubt formed efficient agents for the spread of hospital gangrene.

The results of the treatment of wounds in the hospital were of the most unsatisfactory character, from the neglect of cleanliness in the dressings and wounds themselves, as well as from various other causes which will be more fully considered.

I have frequently seen neglected wounds amongst the Confederate soldiers filled with maggots, as in the case of some of these wounds and ulcers; and as far as my experience extends, these worms destroy only the dead tissues, and do not injure specially the well parts. I have even heard surgeons affirm that a gangrenous wound which has been thoroughly cleansed by maggots heals more rapidly than if it had been left to itself.

This want of cleanliness on the part of the nurses appeared to be the result of carelessness and inattention rather than of malignant design, and the whole trouble can be traced to the want of the proper police and sanitary regulations, and to the absence of intelligent organization and division of labor. The abuses were in a large measure due to the almost total absence of system and government, and of rigid but wholesome sanitary regulations.

Abuses owing to absence of system and discipline.

In extenuation of these abuses it was alleged by the medical officers that the Confederate troops were barely sufficient to guard the prisoners, and that it was impossible to obtain any number of experienced nurses from the Confederate forces. In fact the guard appeared to be too small even for the regulation of the internal hygiene and police of the hospital.

The manner of disposing of the dead was also calculated to depress the already desponding spirits of these men, many of whom had been confined for months, and even for near two years, in Richmond and other places, and whose strength had been wasted by bad air, bad food, and neglect of personal cleanliness. The dead-house is merely a frame covered with old tent-cloths and a few brushes, situated in the southwestern corner of the hospital grounds. When a patient dies, he is simply laid in the narrow street in front of his tent, until he is removed by Federal negroes detailed to carry off the dead. If a patient dies during the night, he lies there until the morning, and during the day even the dead were frequently allowed to remain for hours in these walks. In the dead-house the corpses lie upon the bare ground, and were in most cases covered with filth, vermin, and flies, and their distended and open mouths were frequently filled with maggots before burial. During the night of September 17th, there had fallen quite a shower of rain. Whilst walking next morning in the lanes between the closely clustered tents, filled each with from four to eight patients, I was startled at seeing a bold full-length figure of a man upon the smooth, well-beaten ground of the street. There was the well-defined nose, open mouth, and flowing beard in strong

Manner of disposing of the dead.

profile. It looked as if an exact daguerreotype of the man had been taken upon the filthy soil, saturated with urine and the washings of the food. The impression was life-like in all its proportions, and was of a much darker color than the surrounding soil. Upon inquiry I found that the dead, as was the usual custom, had been removed out of the tent, and had remained there during the night. The descending rain washed off the filth from the clothes and body, and the carbon deposited from the smoke of the pine wood used in cooking. From each point of the body, and the scant covering of clothing, poured a stream of black filth, which painted the body full-length upon the ground. I observed similar impressions wherever a dead body had lain during the night.

Receptacles for excrements.

At short intervals, in the lanes between the tents, wooden boxes are arranged for the reception of the excrements of those patients who are unable to go to the sinks over the stream. These are not emptied until they are filled with excrements. At all times the emaciated men, worn down to skeletons by diarrhœa and dysentery, are seen evacuating their bowels into these filthy receptacles, which from their wooden structure can never be kept properly cleansed. Notwithstanding these objectionable arrangements, the surgeons, from the limited resources of the purveying department of the Confederate States, appear to be unable to devise any better mode of collecting and removing the excrements of the sick. Metallic or earthenware vessels would be far preferable, but it is said that they cannot be obtained at the present time.

Time and again I saw patients who apparently had ample strength to walk to the sinks evacuate their bladders within the tent doors. The whole soil appeared to be saturated with urine and filth of all kinds, and emitted a most disgusting odor.

Cooking arrangements.

The cooking arrangements were of the most miserable and defective character. Two large iron pots, similar to those used for boiling sugar-cane, were the only cooking utensils furnished by the hospital for the cooking of near two thousand men; and the patients were dependent in great measure upon their own miserable utensils. They were allowed to cook in the tent doors and in the lanes, and this was another source of filth and another favorable condition for the generation of flies and other vermin.

Foul air of the entire grounds.

The air of the tents was foul and disagreeable in the extreme, and in fact the entire grounds emitted a most nauseous and disgusting smell.

I entered nearly all the tents, and carefully examined the cases of interest, and especially the cases of gangrene, upon numerous occasions during the prosecution of my pathological inquiries in Andersonville, and therefore enjoyed every opportunity to judge correctly of the hygiene and police of the hospital.

There appeared to be an almost absolute neglect on the part of the patients of personal cleanliness. The clothing of the patients in most instances, and especially of those suffering from gangrene and phagedenic scorbutic ulcers, was filthy in the extreme, and ofttimes covered with vermin.

Neglect of cleanliness.

The patients were, as a general rule, received in a most deplorable condition from the Stockade. I have seen men brought into the hospital grounds from the Stockade in a dying condition, begrimed from head to foot with excrements, and so black from smoke and filth that they resembled negroes rather than white men.

Condition of patients when received from the Stockade.

The food issued to the sick in the hospital was no great improvement over that issued to the prisoners in the Stockade, and consisted of corn-bread, rice, bacon, and beef, with occasional supplies of green pease, molasses, and vinegar.

Food issued to the sick.

CHAPTER FOURTH.

CONSOLIDATED REPORT OF SICK AND WOUNDED FEDERAL PRISONERS AT CAMP SUMPTER, ANDERSONVILLE, GA., MARCH TO AUGUST, 1864.

Number of Cases of Disease treated during Six Months, with Deaths. — Per Cent. of Deaths from all Causes, and from various Diseases, as Typhoid Fever, Scurvy, Diarrhœa, and Dysentery. — Inspection and Sanitary Reports on File in the Office of the Chief Surgeon.

Table of diseases and mortality of the prisoners at Andersonville.

THE following *table*, presenting a consolidated view of the diseases and mortality of the Federal prisoners confined at Andersonville, has been carefully prepared and drawn up from the monthly reports on file in the office of the surgeon of the post, and are respectfully submitted to the consideration of the Surgeon-General, C. S. Army.

REPORT OF SICK AND WOUNDED FEDERAL PRISONERS AT CAMP SUMPTER, ANDERSONVILLE, GA.
(MARCH TO AUGUST, 1864.)

1864.	March.		April.		May.		June.		July.				August.				Totals.	
									Or. Ad.		Re-ad.		Or. Ad.		Re-ad.			
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	Cases.	Deaths.
Febris congestiva	–	–	5	–	1	1	–	2	–	1	1	1	1	1	–	–	8	6
Febris continua communis	54	10	12	–	50	–	10	–	–	–	–	–	–	–	–	–	126	10
Febris continua simplex	–	–	–	–	–	–	–	–	15	–	–	–	140	4	–	–	155	4
Febris intermittens quotidiana	–	–	10	4	481	9	205	7	150	7	–	–	324	29	–	–	1,170	56
Febris intermittens tertiana	35	2	24	–	385	–	192	–	139	–	–	–	–	–	–	–	775	2
Febris intermittens quartana	–	–	–	–	114	–	25	–	56	–	–	–	–	–	–	–	195	–
Febris remittens	37	5	10	1	181	9	240	13	–	–	–	–	–	–	–	–	468	28
Febris remittens biliosa	–	–	–	–	–	–	–	–	160	15	–	–	190	12	–	–	350	27
Febris typhoides	67	28	56	18	92	17	18	32	20	39	19	19	200	32	–	–	472	185
Febris typhus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Febris typhus icterodes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
All other diseases of this class	–	–	10	–	–	–	3	–	–	–	–	–	–	–	–	–	13	–
Erysipelas	–	–	5	2	26	1	5	1	–	–	–	–	–	–	–	–	36	4
Erysipelas idiopathic	–	–	–	–	–	–	–	–	12	–	–	–	–	–	1	1	13	1
Rubeola	10	–	6	1	40	3	8	2	3	–	–	–	–	–	1	1	68	7
Variola	16	3	36	16	3	5	1	5	–	1	1	1	–	–	–	–	57	31
Varioloides	12	2	37	18	10	5	–	5	–	3	3	3	–	1	–	–	62	37
All other diseases of this class	–	–	–	–	1	–	12	–	–	–	–	–	–	–	–	–	13	–
Colica	10	–	1	–	36	–	41	–	14	–	–	–	–	–	–	–	102	–
Constipatio	23	–	3	–	140	–	237	1	810	1	–	–	557	7	–	–	1,770	9
Diarrhœa acuta	386	51	916	220	1,729	251	1,966	330	2,796	517	–	–	1932	742	50	50	9,775	2,161
Diarrhœa chronica	95	26	233	115	608	171	510	447	349	330	–	–	470	230	50	50	2,315	1,369
Dysenteria acuta	143	29	133	49	870	93	540	98	999	215	–	–	859	364	–	–	3,544	848
Dysenteria chronica	42	12	51	27	407	8	271	5	180	27	–	–	187	72	–	–	1,138	151
Dyspepsia	15	–	1	–	40	–	1	–	5	–	–	–	–	–	–	–	62	–
Enteritis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	100	50	100	50
Gastritis	–	–	–	–	10	–	–	–	40	–	–	–	100	1	–	–	150	1
Hæmatemesis	–	–	–	–	–	–	10	–	–	–	–	–	–	–	–	–	10	–
Hepatitis acuta	–	–	–	–	20	1	–	–	4	–	–	–	9	3	–	–	33	4
Hepatitis chronica	–	–	2	–	14	–	–	–	–	–	–	–	–	–	–	–	16	–
Icterus	5	–	5	–	8	–	12	–	62	4	–	–	31	8	–	–	123	12
Parotitis	6	–	4	–	18	–	8	–	2	–	–	–	–	–	–	–	38	–
Pharyngitis	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–
Stomatitis mercurialis	–	–	–	–	–	–	–	–	2	–	–	–	20	–	–	–	22	–
Glossitis	–	–	–	–	–	–	–	–	18	–	–	–	–	–	–	–	18	–

(*Continued on next page.*)

REPORT OF SICK AND WOUNDED FEDERAL PRISONERS AT CAMP SUMPTER, ANDERSONVILLE, GA. (MARCH TO AUGUST, 1864). — (*Continued.*)

1864.	March.		April.		May.		June.		July.				August.				Totals.	
									Or. Ad.		Re-ad.		Or. Ad.		Re-ad.			
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	Cases.	Deaths.
Splenitis	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–
Nephritis	–	–	–	–	–	–	–	–	15	–	–	–	18	2	–	–	33	2
Tonsillitis	10	–	–	–	17	–	8	–	–	–	–	–	–	–	–	–	35	–
All other diseases of this class	–	–	–	–	32	–	58	–	–	–	–	–	–	–	–	–	90	–
Asthma	–	–	–	–	7	–	3	–	8	–	–	–	–	–	–	–	18	–
Bronchitis acuta	73	11	55	6	101	7	133	9	179	12	–	–	229	16	–	–	770	61
Bronchitis chronica	15	–	21	–	47	–	30	1	25	2	–	–	–	–	–	–	138	3
Catarrhus epidemicus	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	4	–
Catarrhus	79	–	88	2	308	1	466	3	–	–	–	–	–	–	–	–	941	6
Catarrhus simplex	–	–	–	–	–	–	–	–	531	6	–	–	428	14	–	–	959	20
Laryngitis	20	–	20	2	7	–	2	–	–	–	–	–	23	–	–	–	72	3
Phthisis	–	–	–	–	–	–	–	1	1	7	6	6	51	4	–	–	58	17
Phthisis pulmonalis	24	8	12	–	16	4	4	4	–	–	–	–	–	–	–	–	56	16
Pleuritis	28	9	19	4	167	5	97	3	12	5	–	–	128	6	–	–	451	32
Pneumonia	102	65	108	58	103	28	21	41	28	27	–	–	166	15	–	–	528	234
All other diseases of this class	–	–	10	1	1	–	–	1	–	–	–	–	–	–	–	–	11	2
Anæmia	25	–	50	–	–	–	2	–	–	–	–	–	–	–	–	–	77	–
Endocarditis	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	2	–
Varicocele	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	4	–
Apoplexia	–	–	–	–	–	–	–	–	1	–	–	–	97	–	–	–	98	–
Cephalalgia	–	–	–	–	6	–	–	–	–	–	–	–	–	–	–	–	6	–
Cerebritis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	75	50	75	50
Epilepsia	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
Ictus solis	–	–	–	–	–	–	1	1	1	1	–	–	–	–	51	51	53	53
Mania	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–
Meningitis	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	2	2
Neuralgia	–	–	–	–	10	–	13	–	9	–	–	–	1	–	–	–	33	–
Paralysis	1	–	1	–	2	1	–	–	1	–	–	–	–	–	–	–	5	1
All other diseases of this class	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Bubo simplex	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
Bubo specific	–	–	–	–	–	–	–	–	13	–	–	–	–	–	–	–	13	–
Bubo syphiliticum	–	–	–	–	6	–	10	–	–	–	–	–	–	–	–	–	16	–
Calculus	–	–	1	–	1	–	2	–	–	–	–	–	10	–	–	–	14	–
Cystitis	5	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	6	–
Diabetes	–	–	1	–	4	–	–	–	–	–	–	–	–	–	–	–	5	–
Diabetes melitus	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	7	–
Marasmus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	53	53	55	55

Gonorrhœa	1	–	–	–	36	–	32	–	–	–	–	–	–	–	–	–	69	–
Gonorrhœa simplex	–	–	–	–	–	–	–	–	–	–	–	–	–	18	–	–	–	18	–
Gonorrhœa virulenta	–	–	–	–	–	–	–	–	20	–	–	–	–	–	–	–	–	20	–
Ischuria vera	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	5	–
Ischuria et dysuria	5	–	–	–	2	–	2	–	–	–	–	–	–	–	–	–	–	9	–
Nephritis	7	–	6	1	29	1	5	–	–	–	–	–	–	–	–	–	–	47	2
Orchitis	–	–	–	–	17	–	1	–	4	–	–	–	–	–	–	–	–	22	–
Strictura urethræ	–	–	–	–	1	–	2	–	3	–	–	–	–	1	–	–	–	7	–
Phymosis	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	3	–
Iritis syphiliticum	–	–	–	–	–	–	–	–	1	–	–	–	–	5	–	–	–	6	–
Syphilis primitiva	1	–	2	–	–	–	6	–	2	–	–	–	–	15	–	–	–	26	–
Syphilis consecutiva	–	–	5	1	20	–	14	–	7	–	–	–	–	–	–	–	–	46	1
All other diseases of this class	–	–	1	1	12	–	8	–	–	–	–	–	–	–	–	–	–	21	1
Anasarca	28	2	32	6	233	50	248	71	304	66	–	–	–	665	120	–	–	1,510	315
Ascites	8	–	6	2	10	1	16	–	5	–	–	–	–	1	1	–	–	46	4
Hydrocele	–	–	6	1	4	–	–	–	1	–	–	–	–	–	–	–	–	11	1
Hydrops pericardii	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	50	24	50	24
Hydrothorax	–	–	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	2	1
All other diseases of this class	–	–	50	–	–	–	2	–	–	–	–	–	–	–	–	–	–	52	–
Lumbago	–	–	–	–	5	–	3	–	4	–	–	–	–	–	–	–	–	12	–
Rheumatismus acutus	27	–	10	5	122	5	88	2	171	2	–	–	–	253	4	–	–	671	18
Rheumatismus chronicus	15	–	20	–	101	–	31	–	14	–	–	–	–	2	2	–	–	183	2
All other diseases of this class	–	–	5	1	–	–	–	–	–	–	–	–	–	–	–	–	–	5	1
Abscessus	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	3	–
Abscessus acutus	–	–	–	–	–	–	–	–	2	1	–	–	–	2	–	–	–	4	1
Scabies	–	–	–	–	–	–	–	–	62	–	–	–	–	14	–	–	–	76	–
Fistula	1	–	5	–	3	–	–	–	–	–	–	–	–	–	–	–	–	9	–
Phagedena gangrenosa	–	–	–	–	–	–	–	–	3	–	–	–	–	54	13	–	–	57	13
Ulcus	–	–	20	–	128	–	41	–	29	–	–	–	–	12	–	–	–	230	–
All other diseases of this class	–	–	–	–	57	–	–	–	–	–	–	–	–	–	–	–	–	57	–
Contusio	–	–	–	–	–	–	4	–	4	–	–	–	–	3	–	–	–	11	–
Fractura	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Hernia	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	3	–
Vulnus punctum	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	3	–
Vulnus sclopeticum	10	–	53	1	52	3	22	1	–	–	–	–	–	–	–	–	–	137	5
Vulnus punctum sclopeticum	–	–	–	–	–	–	–	–	36	10	–	–	–	36	6	–	–	72	16
All other diseases of this class	–	–	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	10	–
Amaurosis	–	–	–	–	4	–	1	–	–	–	–	–	–	–	–	–	–	5	–
Hemeralopia	–	–	20	–	26	–	–	–	–	–	–	–	–	–	–	–	–	46	–
Iritis	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	3	–
Ophthalmia	6	–	1	–	27	–	7	–	27	–	–	–	–	–	–	–	–	68	–
All other diseases of this class	–	–	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	10	–
Otitis	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	2	–
Otorrhœa	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Surditas	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Debilitas	34	3	66	12	137	10	80	37	112	35	–	–	–	446	71	–	–	875	168
Diphtheria	–	–	–	–	–	–	–	1	2	4	2	–	2	–	–	–	–	4	7
Hæmorrhois	8	–	5	–	54	–	15	–	18	–	–	–	–	15	–	–	–	115	–

(*Continued on next page.*)

REPORT OF SICK AND WOUNDED FEDERAL PRISONERS AT CAMP SUMPTER, ANDERSONVILLE, GA.
(MARCH TO AUGUST, 1864.) — (*Continued.*)

1864.	March.		April.		May.		June.		July.				August.				Totals.	
									Or. Ad.		Re-ad.		Or. Ad.		Re-ad.			
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	D.	D.	Cases.	Deaths.
Morbi cutis	16	–	10	–	57	–	43	–	–	–	–	–	–	–	–	–	126	–
Odontalgia	–	–	–	–	11	–	2	–	–	–	–	–	–	–	–	–	13	–
Prolapsus ani	–	–	–	–	14	–	1	–	–	–	–	–	–	–	–	–	15	–
Anæmia	–	–	–	–	–	–	–	–	1	–	–	–	2	2	–	–	3	2
Scirrhus	–	–	–	–	26	–	1	–	–	–	–	–	–	–	–	–	27	–
Scorbutus	15	–	50	–	1,221	14	2,097	68	3,092	195	–	–	3,026	22	–	–	9,501	999
Struma	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
Scrofula	5	–	–	–	3	–	5	–	–	–	–	–	–	–	–	–	13	–
Asphyxia	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
By hanging	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	6
Toxicum	–	–	–	–	–	–	3	–	6	–	–	–	–	–	–	–	9	–
Tumores	–	–	–	–	10	–	3	–	–	–	–	–	–	–	–	–	13	–
Vermes	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–
Morbi varii	–	17	100	–	6	3	9	8	25	203	178	178	156	156	–	–	474	565
Totals	1,530	283	2,425	576	8,583	708	7,968	1,201	10,624	1,742	210	210	10,915	2,662	431	330	42,686	7,712

GENERAL SUMMARY.

TABLE NO. I., MARCH TO JUNE.

1864.	Remaining Last Report.			Taken Sick during the Month.	Aggregate.	Returned to Duty (Stockade).	Died.	Remaining.			Mean Strength.		Number Treated.	Deaths.	Ratio per 1000 of Mean Strength.	
	Sick.	Convalescent.	Total.					Sick.	Convalescent.	Total.	Enlisted Men.	Total.			Cases.	Deaths.
March	-	-	-	1,530	-	353	283	500	136	636	7,500	7,500	1,530	283	204	37.73
April	500	136	636	2,425	3,061	1,463	576	468	554	1,022	10,000	10,000	3,061	576	306.1	57.06
May	468	554	1,022	8,583	9,605	6,276	708	1,150	1,471	2,621	15,000	15,000	9,605	708	640.33	47.02
June	1,150	1,471	2,621	7,969	10,590	5,311	1,201	-	-	4,078	22,291	22,291	10,590	1,201	475.7	53.87

TABLE NO. II., JULY AND AUGUST.

1864.	Remaining at Last Report.		Taken Sick or Wounded during Month.	Supervening Diseases.	Aggregate.	Returned to Duty.	Died.	Remaining.			Mean Strength.		Enlisted Men.				Average Number on Sick Report Daily.		
													Sick.		Wounded.				
	Sick.	Total.						Sick.	Wounded.	Total.	Enlisted Men.	Total.	Cases.	Deaths.	Cases.	Deaths.	In Hospital.	In Quarters.	Total.
July	4,078	4,078	10,624	210	14,912	6,548	1,742	6,386	26	6,412	29,030	29,030	10,588	1,732	36	10	1,237	4,574	5,311
August	6,386	6,412	10,915	431	17,758	9,443	2,932	4,836	56	4,892	32,899	32,899	-	-	-	-	1,934.93	3,933.90	5,868.84

During six months (March to August, 1864, both months included), 42,686 cases of disease and wounds were reported.

The figures representing the cases of disease, far below the truth.

No classified record of the sick in the Stockade was kept after the establishment of the hospital without the prison. This fact, in conjunction with facts already presented, relating to the insufficiency of medical officers, and the extreme illness, and even death, of many of the prisoners in the tents in the Stockade without any medical attention or record beyond the bare number of the dead, demonstrate that these figures, large as they appear to be, are far below the truth.

As the number of prisoners varied greatly at different periods, the relations between those reported sick and well, as far as these statistics extend, can best be determined by a comparison of the statistics for each month.

The following table presents the mean strength, the total diseases and deaths, and the total cases of, and deaths from, the most fatal diseases.

TABLE GIVING MEAN STRENGTH, TOTAL DISEASES AND DEATHS, AND TOTAL CASES OF, AND DEATHS FROM, THE MOST FATAL DISEASES OF FEDERAL PRISONERS CONFINED AT ANDERSONVILLE, GA. (MARCH, 1864 — AUGUST, INCLUSIVE). DRAWN UP FOR THE USE OF THE MEDICAL DEPARTMENT OF THE CONFEDERATE ARMY, BY JOSEPH JONES, SURGEON, C. S. ARMY.

Month and Year.	Mean Strength Federal Prisoners.	Total taken Sick or Wounded during the Month.	Ratio of Sick to Well. One Sick in —	Total Deaths from all Causes.	Per Cent. of Deaths to Sick entered during Month.	One Death in so many Sick and Well Prisoners (Mean Strength).	Per Cent. of Deaths to Mean Strength (Sick and Well).	Typhoid Fever.		Congestive Fever.		Intermittent Fever. Quotidian.		Intermittent Fever. Tertian.		Intermittent Fever. Quartan.		Remittent Fever.		Bilious Remittent Fever.		Pneumonia.		Dropsy.		Scurvy.		Diarrhœa Acute.		Diarrhœa Chronic.		Dysentery Acute.		Dysentery Chronic.		Morbi Varii.	
								C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
1864.																																			
March.	7,500	1,530	4.9	283	18.4	26.4	3.77	67	28	-	-	-	-	35	2		-	37	5	-	-	102	65	28	2	15	-	386	51	95	26	143	29	42	12	-	17
April .	10,000	2,425	4.08	576	23.7	17.3	5.76	56	18	5	-	10	4	24	-		-	10	1	-	-	108	58	32	6	50	-	916	229	233	115	133	49	51	27	100	-
May .	15,000	8,583	1.7	708	8.2	21.18	4.72	92	17	1	1	481	9	385	-	114	-	181	9	-	-	103	28	233	50	1,221	14	1,729	251	608	171	870	93	407	8	6	3
June .	22,291	7,968	2.8	1,391	15.0	18.5	5.38	18	32	-	2	205	7	192	-	25	-	240	13	-	-	21	41	248	71	2,097	68	1,966	330	510	447	540	98	271	5	9	8
July .	29,030	10,834	2.6	1,952	18.1	14.8	6.64	39	58	1	2	150	7	139	-	56	-	-	-	160	15	28	27	304	66	3,092	195	2,796	517	349	330	999	215	180	27	203	381
August	32,899	11,346	2.9	2,992	26.3	10.9	9.09	200	32	1	1	324	29	-	-	-	-	-	-	190	12	116	15	605	120	3,026	722	1,982	792	520	280	859	364	187	72	156	156
Total		42,686		7,712				472	185	8	6	1170	56	775	2	196		468	28	350	27	528	234	1,510	315	9,501	999	9,775	2,161	2,315	1,369	3,541	848	1,738	151	474	565

During this period of six months no less than five hundred and sixty-five deaths are recorded under the head of *morbi varii*. In other words, these men died without having received sufficient medical attention for the determination of even the name of the disease causing death.

Explanation of the large number of deaths from *morbi varii*.

During the month of August, fifty-three cases and fifty-three deaths are recorded marasmus. Surely this large number of deaths must have been due to some morbid state other than slow wasting. If these deaths were due to improper or insufficient food, they should have been classed accordingly, and if to diarrhœa or dysentery or scurvy, their classification would in like manner have been comparatively simple.

Deaths recorded from marasmus.

We observe a progressive increase of the rate of mortality from 3.77 per cent. in March to 9.09 per cent. of mean strength sick and well in August.

Progressive increase of the rate of mortality.

The ratio of mortality continued to increase during September, for notwithstanding the removal of one half the entire number of prisoners during the early portion of this month, one thousand seven hundred and sixty-seven (1767) deaths were registered from September 1st to 21st, and the largest number of deaths ever recorded occurred during this month on the 16th, namely, one hundred and nineteen.

The entire number of Federal prisoners confined at Andersonville was about 40,611; and during the period of near seven months, from February 24th to September 21st, 9479 deaths were recorded; that is, during this period near one fourth, or more exactly one in 4.2, or 23.3 per cent., terminated fatally.

During seven months nearly one fourth of the prisoners died.

The progressive increase of mortality was due in great measure to the accumulation of the sources of disease, as the increase of excrements and filth of all kinds, and the concentration of noxious effluvia, and also to the progressive effects of the bad diet, crowding, and hot climate.

Explanation of the progressive increase of mortality.

Surrounded by these depressing agencies, the postponement of the general exchange of prisoners and the constantly receding hopes of deliverance through the action of their own government depressed the already desponding spirits, and destroyed those mental and moral energies so necessary for the successful struggle against the active agents of disease.

Home-sickness, and the disappointment, mental depression, and distress attending the daily longings for an apparently hopeless release, appeared to be as potent agencies in the destruction of these prisoners as the physical causes of actual disease.

This gigantic mass of human suffering calls loudly for relief, not only for its own sake and the cause of humanity, but also on account of the brave Confederate soldiers now captives in the hands of the Federal Government. Appeal for relief.

In presuming to step aside, for one moment, from the line of labor indicated in the Surgeon-General's order, and to volunteer suggestions with reference to the amelioration of suffering and the rectification of abuses, I am well aware that the same principles of enlarged humanity which the Surgeon-General has ever displayed in the management of the medical department in its varied and difficult relations, as well to the Federal prisoners as to the Confederate armies, actuates the chief executive as well as all the high officers of the government charged with the general direction of such matters; and that no effort has been spared by the Confederate authorities, through Colonel Robert Ould, Agent of Exchange, to effect a complete and speedy exchange of Federal prisoners in their hands. As long as the Confederate government is compelled to hold these prisoners as hostages for the safe return and exchange of the captive men of its own armies, it is difficult to devise efficient measures for the mitigation of much of the suffering of such an immense army of prisoners (equal at least to one fourth of the Confederate forces actively engaged in the field, east of the Mississippi), in a purely agricultural and sparsely settled country, with imperfect lines of communication, with but few manufactories, without commerce, cut off from all communication with the surrounding world, deprived of even the necessary medicines which have been declared by its enemies "contraband of war," with torn and bleeding borders, with progressively diminishing powers of subsistence and resistance, with its entire fighting population in arms, and yet being steadily driven back and overpowered by the hosts of the enemy, with a constant driving in of the population from the constantly contracting borders upon the overcrowded and distressed centre, and with a corresponding increase of travel upon the dilapidated railroads, already taxed far beyond their capacity with the transportation of troops, the munitions of war, and the sick and wounded. In Georgia, especially, the very State in which these prisoners are confined, is the pressure of the Confederate disasters felt with daily increasing force. The disastrous campaign in Northern Georgia has been attended with the desolation of the fairest portions of the State. Thousands of families from the devastated regions, and from all the towns and villages from Chattanooga to Atlanta and beyond, have fled to the regions Difficulties in the way of relief.

considered more safe from invasion, and are occupying old cars, depots, sheds, and tents along the entire railroad system of Georgia. Thousands of old men, delicate women, and defenseless children, have not only lost all their earthly possessions, but are without a roof to cover their heads, and are dependent for their daily bread upon the charities of the State government. The hospitals attached to the army of Tennessee are in a constant state of motion, and the poorly fed and imperfectly treated wounded are suffering with the worst forms of hospital gangrene and pyæmia. Every available building, including churches and colleges and school-houses, suitable for hospital purposes, in all the towns and villages, are crowded with the sick and wounded, and Georgia may with truth be said to be one vast hospital.

It is therefore with a sincere appreciation of the great difficulties of the situation that I respectfully present for the consideration of the Surgeon-General the conditions which I believe to be essential to the relief of these suffering prisoners.

Conditions essential to relief suggested.

1st. Such an increase of the Confederate guard as will allow of the enlargement and proper police of the Military Prison and Hospital. The average area to each prisoner should be increased at least fivefold. The guard should be sufficiently strong within the prison to compel the prisoners to observe strict hygienic rules, not only with reference to the deposition and removal of fecal matters and filth of all kinds, but also with reference to personal cleanliness by frequent ablutions. The experience at this place demonstrates that the enforcement of proper hygienic rules must depend upon a regularly appointed and accountable guard, and not upon the prisoners. The removal of large numbers of the Federal prisoners to Millen, Savannah, Charleston, and other points will, without doubt, tend to better the hygienic condition of the prisoners for a time at least; but it is evident that if no system of police be established within the new prisons, then matters will gradually assume the same deplorable condition as at this place.

2d. The construction of suitable barracks and hospital buildings. These have been projected and commenced, but the work should be hurried to a completion before cold weather.

3d. The increase of the medical staff, and the appointment of one or more chaplains.

4th. The appointment of disabled Confederate soldiers as nurses, ward-masters, and apothecaries; many of these men who are incapable of performing active service in the field possess the neces-

sary intelligence and physical ability to act as hospital attendants, and also to enforce the necessary sanitary regulations.

5th. The great prevalence of scurvy demands that liberal supplies of fresh vegetables, sweet potatoes, and fresh milk should be issued. If the sour oranges of Florida and of the southern seacoast could be obtained, they would produce the best results in the treatment of scurvy.

I consider an abundant and regular supply of fresh milk as also essential to the treatment of chronic diarrhœa and dysentery, which are prevailing to so great an extent, and which appear to be entirely beyond control under the present mode of treatment and diet. I suggested to the surgeon in charge of the Prison Hospital the propriety of purchasing a number of cows for the use of the sick.

That the preceding description of the Stockade and Prison Hospital at Andersonville has not been overdrawn, will appear from the following inspection and sanitary reports, which were accurately copied under my direction and supervision from the originals, on file in the office of the chief surgeon of the post, by my faithful secretary, Mr. Louis Manigault.

Hospital reports.

C. S. Military Prison, Andersonville,
Chief Surgeon's Office, *April 25th*, 1864.

General, — I have the honor to report that the total number of patients treated up to date is two thousand six hundred and ninety-seven, with seven hundred and eighteen deaths. The large ratio of mortality is due to the debilitated condition in which many of the prisoners were when admitted into the prison — having been confined for a long time in other prisons — and to the absence of proper hospital accommodation, the construction of which has been prevented by the difficulty experienced in obtaining lumber; and small-pox was introduced into the prison by prisoners sent from Richmond, Va. Vaccination has been resorted to, the disease has not spread to any extent, and is now on the decline.

Report of Chief Surgeon White to Brig.-General Wright.

The sick are treated in tents, of which there is an inadequate supply.

The present location of the hospital is objectionable for the following reasons: The drainage of the sinks of the prison passes through the hospital grounds. The contiguity to the prisoners will disseminate disease amongst them. The hospital being within the Stockade, hospital bedding and diet and other supplies for the comfort of the sick and wounded are stolen by the prisoners, and the impossibility of keeping them out of the hospital is a source of annoyance to the sick.

I therefore most respectfully suggest that the hospital be placed out-

side of the Stockade, and erected on a site adjacent, admirably adapted to the purpose.

Respectfully submitted,

ISAIAH H. WHITE,
Chief Surgeon.

Brigadier-General MARCUS J. WRIGHT, C. S. Army.

C. S. MILITARY PRISON, ANDERSONVILLE, GA., *April 26th*, 1864.

S. P. MOORE, Surgeon-General, C. S. A.

SIR, — Your communication of the 15th inst., acknowledging receipt of sanitary report, and asking if the attention of the commanding officer had been called to the police of the camp, is at hand.

Letter of Chief Surgeon White to Surgeon-General Moore.

In reply, I have the honor to state that the evil has been remedied, and the condition of the camp at the time of the report was no fault of the commanding officer, but was due to the great difficulty experienced in obtaining shovels and other things requisite. Your honor should be informed that the prison is located in a section barren of resources, and great difficulty is experienced in obtaining the necessary appliances for its proper organization, and a large number of prisoners arrived before its completion.

I take pleasure in stating that the commanding officer, and the chief of each staff department, are using every effort to effect a thorough organization.

Very respectfully, your obedient servant,

ISAIAH H. WHITE,
Chief Surgeon.

SANITARY REPORT.

Sanitary report of Chief Surgeon White.

In compliance with regulations, I have the honor to make the following Report of the Sanitary Condition of the C. S. Military Prison at Andersonville.

There is nothing in the topography of the country that can be said to have influenced the health of the command. The location is elevated and well drained. The soil is sandy, without vegetable mould or other cryptogamous growth likely to engender malaria. The large ratio of diseases of the digestive system has been due to long confinement in prison, with the diet. I am convinced from observation that a majority of the cases of diarrhœa and dysentery have more or less scorbutic connection.

The bakery and other culinary arrangements have just been completed, up to which time there had been an inadequate supply of cooking utensils, and in consequence thereof the articles of diet have been insufficiently cooked.

The ration is the same as that issued to the Confederate soldiers in the field, namely: beef, one pound, or in lieu, one third pound bacon;

corn meal, one and a quarter pounds, with an occasional issue of rice, beans, molasses, and vinegar.

The arrangements for a thorough policing of the Prison are not yet finished. Through the centre of the Stockade passes a stream affording an amply supply of good water. At the upper end of the prison it is designed to construct two dams of different heights; the upper to be used for drinking, the lower for bathing; over the remainder of the stream are to be arranged the sinks. The stream has sufficient volume and velocity to carry off all ordure. Once a day the flood-gates of the dams mentioned above are to be opened, thereby driving off all deposits that may have collected during the day.

At present the police of the camp is defective, but the commander of the interior is using every effort to effect the arrangement mentioned above, which has been retarded up to the present time by an inadequate supply of the necessary tools. The habits of the men, as a rule, are filthy in the extreme, and as soon as the arrangements for bathing have been completed, it will be necessary to compel them to bathe at stated periods.

The dimensions of the prison will not admit of exercise, the absence of which, with the depressing influences on the mind, produced by imprisonment, is a prolific source of disease.

The large ratio of mortality is due to the debilitated condition of the prisoners, produced by long confinement in prison, and to absence of proper hospital accommodations. The worst cases are treated in tents, of which there is an inadequate supply. The present location of the hospital is objectionable for the following reasons: The prisoners with their camp-fires are densely crowded around the hospital, preventing a free circulation of air so necessary to the treatment of the class of diseases prevailing. The mistaken kindness of their comrades who visit them, and furnish them improper diet, produces deleterious consequences. It is to be admitted, however, that such instances are rare, and in many instances assistance is refused to dying comrades in the same tent. In consequence of the predatory forays upon the hospital, by which the sick are robbed of their blankets, clothes, and diet, it will be impossible to furnish the hospital with proper bedding and diet while the hospital remains within the Stockade. The drainage from the prison passing through the hospital grounds is another great objection to its location. I therefore most respectfully suggest that authority be granted to place the hospital outside the Stockade, and that an adequate supply of tents be furnished until proper hospitals can be constructed.

ISAIAH H. WHITE,
Chief Surgeon.

May 6th, 1864.

Report of Chief Surgeon White to Captain Bowie.

Captain, — I have the honor to submit the following report of the sanitary condition of the C. S. Military Prison, at Andersonville, Ga.: —

The prison is situated on two opposing banks of a stream,

which furnishes an ample supply of good water for drinking and bathing purposes. The location is elevated and well drained. The soil is sandy, without vegetable mould, or other cryptogamous growth likely to engender malaria.

The prisoners are not supplied with barracks or tents, but most of them have provided themselves with little huts made of boughs, thus making themselves comparatively comfortable. This, however, will be insufficient during the extremely hot weather of the summer months. There being no trees, or other protection from the rays of the sun, and crowded together as they are, it will be necessary to furnish them with tents, or other more capacious quarters than those now occupied, in order that they may be divided off into proper streets admitting free circulation of air and the enforcing of the necessary police regulations.

At the upper end of the stream it is designed to construct two dams of different altitudes, the upper for drinking, and the lower for bathing purposes; over the remainder of the stream, it is designed to construct the sinks. The stream is of sufficient volume and velocity to carry off all ordure.

The number of cases treated from the foundation of the prison, up to date, has been 4588, with 1026 deaths. The number reported sick and wounded for the month of April, exhibits a ratio of 316.1 cases, and 57.6 deaths per 1000 of mean strength.

Amongst the first prisoners admitted, there was a large ratio of diseases of the respiratory system, contracted in transit from Richmond during very cold weather, and the majority of which resulted fatally, in consequence of the absence of barracks and hospital accommodations, and the emaciated condition of the subjects, due to long confinement in prison.

The diseases now prevailing are chiefly those of the digestive system, diarrhœa and dysentery, which have in most instances a scorbutic connection.

The rations of the prisoners are the same as those issued to Confederate soldiers in the field, namely: one pound beef, or in lieu, three quarters pound bacon, one and a quarter pounds meal, with an occasional issue of beans, rice, molasses, and vinegar. The bakery and other culinary arrangements have just been completed, and rations are now issued cooked. Up to this time, there has been an inadequate supply of cooking utensils, in consequence of which the food was improperly prepared, and increased the number of cases of diarrhœa and dysentery.

The ratio of mortality is due to the lack of vitality in the subjects, produced by long confinement in prison, with its depressing influences on the mind. The remedies employed are unassisted by the *vis medicatrix naturæ*, without which remedial agencies are powerless. It is also impossible to treat diseases with success, with the present hospital ac-

commodations. The patients are now treated in tent flies, of which there is an inadequate supply. The location of the hospital is also objectionable. The prisoners, with their camp fires, are densely crowded around the hospital, producing contaminating effluvia and preventing the free circulation of air, so necessary to the treatment of disease. In consequence of the forays upon the hospital, by the prisoners, it is impossible to supply the sick with proper comforts. The drainage from the sinks of the prison passing through the hospital grounds, is another objection to its location. I therefore most respectfully suggest, that authority be granted to place the hospital outside of the Stockade, and that an adequate supply of tents to accommodate one thousand sick, be immediately furnished.

Respectfully submitted,

ISAIAH H. WHITE,
Chief Surgeon.

Captain Bowie, }
May, 1864. }

Chief Surgeon's Office, }
Andersonville, Ga., *June 20th*, 1864. }

Sir, — I have the honor to submit the following report of the sanitary condition of C. S. Prison at Andersonville, Ga.: —

Report of Chief Surgeon White on the sanitary condition of the prison of Andersonville, to Captain Hammond.

Your inspection of the Prison has, no doubt, convinced you of the too crowded condition of the prisoners within the Stockade, which, combined with the absence of barrack accommodation, is a prolific source of disease.

The arrangements for the enforcing of proper regulations for cleanliness of the camp are in progress.

The hospital up to the 22d ultimo, was located within the Stockade, where it was impossible to provide the sick with the necessary comforts. The supply of tents has never been adequate to accommodate the number of sick. The present site of the hospital affords a fine shade, and a good supply of water for drinking and cleanliness. The area is a parallelogram, whose sides are two hundred and sixty and three hundred and forty feet. There are two hundred and nine tents of all kinds, the majority of which are small picket tents, and tent flies, illy adapted to hospital purposes. The capacity consistent with comfort, does not exceed eight hundred men; but in consequence of an inadequate supply, they have been compelled to accommodate one thousand and twenty of the worst cases. They are now so crowded as to render it necessary to refuse admission to many cases which cannot be treated with success in the kind of quarters occupied by inmates of the Prison. Two hundred hospital tents are required to accommodate the present and daily increasing number of sick. Delay in obtaining medical supplies frequently arises, in consequence of the requisitions being required to be sent to Medical Director of Hospitals at Atlanta, for approval, whilst the supplies are drawn from Macon, Ga., only sixty miles distant. I would

suggest, for the consideration of the proper authority, the propriety of permitting the medical purveyor at Macon to issue on requisition of the chief surgeon of the post, approved by the commanding officer. The supply of medicines is not at all times equal to the demand, being issued in quantities much less than is allowed by the supply table. The deficiencies which occur, cannot be promptly met in consequence of the delay which arises from sending requisitions to Atlanta for approval, and awaiting their return.

The report of sick and wounded for the month of April, exhibits a ratio per one thousand (1000) of mean strength, three hundred and six and one tenth cases treated, and fifty-seven and six tenths deaths. May, six hundred and forty and thirty-three one hundreths cases treated, and forty-seven and three tenths deaths. The daily ratio per one thousand of mean strength, for the twenty days of present month, has been one and five sevenths deaths, which, taken as an average for the thirty days, would make fifty-one and four tenths deaths per one thousand of mean strength for month of June.

The morning report of C. S. Prison shows remaining in hospital one thousand and twenty-two; in quarters, two thousand six hundred and sixty-five; deaths, forty; strength of command, twenty-three thousand nine hundred and eleven.

The number of medical officers on duty at the prison is inadequate to perform the duties required of them. There are in all twelve, seven of whom attend sick-call, and five on duty at hospital. Of the entire number, five are employed by contract. I would suggest that the medical force be increased by ten additional officers.

Respectfully submitted,

ISAIAH H. WHITE,
Chief Surgeon.

Captain HAMMOND.

SANITARY REPORT C. S. MILITARY PRISON HOSPITAL, ANDERSONVILLE, GEORGIA.

Sanitary report of Chief Surgeon White.

There is nothing in the topography of the country that can be said to have influenced the health of the command, except, perhaps, in the immediate camp, through which passes a stream of water, the margins of which are low and swampy, and have been recently drained with a view of reclaiming them sufficiently for camping purposes, the result of which has been to expose to the rays of the summer's sun a large surface covered with decaying vegetable matter, a condition favorable to the production of malarious diseases. This surface is now being covered with dry sand. With this exception, the land is high and well drained, and the soil light and sandy.

The prisoners being from the United States, have been influenced as much, perhaps, by the climate as any other agency. The prison was built to accommodate ten thousand (10,000) prisoners, in which have unavoidably been placed, over twenty-six thousand (26,000), causing

them to become so crowded as to prevent a proper circulation and due allowance of atmospheric air. With this crowded condition there is an absence of barracks or tents; the only protection from the weather being little huts made of boughs, blankets, and small picket tents, used in the U. S. army, which being irregularly arranged, obstruct the free circulation of air. Within the last few days, the Stockade has been increased ten acres, relieving the crowded condition heretofore existing. Barracks are also being constructed; it however is an immense task, and will not soon be completed.

The diet of the prisoners is the same as that issued to Confederate soldiers in the field, namely: one pound beef, or one third pound bacon, one and a quarter pounds meal, with an occasional issue of beans and rice.

There is a great lack of cleanliness on the part of the prisoners. The chief cause of disease and mortality is long confinement in prison, which in connection with the diet (having produced scurvy among them), has so lowered their vitality as to render them unable to resist disease. The hospital in the early part of the quarter being situated within the Stockade, it was impossible to supply the sick with the necessary comforts; hospital bedding, diet, etc., being stolen from the hospital by the prisoners. In the latter part of the month of May, authority was granted to move the hospital without the Stockade. The condition of the sick has been much improved by the change. They are now treated in a hospital camp, well supplied with shade and water. The tents are, for the most part, small and illy adapted to hospital purposes, and insufficient in number to accommodate the large number of sick to be treated. The tents are all filled to excess, and many men are refused admission to hospital for want of room.

During the quarter, the Prison has been, on several occasions, without any medicines whatever. Requisitions are made for one month's supply, which are filled in such diminished quantities as to create the necessity for other requisitions during the month. These have to go to Atlanta for approval; in consequence of the irregularity of the mail, they do not return frequently under eight or ten days; they have then to be sent to medical purveyor at Macon, where they are usually filled with promptness; but before they are received, one half the period drawn for has elapsed, and the former supply is exhausted.

The number of medical officers on duty at the Prison, is inadequate to perform the required duties. There are over twenty-six thousand (26,000) prisoners, with only thirteen (13) medical officers; of this number, five attend the hospital, where there are eleven hundred and thirty-four (1134) sick.

Respectfully submitted,

ISAIAH H. WHITE,
Chief Surgeon Post.

Quarter ending June 30th, 1864.

HEADQUARTERS, POST ANDERSONVILLE, GA.,
MED. DEPARTMENT, *June 26th*, 1864.

Report of Chief Surgeon White to Surgeon Beemis, acting director of hospitals.

SIR, — I have just established a hospital for the troops on duty at this post, to accommodate one hundred sick, and have assigned Assistant-Surgeon W. B. Harrison in charge. Be pleased to instruct me through what channel medical officers serving with the troops doing duty at this post are to report.

On the removal of the hospital from the Stockade, I informed you what accommodation I had made for the sick. The strength of the command having increased to twenty-five thousand men, more than double that for which hospital accommodations were prepared, the hospital is now filled far beyond its healthy capacity. I have tents of all kinds to accommodate eight hundred men, in which I have been compelled to crowd over twelve hundred, being unable to procure others. General Winder, commanding post, has telegraphed to Richmond, to see if we can obtain the tents that were occupied by the prisoners on Belle-Isle, at Richmond, Va.; if successful, it will take some weeks for them to reach here. For humanity's sake, please assist me in obtaining two hundred tents at once. There are nearly three thousand (3000) sick in the Prison, many of whom require hospital treatment, which cannot be furnished because of the already crowded condition of the hospital. It is impossible to get tents from the quartermaster in this department.

The number of medical officers on duty here is utterly inadequate to perform the duties required of them. There are one thousand and thirty-five patients in hospital, with only five medical officers, only eight to attend sick-call at the prison, with a command of twenty-five thousand men, daily increasing. Please assign one or more good surgeons, that I can place in charge of the different divisions of the prison hospital.

The direct contact with which the surgeon in charge of the prison hospital is brought with the commandant of the interior of the prison would produce incalculable discord and confusion if he were not willing to coöperate, and forego many things that would be desired for the proper arrangement of a hospital. I hope you will consider these things in making the assignment. Send a man of sufficient intelligence and zeal for the cause, to duly appreciate all the disadvantages to be encountered.

Surgeon Stout's communication of the 7th inst., in relation to recommending competent private physicians for contract has been received. Being an entire stranger here, I have no one to recommend. It seems impossible to obtain any one exempt from military service; almost any employment being more lucrative. I am aware that the recent operations of the army have created a great demand for medical officers in

your department, and it is with great reluctance that I urge the necessity of assigning at least ten additional medical officers.

Very respectfully,

Your obedient servant,

ISAIAH H. WHITE.

Chief Surgeon of Post.

S. M. Beemis, Surgeon P. A. C. S. }
Actg. Med. Direc. Hospitals. }

Chief Surgeon's Office, }
Andersonvillle, Ga., *July* 1*st*, 1864. }

S. P. Moore, Surgeon-General, C. S. A.: —

Sir, — I am instructed by the general commanding, to represent that inconvenience and delay arise in obtaining medical and hospital supplies, in consequence of requisitions being required to be sent to Surgeon Stout, Medical Director of Hospitals at Atlanta, Ga., for approval. In consequence of the irregularity of the mails, eight or ten days frequently elapse before the requisition with approval returns to this office, which has then to be sent to the medical purveyor at Macon. Before the medicines arrive here, two weeks (or one half the period for which requisition is made) have elapsed, creating a scarcity, and in some instances an entire lack of medicines.

Letter of Chief Surgeon White to Surgeon-Gen. Moore.

In addition to prisoners, of which there are twenty-six thousand three hundred and sixty-seven (26,367), the command consists of five regiments, and one company of artillery as guard. I am informed by Surgeon Stout, that medical officers on duty with these regiments do not report through him. Brigadier-General John H. Winder, commanding post, reports directly to Secretary of War, this not being considered a part of any military department in this State. If compatible with the interests of the service, I most respectfully request that I be permitted to report directly to the Surgeon-General, and that the medical purveyor at Macon, Ga., be instructed to issue to this post on requisition with my approval.

Very respectfully,

Your obedient servant,

ISAIAH H. WHITE,

Chief Surgeon Post.

Chief Surgeon's Office, }
Andersonville, Ga., *August* 2*d*, 1864. }

Colonel, — I have the honor to submit the following report of the sanitary condition of the C. S. Military Prison: —

The number of sick on morning report, is one thousand three hundred and five (1305) in hospital, and five thousand and ten (5010) in quarters.

Report of Chief Surgeon White to Colonel Chandler.

The total number of deaths from the organization of the Prison (Febuary 24, 1864), up to date, is four thousand five hundred and eighty-five.

The following table exhibits the ratio per 1000 (one thousand) of mean strength during the different months: —

Month.	Mean Strength.	Deaths.	Ratio per 1000 of Mean Strength.
March	7,500	283	37.4
April	10,000	576	57.6
May	15,000	708	47.2
June	22,291	1,201	53.87
July	29,030	1,817	62.7

Owing to insufficient hospital accommodations, many are treated in quarters who should be in hospital. The present capacity of the hospital is for one thousand four hundred sick. The hospital is situated in an oak grove, affording good shade. Through the prison passes a stream of water, furnishing an ample supply of water for cleanliness. Drinking water is obtained of good quality from wells and springs on the banks of the stream.

The tents are insufficient in number, and not of proper size for the treatment of sick. Most of them are the small fly tent and tent flies. There should be at least two hundred or five hundred wall-tents to properly accommodate the sick.

It has been impossible up to this time to obtain straw for bedding, this not being a grain-growing district. Small crops of wheat have been raised this year, and efforts are being made to collect a sufficient quantity as soon as the present crop is threshed. But there is a lack of transportation at the post, and farmers are unwilling to hire their own teams for the purpose.

The attendants are paroled prisoners, who as a rule are faithful in the performance of their duty, being actuated by the improvement of their own condition on removal from the Stockade, and a fear of a return, if negligent in the performance of duty, apart from a desire to serve their own sick comrades.

The number of medical officers, until the recent call of the militia by the Governor of Georgia, was utterly inadequate; since that time a number of physicians have been employed by contract, and others have been detailed by the Governor to serve in the medical department. These having been but recently assigned, it is impossible to decide upon their proficiency. The other medical officers, with a few exceptions, are capable and attentive. The physicians which have been recently employed will no doubt cancel their contracts as soon as the militia is disbanded, and the services of the detailed physicians will also be lost. With this view, I would suggest that a sufficient number of competent medical officers be assigned.

There is a deficiency of medical supplies issued by the Medical Pur-

veyor. Supplies of medicines have been occasionally entirely exhausted, and we have been left several days at a time without any whatever. This has arisen from the delay experienced in sending requisitions to the Medical Director at Atlanta for approval.

The hospital ration is commuted as for other general hospitals, and supplies for the subsistence and comfort of sick are purchased with the hospital fund. Heretofore we have been able to supply the sick with vegetables, but during the entire month of July the commissary has been without funds, and difficulty has been experienced in purchasing on time. The ration issued to the prisoners is the same as that issued to Confederate soldiers in the field; namely, one third pound pork, one and a quarter pounds meal, with an occasional issue of beans, rice, and molasses. The meal is issued unbolted, and when baked is coarse and unwholesome. Amongst the old prisoners scurvy prevails to a great extent, which is usually accompanied by diseases of the digestive organs. This, in connection with the mental depression produced by long imprisonment, is the chief cause of the mortality.

There is nothing in the topography of the country that can be said to influence the health of the prison. The land is high and well drained, the soil light and sandy, with no marshes or other source of malaria in the vicinity.

The densely crowded condition of the prisoners, with the innumerable little shelters irregularly arranged, precludes the enforcement of proper police, and prevents free circulation of air.

The lack of barrack accommodation exposes the men to the heat of the sun during the day, and to the dews at night, and is a prolific source of disease. The margins of the stream passing through the Stockade are low and boggy, and having been recently drained, has exposed a large surface covered with vegetable mold to the rays of the sun, a condition favorable to the development of malarious diseases.

It is the design of the commandant of the prison to cover the surface with dry sand, but the work has been unavoidably delayed.

The absence of proper sinks and the filthy habits of the men have caused a deposit of fecal matter over almost the entire surface of this bottom land. The point of exit of the stream through the walls of the Stockade is not sufficiently bold to permit a free passage of ordure. When the stream is swollen by rains the lower portion of this bottom land is overflowed by a solution of excrement, which subsiding, and the surface becoming exposed to the sun, produces a horrible stench. Captain Wirz, the commandant of the prison, has doubtless explained to you the difficulties which have prevented these with other projected improvements in the way of bathing and other arrangements for cleanliness.

Very respectfully, your obedient servant,

ISAIAH H. WHITE,
Chief Surgeon of Post.

To Colonel CHANDLER.

REPORT OF CHIEF SURGEON WHITE TO GENERAL WINDER ON THE SANITARY CONDITION OF THE MILITARY PRISON AT ANDERSONVILLE.

CHIEF SURGEON'S OFFICE,
ANDERSONVILLE, GA., *August 6th*, 1864.

GENERAL, — I have the honor to submit the following report of the sanitary condition of the C. S. Military Prison : —

I. *Medical Topography of the Station.* — The location is high and well drained ; the soil light and sandy. Near the Stockade, in a southward direction, is a creek whose margins are muddy and boggy. Through the centre of the Stockade passes a smaller stream of similar character. The condition is favorable to the development of malarious diseases, but the report of the sick and wounded for the month of July exhibits a small ratio of this class of diseases. Out of ten thousand six hundred and twenty-one cases treated, only five hundred and five are of a malarious character. This cause appears to have acted more on the garrison than on the prisoners ; out of sixteen hundred and three cases treated, one hundred and forty-five malarious diseases are reported.

II. *The Climate.* — The climate is hot, and the prisoners coming from a much higher latitude have been influenced greatly by this agency.

III. *Nature of Barracks and Hospital Accommodations.* — The prisoners are without barracks or tents. Thirty thousand men being densely crowded together, sheltered only by blankets and low hovels densely and irregularly arranged, preventing free circulation, engendering foul and noxious vapors, and precluding any system of police ; the men are exposed during the day to the rays of the sun, and the dews at night, and many are unprotected during the rains.

IV. *The Hospital Accommodations* are utterly inadequate to accommodate the large number of sick. The hospital is located in a grove, on the banks of the creek, southeast of the Stockade. The site is the most eligible in the vicinity, with the present appliances. There is a great deficiency in the number of tents in which the sick are treated ; they are also too small for hospital purposes. A constant increase in the number of prisoners, and hence of the sick, has called for a continued expansion of hospital accommodations. The hospital camp was first designed to accommodate one thousand sick, and was fitted up as best could be with the means at hand. Since that time the number of sick in hospital has increased to two thousand two hundred and eight, and three hundred and seventeen attendants ; total, two thousand five hundred and twenty five ; the result of which has been to place the hospital in a constant state of organization, and the efforts to make some provision for all have resulted in leaving all portions of the hospital in an unfinished state. All the tents of the original camp have been filled with bunks ; at present the quartermaster cannot furnish plank to complete the others. It has been impossible to obtain straw for bedding, there being none in the country until the present crop. The

chief surgeon has made every effort to have it supplied. Until the number of sick became so large, pine straw was used for the purpose, but it being necessary to renew the supply once in two weeks (in consequence of vermin), it is impossible to obtain a sufficient quantity. It would require five wagons constantly employed to furnish an adequate supply. The chief surgeon has instructed the agent for the purchase of supplies, after subsistence or comfort of sick, to purchase wheat straw and ship by railroad, the quartermaster having failed to supply us.

V. *Diet.* — The ration consists of one third pound bacon, one and a quarter pounds meal. The meal is unbolted, and when baked, the bread is coarse and irritating, producing diseases of the organs of the digestive system (diarrhœa and dysentery). The absence of vegetable diet has produced scurvy to an alarming extent, especially amongst the old prisoners.

VI. *Water.* — The drinking water is obtained from springs settled on the banks of the stream and from wells, and to some extent from the stream. The water obtained from the stream is unfit for use, containing many impurities from the bakery and cook-house. Some of the camps of the garrison are situated on this stream, the surface drainage from which empties into this stream before passing through the Stockade. The supply from the springs near the stream is a little brackish, but better than the stream. A large number of wells have been dug in the prison, affording water of excellent quality.

VII. *Clothing.* — Those who have been prisoners for a long time are badly supplied with clothing, and but few of them have a change, in consequence of which they are for the most part very filthy.

VIII. *General Habits of the Men as to Cleanliness.* — With but few exceptions, they are very filthy as regards their person and clothing, and do not seem to appreciate the great necessity for bathing.

IX. *Police System of the Camp.* — This is sadly defective. Amongst the very shelters, under their very noses, when asleep, fæces are deposited. The bottom land, through which the stream passes, is filthy beyond description. The character of the land is low and swampy; a large surface covered with vegetable mould is exposed to the rays of the sun, a condition favorable to the development of malarious diseases. This appears to be the place where all who have not the energy and cleanliness to go beyond the camping ground defecate, until it has become a morass of human excrement. The place of exit of the stream beyond the Stockade is not sufficiently bold to permit a free efflux, and the fall of the stream beyond the Stockade is not great enough. When the stream is swollen by rains, the lower portion of this bottom land within the Stockade, and for some distance outside, is overflowed with a solution of human excrement, which subsiding, and becoming exposed to the sun, produces an intolerable stench, which, if not corrected before the fall months, will in all probability produce some epidemic form of disease increasing the already frightful mortality.

X. *Crowded Condition of the Prisoners.* — The prison is filled far beyond its healthy capacity. The number of prisoners should be reduced sufficiently to admit of their camps being regularly laid out, with streets of sufficient width to admit free circulation of air, and the enforcement of stringent police regulations. An area of sufficient size should be left for exercise.

XI. *Mental Depression.* — Long confinement and hope deferred have produced with many of the prisoners a state of mental depression dreaded by the physician, even in civil practice, which, combined with the existing state of physical debility, renders them unable to resist disease.

THE EVILS WITHIN THE POWER OF THE PROPER AUTHORITIES TO CORRECT.

I. *The Crowded Condition of the Prisoners.* — The number within the Stockade should not exceed fifteen thousand. This would allow ample room for the remainder to be camped in order, with streets of sufficient width to allow free circulation of air, and enforcement of police regulations. All that portion of the camp on the north side of the stream could then be used for exercise, where roll-calls could also be held, thereby materially aiding the commandant of the interior.

II. *Construction of Barracks and Hospital Accommodations.* — There should be no delay in the construction of barracks; with the greatest amount of energy it will be difficult to complete them before the cold weather comes on, when they will be required more than at present. Too great stress cannot be placed on the necessity for the construction of proper accommodations for the sick. There are at present two thousand two hundred and eight in hospital, all poorly provided for, and some three hundred without any shelter whatever. There are also at least one thousand men now in Stockade who are helpless, and should be at once removed to hospital. Their removal is prevented by the absence of accommodations. The construction of hospitals should be at once begun, and in the mean time the sick should be at once transferred to some points where they can be properly provided for. An officer should be employed to arrange the stream passing through the Stockade. The bottom land should be covered over with sand, the stream be made deeper and wider, the walls and bottom covered with plank; the same arrangements to continue outside, conducting the drainage freely to the creek beyond, and if necessary build a dam to prevent the overflow of the banks. The stream from the Stockade to the railroad should also be improved, and the use of it by the troops or others outside should be prohibited. Sinks should be at once arranged over the stream of such a nature as to render them inviting; at present, those who have an inclination to use them have to wade through mud and fæces to use them. At the upper part of the stream, proper bathing arrangements should be constructed.

III. *Enforce Stringent Police Regulations.* — Some stringent rules of police should be established, and scavenger wagons should be sent in every day to remove the collections of filth. A large quantity of mouldy bread and other decomposing matter scattered through the camp and beyond the dead-line, should be removed at once. If necessary, sentinels should be instructed to fire on any one committing a nuisance in any other place than the sinks.

IV. *Establishment of Regulations in regard to Cleanliness.* — It should be the duty of Confederate sergeants, attending roll-calls, or others, to see that all men of their command bathe at stated intervals, and that their clothes are washed at least once a week. For this purpose soap should be issued to the prisoners.

V. *Improvement in Rations.* — The meal should be bolted or sifted before being issued. Arrangements should be speedily made by which rice, beans, and other anti-scorbutics should be issued during the present season; green corn might be issued in lieu of bread ration, if not regularly, at least three times a week. If possible, the prisoners should be supplied with vinegar, and with an occasional issue of molasses in lieu of the meat ration, which would tend greatly to correct the scurvy which prevails to a great extent.

Very respectfully, your obedient servant,

ISAIAH H. WHITE,

Brigadier-General JOHN H. WINDER. *Chief Surgeon of Post.*

OFFICE OF SURGEON IN CHARGE, C. S. MILITARY PRISON HOSPITAL,
ANDERSONVILLE, GA., *Sept.* 1*st*, 1864.

Report of Surgeon Stevenson to Surgeon-General Moore.

SIR, — Having been assigned to duty in charge of the C. S. Military Prison Hospital at this place, and finding no building of any character whatever for the accommodation of the sick and wounded, I respectfully submit to your consideration the accompanying plan of a series of sheds for the accommodation of the sick and wounded, covering a space of ground four hundred and fifty by nine hundred feet.

These sheds can be erected very rapidly, and with but little expense to the government.

I propose to make these sheds one hundred feet long, twenty-two feet wide, and eight feet high at the eaves. Posts set in the ground, with a streamer running the entire length of the building, twelve inches from the eaves, to which is attached an awning made from old tents (of which any quantity can be procured). This at once gives a ward that will contain fifty patients (the awning to be raised or lowered at pleasure) in a well ventilated room. I propose to erect forty of these sheds, giving ten to the division, with a capacity of five hundred patients to the division, or two thousand to the hospital.

I also propose a cooking, baking, and convalescent dining-room to

each division, with one special diet kitchen and laundry to the whole hospital, the whole to be inclosed with a stockade. Outside the stockade I propose to erect a suitable depot building for the reception of commissary stores, medicines, etc. A hospital of this description can be erected at this post, or any other, where lumber and material are so easily procured, with much less cost to the government than by any other means.

While tents may answer for temporary purposes, I am opposed to using them for permanent hospitals, it being a matter of impossibility to keep them properly policed.

Hoping that this plan may meet with your favorable consideration, and that I will receive your coöperation on this subject,

I have the honor to be,
Very respectfully, your obedient servant,

R. R. STEVENSON,
Surgeon in Charge.

To S. P. Moore, Surgeon-General, C. S. A., Richmond, Va.

Office of Surgeon in Charge, C. S. Military Prison Hospital, Andersonville, Ga., *Sept. 16th*, 1864.

Report of Surgeon Stevenson to Surgeon-General Moore.

Sir, — I have the honor to report to you that I have been assigned to duty by Surgeon I. H. White, Chief Surgeon of Post, in charge of Confederate States Military Prison Hospital.

In assuming the responsibilities of so important a position, and before entering upon my duties, I deem it necessary to make the following statement of the sanitary condition of the hospital, and appliances for the comfort of the sick and wounded. The topography, climate, and prevalent diseases of the country have been given you in former reports by my predecessor; I shall confine myself principally to the following.

I. *Nature of Barrack Accommodations.* — The Stockade (in the shape of a parallelogram) includes twenty-seven acres of ground. A considerable stream of water passes through it, running west and east. In this space of ground, from thirty to forty thousand prisoners have been crowded, with no protection whatever from the burning rays of the sun, except such as could be made from blankets or dirt hovels. Along the banks of the stream the ground is quite boggy, and water is constantly oozing from the low banks. Recently, four sheds have been built inside the Stockade; these were the beginning of a series of barracks capable of accommodating two hundred and seventy men each. A temporary structure is erected on the banks of the stream, and is used as a privy All the inmates of the prison use this horrid cesspool of excrementitious matter as a privy, except the sick, and they are compelled to dig small holes near their hovels and use them for the deposit of fæces. The stream that flows through the Stockade overflowed its low swampy banks

in the early part of the season, and the amount of fæcal matter deposited a short distance from the outside of the Stockade is enormous. At all times of the day and night a most noisome stench arises from the decomposing excrementitious matters deposited in the prison and hospital grounds.

From three to four thousand sick and wounded men are inside the Stockade. The number of medical officers is entirely inadequate to the demands of the sick. At present writing, only four medical officers are on duty; whereas, to take the proper care of the sick and wounded, there should be not less than twenty-five efficient medical officers constantly on duty in the Stockade, in order to meet the wants of the sick, and keep the proper register and reports. Under the present regime, hundreds die in the Stockade, and are buried, whose names and diseases are unknown. This can be remedied by no other means than by a sufficient corps of medical officers. All the medical officers who have been on duty here are detailed men from the militia, and contract physicians, and as a matter of course are very inefficient.

II. *Nature of Hospital Accommodations.* — The Hospital is situated near the southwest corner of the Stockade, covering about five acres of ground, inclosed by a frail board fence. A sluggish stream of water flows through the southern part of the lot. The ground is sloping, and facing the southeast. On the southwest side of the inclosure is a swamp, about three hundred yards in width, and on the northwest side is the stream which flows through the Stockade. The banks being very low, and subject to overflow, from these swamps arise putrid exhalations, at times almost insupportable. It will be seen by the accompanying drawing that the hospital is but a short distance from the confluence of the branch and the creek; and although on rolling table land, it is much lower than the surrounding country, and very near where the branch disembogues from the Stockade, occupying such a position that all the surrounding depressing agencies would seem to centre in the Hospital.

As well as in the Stockade, the number of medical officers is deficient, being composed (with a few exceptions) of men who are either detailed or under contract. On examining the roster, I find that twenty-four medical officers are charged to the hospital, and yet but twelve are on duty. The rest, either by order of Governor Brown (at their own request), are off on sick leave, or leave of indulgence. In order to attend to the wants of the sick and wounded, not less than thirty efficient medical officers should be on duty in the hospital. Confusion will necessarily occur without this number.

From eighteen hundred to twenty-five hundred patients are crowded into this space. Tents of a very inferior quality are the only means of protection, a majority of them being in the small 'A' tents. Temporary bunks are erected in most of them by driving forks into the ground, and placing small poles or boards to lay on; a great number of patients

are compelled to lie on the ground, in consequence of the smallness of the tents. The cooking arrangements are very deficient; two large kettles, erected on a furnace, are nearly all the utensils that are used. The bread is of the most unhealthy character, being made of coarse, unbolted corn meal. This of itself, under the most favorable circumstances, must prove a source of great irritation to the bowels. Scurvy, gangrene, and bowel affections are prevailing at present to an alarming extent. Frequent issues of green corn, pease, molasses, vinegar, rice, flour, and sweet potatoes are being made; and under suitable hospital accommodations, the condition of the sick would be greatly ameliorated. The purveyor's department has been able to supply nearly all the necessary medicines. The indigenous remedies are being extensively used with much good effect. The medical officers in charge of the different wards and divisions are all diligent, and seem willing to discharge their duties, although laboring under many and *great disadvantages.*

Great efforts have been made to make the Stockade secure, and prevent the escape of the prisoners; and but little attention is paid to the hygienic and sanitary condition of the sick.

Surgeon I. H. White, Chief Surgeon of Post, informs me that timely requisitions have been made on the quartermaster's department for the necessary materials to make the sick and wounded comfortable, but thus far he has been able to procure scarcely any thing. The means of transportation being very limited, both by railroad and teams, have proved a source of great annoyance. I would respectfully suggest that the necessary steps be taken to secure transportation for hospital material over all other stores, except ammunition. This would at once remedy a great evil.

The greatest amount of confusion seems to have prevailed in consequence of soliciting attaches for the Hospital from Federal prisoners, in place of disabled Confederate soldiers. Great waste in property, medicines, and provisions has been the result. This I shall endeavor to correct as speedily as possible.

I would respectfully request that an efficient quartermaster and commissary be ordered to report to me for special hospital duty, with full power from the War Department to provide for the comfort of the sick and wounded Federal prisoners. Without an arrangement of this kind, I very much fear the hospital department in C. S. Military Prison will continue to be neglected. Hoping that this communication may meet with favorable consideration,

I have the honor to be,

Very respectfully, your obedient servant,

R. R. STEVENSON,
Surgeon in Charge.

To S. P. MOORE, Surgeon-General, C. S. A.
Richmond, Va.

CHAPTER FIFTH.

CONSOLIDATED REPORT OF SICK AND WOUNDED CONFEDERATE SOLDIERS ACTING AS A GUARD TO THE FEDERAL PRISONERS AT CAMP SUMPTER.

Comparison between the Diseases of the Federal Prisoners and Confederate Soldiers performing Guard Duty. — Malarial and Typhoid Fevers more prevalent amongst the Confederate Troops. — Hospital Gangrene amongst the Confederate Troops.

I FOUND no record of the diseases of the Confederate garrison at Andersonville previous to July.

The following tables present a consolidated report of the sick and wounded of the different regiments and companies composing the Confederate forces guarding the Federal prisoners at Andersonville, Ga., during the months of July and August, 1864.

Report of sick and wounded of Confederate guard at Andersonville.

REPORT OF SICK AND WOUNDED (IN REGIMENTAL HOSPITALS) OF CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA., FOR THE MONTH OF JULY, 1864.

1864	First Regiment, Ga. Res.				Second Regiment, Ga. Res.				Third Regiment, Ga. Res.				Fourth Regiment, Ga. Res.				Fifty-fifth Ga. (Regt.) Detachment.				Fla. Light Artillery.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.		
Febris continua simplex	25	–	12	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	6	–	–	–	44	–
Febris continua communis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Febris intermittens quotidiana	10	–	4	–	–	–	–	–	–	–	–	–	5	–	–	–	5	–	–	–	6	–	–	–	30	–
Febris intermittens tertiana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	3	–	–	–	5	–
Febris intermittens quartana	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	–	–	–	–	–	–	–	–	7	–
Febris remittens	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Febris remittens biliosa	20	–	9	–	–	–	–	–	–	–	–	–	18	–	–	–	13	–	–	–	2	–	–	–	62	–
Febris typhoides	4	–	–	–	3	–	–	–	–	–	–	–	12	–	–	–	–	–	–	–	1	–	–	–	20	–
Erysipelas	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Erysipelas idiopathic	–	–	–	–	4	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	6	–
Rubeola	40	–	20	–	36	–	–	–	42	–	–	–	19	1	–	–	2	–	1	–	–	–	–	–	160	1
Cholera morbus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera sporadica	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Colica	10	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	13	–
Constipatio	–	–	–	–	25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25	–
Diarrhœa acuta	30	–	15	–	5	–	–	–	37	–	–	–	10	–	–	–	9	–	–	–	4	–	–	–	110	–
Diarrhœa chronica	17	–	4	–	–	–	–	–	1	–	–	–	8	–	–	–	4	–	–	–	–	–	–	–	34	–
Dysenteria acuta	–	–	–	–	6	–	–	–	17	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	28	–
Dysenteria chronica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dyspepsia	3	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–
Hepatitis acuta	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–
Hepatitis chronica	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	4	–
Icterus	–	–	–	–	6	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	9	–
Parotitis	5	–	3	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	13	–
Stomatis mercurialis	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–
Glossitis	20	–	9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29	–
Gastritis	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	5	–
Enteritis	6	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	11	–
Enteritis mucosa	–	–	–	–	–	–	–	–	–	–	–	–	13	–	–	–	–	–	–	–	–	–	–	–	13	–
Tonsiliitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Asthma	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	–
Bronchitis acuta	3	–	1	–	2	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	9	–
Catarrhus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Catarrhus simplex	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	8	–
Hæmoptysis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Laryngitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

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REPORT OF SICK AND WOUNDED (IN REGIMENTAL HOSPITALS) OF CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA., FOR THE MONTH OF JULY, 1864. — (*Continued.*)

1864.	First Regiment, Ga. Res.				Second Regiment, Ga. Res.				Third Regiment, Ga. Res.				Fourth Regiment, Ga. Res.				Fifty-fifth Ga. (Regt.) Detachment.				Fla. Light Artillery.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.		
Vulnus punctum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
Vulnus punctum sclopeticum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
All other diseases of this class	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ophthalmia	4	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–
Debilitas	20	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	31	–
Epistaxis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hæmorrhois	20	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	30	–
Scabies	50	–	30	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	81	–
Nostalgia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scrofula	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vermes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	399	–	173	–	98	–	–	–	118	–	–	–	131	1	–	–	57	–	1	–	33	–	–	–	1,010	1

REPORT OF SICK AND WOUNDED (IN REGIMENTAL HOSPITALS) OF CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA., FOR THE MONTH OF AUGUST, 1864.

1864.	First Regiment, Ga. Res.				Second Regiment, Ga. Res.				Third Regiment, Ga. Res.				Fourth Regiment, Ga. Res.				Fifty-fifth Ga. Detachment.				Fla. Light Artillery.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.		
Febris continua simplex	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Febris continua communis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	7	–
Febris intermittens quotidiana	16	–	–	–	–	–	–	–	–	–	–	–	30	–	–	–	1	–	–	–	7	–	–	–	54	–
Febris intermittens tertiana	–	–	–	–	6	–	–	–	6	–	–	–	20	–	–	–	–	–	–	–	2	–	–	–	34	–
Febris intermittens quartana	–	–	–	–	–	–	–	–	–	–	–	–	10	–	–	–	–	–	–	–	–	–	–	–	10	–
Febris remittens	48	–	–	–	32	–	–	–	130	–	–	–	37	–	–	–	13	–	–	–	–	–	–	–	260	–
Febris remittens biliosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Febris typhoides	–	–	–	–	15	2	–	–	–	–	–	–	3	1	–	–	–	–	–	–	–	–	–	–	18	3
Erysipelas	–	–	–	–	2	–	–	–	8	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	11	–
Erysipelas idiopathic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Rubeola	26	–	–	–	21	2	–	–	–	–	–	–	52	–	–	–	–	–	–	–	1	–	–	–	100	–
Cholera morbus	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Cholera sporadica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Colica	1	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	1	–	–	–	5	–
Constipatio	–	–	–	–	29	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29	–
Diarrhœa acuta	214	–	–	–	8	–	–	–	26	–	–	–	19	–	–	–	4	–	–	–	24	–	–	–	295	1
Diarrhœa chronica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–
Dysenteria acuta	8	–	–	–	4	–	–	–	25	–	–	–	6	–	–	–	–	–	–	–	12	–	–	–	55	1
Dysenteria chronica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dyspepsia	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Hepatitis acuta	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	–
Hepatitis chronica	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–
Icterus	5	–	–	–	–	–	–	–	1	–	–	–	6	–	–	–	–	–	–	–	–	–	–	–	12	–
Parotitis	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	3	–
Stomatis mercurialis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Glossitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gastritis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Enteritis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Enteritis mucosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tonsillitis	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–
Asthma	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Bronchitis acuta	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Catarrhus	57	–	–	–	3	–	–	–	–	–	–	–	3	–	–	–	1	–	–	–	4	–	–	–	68	–
Catarrhus simplex	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

(*Continued on next page.*)

REPORT OF SICK AND WOUNDED (IN REGIMENTAL HOSPITALS) OF CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA., FOR THE MONTH OF AUGUST, 1864.—(*Continued.*)

1864.	First Regiment, Ga. Res.				Second Regiment, Ga. Res.				Third Regiment, Ga. Res.				Fourth Regiment, Ga. Res.				Fifty-fifth Ga. Detachment.				Fla. Light Artillery.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.		
Hæmoptysis	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Laryngitis	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–
Phthisis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Phthisis pulmonalis	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Pneumonia	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2	–
Tracheitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cystitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Anæmia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scorbutus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Epilepsia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–
Meningitis	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–
Cerebro-spinal meningitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Irritatio spinalis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Neuralgia	3	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	5	–
Paralysis	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Gonorrhœa	1	–	–	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	–	–	–	–	7	–
Gonorrhœa simplex	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gonorrhœa virulenta	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nephritis	–	–	–	–	–	–	–	–	1	–	–	–	3	–	–	–	1	–	–	–	–	–	–	–	5	–
Nephritis albuminosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Orchitis	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	4	–
Varicocele	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis primitiva	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Hæmatocele	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hydrothorax	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hæmatemesis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Fistula in ano	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Anasarca	–	–	–	–	–	–	–	–	4	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	5	2
Ascites	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2
Lumbago	2	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	5	–
Rheumatismus acutus	8	–	–	–	–	–	–	–	8	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	17	–
Rheumatismus chronicus	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	1	–	–	–	–	–	–	–	3	–
Abscessus	5	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	8	–
Abscessus acutus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paronychia	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–

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REPORT OF SICK AND WOUNDED (IN SUMPTER HOSPITAL) OF THE CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA.

1864.	July.				August.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.		
Febris continua simplex	–	–	–	–	–	–	–	–	–	–
Febris continua communis	–	–	–	–	–	–	–	–	–	–
Febris intermittens quotidiana	–	–	–	–	13	–	–	–	13	–
Febris intermittens tertiana	12	–	–	–	–	–	–	–	12	–
Febris intermittens quartana	–	–	–	–	–	–	–	–	–	–
Febris remittens	–	–	–	–	–	–	–	–	–	–
Febris remittens biliosa	77	3	–	–	17	–	–	–	94	3
Febris typhoides	26	18	–	–	38	17	–	–	64	35
Erysipelas	–	–	–	–	–	–	–	–	–	–
Erysipelas idiopathic	1	–	–	–	–	–	–	–	1	–
Rubeola	65	–	–	–	17	–	–	–	82	–
Cholera morbus	–	–	–	–	–	–	–	–	–	–
Cholera sporadica	–	–	–	–	1	–	–	–	1	–
Colica	–	–	–	–	–	–	–	–	–	–
Constipatio	–	–	–	–	–	–	–	–	–	–
Diarrhœa acuta	20	–	–	–	6	3	–	–	26	3
Diarrhœa chronica	20	4	–	–	2	2	–	–	22	6
Dysenteria acuta	3	–	–	–	6	4	–	–	9	4
Dysenteria chronica	4	2	–	–	–	–	–	–	4	2
Dyspepsia	–	–	–	–	–	–	–	–	–	–
Hepatitis acuta	–	–	–	–	–	–	–	–	–	–
Hepatitis chronica	–	–	–	–	–	–	–	–	–	–
Icterus	1	–	–	–	–	–	–	–	1	–
Parotitis	–	–	–	–	–	–	–	–	–	–
Stomatis mercurialis	–	–	–	–	–	–	–	–	–	–
Glossitis	–	–	–	–	–	–	–	–	–	–
Gastritis	–	–	–	–	–	–	–	–	–	–
Enteritis	–	–	–	–	–	–	–	–	–	–
Enteritis mucosa	–	–	–	–	–	–	–	–	–	–
Tonsillitis	–	–	–	–	–	–	–	–	–	–
Asthma	–	–	–	–	–	–	–	–	–	–
Bronchitis acuta	2	–	–	–	2	–	–	–	4	–
Catarrhus	–	–	–	–	–	–	–	–	–	–
Catarrhus simplex	–	–	–	–	1	–	–	–	1	–
Hæmoptysis	–	–	–	–	–	–	–	–	–	–
Laryngitis	–	–	–	–	1	–	–	–	1	–
Phthisis	–	–	–	–	–	–	–	–	–	–
Phthisis pulmonalis	–	–	–	–	–	–	–	–	–	–
Pneumonia	2	–	–	–	1	1	–	–	4	1
Tracheitis	–	–	–	–	–	–	–	–	–	–
Cystitis	–	–	–	–	–	–	–	–	–	–
Anæmia	–	–	–	–	–	–	–	–	–	–
Scorbutus	1	–	–	–	–	–	–	–	1	–
Epilepsia	1	–	–	–	–	–	–	–	1	–
Meningitis	–	–	–	–	1	1	–	–	1	1
Cerebro-spinal meningitis	1	1	–	–	–	–	–	–	1	1
Irritatio spinalis	–	–	–	–	–	–	–	–	–	–
Neuralgia	1	–	–	–	–	–	–	–	1	–
Paralysis	–	–	–	–	–	–	–	–	–	–
Gonorrhœa	–	–	–	–	–	–	–	–	–	–
Gonorrhœa simplex	–	–	–	–	–	–	–	–	–	–
Gonorrhœa virulenta	–	–	–	–	–	–	–	–	–	–
Nephritis	–	–	–	–	–	–	–	–	–	–
Nephritis albuminosa	–	–	–	–	–	–	–	–	–	–
Orchitis	–	–	–	–	–	–	–	–	–	–
Varicocele	–	–	–	–	–	–	–	–	–	–
Syphilis primitiva	1	–	–	–	–	–	–	–	1	–
Hæmatocele	–	–	–	–	–	–	–	–	–	–
Hydrothorax	1	–	–	–	–	–	–	–	1	–
Hæmatemesis	–	–	–	–	–	–	–	–	–	–
Fistula in ano	1	–	–	–	–	–	–	–	–	–
Anasarca	–	–	–	–	–	–	–	–	–	–
Ascites	1	–	–	–	2	–	–	–	3	–
Lumbago	–	–	–	–	–	–	–	–	–	–
Rheumatismus acutus	2	–	–	–	2	–	–	–	4	–
Rheumatismus chronicus	–	–	–	–	1	–	–	–	1	–
Abscessus	–	–	–	–	–	–	–	–	–	–
Abscessus acutus	–	–	–	–	–	–	–	–	–	–
Paronychia	–	–	–	–	–	–	–	–	–	–
Phlegmon	–	–	–	–	–	–	–	–	–	–

(*Continued on next page.*)

REPORT OF SICK AND WOUNDED (IN SUMPTER HOSPITAL) OF THE CONFEDERATE GUARD AT CAMP SUMPTER, ANDERSONVILLE, GA.

(*Continued.*)

1864.	July.				August.				Totals.	
	Or. Ad.		Re-ad.		Or. Ad.		Re-ad.		Cases.	Deaths.
	C.	D.	C.	D.	C.	D.	C.	D.		
Ulcus	–	–	–	–	2	–	–	–	2	–
All other diseases of this class	–	–	–	–	–	–	–	–	–	–
Contusio	–	–	–	–	–	–	–	–	–	–
Fractura simplex	1	–	–	–	–	–	–	–	1	–
Cephalalgia	–	–	–	–	–	–	–	–	–	–
Mania	–	–	–	–	–	–	–	–	–	–
Hypertrophia cordis	–	–	–	–	–	–	–	–	–	–
Diabetes mellitus	–	–	–	–	–	–	–	–	–	–
Otalgia	–	–	–	–	–	–	–	–	–	–
Strictura urethræ	–	–	–	–	–	–	–	–	–	–
Phymosis	–	–	–	–	–	–	–	–	–	–
Hernia	–	–	–	–	–	–	–	–	–	–
Hernia inguinalis	–	–	–	–	2	–	–	–	2	–
Vulnus incisum	–	–	–	–	–	–	–	–	–	–
Vulnus punctum	–	–	–	–	–	–	–	–	–	–
Vulnus punctum sclopeticum	1	–	–	–	2	–	–	–	3	–
All other diseases of this class	–	–	–	–	–	–	–	–	–	–
Ophthalmia	–	–	–	–	–	–	–	–	–	–
Debilitas	4	–	–	–	1	–	–	–	5	–
Epistaxis	–	–	–	–	–	–	–	–	–	–
Hæmorrhois	–	–	–	–	–	–	–	–	–	–
Scabies	–	–	–	–	–	–	–	–	–	–
Nostalgia	–	–	–	–	–	–	–	–	–	–
Scrofula	–	–	–	–	–	–	–	–	–	–
Vermes	–	–	–	–	–	–	–	–	–	–
Totals	248	28	–	–	119	28	–	–	367	56

GENERAL SUMMARY.

Hospital.	Month.	Remaining Last Report.			Taken Sick during the Month.	Aggregate.	Sent to General Hospital.	Returned to Duty.	On Furlough.	Discharged.	Died.	Remaining.			Mean Strength.			Number Treated.	Deaths.	Ratio per 1000 of Mean Strength.	
		Sick.	Convalescent.	Total.								Sick.	Convalescent.	Total.	Officers.	Enlisted Men.	Total.			Cases.	Deaths.
	1864.																				
First Regiment Ga. Res.	July	114	–	–	425	734	33	547	26	2	2	126	–	734	45	684	729	620	2	113.06	–
	August	–	–	–	455	–	31	356	21	1	–	45	–	455	45	756	801	455	–	568.04	–
Second Regiment Ga. Res.	July	45	–	45	152	197	13	130	4	–	2	47	–	47	42	433	475	152	2	–	–
	August	47	–	47	130	177	21	86	1	–	4	15	50	65	43	582	625	130	4	208	6
Third Regiment Ga. Res.	July	38	–	38	254	292	24	64	–	–	–	204	–	204	45	974	1,019	254	–	–	–
	August	70	–	70	215	285	9	242	–	1	–	34	–	34	46	987	1,033	276	–	28	–
Fourth Regiment Ga. Res.	July	74	–	74	133	207	51	55	11	1	1	88	–	88	45	650	695	133	1	–	–
	August	50	38	88	229	317	17	230	15	–	1	40	13	53	42	750	792	229	1	289.14	1.35
Fifty-fifth Ga. Detachment	July	18	–	–	57	78	2	43	5	–	–	28	–	28	9	225	234	57	–	–	–
	August	28	–	28	30	58	–	42	5	–	–	11	–	11	10	224	234	55	–	230.77	–
Fla. Light Artillery	July	114	–	–	425	734	33	547	26	–	2	126	–	734	45	684	729	622	–	–	–
	August	14	–	14	62	76	–	47	2	–	–	13	–	13	4	140	144	62	–	430.556	–
Sumpter Hospital	July	–	–	–	248	250	2	82	43	–	28	91	–	92	–	–	–	274	–	–	–
	August	91	1	92	110	212	1	62	27	–	28	72	2	74	–	–	–	202	–	–	–

Extent of suffering of Confederate troops from disease, and the prevailing diseases.

It will be seen from the preceding table that the Confederate troops composing the garrison suffered severely from disease.

During the months of July and August, with a mean strength of 3755 officers and men, 2117 cases and 6 deaths were entered upon the field, and 367 cases and 56 deaths were entered upon the hospital reports. If the hospital report be consolidated with the field report, the per cent. of cases to mean strength would be 66.1. Nearly one fourth, or 584, of the cases of disease are recorded as acute and chronic diarrhœa and dysentery. In the hospital nearly one fifth of the cases of diarrhœa terminated fatally; and six out of thirteen cases of dysentery, or very nearly one half, died.

No case of typhus fever was reported amongst either the Federal prisoners or Confederate troops.

The prevalence of typhoid fever among Confederate soldiers greater than among the prisoners.

During a period of six months, from 1st of March to 1st of September, 1864, 473 cases and 185 deaths from typhoid fever were recorded amongst the Federal prisoners, the number of the prisoners confined during this period being about 40,-611. The per cent. of deaths from this disease amongst the Federal prisoners was 39.1, or one death in 2.55 cases. In the Confederate forces guarding the Federal prisoners during the months of July and August, with a mean strength of 3755 officers and men, 102 cases of typhoid fever, with 38 deaths, were recorded. The ratio of deaths to cases of typhoid fever were very nearly as great amongst the Confederate troops as amongst the Federal prisoners, being one death in 2.68 cases, or 37.2 per cent. of deaths. The ratio of cases of typhoid fever to the mean strength amongst the Confederate forces was, however, nearly three times as great as amongst the Federal prisoners; being in the former in the ratio of one case of typhoid fever in 36.8 men, or 2.71 per cent. of the entire command, suffered with typhoid fever; and in the latter, one case of typhoid fever in 86 Federal prisoners, or 1.16 per cent. of the mean strength.

The greater prevalence of typhoid fever amongst the Confederate troops is still further shown by the fact that these statistics related to only two months, whilst those of the Federal prisoners embrace a period of six months.

This difference appears to be due to the fact that the Confederate forces were composed of reserves between the ages of sixteen and eighteen, and forty and fifty years, and had been but recently collected together for service. They were raw troops who had not

as yet passed through the diseases of camp. On the other hand, the Federal prisoners had passed through most of the diseases incident to raw troops, as measles and typhoid fever.

Greater prevalence of malarial fever.

It is also worthy of note that the various forms of malarial fever prevailed more extensively amongst the Confederate forces than amongst the Federal prisoners; for during the period of only two months, July and August, 581 cases were reported, or 15.4 per cent. of the mean strength of the Confederate troops; whilst amongst the Federal prisoners, during a period of six months, from the 1st of March to the 1st of September, the cases of malarial fever (remittent, intermittent, and congestive) numbered 2958, and the deaths 113; that is, 7.2 per cent. of the mean strength of the Federal prisoners were affected with malarial fever during this period of six months.

The Federal prisoners were imprisoned in a hot, and to a certain extent, malarious climate. They were to a great extent unaccustomed to either the extreme heat, or the malaria of the swamps.

The Confederate forces, on the other hand, were natives of the soil, and had been in many cases subjected to these influences from birth.

It would have been but reasonable to suppose that the former would have suffered more severely from malarial fever than the latter.

We can only account for the comparative immunity of the Federal prisoners on the supposition that the artificial atmosphere created by the immense accumulations of filth and human excrements within and around the Stockade and Hospital counteracted or destroyed in some unknown manner the malarial poison.

Confederate troops affected by emanations from the Stockade and Hospital.

The emanations of the Stockade and Hospital appeared to affect even the Confederate troops, and especially when, as in the first two or three months after the establishment of the prison, they were encamped immediately around the walls.

I was informed by the Confederate surgeons that when the Confederate troops were camped within a short distance of the Federal prisoners, the mortality was far greater than during the months of July and August, after their removal to the adjoining hills, from half to three fourths of a mile off. I had selected a commanding eminence immediately overlooking the Stockade upon which to pitch my tent, during the prosecution of my labors in the Prison and Hospital, but was induced to remove my quarters across the railroad to a shady hill, upon the advice of one of the surgeons,

who informed me that the regiment camped upon that spot originally selected had suffered heavily with a fatal form of continued fever.

During the months of July and August 2494 cases of disease were recorded amongst the Confederate troops; that is, 66.4 per cent. of the entire command was entered upon the sick list during this short period, and the loss by death, although far less than amongst the Federal prisoners, still amounted to 2.2 per cent. If the same mortality continued through the entire year, the command would lose by death alone 13.2 per cent. of the mean strength. Such mortality would insure the complete obliteration of the command by disease alone in the short period of about seven years and seven months. From the testimony of the surgeons in charge of the Confederate troops, I was led to believe that the ratio of mortality had been even much greater than this whilst the forces were camped in close proximity to the Prison and Hospital.

In the chapter upon hospital gangrene, we will show that the Confederate soldiers guarding the prisoners were in several instances attacked with hospital gangrene, in small sores and abrasions.

CHAPTER SIXTH.

DISEASES OF FEDERAL PRISONERS AT ANDERSONVILLE WHICH WERE REFERABLE TO CLIMATIC CHANGES, EXPOSURE, ETC.

Diseases of Federal Prisoners Confined at Andersonville, which were referable chiefly to Climatic Changes and Influences. — Malarial Fevers; Quotidian, Tertian, and Quartan Intermittents; Remittent and Congestive Fevers. — Sun-Stroke. — Comparison of the Statistics of Malarial Fevers amongst the Federal Prisoners, with the Sick Reports of the Confederate Troops.

Diseases amongst the Federal Prisoners which were referable in a large measure to Exposure without Proper Clothing and Shelter from the Hot Sun, Rain, Dew, and Night Air. — Pneumonia, Pleurisy, Bronchitis, Catarrh, Acute and Chronic Rheumatism, Pericarditis. — Relations of Rheumatism to Scurvy.

MALARIAL FEVER.

Total number of cases among the prisoners from March to August inclusive, 1864.

THE following table presents the total number of cases of intermittent, remittent, and congestive fever entered upon the sick reports of the Federal prisoners during six months, — March to August, 1864. While it is evident from the results of the examinations recorded in the fourth chapter that these statistics are below rather than above the absolute numbers, still it does not appear that the errors were greater in this class of diseases than in the others, and in fact from the nature of malarial fever we would be disposed to consider them less.

TABLE OF CASES OF MALARIAL FEVER AND DEATHS AMONGST THE FEDERAL PRISONERS CONFINED AT ANDERSONVILLE DURING SIX MONTHS, MARCH TO AUGUST, 1864.

Month and Year.	Mean Strength.	Intermittent Fever, Quotidian.		Intermittent Fever, Tertian.		Intermittent Fever, Quartan.		Remittent Fever.		Congestive Fever.		Total Cases of Malarial Fever.	Total Deaths from Malarial Fever.	Total Cases of all Diseases and Wounds entered during Month.	Total Deaths from all Causes.	Per cent. of Cases of Malarial Fever amongst Cases of all Diseases.	Per cent. of Deaths from Malarial Fever to Cases of Malarial Fever.	Per cent. of Deaths from Malarial Fever amongst Deaths from all Causes.	Cases of Malarial Fever in so many of Mean Strength.	Deaths from Malarial Fever in so many of Mean Strength.	Per cent. of Deaths from Malarial Fever in Mean Strength.	Per cent. of Cases of Malarial Fever in Mean Strength.
		C.	D.	C.	D.	C.	D.	C.	D.	C.	D.											
1864.																						
March	7,500	-	-	35	2	-	-	37	5	-	-	72	7	1,530	283	4.7	9.7	2.4	104	1,071	0.09	0.9
April	10,000	10	4	24	-	-	-	10	1	5	-	49	5	2,425	576	2.0	10.2	0.86	204	2,000	0.05	0.4
May	15,000	481	9	385	-	114	-	181	9	1	1	1,162	19	8,583	708	13.5	1.6	2.6	12.9	784	0.12	7.7
June	22,291	205	7	192	-	25	-	240	13	-	2	662	22	7,968	1,201	8.3	3.3	1.8	33.7	1,013	0.09	2.9
July	29,030	150	7	139	-	56	-	160	15	1	2	506	24	10,834	1,952	4.5	4.7	1.2	57.3	1,209	0.08	1.7
August	32,899	324	29		-	-	-	190	12	1	1	515	42	11,346	2,992	4.5	8.0	1.4	63.8	783	0.12	1.5
Totals . . .	21,120	1,170	56	775	2	195	-	818	55	8	6	2,966	119	42,686	7,712	6.9	4.0	1.5	13.7	341	0.26	14.00

This table establishes —

Conclusions respecting malarial fever drawn from the foregoing table.

1st. With the increase of heat in May, there was an increase of cases of malarial fever, both absolutely in relation to the mean strength, and relatively to the entire number of sick.

2d. From the month of May there was a progressive decrease of cases of malarial fever, both absolutely in relation to the mean strength, and relatively to the entire number of sick.

The reverse condition existed amongst the Confederate forces during the months of June, July, and August.

The march of malarial fever amongst these Federal prisoners did not conform to the almost universal law of the progressive increase of these diseases during the months of May, June, July, August, and September in the Southern States.

We can account for the progressive diminution of malarial fever only upon the supposition that just in proportion as the Stockade and Hospital became crowded and foul, and possessed of an artificial atmosphere reeking with the effluvia from human excrements, and fermenting bread and offal of all kinds, the malarial poison was either destroyed, or its action was neutralized by more powerful deleterious agents.

The comparative immunity from the action of malaria of large bodies of human beings, whether congregated in armies or cities, would appear to favor the view that the malarial poison is definite in amount and constitution, and is either so diluted by its action upon large masses, that it fails to induce its usual effects, or else that it is neutralized by the action of animal exhalations.

Such facts as these, established by this great experiment upon forty thousand men, suddenly translated from northern regions to a hot, malarious climate, and crowded upon a small space of land which rapidly became loaded with all manner of filth, militated strongly against the doctrine of the cryptogamic origin and propagation of malarial fever. In this immense mass of putrefying excrements and bread there existed apparently a most suitable nidus for the development and rapid multiplication of almost all the lower forms of microscopical plants and animals; and in fact I have never seen so extensive and rapid a production and growth of cryptogamous plants as was manifested in the fragments of bread scattered in and around the Stockade and Hospital. The corn bread thrown away in large quantities by the prisoners soon became thoroughly penetrated and coated over with fungi. The development of animalcules as well as of myriads of maggots in the human excrements consisting in large measure of undigested food,

and various morbid products, as bloody and serous evacuations, was great beyond anything that I had ever conceived.

All the conditions appeared to exist in this hot and filthy place for the generation of yellow fever, except sea air and foreign importation, and yet no case was reported during the season most favorable to its development.

3d. But a comparatively small number of the Federal prisoners were affected with malarial fever, and the deaths from this disease amounted to but a very small fraction of the deaths from all causes. Thus the per cent. of the cases of malarial fever to the mean strength was 7.3, to the entire cases of all diseases, 6.9; and the ratio of deaths from malarial fever to the mean strength was only 0.26 per cent., and 1.5 per cent. of the deaths from all causes.

The small number of cases of, and deaths from, malarial fever.

Malarial fever prevailed to a far greater extent amongst the Confederate troops serving in the department of South Carolina, Georgia, and Florida; and in certain localities the efficiency of entire commands was greatly impaired by the various forms of paroxysmal fever.

The following table, illustrating the numerical relations of malarial fever to other diseases, and its effects in reducing the strength of the command serving at Fort Jackson, and the surrounding river batteries situated in the low rice lands of the Savannah River, will furnish data for comparison.

Numerical relations of malarial fever to other diseases.

CASES OF MALARIAL FEVER, AND OF ALL DISEASES OCCURRING DURING A PERIOD OF FIFTEEN MONTHS, OCTOBER, 1862, TO JANUARY, 1864, IN THE CONFEDERATE COMMAND SERVING IN AND AROUND FORT JACKSON, ON SAVANNAH RIVER, A SHORT DISTANCE BELOW THE CITY OF SAVANNAH, GA.

Month and Year.	Congestive Fever.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Cases Malarial Fever.	Total Cases of all other Diseases entered during the month.	Total Cases of all Diseases entered during the month.	Aggregate Sick each month.	Mean Strength, Officers and Men.
1862.										
October	–	262	71	–	12	345	126	471	583	872
November	–	67	24	–	5	96	44	140	218	913
December	–	128	58	–	11	197	118	315	350	913
1863.										
January	–	42	88	–	5	135	172	307	331	1,144
February	–	85	104	–	9	198	149	347	428	913
March	–	78	133	33	2	246	143	389	458	913
April	–	37	157	–	4	198	226	424	489	913
May	–	62	76	–	2	140	184	324	360	878
June	–	66	66	–	10	142	131	273	316	878
July	–	77	177	–	67	321	137	458	504	878
August	–	97	149	–	134	380	103	483	533	890
September	–	149	127	–	134	410	98	508	588	822
October	–	97	108	–	62	267	133	400	485	660
November	1	47	54	–	22	124	60	184	235	789
December	1	41	62	–	10	114	111	225	279	800
Totals	2	1,335	1,444	33	489	3,313	1,936	5,248		

Analysis of foregoing table.

In an average command of 878 men, stationed at Fort Jackson and the surrounding river batteries, nearly one half, or 410 men, on an average, were entered on the sick list each month, and the new cases of malarial fever averaged each month 220.

During this period of fifteen months, 3313 cases of malarial fever in the form of congestive fever, quotidians, tertians, quartans, and remittents occurred; whilst all other diseases, including also those diseases, as neuralgia and dropsy, which might be traced in a measure to the action of malaria, numbered 1935 cases, or only a little more than one half the number of cases of malarial fever.

Throughout the entire period more than one fourth the command were unfit for duty; and during the fall months more than one half of the garrison was on an average incapable of performing military duty.

In this command of less than 1000 Confederate troops during six months, March to August, 1863, 1427 cases of malarial fever were entered upon the sick list, whilst amongst the 40,000 Federal prisoners confined at Andersonville, during the same months in 1864, only about twice as many, or 2966 cases of malarial fever, were reported.

Relations of cases of, and deaths from, malarial fever to the mean strength, cases of other diseases, and deaths from all causes among the Confederate troops.

From the following tables may be gathered the numerical relations of the cases and deaths of malarial fever to the mean strength, and to the total cases and deaths from all causes, amongst the Confederate troops serving to the south and southeast of Andersonville, along the coast of South Carolina, Georgia, and Florida.

TABLES GIVING THE NUMBER OF OFFICERS AND MEN (MEAN STRENGTH), THE TOTAL CASES OF ALL DISEASES AND WOUNDS, THE NUMBER OF DEATHS FROM ALL CAUSES, AND THE CASES AND DEATHS OF MALARIAL FEVER AMONG THE CONFEDERATE TROOPS SERVING IN THE DEPARTMENT OF SOUTH CAROLINA, GEORGIA, AND FLORIDA, JANUARY, 1862, TO JULY 1863, CONSOLIDATED AND CLASSIFIED FROM FIELD AND HOSPITAL REPORTS IN SURGEON-GENERAL'S OFFICE, RICHMOND, VA., BY JOSEPH JONES, SURGEON P. A. C. S.

TABLE I.—FIELD REPORTS.

Month and Year.	Mean Strength, Officers and Men.	Total Cases of Disease entered during the month.	Aggregate Cases of Disease treated during month.	Deaths from all Causes.	Congestive Fever.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Deaths from Malarial Fever.	Total Cases of Malarial Fever.	Per cent. of Cases of Malarial Fever in Mean Strength.
1862.												
January	19,148	8,627	10,415	75	8	197	203	5	141	-	554	2.8
February	26,262	6,746	8,724	82	13	139	158	4	173	5	487	1.8
March	25,730	7,305	8,577	78	6	60	220	7	100	-	393	1.5
April	28,986	11,109	11,299	78	16	203	346	33	219	-	817	2.8
May	26,313	11,148	13,558	55	17	366	310	15	297	8	1,005	3.8
June	28,620	10,487	11,923	104	6	591	563	25	504	5	1,689	5.9
July	22,608	9,495	10,828	70	8	1,255	1,253	53	864	9	3,433	15.1
August	23,784	10,091	11,448	52	10	2,189	1,961	114	809	13	5,073	21.3
September	24,266	9,807	11,802	52	8	2,967	1,617	66	507	7	5,156	21.2
October	25,007	9,404	11,693	57	12	1,951	556	128	431	-	3,078	12.3
November	24,710	7,202	9,510	27	5	1,590	1,029	54	125	7	2,799	11.3
December	20,570	5,742	6,895	14	3	927	824	100	51	1	1,905	9.2
1863.												
January	19,709	4,455	5,282	19	1	605	448	40	43	-	1,137	5.7
February	31,880	7,065	8,433	22	11	775	1,200	39	40	1	2,065	6.4
March	38,901	10,157	11,886	28	16	895	1,633	88	148	8	2,780	7.1
April	33,363	9,402	10,885	29	8	629	1,652	63	126	2	2,478	7.4
May	26,307	7,641	8,793	31	14	715	966	61	181	1	1,937	7.3
June	23,109	6,372	7,435	23	2	758	990	46	340	4	2,136	9.2
July	19,478	5,748	6,636	28	9	1,127	843	100	515	3	2,594	13.3
Totals	25,723	157,013		924						74	41,526	161.0

TABLE II.—HOSPITAL REPORTS.

Month and Year.	Total Cases of Disease entered each month.	Aggregate Cases of Disease under treatment.	Total Deaths from all Causes.	Congestive Fever.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Deaths from Malarial Fever.	Total Cases Malarial Fever.	Per cent. of Deaths in Cases treated, Malarial Fever.	Total Deaths from Malarial Fever in Field and Hospital Reports.
1862.												
January	1,602	1,716	57	1	16	8	8	8	2	41	4.9	2
February	965	1,175	83	-	8	9	-	11	-	28	-	5
March	1,039	1,082	85	2	13	21	1	15	1	53	1.9	1
April	1,726	2,884	20	2	69	17	2	42	-	132	-	-
May	2,168	2,854	142	5	73	62	1	113	3	254	1.1	11
June	3,643	4,348	212	10	261	113	25	455	29	864	3.3	34
July	4,492	5,595	232	20	687	436	2	725	42	1,870	2.4	51
August	2,970	3,922	87	11	860	311	2	478	19	1,662	1.1	32
September	2,355	3,710	104	10	617	318	-	276	19	1,221	1.5	26
October	2,131	3,219	50	6	629	232	2	73	-	942	-	-
November	1,645	2,621	36	4	344	275	-	82	5	705	0.7	12
December	1,350	2,308	48	1	223	195	3	22	-	444	-	1
1863.												
January	1,400	2,341	47	4	150	64	4	13	2	235	0.8	2
February	1,309	2,388	28	1	71	78	4	5	1	159	0.6	2
March	1,758	2,659	79	12	133	95	5	40	4	285	1.4	12
April	2,041	3,047	67	10	158	121	2	61	4	352	1.1	6
May	1,932	3,338	77	12	158	90	-	63	12	323	3.7	13
June	1,634	2,903	57	2	180	45	1	100	6	328	1.8	10
July	3,598	4,869	73	7	489	285	17	241	4	1,039	0.3	7
Totals	39,750		1,584						153	10,967	1.39	227

Analysis of foregoing tables.

During a period of nineteen months, January, 1862, to July, 1863, inclusive, in the Confederate army serving along the sea-coast of South Carolina, Georgia, and Florida, with an average mean strength of 25,723 officers and men, 157,013 cases of disease and wounds were entered upon the field reports, and of this number 41,526 cases were recorded under the heads of the various forms of malarial fever. Congestive fever, quotidian, tertian, and quartan intermittents and remittent fever collectively constituted a little more than one sixth, or 16.3 per cent. of all the diseases entered upon the field reports. The number of cases of malarial fever reported monthly varied from 1.5 per cent. to 21.3 per cent. of the mean strength; and during this period of nineteen months the per cent. of cases of malarial fever in the command was 161; or in other words, each man on an average had been entered upon the sick list with one or the other of the forms of paroxysmal fever 1.6 times.

During this period, 39,750 cases were entered upon the hospital reports, and of this number 10,957 were recorded as congestive, intermittent, and remittent fevers; that is, 27.5 per cent. of all the diseases were unmistakably malarial in their character. The ratio of malarial diseases would be far higher upon the field and hospital reports, if various other affections clearly referable to the action of malaria, as neuralgia, anasarca, anæmia, splenitis, debility, and in many instances diarrhœa and dysentery, were added.

The deaths from all causes in the field numbered 924; in the hospitals, 1584; total in field and general hospital, 2508; giving a ratio of 9.7 per cent. of the mean strength during this period. The deaths from malarial fever numbered 227, or 0.84 per cent. of the mean strength, and 9 per cent. of the deaths from all causes.

If six months corresponding to that period of the year in which the Federal prisoners were confined at Andersonville, namely, March to August, 1862, be selected in the preceding tables, it will be seen that in a command of Confederate troops serving along the Atlantic coast of South Carolina, Georgia, and Florida, with a mean strength of 26,006 officers and men, 12,410 cases of malarial fever were entered upon the field reports, with 35 deaths; and 4835 cases upon the hospital reports, with a mortality of 94, giving a total mortality from malarial fever of 129, whilst the deaths from all causes during these six months numbered 1215. It is evident therefore, from the preceding statistics, that during a period of six months, March, April, May, June, July, and August, 1864, the per cent. of cases of malarial fever in the mean strength of the

Federal prisoners was 7.3; whilst during the same months, in 1862, the per cent. of cases of malarial fever amongst the Confederate forces under consideration was 47.7; the per cent. of deaths from malarial fever amongst total number of Federal prisoners was 0.26; and amongst the Confederate troops from the same causes 0.48 per cent.

Prevalence of malarial fever among Confederate troops around Savannah.

Certain localities suffered much more heavily than other portions of the coast from malarial fever. Thus the Confederate troops manning the lines around Savannah, and the forts in the low rice lands around this city, and in the rich low lands formed by the sediment of the Ogeechee and Savannah rivers, were greatly injured by the malarious influence. During the months of August, September, October, November, and December, 1863, in the command serving on the coast of Georgia, and chiefly in and around Savannah, with an average mean strength of 5898 officers and men, 9 cases of congestive fever, 2930 cases of quotidians, 2596 cases of tertians, 80 cases of quartan intermittents, and 733 cases of remittent fevers were entered upon the field reports, giving a grand total of malarial fevers during this short period of 6339 cases in this small command.

In the fall of the year it was difficult to keep up the Confederate guards in the low rice lands surrounding Savannah, and the soldiers could not be exposed to the damp malarious exhalations from those rich river bottom lands for two or three nights consecutively without being smitten with one or the other of the forms of malarial fever. Many lives were lost, and many constitutions were ruined for life, by the slow action of this hidden poison; and the pale, anæmic, exhausted Confederate soldier, with sallow complexion, enlarged spleen and torpid liver, palpitating heart and depressed spirits, paid a silent but noble tribute to his native land, as he tramped his weary rounds in the still hours of the night along those battlements, still facing with undaunted courage an unseen but deadly enemy.

Difficulty of obtaining quinia.

On account of the strict blockade of the Confederate ports, and from the fact that medicines had been declared contraband of war by the Federal government, it was found to be impossible, or at least impracticable, to protect these men systematically by the daily use of quinine. On the other hand, the United States forces along the Atlantic and Gulf coasts suffered far less than the Confederate troops from malaria, because they occupied, as a general rule, the most healthy sea islands exposed to the sea, and surrounded on the land side by salt-water rivers and

marshes. These islands have been noted for their healthfulness and immunity from malarious diseases since the first settlement of the country. In addition to this, the United States have been open to the commerce of the world, and it is said that the United States medical officers have protected their men wherever exposed in unhealthy malarious localities, by the free use of quinine as a prophylactic.

Malarial fever on the coast of the Gulf of Mexico.

The Confederate forces serving to the southwest of Andersonville, along the coast of the Gulf of Mexico, have in like manner suffered far more severely than the Federal prisoners from paludal fevers, as will be seen by an examination of the following table, giving the numerical relations of malarial fever in the Confederate forces serving on the coast of Alabama.

MEAN STRENGTH, OFFICERS AND MEN, TOTAL CASES OF ALL DISEASES, TOTAL DEATHS FROM ALL CAUSES, AND THE CASES AND DEATHS FROM MALARIAL FEVER IN THE CONFEDERATE FORCES SERVING IN AND AROUND MOBILE, ON THE GULF OF MEXICO, CONDENSED AND CLASSIFIED FROM MONTHLY REPORTS IN SURGEON-GENERAL'S OFFICE, C. S. A., RICHMOND, VA., BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Mean Strength, Officers and Men.	Total Cases Disease and Wounds entered during month.	Aggregate Cases under treatment during Month.	Deaths from all Causes.	Congestive Fever Cases.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Deaths from Malarial Fever.	Total Cases Malarial Fever.	Per cent. of Cases of Malarial Fever in mean strength.
1862.												
January .	8,178	2,918	3,786	96	4	107	129	4	164	1	244	2.9
February .	3,431	1,048	1,239	29	-	8	43	-	55	-	106	3.0
April . .	2,511	1,715	1,948	27	-	15	138	55	65	-	273	10.8
May . . .	4,955	3,444	3,893	46	6	28	250	2	118	5	504	10.1
June. . .	7,025	4,971	6,397	135	8	95	395	4	231	12	733	10.4
July . . .	3,625	3,146	4,426	127	5	123	348	17	350	8	843	23.2
August . .	9,208	5,296	7,099	158	7	176	428	25	492	8	1,128	13.3
September .	9,425	4,929	6,509	72	8	542	465	6	336	5	1,357	14.4
October .	9,126	4,536	6,086	55	3	591	632	11	272	2	1,509	16.5
November .	9,571	3,899	5,453	67	13	593	458	26	142	7	1,232	12.8
December .	8,923	3,610	4,956	74	2	32	1,375	9	110	1	1,528	17.1
1863.												
January .	9,213	3,708	4,956	39	2	255	365	14	86	2	722	7.8
February .	9,231	2,845	4,214	41	7	212	219	19	103	4	560	6.0
March . .	9,417	3,233	4,389	36	1	260	277	55	103	1	696	7.4
April . . .	5,121	1,815	2,829	40	5	105	76	4	71	5	261	5.0
May . . .	4,366	2,063	2,974	58	2	146	129	3	78	-	358	7.9
June . . .	4,683	2,006	3,514	42	2	334	240	8	100	-	684	14.6
July . . .	3,539	3,291	4,611	59	7	286	443	110	292	8	1,140	32.2
Totals .	6,752	58,453		1,201						69	13,668	202.4

Analysis of foregoing table.

From the preceding table it is evident that the Confederate forces serving along the shore of the Gulf of Mexico, and in and around Mobile, suffered even more severely from malarial fever than the forces serving along the Atlantic coast of South Carolina, Georgia, and Florida.

In a command with an average mean strength of 6752 officers and men, during a period of eighteen months, 58,453 cases of disease were entered upon the sick reports, and of this number nearly one fourth, or 13,668 cases, were recorded as congestive, intermittent, and remittent fever. The ratio of cases of malarial fever in the mean strength varied monthly from 2.9 to 32.2 per cent., and the ratio of cases of malarial fever to the mean strength during the entire period of eighteen months was 202.4 per cent. In this command each man on an average was entered upon the sick list, with one or the other of the forms of malarial fever, a little over twice during eighteen months.

Prevalence of malarial fever among Confederate troops in the mountainous regions north and northwest of Andersonville.

The Confederate troops serving in the more elevated and mountainous regions, lying to the northwest and north of Andersonville in Northern Alabama, Mississippi, and Georgia, and in Tennessee, suffered far more severely with the various forms of paroxysmal fever than the Federal prisoners, notwithstanding the advantage of a cooler climate and more elevated country.

The truth of this statement is established by the following statistics relating to the army commanded successively by Generals Albert Sidney Johnston, Beauregard, and Bragg, and known most generally as the Army of Tennessee.

TABLE GIVING MEAN STRENGTH, OFFICERS AND MEN, TOTAL CASES OF DISEASES AND WOUNDS, TOTAL NUMBER OF DEATHS FROM ALL CAUSES, AND THE CASES AND DEATHS FROM MALARIAL FEVER IN THE CONFEDERATE ARMY OF TENNESSEE, CONSOLIDATED FROM MONTHLY REPORTS ON FILE IN SURGEON-GENERAL'S OFFICE, C. S. A., RICHMOND, VA., BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Mean Strength, Officers and Men.	Total Cases of Disease and Wounds entered during Month.	Aggregate Cases treated during the Month.	Deaths from all Causes.	Congestive Fever.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Deaths from Malarial Fever.	Total Cases Malarial Fever.	Per cent. of Cases of Malarial Fever in Mean Strength.
1862.												
April . .	*	22,636	23,821	1,007	44	776	900	94	777	12	2,591	–
May . .	*	10,036	12,487	948	6	348	165	29	329	15	877	–
June . .	40,675	34,114	41,589	1,435	57	1,543	1,307	362	2,487	71	5,756	14.1
July . .	*10,658	11,197	18,547	739	15	629	255	83	927	29	1,909	17.9
August .	30,025	18,251	23,031	455	23	895	1,110	133	1,593	71	3,753	12.5
September	*9,311	2,677	3,034	29	13	301	207	22	97	4	640	6.8
October .	*15,082	5,379	6,505	127	13	518	350	21	230	4	1,212	8.0
November	33,791	9,720	10,947	145	91	541	625	53	268	7	1,578	4.6
December	48,958	19,747	27,070	1,190	28	755	803	109	398	9	2,093	4.2
1863.												
January .	50,604	27,066	33,482	434	13	826	870	86	491	10	2,286	4.5
February	63,494	20,800	28,968	520	26	973	1,096	118	613	25	2,816	4.4
March .	61,226	27,728	35,583	600	48	1,550	1,393	112	908	24	4,012	6.5
April . .	64,441	28,169	36,869	648	46	1,656	1,815	217	1,418	29	5,152	7.9
May . .	55,121	21,873	29,817	481	31	1,373	1,468	158	1,498	13	5,528	10.0
Totals		259,383								323	40,203	

* Returns incomplete.

Analysis of foregoing table.

As far as these returns from the army of Tennessee extend, they exhibit 259,383 cases of disease and wounds entered upon the monthly reports during fourteen months (April, 1862, to May, 1863); and of this number 40,203 were recorded as congestive, intermittent, and remittent fever; that is, 15.5 per cent. of all cases treated were classified under five forms of malarial fever. In this army, the monthly ratio of cases of malarial fever to the mean strength officers and men ranged from 4.2 to 17.9 per cent.

Prevalence of malarial fever in the army of "Stonewall Jackson."

Even the army of General T. J. Jackson ("Stonewall Jackson"), serving in the Valley of Virginia, one of the most elevated and healthy regions of the Confederate States, suffered to a greater extent from malarial fever than the Federal prisoners.

Before instituting an examination of the numerical relations of the malarial affections of this army, it will be of interest to consider the main topographical features of the Valley of Virginia.

According to Captain Jed Hotchkiss of the engineer staff of General "Stonewall" Jackson's army —

Topographical features of the Valley of Virginia.

"This region lies under the isotherm of a mean temperature of seventy-two degrees for the four summer months of June, July, August, and September, and comes within the region of from eight to ten inches of summer rain. . . . In addition to the temperature and the moisture, there is a peculiarity in the location of the Blue Ridge that is an important element in this connection. The Potomac River at Harper's Ferry, at the mouth of the Shenandoah, has an elevation of two hundred and forty-two feet above the sea level; at Waynesboro, on the Virginia Central Railroad, one hundred miles southwest, the Shenandoah has an elevation of one thousand two hundred and sixty-one feet; the mouth of North River of the James, sixty miles southwest, is elevated seven hundred and one feet. These points give us the elevation of the eastern side of the valley, the western base of the Blue Ridge. Again, the summit of the Blue Ridge at Harper's Ferry is about twelve hundred feet; at Rockfish Gap, near Waynesboro, it is nineteen hundred and ninety-six feet; and at the passage of the James, it is, I suppose, about twelve hundred feet. This gives us an average rather too low for the crest of the ridge. The eastern base of the Blue Ridge on the Central Railroad, at Mechum's River, has an elevation of four hundred and forty-nine feet; it is not more than two hundred where the Potomac leaves it, and about six hundred where the James leaves it above Lynchburg. See from these data what a long slope the eastern or sunny side of the Ridge has. But it may be said its elevation is such, that much of it must be exposed to

cold winds and sudden atmospheric changes. We will call attention to a few more figures. The Virginia Central Railroad crosses the Valley of Virginia at right angles to its course, and when it reaches the foot of the North Mountain, on the west side of the valley, it is at an elevation of sixteen hundred feet; three miles further on it is two thousand and seventy-three feet, above tide, higher than the *top* of the Blue Ridge; yet the mountain west of it is two thousand three hundred and seventy-five feet above it, or four thousand four hundred and forty-eight feet above tide; and this is true of the whole chain of the great North or Kitatening Mountain, for the three hundred miles that it stretches in a graceful curve, and under various local names, along the western side of the great valley, parallel to the Blue Ridge, and at a distance from it of about twenty-five miles. It is everywhere from fifteen hundred to two thousand feet higher than the top of the Blue Ridge. And what follows from this? The valley rises from east to west, in its width of twenty-five miles, over five hundred feet. It lies to the sun like a hot-bed; any one knows what follows from that. But further, the North Mountain is to the Blue Ridge a high sheltering wall — it breaks the cold winds to the northeast that come sweeping over the vast plain that stretches from the Arctic Ocean almost to the western base of the Alleghanies; it and the mountains west of it condense the moisture of these winds, and rob them of their snow. Man never built such a wall to protect a vineyard, to throw back upon it the accumulated warmth of a reflector three hundred miles long and two thousand feet high."

The following table gives the numerical relations of malarial fever to the mean strength and total cases of disease and wounds in the army of the Valley of Virginia, under the command of General "Stonewall" Jackson, during a period of ten months, January to October, 1862.

TABLE GIVING THE MEAN STRENGTH, OFFICERS AND MEN, THE TOTAL CASES OF ALL DISEASES, THE NUMBER OF DEATHS FROM ALL CAUSES, AND THE DEATHS FROM MALARIAL FEVER IN THE ARMY OF THE VALLEY OF VIRGINIA, UNDER THE COMMAND OF GENERAL T. J. ("STONEWALL") JACKSON, CONSOLIDATED FROM THE FIELD REPORTS IN THE SURGEON-GENERAL'S OFFICE, C. S. A., RICHMOND, VA., BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Mean Strength, Officers and Men.	Total Cases Disease and Wounds entered during month.	Aggregate Cases of Disease and Wounds treated during month.	Deaths from all Causes.	Congestive Fever.	Intermittent Fever, Quotidian.	Intermittent Fever, Tertian.	Intermittent Fever, Quartan.	Remittent Fever.	Total Deaths from Malarial Fever.	Total Cases Malarial Fever.	Per cent. of Cases of Malarial Fever in Mean Strength.
1862.												
January . .	9,278	4,956	5,663	63	–	11	7	5	13	–	36	0.3
February .	8,193	2,594	3,600	22	5	3	4	4	9	– –	25	0.3
March . .	7,418	1,389	1,615	75	–	1	5	–	7	– –	13	0.1
April . . .	9,554	2,014	2,261	6	18	7	5	1	3	– –	34	0.3
May . . .	16,731	4,856	5,417	100	–	162	113	16	48	– –	339	2.0
June . . .	18,099	8,741	9,758	216	6	156	136	21	210	– –	520	2.8
July . . .	15,589	7,613	8,641	119	9	235	164	65	239	– –	712	4.5
August . .	15,643	6,423	7 294	237	–	167	235	32	305	–	739	4.7
September .	21,123	5,949	6,921	298	1	157	178	12	127	–	475	2.2
October . .	34,200	8,663	9,783	31	–	275	323	34	351	–	983	2.8
Totals . .	15,582	53,198									3,876	24.8

In the army of General Jackson, with an average mean strength of 15,582 officers and men, during a period of ten months, 53,198 cases of disease and wounds were entered upon the field reports, and of this number 3876 were recorded under the heads of congestive, intermittent, and remittent fever.

Greater prevalence of malarial fever in the army of the Valley of Virginia than among the prisoners at Andersonville.

Whilst it is evident from these statistics that the relative number of malarial cases was far less amongst the Confederate troops serving in the elevated, healthy, and long settled and cultivated Valley of Virginia, than amongst the Confederate forces along the Atlantic and Gulf coast, at the same time it is worthy of note that malarial fever was more prevalent in the army of the Valley of Virginia than amongst the Federal prisoners at Andersonville. Thus, during six months of 1862, March to August, 2357 cases of congestive, intermittent, and remittent fever were recorded upon the field reports of General Jackson's army with a mean strength (average) officers and men of 13,839; whilst during the corresponding months in 1864, only 2966 cases of malarial fever were entered upon the sick reports of the Federal prisoners, with an average mean strength during this time of 21,120; or the relative proportion of malarial

diseases in the two bodies of men may be more readily comprehended by stating that in the former seventeen per cent. of the mean strength suffered with one or the other forms of malarial fever; whilst in the latter, fourteen per cent. of the mean strength suffered with the same diseases.

Malarial fever more prevalent among the United States forces than among the prisoners at Andersonville.

And as far as our information extends, even the United States forces, with all the advantage of position, and of unbounded supplies of quinine, and of the best and most wholesome food, suffered more extensively with malarial fever than the Federal prisoners at Andersonville.

"Under the several heads of quotidian, tertian, quartan, and congestive intermittents, 72,810 cases were reported to the Surgeon-General's office during the year ending June 30th, 1862, in reports representing an average annual mean strength of 281,177 men; so that 259 men of every 1000, or more than one fourth of the whole army, suffered from these affections during the year. Of these, 40,375 cases and 32 deaths were reported under the head of quotidian, 26,750 cases and 33 deaths as tertian, 3451 cases and 4 deaths as quartan, and 2234 cases and 351 deaths as congestive."[1]

These results would have been still more striking if remittent fever had been included with the intermittents.

The small number of cases of neuralgia among the prisoners at Andersonville.

The comparative immunity from malarious disease amongst the Federal prisoners is still further shown by the small number of cases of neuralgia entered upon the sick reports; amongst this large body of Federal prisoners, with a mean monthly strength of 21,120, only 33 cases of neuralgia were reported during a period of six months.

Neuralgia, on the other hand, prevailed extensively amongst the Confederate troops, as will be seen by the following table.

[1] *Outlines of the Chief Camp Diseases of the United States Armies, &c.*, by Joseph Janvier Woodward, M. D., A. S. U. S. A.; Philadelphia, 1863, p. 162.

CASES OF NEURALGIA ENTERED UPON FIELD REPORTS OF CONFEDERATE ARMIES SERVING IN SOUTH CAROLINA, GEORGIA, AND FLORIDA, ON THE GULF OF MEXICO, AND NORTHERN ALABAMA, MISSISSIPPI, AND GEORGIA (ARMY OF TENNESSEE), AND IN THE VALLEY OF VIRGINIA (ARMY OF STONEWALL JACKSON).

Month and Year.	Confederate Forces serving in Department of S. C., Ga., and Fla. — Field Reports.		Confederate Forces serving in and around Mobile on Gulf of Mexico.		Army of Tennessee.—Field Reports.		Valley of Virginia.—Army of General T. J. (Stonewall) Jackson.	
	Mean Strength.	Cases of Neuralgia.	Mean Strength.	Cases of Neuralgia.	Mean Strength.	Cases of Neuralgia.	Mean Strength.	Cases of Neuralgia.
1862.								
January	19,148	74	8,178	31	–	–	9,278	102
February	26,262	66	3,431	–	–	–	8,193	58
March	25,730	62	–	–	–	–	7,418	23
April	28,986	87	2,511	9	–	124	9 554	52
May	26,313	103	4,955	33	–	191	16,731	61
June	28,620	65	7,025	34	40,675	297	18,099	84
July	22,608	90	3,625	23	10,658	129	15,589	76
August	28,784	44	9,208	56	30,025	162	15,643	50
September	24,266	54	9,425	21	9,311	31	21,123	61
October	25,007	49	9,126	40	15,082	57	34,200	104
November	24,710	51	9,571	46	33,791	156	–	–
December	20,570	54	8,923	24	48,958	233	–	–
1863.								
January	19,709	48	9,213	56	50,604	227	–	–
February	31,880	72	9,231	52	63,494	238	–	–
March	38,901	111	9,417	39	61,226	367	–	–
April	33,363	64	5,121	20	64,441	366	–	–
May	26,307	45	4,366	12	55,121	237	–	–
June	23,109	37	4,683	20	–	–	–	–
July	19,478	39	3,589	18	–	–	–	–
Monthly Average	25,723		6,752				15,582	

Prevalence of neuralgia among the Confederate forces.

The following table presents the numerical relations of neuralgia to the mean strength and total cases of disease and wounds reported upon the monthly field returns of the various Confederate armies which furnished the mean strength. A number of these reports were defective in not giving the mean strength; these have been excluded. Many reports were missing, especially from those armies which were conducting campaigns, and from the trans-Mississippi Department; and hence the great variations noticed in the mean strength from month to month.

TABLE, GIVING MEAN STRENGTH, TOTAL CASES OF DISEASE AND WOUNDS, AND TOTAL CASES OF NEURALGIA, RECORDED UPON THE FIELD REPORTS OF THE CONFEDERATE ARMIES DURING NINETEEN MONTHS, JANUARY, 1862 — JULY, 1863; CONSOLIDATED AND CLASSIFIED BY JOSEPH JONES, SURGEON, P. A. C. S., FROM MONTHLY REPORTS ON FILE IN SURGEON-GENERAL'S OFFICE, C. S. ARMY.

Month and Year.	Mean Strength, Officers and Men.	Total Diseases and Wounds entered during Month.	Aggregate Diseases and Wounds	Total Cases of Neuralgia entered during Month.
1862.				
January	232,138	90,757	115,416	1,133
February	219,069	71,672	96,463	1,177
March	165,047	50,385	63,387	871
April	58,304	23,243	27,559	381
May	58,690	25,985	30,491	261
June	136,362	78,583	94,487	757
July	79,999	41,700	55,997	649
August	113,407	50,987	64,436	442
September	125,408	42,450	51,432	300
October	156,734	48,605	59,841	566
November	270,480	71,328	90,472	950
December	172,800	67,461	85,769	689
1863.				
January	192,776	76,620	96,053	1,118
February	215,458	60,135	80,889	822
March	313,848	92,788	117,171	1,184
April	190,518	60,407	74,806	558
May	163,711	48,589	63,211	519
June	107,153	33,805	43,114	154
July	72,396	20,849	24,807	254

Finally, I confirmed, by personal inspection of the sick, and by *post-mortem* examinations, the truth of the preceding statement, that the various forms of malarial fever, as well as the results of the action of malaria generally, were comparatively rare amongst the Federal prisoners confined at Andersonville. Diseases with true malarial phenomena and complications were exceedingly rare, and in no case, when the viscera were examined after death, was the bronzed liver and enlarged, softened spleen of malarial fever observed.

Absence of the post-mortem appearances denoting malarial poisoning among the prisoners at Anderson-ville.

SUN-STROKE.

One case and one death from this cause were reported in June, and also in July, and in August fifty-one cases with fifty-one deaths amongst the Federal prisoners at Anderson-ville during six months.

Number of cases among the prisoners at Anderson-ville.

During nineteen months, January, 1862 – July, 1863, sixty-four cases of sun-stroke were reported upon the field reports of the forces serving in Virginia: sixteen in North Carolina; thirty-three in the Department of South Car-

Number of cases among the Confed-erate troops.

olina, Georgia, and Florida; thirteen amongst the forces serving along the Gulf of Mexico; and fifty-eight amongst the large armies serving in and around Vicksburg, and in Mississippi, Alabama, Kentucky, and Tennessee, including the army of Tennessee. During this period of nineteen months, the average monthly mean strength of the Confederate forces reported upon the field reports, on file in the Surgeon-General's Office, C. S. Army, from whence these statistics were consolidated, numbered 160,231 officers and men, and amongst this number one hundred and eighty-four cases of sun-stroke were reported. Considering the heat of the southern climate, and the arduous nature of the service performed by the Confederate troops, this was an inconsiderable number, and the deaths from this cause were comparatively few.

Only eleven hundredths of one per cent. of the Confederate troops were affected with sun-stroke during a period of nineteen months; whilst during six months twenty-five hundredths per cent. of the average mean strength of the Federal prisoners were affected by sun-stroke.

In their debilitated and depressed state, with imperfect shelter from the hot sun, and with little comfort or pleasure in the present, and with but little hope for the future, it is not surprising that the prisoners should have suffered from this cause.

DISEASES AMONGST THE FEDERAL PRISONERS WHICH WERE REFERABLE IN A MEASURE TO EXPOSURE WITHOUT PROPER CLOTHING AND SHELTER.

Enumeration of the diseases thus referable.

Under this head may be classed pneumonia, pleurisy, acute and chronic bronchitis, catarrh, laryngitis, tonsillitis, and acute and chronic rheumatism.

Numerical relations of these diseases to the mean strength, etc.

The following table furnishes the numerical relations of this class of diseases to the mean strength, and to the total diseases from all causes.

DISEASES AMONGST THE FEDERAL PRISONERS WHICH WERE REFERABLE IN A MEASURE TO EXPOSURE WITHOUT CLOTHING AND SHELTER. — PNEUMONIA, PLEURITIS, ACUTE AND CHRONIC BRONCHITIS, CATARRH, LARYNGITIS, TONSILLITIS, PHTHISIS, ASTHMA, ACUTE AND CHRONIC RHEUMATISM. — NUMERICAL RELATIONS OF THESE VARIOUS DISEASES TO MEAN STRENGTH AND TOTAL DISEASES TREATED.

Month and Year.	Pneumonia.		Pneumonia, per cent. of Cases in.		Pneumonia, per cent. of Deaths in.		Pleuritis.		Bronchitis, Acute.		Bronchitis, Chronic.		Catarrh, Epidemic.		Catarrh, Simple.		Laryngitis.		Tonsillitis.		Phthisis.		Asthma.		Rheumatism, Acute.		Rheumatism, Chronic.		Total of these Diseases.		Total Diseases entered during Month.		Mean Strength.	Per cent. of Deaths from Exposure in Mean Strength.	Per cent. of Cases from Exposure in total Diseases.	Per cent. of Deaths from Exposure in Deaths from all Causes.
	Cases.	Deaths.	Mean Strength.	Cases entered during month.	Cases of Pneumonia.	Deaths from all Causes.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Mean Strength.			
1864.																																				
March . .	102	65	1.3	6.6	63.7	22.9	28	9	73	11	15	-	-	-	79	-	20	-	10	-	24	8	-	-	27	-	15	-	393	93	1,530	283	7,500	5.2	24.3	32.8
April . . .	108	58	1.0	4.4	53.7	10.0	19	4	55	6	21	-	-	-	88	2	20	2	-	-	12	-	-	-	10	5	20	-	353	77	2,425	576	10,000	3.5	14.5	13.3
May . . .	103	28	0.6	1.2	27.1	3.9	167	5	101	7	47	-	4	-	308	1	7	-	17	-	16	4	7	-	122	5	101	-	1,000	51	8,583	708	15,000	6.6	11.6	7.1
June . . .	21	41	0.09	0.2	195.2	3.4	17	3	133	9	30	1	-	-	466	3	2	1	8	-	4	4	3	-	88	2	31	-	803	64	7,968	1,201	22,291	3.6	10.0	5.3
July . . .	28	27	0.09	0.2	92.8	1.3	12	5	179	12	25	2	-	-	531	6	-	-	-	-	7	13	8	-	171	2	14	-	975	67	10,839	1,952	29,030	3.3	8.9	3.4
August . .	166	15	0.5	1.4	8.0	0.5	108	6	229	16	-	-	-	-	428	14	23	-	-	-	51	4	-	-	253	4	2	2	1,360	61	11,346	2,992	32,899	3.8	11.1	2.3
Totals . .	528	234	2.5	1.2	44.3	3.0	451	32	770	61	138	3	4	-	1,900	26	73	3	35	-	114	33	18	-	671	18	183	2	4,784	403	42,686	7,712	21,120	22 6	11.2	5.2

Analysis of foregoing table.

During this period of six months, 528 cases of pneumonia, with 234 deaths from this disease, were entered upon the sick reports; nearly one half, or more accurately, 44.3 per cent. of the cases of pneumonia terminated fatally; whilst only 2.5 per cent. of the average mean strength were affected with pneumonia, and it constituted only 1.2 per cent. of all the diseases treated during this period, and the deaths from this disease amounted to only 3 per cent. of the deaths from all causes. 114 cases of phthisis were reported, of which near 29 (28.9) per cent. proved fatal. The cases of pleuritis numbered 451, and the deaths 32, or 7.3 per cent. of the cases treated. Under the head of acute bronchitis, 770 cases are recorded, with 61 deaths; the ratio of deaths to cases in this disease being 7.9 per cent.

The cases of acute and chronic rheumatism numbered 854, or 17.9 per cent. of the total diseases caused chiefly by exposure, and only 2 per cent. of the diseases from all causes; and only 4.2 per cent. of the average mean monthly strength, during this period of six months, were reported as affected with acute and chronic rheumatism.

The ratio of cases of disease, referable chiefly to exposure, to the total diseases entered each month, progressively diminished, as the season advanced and the weather became warm, from 24.3 per cent. in March, to 11.1 per cent. in August; and the ratio of deaths in this class of diseases in like manner diminished progressively in relation to the deaths from all causes, from 32.8 per cent. in March, to 2.3 per cent. in August. The cases of disease resulting chiefly from exposure numbered 4784, or 22.6 per cent. of the mean strength; and 11.2 per cent. of the total diseases and wounds treated during six months; and the deaths from this class of disease numbered 403, constituting 5.2 per cent. of the deaths from all causes.

Numerical relations of these diseases among the Confederate troops.

We will, in the next place, institute a comparison between these results and the numerical relations of the same diseases amongst the Confederate troops.

The following tables will present materials for an impartial comparison.

DISEASES REFERABLE IN A MEASURE TO EXPOSURE AMONGST THE CONFEDERATE FORCES SERVING IN THE DEPARTMENT OF GEORGIA, SOUTH CAROLINA, AND FLORIDA. — PNEUMONIA, PLEURITIS, ACUTE AND CHRONIC BRONCHITIS, CATARRH, LARYNGITIS, ASTHMA, ACUTE AND CHRONIC RHEUMATISM. — NUMERICAL RELATIONS OF THESE DISEASES TO MEAN STRENGTH AND TO TOTAL DISEASES TREATED. CONSOLIDATED FROM MONTHLY REPORTS IN OFFICE OF SURGEON-GENERAL, C. S. A., BY JOSEPH JONES, SURGEON, P. A. C. S.

TABLE I. — FIELD REPORTS.

Month and Year.	Pneumonia.		Cases.													
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Asthma.	Rheumatism, Acute.	Rheumatism, Chronic.	Total Cases of these Diseases.	Total Diseases and Wounds entered during Month.	Mean Strength Officers and Men.	Total Deaths from all Causes.
1862.																	
January	326	10	41	43	28	144	149	36	101	1,650	8	182	172	–	8,627	19,148	75
February	272	27	48	29	17	98	96	20	273	913	8	166	117	–	6,746	26,262	82
March	281	25	45	41	6	111	130	144	192	1,511	13	99	214	–	7,305	25,730	78
April	407	–	81	22	6	135	151	16	475	1,645	12	122	126	–	11,109	28,986	78
May	116	14	19	14	14	83	87	13	120	1,072	13	98	155	–	11,148	26,313	55
June	50	2	18	18	22	43	106	24	45	860	12	157	170	–	10,487	28,620	104
July	57	10	17	15	14	63	46	27	25	561	8	101	130	–	9,495	22,608	70
August	24	1	12	11	6	33	59	8	19	543	15	71	87	–	10,091	23,784	52
September	23	–	4	7	8	51	46	7	15	481	15	10	96	–	9,807	24,266	52
October	24	1	12	10	11	36	60	5	35	557	14	109	89	–	9,404	25,007	57
November	47	3	10	13	6	79	34	9	29	783	16	83	90	–	7,202	24,710	27
December	75	3	29	35	9	101	37	11	57	139	17	107	66	–	5,742	20,570	17
1863.																	
January	85	7	14	21	5	76	49	7	63	76	7	115	55	–	4,455	19,709	11
February	118	8	24	13	6	77	49	2	23	1,272	9	155	86	–	7,065	31,880	22
March	151	6	27	27	4	92	75	13	55	1,444	15	158	157	–	10,157	38,901	28
April	92	5	20	18	4	87	68	5	40	1,236	17	109	103	–	9,402	33,363	29
May	46	3	15	16	11	57	18	15	90	490	37	83	57	–	7,641	26,307	31
June	22	1	6	15	2	46	30	6	71	330	12	62	47	–	6,372	23,109	23
July	4	1	3	5	5	16	18	5	16	247	3	66	30	–	5,748	19,478	28
Totals	2,220	127	445	373	184	1,428	1,308	373	1,744	15,810	251	1,953	2,047	28,136	157,113	25,723	924

TABLE II. — HOSPITAL REPORTS.

Month and Year	Pneumonia.		Cases.											Total Cases of these Diseases.	Total Cases of Diseases and Wounds entered during Month.	Total Deaths from all Causes.
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Asthma.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Rheumatism, Acute.	Rheumatism, Chronic.			
1862.																
January	70	24	10	4	2	8	3	13	5	19	41	12	12	–	1,602	57
February	145	38	7	2	1	3	1	29	2	–	48	11	13	–	965	83
March	221	50	12	5	3	6	1	31	1	–	113	19	33	–	1,039	85
April	287	43	90	6	5	15	2	47	6	–	86	49	66	–	1,726	20
May	164	59	–	3	6	6	3	61	6	16	34	24	58	–	2,168	142
June	111	40	8	2	5	7	5	87	16	–	19	72	94	–	3,643	212
July	61	6	4	5	22	6	8	48	19	–	95	25	124	–	4,492	232
August	18	1	–	–	6	2	3	37	9	11	46	33	69	–	2,970	87
September	22	7	2	3	4	1	6	16	6	–	26	25	65	–	2,355	104
October	10	–	2	5	5	2	6	33	10	–	28	30	68	–	2,131	50
November	37	4	1	–	3	5	2	15	21	22	36	45	83	–	1,645	36
December	58	15	4	–	13	8	3	19	16	2	68	21	95	–	1,350	48
1863.																
January	127	9	3	7	8	6	4	30	25	1	82	27	124	–	1,400	47
February	83	9	3	3	19	11	1	16	34	–	58	37	89	–	1,309	28
March	146	18	7	8	13	7	5	23	44	–	59	38	107	–	1,758	79
April	173	23	11	4	10	8	4	32	35	1	70	53	126	–	2,041	67
May	79	18	6	1	13	7	3	14	21	–	42	31	115	–	1,932	77
June	28	6	6	1	15	3	1	11	18	–	16	20	66	–	1,634	57
July	16	–	1	3	9	12	11	10	27	–	58	11	96	–	3,598	73
Totals	1,786	370	177	60	162	122	72	572	321	72	1,025	583	1,503	6,455	39,758	1,584

DISEASES REFERABLE IN A MEASURE TO EXPOSURE, AMONGST THE CONFEDERATE TROOPS SERVING IN AND AROUND MOBILE, ON THE GULF OF MEXICO. — PNEUMONIA, PLEURITIS, ACUTE AND CHRONIC RHEUMATISM, ACUTE AND CHRONIC BRONCHITIS, CATARRH, LARYNGITIS, TONSILLITIS, ETC. CONSOLIDATED FROM MONTHLY REPORTS ON FILE IN THE SURGEON-GENERAL'S OFFICE, C. S. ARMY, BY JOSEPH JONES.

Month and Year.	Pneumonia		Cases.														
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Asthma.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Rheumatism, Acute.	Rheumatism, Chronic.	Total Cases of these Diseases.	Total Diseases entered during Month.	Mean Strength.	Total Deaths from all Causes.
1862.																	
January . .	224	39	9	2	7	45	7	77	11	–	228	77	29	–	2,918	8,178	96
February . .	37	4	3	2	6	5	3	16	3	–	97	35	22	–	1,048	3,431	29
April . . .	14	3	7	2	3	12	9	16	3	–	127	47	17	–	1,715	2,511	27
May	39	1	3	1	15	9	3	25	11	–	105	53	24	–	3,444	4,955	46
June	123	–	12	3	18	27	7	30	16	–	162	117	60	–	4,971	7,025	135
July	38	9	6	4	8	18	2	30	13	–	100	42	32	–	3,146	3,625	127
August . . .	31	7	5	3	20	12	9	33	9	16	79	84	80	–	5,296	9,208	158
September . .	11	3	6	1	12	16	7	17	5	–	86	67	54	–	6,929	9,425	72
October . .	40	7	7	6	9	9	7	14	14	–	290	65	56	–	4,536	9,126	55
November . .	121	10	9	3	20	28	6	45	8	–	262	70	65	–	3,899	9,571	67
December . .	114	23	17	4	8	28	11	34	18	122	181	115	38	–	3,610	8,923	74
1863.																	
January . .	87	7	21	1	8	64	11	39	6	–	362	122	75	–	3,708	9,213	39
February . .	94	10	7	2	6	55	5	23	4	–	356	72	74	–	2,845	9,231	41
March . . .	84	6	7	6	8	43	11	44	11	–	252	79	51	–	3,233	9,417	36
April . . .	43	4	7	2	8	25	3	31	7	3	74	35	29	–	1,815	5,121	40
May	40	12	2	–	17	7	3	7	17	–	51	44	72	–	2,063	4,366	58
June . . .	14	4	2	1	12	4	5	5	13	–	17	25	39	–	2,006	4,683	42
July	7	2	5	2	6	1	2	14	7	–	30	40	27	–	3,291	3,539	59
Totals . .	1,161	151	135	45	191	408	111	500	176	141	2,859	1,189	854	7,680	60,473	6,752	1,201

DISEASES REFERABLE IN A MEASURE TO EXPOSURE, AMONGST THE CONFEDERATE TROOPS SERVING IN THE ARMY OF TENNESSEE.—PNEUMONIA, PLEURITIS, ACUTE AND CHRONIC RHEUMATISM, ACUTE AND CHRONIC BRONCHITIS, CATARRH, ETC. CONSOLIDATED FROM MONTHLY REPORTS IN SURGEON-GENERAL'S OFFICE, C. S. ARMY, BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Pneumonia.		Cases.														
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Asthma.	Rheumatism, Acute.	Rheumatism, Chronic.	Total of these Diseases.	Total Diseases entered during Month.	Total Deaths from all Causes.	Mean Strength.
1862.																	
January	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
February	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
April	826	37	94	17	67	80	171	66	89	887	9	253	259	–	22,636	1,007	–
May	478	104	54	2	41	10	125	38	57	99	5	204	119	–	10,036	948	–
June	462	158	126	27	212	110	186	93	20	510	36	522	547	–	34,114	1,435	40,675
July	469	87	70	16	74	25	72	26	2	154	10	336	242	–	11,197	799	10,658
August	267	49	33	10	81	23	62	53	48	155	12	281	284	–	18,251	455	30,025
September	53	6	8	3	3	5	14	9	–	79	1	27	18	–	2,677	29	9,311
October	96	6	30	1	16	18	37	10	–	338	4	53	52	–	5,379	127	15,082
November	498	51	73	9	31	52	111	9	13	745	16	255	174	–	9,720	145	33,791
December	518	123	148	21	69	123	228	83	45	1,016	27	423	656	–	19,747	1,190	48,958
1863.																	
January	917	168	124	13	54	87	317	107	38	1,206	38	496	793	–	27,066	434	50,604
February	1,001	150	118	26	59	95	273	92	72	1,461	20	528	514	–	20,800	520	63,494
March	1,056	144	176	48	106	90	335	133	38	1,509	42	628	804	–	27,728	600	61,226
April	977	141	160	30	116	138	305	124	45	1,325	42	633	591	–	28,169	648	64,441
May	660	67	92	17	81	92	179	116	24	613	42	550	520	–	21,873	481	55,121
June	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	8,278	1,291	1,306	240	1,010	948	2,415	969	491	10,097	304	5,573	5,189	36,830	259,393	8,818	

DISEASES REFERABLE IN A MEASURE TO EXPOSURE AMONGST THE CONFEDERATE TROOPS SERVING IN THE VALLEY OF VIRGINIA, UNDER THE COMMAND OF GENERAL T. J. ("STONEWALL") JACKSON.—PNEUMONIA, PLEURITIS, TONSILLITIS, ACUTE AND CHRONIC BRONCHITIS, ACUTE AND CHRONIC RHEUMATISM, ETC. CONSOLIDATED FROM MONTHLY REPORTS IN SURGEON-GENERAL'S OFFICE, C. S. A., BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Pneumonia.		Cases.													Mean Strength.	Total Deaths from all Causes.
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Asthma.	Rheumatism, Acute.	Rheumatism, Chronic.	Total of these Diseases.	Total Diseases entered during month.		
1862.																	
January	284	26	42	25	3	119	380	84	1	900	4	374	117	–	4,956	9,278	63
February	241	9	31	3	8	60	84	11	–	444	4	114	126	–	2,594	8,193	22
March	38	3	9	–	5	26	57	5	–	219	–	44	29	–	1,389	7,418	75
April	37	–	17	2	1	62	56	3	5	426	2	43	73	–	2,014	9,554	6
May	81	2	25	16	2	59	62	8	44	385	–	112	98	–	4,856	16,731	100
June	83	6	15	11	20	26	86	13	35	651	6	209	143	–	8,741	18,099	216
July	155	4	22	9	25	55	73	78	56	322	5	222	127	–	7,613	15,589	119
August	31	–	6	1	1	14	25	4	–	241	–	109	70	–	6,423	15,643	237
September	10	–	10	4	5	19	27	10	–	208	1	70	92	–	5,949	21,123	298
October	74	–	34	30	15	74	82	19	10	529	14	221	166	–	8,663	34,200	31
November	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
December	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1863.																	
January	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
February	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
March	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
April	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	1,034	50	211	101	85	514	932	235	151	4,325	36	1,518	1,040	10,182	53,198	15,582	1,167

DISEASES REFERABLE IN A MEASURE TO EXPOSURE, TREATED IN THE GENERAL HOSPITALS OF VIRGINIA, EXCLUSIVE OF THE GENERAL HOSPITALS IN RICHMOND, CONNECTED CHIEFLY WITH ARMY OF THE POTOMAC, AND OF NORTHERN VIRGINIA.—PNEUMONIA, PLEURISY, CATARRH, RHEUMATISM, TONSILLITIS, ETC. CONSOLIDATED BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Pneumonia.		Cases.													
	Cases.	Deaths.	Pleuritis.	Laryngitis.	Phthisis.	Tonsillitis.	Asthma.	Bronchitis, Acute.	Bronchitis, Chronic.	Catarrh, Epidemic.	Catarrh, Simple.	Acute Rheumatism.	Chronic Rheumatism.	Total of these Diseases.	Total Diseases entered during month.	Total Deaths from all Causes.
1862.																
January	367	127	19	–	9	6	5	38	14	–	91	68	48	–	1,690	244
February	220	79	8	7	5	2	1	55	23	–	70	67	70	–	1,508	144
March	187	59	4	–	3	2	3	28	8	–	64	66	38	–	1,302	122
April	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
May	376	128	18	3	27	5	7	70	34	–	248	385	311	–	6,048	326
June	310	74	19	6	29	9	7	128	36	–	192	480	286	–	8,811	405
July	177	48	39	7	34	28	8	110	61	12	184	326	51	–	9,448	556
August	321	17	129	25	44	108	23	178	88	1	696	388	356	–	17,318	635
September	69	10	13	7	60	6	10	192	45	–	356	338	455	–	18,055	560
October	68	16	13	1	89	14	18	52	57	–	73	927	189	–	8,255	378
November	816	153	121	6	117	24	25	426	80	–	337	1,256	934	–	14,131	510
December	581	156	125	4	33	8	14	235	75	–	229	254	808	–	8,113	451
1863.																
January	438	182	103	10	27	14	3	223	63	2	242	115	409	–	5,557	479
February	419	113	60	13	28	17	5	134	76	1	223	92	346	–	4,742	380
March	515	99	68	23	59	17	10	164	87	12	197	166	346	–	5,567	325
April	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals	4,864	1,261	739	112	564	260	139	2,033	847	28	3,202	4,928	4,647	22,363	111,545	5,515

Pneumonia prevailed to fully as great an extent amongst the Confederate troops, and caused a large number of deaths. Thus in a command with a monthly mean strength of 25,723 officers and men, serving in the department of South Carolina, Georgia, and Florida, during a period of nineteen months (January, 1862, to July, 1863), 2220 cases of pneumonia, with 127 deaths, were entered upon the field reports, and 1786 cases, with 370 deaths, upon the hospital reports. As the cases were in most instances entered upon the field reports, and then transferred to the General Hospitals, we will approximate more nearly to the truth by assuming that the 2220 cases of pneumonia entered upon the field reports included those also transferred to the general hospitals; and the mortality of the cases treated in general hospitals should be added to the mortality of the cases in the field, thus giving a mortality of 497 in 2220 cases of pneumonia. According to this calculation, 22.3 per cent. of the cases of pneumonia occurring in the department of South Carolina, Georgia, and Florida, terminated fatally; or one death occurred in 4.4 cases.

Prevalence of pneumonia among the Confederate troops.

In the Confederate army serving on the Gulf of Mexico, in and around Mobile, with a mean monthly strength of 6752, the cases of pneumonia numbered 1161, and the deaths from this disease 151, during a period of eighteen months; or one death occurred in 7.6 cases of pneumonia.

In the army of Tennessee, during a period of fourteen months, 8278 cases of pneumonia were recorded, with 1291 deaths; the ratio of deaths from this disease being 15.5 per cent., or one death in 6.4 cases. These returns were incomplete, and related chiefly to the field reports. The hospital reports, which were still more incomplete than the field reports, gave a still higher mortality.

Upon the field reports of General T. J. Jackson's army, serving in the Valley of Virginia, during a period of ten months, with an average monthly mean strength of 15,562 officers and men, 1034 cases of pneumonia were reported. During this short period 6.6 per cent. of the mean strength were affected with this disease, giving a far higher ratio of cases of pneumonia to the mean strength than amongst the Federal prisoners confined at Andersonville. The number of deaths from pneumonia entered upon the field reports of General "Stonewall" Jackson's army was only 50, or only 4.8 per cent. of the cases. The returns of deaths were incomplete; and it was also true that the cases of pneumonia in this active and fighting army were in most cases transferred to the general hospitals, and chiefly to the large General Hospital at Staunton. The

following table presents the statistics of pneumonia in the Staunton General Hospital, and furnishes the most correct data for an estimate of the mortality of this disease amongst the forces serving in the Valley of Virginia, throughout the war, under Generals Jackson and Early.

CASES OF, AND DEATHS FROM, PNEUMONIA, AND TOTAL CASES AND DEATHS FROM ALL CAUSES IN THE GENERAL HOSPITAL AT STAUNTON, VA., DURING THE WAR OF 1861 TO 1865. CONSOLIDATED BY JOSEPH JONES.

Month and Year.	Pneumonia, Cases.	Pneumonia, Deaths.	Total Cases of Disease and Wounds entered during month.	Total Deaths from all Causes.	Month and Year.	Pneumonia, Cases.	Pneumonia, Deaths.	Total Cases of Disease and Wounds entered during month.	Total Deaths from all Causes.
1861.					June	16	4	1,542	14
July, August, September	17	3	1,430	30	July	25	1	8,428	25
					August	12	1	1,209	37
October	3	–	938	19	September	3	–	406	16
November	19	–	650	11	October	4	1	308	12
December	37	23	734	59	November	3	2	127	12
1863.					December	6	1	228	1
January	4	8	126	17	1864.				
February	12	2	254	5	January	10	1	225	3
March	68	2	614	10	February	6	1	108	3
April	65	7	705	27	March	14	–	177	1
May	53	28	2,272	83	April	7	1	138	4
June	23	5	1,229	36	May	7	–	1,475	47
July	–	5	892	42	June	3	–	826	29
August	3	3	805	78	July	9	3	1,598	19
September	–	3	1,435	29	August	2	–	1,304	21
October	27	4	4,549	95	September	1	–	1,693	13
November	180	24	3,923	151	October	4	–	1,531	30
December	19	12	361	69	November	10	1	511	25
1863.					December	30	4	505	14
January	1	5	102	15	1865.				
February	5	4	96	8	January	4	1	130	2
March	75	4	483	13	February	9	–	114	–
April	14	20	155	37					
May	23	8	639	15	Totals	833	191		

During a period of forty-four months, July, 1861, to February, 1865, in the General Hospital at Staunton, Va., 833 cases of pneumonia were treated, with 191 deaths. In this large and well-conducted hospital 22.9 per cent. (or one death in 4.3 cases) of the cases of pneumonia terminated fatally. A portion of this mortality, as well as of the mortality from typhoid fever and gunshot wounds, was attributable to the previous exposures and fatigue of the sick during their transportation from a distance, and to the sudden crowding of the hospital, during the active operations of the Confederate forces in the valley of Virginia. This will be clearly seen from the following extracts from the quarterly reports of Surgeon James Alexander Waddell and of Surgeon William Hay: —

Surgeon-General S. P. Moore.

General Hospital, Staunton, Va.

Sir, — Shortly after my last quarterly report, from some cause not appreciable, there was a decided decrease in the number of very sick men in this hospital for a week or ten days. But soon, from the crowded condition of the wards, consequent upon army movements, and the breaking up of hospitals out West, diseases which had not been marked by even the usual mortality assumed more serious characters and results. The typhoid fever, so commonly associated with bronchitis and diarrhœa, now assumed more of the typhus element, as manifested by the pneumonia complication; sordes upon the teeth; injected eyes, and often costive state of the bowels. A decided increase of erysipelas of the different varieties also occurred, and assumed an unwonted severity and malignity. But where no unusual transformations or lesions existed, certain results were justly attributable in many instances to transfers where patients were in a moribund state, or in whom the vital powers were worn out, under the exhausting influences of a tedious and ill-timed transportation.

Report of Surgeon Waddell on the diseases at the hospital at Staunton, Virginia.

JAMES ALEXANDER WADDELL,
Surgeon-in-Charge.

Surgeon Wm. Hay, in his monthly report to the Surgeon-General, for November, 1862, remarks: —

"I would state that the large number of deaths this month is owing to the state of the men when received into the hospital. A great number died twelve hours, or less, after getting here. A large number in forty-eight hours. These men had been brought from Winchester in ambulances; many had to be freely stimulated to get them into the wards. Three men were brought to the hospital dead in the ambulances."

Report of Surgeon Hay.

WILLIAM HAY,
Surgeon-in-Charge.

The statistics of the general hospitals of Virginia, exclusive of the hospitals in and around Richmond, possess great interest as furnishing the most reliable data for the determination of the ratio of mortality in pneumonia. During a period of fourteen months, 4864 cases of pneumonia were entered upon the hospital reports, with a mortality of 1261; the ratio of deaths amongst this large number of cases of pneumonia treated in some of the largest and best conducted hospitals in the Southern Confederacy was 25.9 per cent., or one death in 3.8 cases.

Statistics of pneumonia in the hospitals of Virginia, exclusive of those around Richmond.

The mortality caused by pneumonia amongst the Confederate

forces will be still further considered in the next chapter, in connection with the observations on typhoid fever.

From official sources we infer that pneumonia has prevailed to as great an extent amongst the Federal armies, and with as high a ratio of mortality: 11,061 cases, with 2134 deaths, having been reported prior to July, 1862, giving the high mortality of 19.3 per cent., or one death in 5.1 cases.

Prevalence of diseases referable to exposure as great among the Confederate troops as among the prisoners at Andersonville.

The diseases referable to exposure prevailed to as great an extent amongst the Confederate troops as amongst the Federal prisoners. Thus, 28,136 cases of diseases referable in a measure to exposure, as pneumonia, pleuritis, bronchitis, laryngitis, tonsillitis, catarrh, and rheumatism, were entered upon the field reports of the Confederate army serving in the department of South Carolina, Georgia, and Florida, during a period of nineteen months, with an average mean monthly strength of 25,723 officers and men. The ratio of this class of diseases was 19.9 per cent. of the 157,013 cases of disease and wounds entered upon the reports; and 109.3 per cent. of the mean strength were entered upon the sick reports with one or the other of these diseases.

On the Gulf Coast, 7680 cases were recorded as due to this class of diseases, out of 60,473 cases of all kinds; or 12.5 per cent. of all diseases entered during eighteen months were referable to pneumonia, pleuritis, laryngitis, tonsillitis, bronchitis, phthisis, catarrh, and rheumatism; and 113.7 per cent. of the mean strength were entered upon the sick reports with one or the other of these diseases.

In the army of Tennessee, during a period of fourteen months, 36,830 cases of disease referable chiefly to exposure were recorded in a total number of 259,393 cases; the ratio being 14.1 per cent.

10,182 cases of these diseases were recorded upon the sick reports of the army of the Valley of Virginia in a grand total of 53,198 cases entered during ten months; in this command, with a mean monthly strength of 15,582 officers and men, 19.1 per cent. of all diseases were referable to the class of diseases caused by exposure, and the ratio of these cases to the mean strength was 65.3 per cent.

Ratio of cases of rheumatism to mean strength, etc., as great among the

The ratio of acute and chronic rheumatism to the mean strength and to the total cases of disease and wounds, was as great amongst the Confederate troops as amongst the Federal prisoners.

Thus in the department of South Carolina, Georgia,

and Florida, 4000 cases of chronic and acute rheumatism were reported during nineteen months; 15.5 per cent. of the average monthly mean strength were entered upon the sick reports with one or the other form of rheumatism.

Confederate troops as among the prisoners at Andersonville.

2043 cases of acute and chronic rheumatism were entered during eighteen months upon the sick reports of the Confederate forces serving on the coast of Alabama; 30.2 per cent. of the monthly mean strength of this command were therefore during this period entered upon the sick reports with rheumatism.

In the army of Tennessee, 10,762 cases of rheumatism were treated during a period of fourteen months, thus giving a ratio of 4.1 per cent. of all diseases.

In the army of General "Stonewall" Jackson, 2558 cases of rheumatism were entered upon the field reports during a period of ten months; 16.3 per cent. of the mean strength of this army were entered upon the sick reports with rheumatism, and this disease constituted 4.8 per cent. of all the diseases treated.

An examination of the preceding statistics of chronic and acute rheumatism reveals no progressive increase of this disease amongst the Confederate troops.

No progressive increase of rheumatism among the Confederate troops; hence, cases of so-called rheumatism not attributable to scurvy.

If the view of certain writers be true, that a large number of cases entered upon the sick reports of armies as acute and chronic rheumatism are nothing more than symptoms of scurvy, then it follows necessarily that chronic and acute rheumatism should have been far more prevalent amongst the scorbutic Federal prisoners than amongst the Confederate troops during the earlier periods of the war; and that upon the scant salt diet without fresh vegetables, to which the Confederate troops were necessarily confined during the war, the number of cases of rheumatism would have progressively increased, as the Confederate soldiers became more and more scorbutic. To test this question fairly, we have drawn up the following table, in addition to the statistics already presented.

CASES OF ACUTE AND CHRONIC RHEUMATISM TREATED IN VARIOUS CONFEDERATE GENERAL HOSPITALS,—GENERAL HOSPITALS OF CHARLOTTESVILLE, STAUNTON, MEDICAL COLLEGE, EMPIRE, INSTITUTE, GATE CITY, AND FAIR GROUND, ATLANTA, AND FLOYD HOUSE, MACON,—CONSOLIDATED BY JOSEPH JONES.

Year and Month.	General Hospital, Charlottesville, Va.			General Hospital, Staunton, Va.			Medical College Hospital, Atlanta, Ga.			Empire Hospital, Atlanta, Ga.			Institute Hospital, Atlanta, Ga.			Gate City Hospital, Atlanta, Ga.			Fair Ground Hospital, No. 1, Atlanta, Ga.			Fair Ground Hospital, No. 2, Atlanta, Ga.			Floyd House Hospital, Macon, Ga.		
	Total Cases of all Diseases entered during Month.	Cases Acute Rheumatism.	Cases Chronic Rheumatism.	Total Cases of all Diseases entered during Month.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases entered during Month.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.	Total Cases of all Diseases.	Acute Rheumatism.	Chronic Rheumatism.
1861.																											
July . .	2,608	2	74	1,233	8	95	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
August .	329	–	15																								
September	511	–	34																								
October .	556	–	13	938	–	94	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
November	448	–	30	615	–	67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
December	329	–	18	734	–	60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1862.																											
January .	226	2	19	126	6	12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
February	300	7	35	254	–	31	94	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
March .	290	7	28	614	7	71	170	5	1	990	25	–	–	–	–	1,104	3	18	–	–	–	–	–	–	–	–	–
April . .	539	5	15	705	54	26	117	2	2	227	4	–	–	–	–	496	4	24	–	–	–	–	–	–	280	12	–
May . .	429	10	45	2,292	134	37	57	–	–	134	2	–	–	–	–	–	–	–	–	–	–	–	–	–	139	11	–
June . .	754	5	22	1,229	157	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	139	5	–
July . .	337	9	14	892	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	95	2	–
August .	682	1	5	805	16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	136	–	–
September	886	–	3	1,435	64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	170	1	3
October .	340	–	10	4,549	757	–	204	–	18	166	1	18	–	–	–	170	10	10	262	13	20	–	–	–	128	1	4
November	910	19	62	3,928	866	–	355	27	–	267	8	3	–	–	–	389	9	4	606	6	75	–	–	–	56	–	10
December	993	7	44	361	–	63	124	14	5	90	–	6	–	–	–	188	4	–	24	–	1	–	–	–	41	–	1
Total, 1862	–	–	–	–	–	–	1,121	54	26	–	–	–	–	–	–	2,347	30	57	–	–	–	–	–	–	1,184	2	48
1863.																											
January .	601	4	34	102	–	7	481	11	28	380	7	10	–	–	–	544	5	8	1,527	39	73	–	–	–	56	–	11
February	312	8	27	96	–	20	59	1	8	77	2	8	–	–	–	175	8	11	238	–	15	336	3	19	89	–	12
March	198	3	8	483	–	28	132	2	4	185	7	10	–	–	–	362	14	21	256	–	25	484	5	34	106	–	9

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If the statistics of each individual hospital entered upon this table be examined with a view to determine the relations between the total number of cases of all diseases and of rheumatism entered each month, it will be evident that there was no progressive increase of rheumatism amongst the Confederate troops, notwithstanding the progressive increase of scurvy, and of a scorbutic condition of the blood, as manifested in the progressive increase of hospital gangrene and of secondary hemorrhage amongst the Confederate wounded.

On the other hand, Dr. Hanbury, in his account of scurvy as it prevailed in the British army during the war against Russia, 1854–1856, observes that —

Dr. Hanbury's account of scurvy as it prevailed in the British Army in the war with Russia in 1854–56.

"One of the most constant precursory symptoms of scurvy was an obscure form of muscular rheumatism; the individual complained of pains in his legs of an aching character, and his movements were tedious and painful; there was in these cases no articular inflammation observed, and though the feet and legs were generally edematous, there was little enlargement of the ankle joints. The affection has probably been in some instances mistaken for rheumatism, and perhaps treated in the ordinary manner; but it was merely one of the signs of general cachexia, and advantageously treated by a return to the comforts of ordinary life. It is, perhaps, possible to explain the occurrence of the pains by reference to the depraved condition of the blood and its peculiar operation upon the nervous filaments, or the irritability of the muscular fibres. They were, however, not unfrequently observed during the recovery from fever, and were in these cases much complained of in the back and loins; and it may be stated that in fever the relation between the muscular and nervous system was usually very much disturbed, and before debility was induced in the course of protracted disease, there was often almost total inability to command the use of the limbs, or to exert on them the efforts of the will, and apparently this indication was to some extent connected with a scorbutic taint of the system." [1]

Views of Dr. Hammond and Dr. Woodward.

Dr. William A. Hammond, formerly Surgeon-General of the United States Army, has taken the same ground in an article on scurvy published by the United States Sanitary Commission, and expresses his belief that there is "but little doubt that many of the cases designated in the medical reports as chronic rheumatism are, in reality, of a scorbutic nature." [2]

[1] *Medical and Surgical History of the British Army which served in Turkey and the Crimea during the War against Russia, in the years* 1854, 1855, 1856, vol. ii., 1858, p. 175.

[2] *Military, Medical, and Surgical Essays, prepared for the United States Sanitary Commission*, pp. 184–85.

Similar views are expressed by Dr. Woodward in the chapter on "Pseudo-Rheumatic Affections" in his "Observations of the Chief Camp Diseases of the United States Armies." In support of his observations, Dr. Woodward also quotes the testimony of Surgeon Basil Norris of the United States Army.

CHAPTER SEVENTH.

DISEASES DEPENDENT UPON THE ACTION OF SPECIFIC POISONS, AND SUPPOSED TO ARISE FROM CROWDING AND FOUL EXHALATIONS.

Typhus Fever. — Typhoid Fever. — Small-Pox. — Measles.

TYPHUS FEVER.

No cases of typhus among the prisoners at Andersonville, or among the prisoners and Confederate troops there and elsewhere.

No case of typhus fever was reported during six months in 42,686 cases of all diseases amongst the Federal prisoners confined at Andersonville, notwithstanding that 40,000 men were crowded upon twenty-seven acres of land, and notwithstanding that all sanitary and hygienic laws were utterly neglected, and the earth was covered with abnormal human excrements and fragments of bread and saturated with urine, and the atmosphere was loaded with stinking effluvia. During the recent civil war I sought for typhus fever amongst the Confederate troops serving in the field, and amongst the general hospitals in various parts of the Confederate States; thousands of sick and wounded were examined with a view to the determination of the existence or non-existence of this disease amongst the Confederate armies; and even the prisoners confined upon Belle Isle, in the Libby Prison, and in Castle Thunder, in Richmond, Va., were not neglected in these examinations, and numerous medical officers of the Confederate army were interrogated upon this subject personally and by letter. No case of true typhus fever came under my observation during the war in any army, in any field hospital, general hospital, or military prison.

The cases reported as typhus were cases of typhoid fever.

The cases entered upon the Confederate sick reports as typhus fever were, without doubt, in almost every case, if not in all cases, typhoid fever, occurring in those whose blood was scorbutic. I examined a number of cases which had been thus entered as typhus fever, and in every instance found the characteristic phenomena of typhoid fever; the diarrhœa and tedious convalescence and great emaciation were well marked in all cases. I supposed that if typhus fever existed anywhere in the Confederate States it would be found at Anderson-

ville, and especially amongst the foreign element of the Federal armies, which had been but recently imported from the bogs of Ireland, and from the hovels of the densely populated European countries. The statements of various surgeons with reference to cases of typhus fever occurring in the Confederate armies, have already been considered in my report to the Surgeon-General on typhoid fever. The following table presents the numerical relations and mortality of typhoid fever, measles, and small-pox amongst the Federal prisoners.

DISEASES AMONGST THE FEDERAL PRISONERS CONFINED AT ANDERSONVILLE, CAUSED BY SPECIAL POISONS; TYPHOID FEVER, VARIOLA, VARIOLOID, RUBEOLA; CASES AND DEATHS; NUMERICAL RELATIONS TO MEAN STRENGTH, AND TO TOTAL DISEASES ENTERED UPON SICK REPORTS, CONSOLIDATED FROM ORIGINAL MONTHLY REPORTS IN OFFICE OF SURGEON OF POST, BY JOSEPH JONES SURGEON, P. A. C. S.

Month and Year.	Typhoid Fever.		Variola.		Varioloid.		Rubeola.		Mean Strength.	Total Cases entered during Month.	Total Deaths from all Causes
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.			
1864.											
March	67	28	16	3	12	2	10	–	7,500	1,530	283
April	56	18	36	16	37	18	6	1	10,000	2,425	576
May	92	17	3	5	10	5	40	3	15,000	8,583	708
June	18	32	1	5	–	5	8	2	22,291	7,968	1,201
July	39	58	1	2	3	6	3	–	29,030	10,834	1,952
August	200	32	–	–	–	1	1	1	32.899	11,346	2,992
Totals . . .	472	185	57	31	62	37	68	7	21,120	42,686	7,712

TYPHOID FEVER.

Notwithstanding the crowded and filthy condition of the Confederate Military Prison and Hospital, and notwithstanding the effluvia from the immense collections of abnormal human excrements, only 472 cases of typhoid fever were reported amongst over 40,000 men, with an average monthly mean strength of 21,120, during a period of six months. The cases of typhoid fever constituted only a little over one per cent. of the entire number of cases of disease entered upon the sick reports, and of the entire number of prisoners confined during six months at Andersonville. If the view advocated by some

The cases of typhoid fever very few among the prisoners at Andersonville

writers that typhoid fever is frequently caused from the exhalations of human excrements, and especially by the exhalations from diseased human excrements, be true, then we are at a loss to explain the comparative immunity of these prisoners from this disease.

The fact is that the problem of the origin of typhus and typhoid fever is not so simple as some writers would lead us to suppose.

We do not as yet understand fully the effects of the effluvia of excrements, and putrefying animal and vegetable matters.[1]

From an extended and we trust candid review of facts bearing upon the crowded condition of the Federal prisoners at Andersonville, we feel justified in drawing the following conclusions: —

1. Facts recorded by various observers tend to prove that no contagious disease ever arises *de novo* from putrefying animal matters and excrements, however concentrated the animal effluvia, and however great the mass undergoing decomposition.

Facts recorded by various observers go to show that a contagious disease never arises from putrefying animal matter and excrements.

The immunity of dust-men, sewer-cleansers and hunters, and privy-cleansers, and all men engaged in removing the filth and offal of large cities, from the various forms of continued fever, and even from cholera, militates strongly against the theory of Dr. William Budd, who affirms that the bowel discharges are means by which patients, whether migratory or stationary, can be instrumental in disseminating typhoid fever and cholera. If, according to Dr. Budd, the dejections of typhoid fever are "charged with matters on which the specific poison of a contagious fever has set its most specific mark, and to inhale sewer emanations is, therefore, under conditions of the most frequent occurrence, *actually to inhale* the very quintesscence, *so to speak of a preëxisting fever*," how is it possible for those to escape typhoid fever who most commonly inhale the emanations from privies and sinks in the large cities of London and Paris, from which typhoid fever is never absent?

Budd's theory of the diffusion of typhoid fever by means of the intestinal excreta.

How is it possible to reconcile the comparative immunity of the class of scavengers from contagious fevers with the statement of a recent writer, that —

"In large towns the sewers are constantly charged with the *materies morbi* of specific diseases always abounding in towns?" . . . "In small villages and other places, where no sewers exist, the air only may be infected, or the water contaminated, by the direct or indirect im-

[1] Extracts from numerous authors, in relation to the effects of the effluvia of excrements and putrefying matter, animal and vegetable, which have been introduced by the writer, are omitted. — EDITOR.

portation of cases of specific disease, or their equivalents — the poison itself — so that the organic impurities, the dung-heaps, the open soil which surrounds the dwellings of the patients, the cesspools, and the privies common to several houses, gradually but eventually become impregnated with the specific poison of the disease. Thus the atmosphere of the village may become incomparably more virulent than the atmosphere of the sick-chamber itself. Hence the rapid epidemic spread of the miasmatic diseases in the limited space of rural villages, which gives rise to the popular error that such diseases are invariably contagious in country places, and only rarely so, or by exception, in cities or large towns." [1]

If the contagious nature of typhoid fever be admitted, might not the relative greater proportion of persons liable to the disease in the country and villages where it more seldom prevails, as well as the intimate relations and associations and constant visiting amongst the entire population, and especially the collection together at stated periods in one or more houses of worship of a large proportion of the inhabitants, account for the apparent more extended action of the fever after its introduction into small towns and villages, without the necessity of resorting to the hypothesis of the propagation of the disease by the emanations of the cesspools. However, if the entire lesion of typhoid fever be the characteristic manifestation of the disease, corresponding to the eruption of small-pox, we must admit that the theory of Drs. Budd, Simon, and Aitken, has much plausibility, and even probability. According to this view, the discharges from the bowels in typhoid fever might be regarded in the same light, as far as their contagious nature was concerned, as the matter formed upon the surface and cast off in the form of scabs in small-pox. We would certainly be disposed to admit the contagious nature of the scabs of small-pox, whether found in the clothing and bedding, or cast off into any comparatively dry and confined space. The admission of this theory does not at all overthrow the assertion that animal putrefaction does not generate under any circumstances a contagious fever; for in the case of the excrements voided in typhoid fever, the poison is the result of the actions going on in the living body, and is not the product of the decomposing excrements.

2. The emanations from putrefying animal matter and excrements generate deleterious gases, as sulphureted hydrogen, and hydro-sulphuret of ammonia, which act in a definite manner upon the animal system, inducing disor-

The gases generated in putrefying animal matter and excrements do

[1] *The Science and Practice of Medicine*, by William Aitken, M. D.; London, 1864, vol. i. p. 216.

not produce contagious diseases.

ganization of the blood, derangement of the nervous and muscular systems, attended with variations of the pulse and temperature — in fact, with the deranged actions ordinarily called *fever;* but such diseased states produced by these foul exhalations do not follow the course of the well-known contagious diseases, as typhoid fever, small-pox, measles, and typhus fever. As far as our knowledge extends, the various gases resulting from the decomposition of animal matters produce injurious effects upon the system, which are no more contagious than the diseases produced by arsenic, mercury, or any other well-known poison or medicinal agent.

A wide field for experiment and observation is open for the determination of the mode of action and effects of small portions of the deleterious gases generated during the putrefaction of animal matter and human fæces, acting continuously through long periods of time upon the human constitution. We are as yet without any series of investigations upon the effects of definite admixtures of atmospheric air and carbonic acid gas upon the phenomena of life.

The results of the observations of various writers upon nightmen, sewer-hunters, and all those exposed habitually to foul emanations from decomposing animal matters and fæces, go to show that the human constitution readily adapts itself to these deleterious influences, and is capable of throwing them off and of maintaining itself in a state of comparative health.

A careful series of experiments upon the effects of varying proportions of each and every one of the various constituents of the emanations from sewers, cesspools, and decomposing corpses, through considerable periods of time, would throw much light upon many difficult questions in hygiene and sanitary science generally. Such investigations should be preceded by a careful examination of the varying products of putrefaction under different conditions of temperature and moisture, and of varying supplies of oxygen.

3. If the preceding propositions be admitted, and if the falsity of the doctrine of spontaneous generation of plants and animals be maintained, and the view be clearly held that no organized form, animal or vegetable, however simple in structure and functions, can arise spontaneously from any form of matter, inorganic or organic, in any condition or combination, or under any circumstances; then it necessarily follows that if any contagious diseases are due to the action of special vegetable or animal forms, such living animals and vegetables or their germs could

If contagious diseases be due to the action of special vegetable or animal forms, decomposing animal matter may constitute the nidus for their support and multiplication.

at best find only a resting-place or nidus for their support and multiplication in decomposing organic matter.

Effects of animal effluvia dependent on the occupation, habits, and diet of those exposed.

4. The injurious effects of animal effluvia will depend in a great measure upon the occupation, habits, and especially upon the diet, of those exposed.

This was illustrated in a measure at Andersonville. All the paroled Federal prisoners, who had an extra ration, and were able to make considerable sums of money by trading clandestinely with their friends in confinement, enjoyed most robust health, notwithstanding frequent, and we might say constant, exposure to the foul exhalations of the Stockade and Hospital; and in truth these paroled men were stronger and healthier than the Confederate guard who were confined to a single ration.

The ephemeral febrile states produced, and the conditions of ill health established by the action of deleterious emanations from decomposing animal matters, will vary in character and extent according to the habits and diet and original constitution of those exposed; and the states of system thus induced will be more or less favorable to the spread of contagious diseases after their specific germs or active principles of propagation and development have been introduced.

Differences as regards health in different localities not dependent on varying amounts of organic matter in the air.

5. The facts established by the researches of Dr. Robert Angus Smith, namely, that organic matter exists in the atmosphere, that the amount varies in different localities, being increased in cities, in the neighborhood of cess-pools, sewers, and rivers receiving much filth, and diminished in the country, upon mountains, and over the sea, does not at all prove that the difference of health of various localities is due to the varying amounts of organic matter in the air. Neither are there any established facts to show that epidemics are in any manner connected with the organic matter existing in the air. We have recorded a large number of facts to show that those occupations in which it is necessary to breathe an atmosphere rank with putrid animal matters are not necessarily injurious to the health; nor are they more injurious to the health than occupations in which a far less, and in reality the minimum, amount of putrescent organic matter is respired. The universality of the presence of this organic matter in the atmosphere, as shown by the numerous experiments of Dr. Smith, completely overthrows all special hypotheses like those of Dr. Hume, with reference to yellow fever. The organic matter which he detected may or may not have been connected with yellow fever; it may have

been harmless animalcules or sporules, or comparatively innocuous matter existing in a gaseous state, or the exhalations from cess-pools possessing injurious actions wholly different from yellow fever.

It certainly requires, in the present imperfect state of our knowledge upon this subject, a great exercise of the imagination to refer the existence of epidemics to the action of an undefined organic matter existing in varying proportions in all parts of the atmosphere breathed by man.

The problems of sanitary science are of too complicated a nature to be solved by such suppositions, based as they are, too, upon comparatively imperfect and unsatisfactory means of investigation.

Before any general laws can be announced and established, it will be necessary :

Requirements for the establishment of general sanitary laws.

First, to show the chemical composition and relations of the various forms of organic matter found in the air of various localities, and determine definitely what portion is deleterious, and under what conditions and from what sources it is formed.

Second, the effects of the prolonged action in varying proportions of the products of putrefaction already known, as sulphureted hydrogen, hydro-sulphuret of ammonia, and carbonic acid and carbonic oxide, carbureted hydrogen and phosphoreted hydrogen, and sulpho-cyanide of ammonia.

Third, the effects of moral causes, care and vice, cheerfulness, industry, and happiness; of excessive muscular action, putrescent food, foul water, insufficient food, air, and sunlight, starvation, the abuse of alcoholic stimulants, and all causes which tend to produce morbid conditions of the blood and a condition of ill health, and a tendency to putrescence in the living structures ; and of continued exposure to cold, with scant supplies of food and clothing ; and of special poisons, as syphilis ; and of the hereditary diseases developed and aggravated by the vices and modes of living in large cities.

A correct determination of the mortality and disease due to any one cause, necessarily presupposes the elimination of the disturbances produced by other causes or agents.

The influence of such depressing causes as sameness of diet, long-continued imprisonment, depressed spirits, neglect of personal cleanliness and of general sanitary regulations, were clearly seen in the high rate of mortality amongst these Federal prisoners from typhoid fever and

The influence of depressing causes seen in the high rate of mortality

small-pox. One hundred and eighty-five deaths are recorded in four hundred and seventy-two cases of typhoid fever; the ratio of deaths to cases being thirty-nine per cent., or one death in two and five tenths cases.

from typhoid fever and small-pox among the prisoners at Andersonville.

One hundred and twenty-six cases and ten deaths are recorded under the head of common continued fever. It is probable that a large number of these cases were typhoid fever. The mortality, therefore, of this disease was probably less than thirty-nine per cent. Great as this mortality appears to be, it is actually less than that of one or two of the Confederate hospitals.

By an extended series of observations, I was enabled to establish the following points of interest with reference to the history of typhoid fever amongst the Confederate troops.

Conclusions respecting the history of typhoid fever among the Confederate troops.

a. In detached commands raised from men living in the low, malarious, swampy, tertiary plain bordering the Atlantic Ocean along the coast of Carolina and Georgia, where, up to the present war, typhoid fever has been a very rare disease, this disease was almost unknown as long as these companies, chiefly of cavalry, were kept within this region and assigned to detached service. When these companies were collected together into regiments, and mingled with other companies in which typhoid fever was prevailing, and which were composed of troops raised in the more elevated regions where typhoid fever prevails, then this disease attacked the troops of the companies raised in the malarious districts, which had been previously exempt from the disease. After the introduction of the disease amongst the companies raised in those regions where typhoid fever was previously almost unknown, then it prevailed to as great an extent and with as fatal results (if not with more fatal results) as amongst the troops from the more elevated and healthy regions.

Typhoid fever chiefly occurred among troops collected in regiments, and raised in regions where the disease prevails.

b. As soon as large bodies of Confederate troops were collected in various portions of the Confederate States, typhoid fever made its appearance and prevailed to a great extent in the earlier periods of the war. A large percentage of the Confederate troops were attacked by the disease, and those who escaped appeared to be exempt either through a previous attack, or in virtue of some natural insusceptibility to the disease. As the war progressed, the veterans were comparatively exempt from the disease, and it was confined chiefly to the new recruits. The disease would have

As the war progressed veterans were exempt from typhoid fever, the disease affecting chiefly new recruits.

almost disappeared from the army but for the sweeping conscription and the constant addition of the boys as they passed the age of sixteen.

In this respect, therefore, typhoid fever followed the laws of contagious diseases generally.

The diffusion of typhoid fever and measles compared.

A relation was thus established between the mode of multiplication of the cases of measles and of typhoid fever, with this difference, that the former is a highly contagious disease, and manifests its phenomena rapidly after contact, the period of incubation being comparatively short, and the disease itself, and especially its contagious stage, comparatively evanescent; whilst the latter is comparatively slow to communicate itself by contact, and requires a larger number of conditions for its propagation. Its period of incubation is long, and the cycles of its phenomena comparatively slow in their evolution.[1]

SMALL-POX. — SPURIOUS VACCINATION.

Number of cases of small-pox among the prisoners at Andersonville during six months, and the number of deaths.

The cases of variola reported amongst the Federal prisoners confined at Andersonville during six months, numbered 57, with 31 deaths; 54.3 per cent. of the cases of variola terminated fatally. 62 cases of varioloid, with 37 deaths, were reported during the same period, giving a mortality of 59.3 per cent. in this disease. In the 119 cases of small-pox, 68 deaths were recorded, showing the high mortality of 57.1 per cent. The fatal nature of small-pox was clearly referable to the scorbutic condition of the blood and the depressed state of the vital forces.

The high ratio of mortality in the cases recorded as varioloid would lead us to suspect that errors had been committed in the diagnosis.

Number of cases and deaths in the general hospitals of Virginia.

In the general hospitals of Virginia, during sixteen months, October, 1862 to January 21st, 1864, 2513 cases of variola were treated, with 1020 deaths, thus giving a mortality in this disease of 40.58 per cent.; whilst during the same period, 1196 cases of varioloid were reported, with a mortality of only 39 deaths, or 3.26 per cent.

The following valuable table of eruptive fevers treated in the general hospitals of Virginia, consolidated by Surgeon Wm. A.

[1] Tables condensed from the monthly reports from the various divisions of the Confederate army, showing the numerical relations of typhoid fever and pneumonia to the total diseases and mean strength, and conclusions drawn therefrom, are here introduced by the writer, and are omitted, the writer having contributed a chapter relating to the same topics in the second section of this volume. — EDITOR.

Carrington, Medical Director, furnishes important data for comparison : —

REPORT OF ERUPTIVE FEVERS TREATED IN GENERAL HOSPITALS, DEPARTMENT OF VIRGINIA, FROM OCTOBER 1, 1862, TO JANUARY 21, 1864, CONSOLIDATED BY SURGEON WM. A. CARRINGTON, MEDICAL DIRECTOR.

Month and Year.	Erysipelas.		Rubeola.		Scarlatina.		Variola.		Varioloid.		All other Diseases of this Class.
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.
1862.											
October	38	5	337	3	4	–	12	1	1	–	17
November	58	3	298	8	2	–	161	30	54	–	10
December	68	5	158	3	1	–	424	145	213	5	17
1863.											
January	118	15	146	–	5	3	438	221	169	9	5
February	99	10	92	7	1	1	187	137	87	5	27
March	70	11	136	9	34	–	133	57	57	4	19
April	127	9	80	3	4	–	192	62	120	1	59
May	200	13	132	1	2	–	66	39	41	1	123
June	165	14	91	5	3	1	110	24	60	1	67
July	86	6	48	1	2	–	43	30	68	2	35
August	74	5	51	1	–	–	8	4	6	2	7
September	40	1	18	–	–	–	–	–	1	–	15
October	50	6	6	1	–	–	13	2	9	–	19
November	59	2	33	1	–	–	100	13	27	–	32
December	72	3	87	1	–	–	403	114	96	–	5
1864.											
January	62	–	494	2	–	–	223	141	187	9	86
Totals	1,386	108	2,207	46	58	5	2,513	1,020	1,196	39	543
Per centum of deaths		7.79		2.09		8.62		40.58		3.26	

Per centum of eruptive fevers (7903) to total number of cases treated (178,586) = 4.42.
Per centum of deaths from eruptive fevers (1218) to total number of deaths (10,961) = 11.11.
Mortality in all cases treated, 6.13 ; in eruptive fevers, 15.41 ; in variolous diseases, 28.76.

Surgeon Carrington accompanies this report with the following interesting observations : —

Observations by Surgeon Carrington.

" Eruptive fevers constitute an important class in the reports required from medical officers of the Confederate States army. On inspecting the records of the first division of this class, erysipelas, the uniformity in the number of cases occurring in each month is worthy of notice ; while in other divisions the well-known prevalence in the colder, and the diminution in the warmer, seasons of the year are well illustrated, especially in the reports of small-pox in the months of August, September, December, and January. It should be considered that many of the cases reported as of this division are traumatic, and should not properly be classified among 'eruptive fevers,' but as instances of 'local erysipelatous inflammation.'

" The second division of this class is one of the most interesting to the army surgeon, from its universal prevalence among soldiers. The reports from April, 1861, to October, 1862, would show a much greater prevalence than here reported. When it is remembered that only the

severe cases of this diseases are sent to hospitals, the mortality appears slight.

"The reports of scarlatina bear out the experience of previous observers, that it is not a disease of armies.

"The sixth division, embracing all anomalous forms of eruptive fever, were probably cases of *roseola*, and were so slight that no deaths are reported as having occurred among them.

"The fourth and fifth divisions of this class, comprising modifications of the same disease, will painfully attract, both by the large number of cases occurring and the rate of mortality. From actual observation and investigation at the time, I can definitely pronounce upon the origin and progress of small-pox in these hospitals. On October 18th, 1862, the first cases were brought to Richmond from Fort Delaware. Up to that time no cases had been reported here for some months in the army or among citizens. By the 31st of October twelve cases had been reported. In carefully tracing each, it was determined that those from Fort Delaware did not disseminate the disease, being quarantined and avoided by all; but that soldiers from the army of Northern Virginia had brought the disease to the hospitals, and being unconscious and unsuspected, had exposed many to it before the diagnosis was made. The army had just reached the vicinity of Winchester after evacuating Maryland, subsequent to the battle of Sharpsburg. There were but few cases from the army, and those had not been prisoners, nor had they seen any returned prisoners. These cases went to Charlottesville, Lynchburg, and Richmond, at which points the malady spread, but much more rapidly and extensively at Richmond.

"It is a fact of interest that the disease has not spread in the army. The free ventilation of the field, with the men in bivouac and without even tents, seems to have so diluted the poison that it could not reproduce the disease in others. So in general hospitals no combination of remedies, regimen, or expedients have been found so much to influence the progress or termination of the disease as free ventilation. A diminution of the capacity of the hospitals from eight hundred to sixteen hundred cubic feet for each patient showed sensible effects, and removal to large tents still more reduced the mortality.

"There are several reasons by which we may rationally account for the great excess in the mortality of small-pox over that in ordinary civic practice: —

"1st. The mass of the army, being from the rural population, became soldiers unprotected by vaccination. In cities, where the rich and the poor are by public or private expense all vaccinated for generations, the disease assumes a modified form; while in races not hereditarily protected, as among our American Indians, it assumes as malignant a form as that existing before Jenner's great discovery.

"2d. The subjects of the disease were men previously debilitated by

privations, fatigue, and disease, and oppressed with nostalgia; and to this is now superadded the consciousness of being afflicted with a loathsome, obnoxious, and dangerous disease, and the bad effects of removal from one hospital to another.

"3d. *The Malignity of the Epidemic.* — Of this I have much evidence from my own observation; but I beg leave to quote the very forcible and apposite remarks on this subject contained in a letter of January, 1863, from Dr. Albert Snead, City Physician of Richmond: —

"'I have had charge of the City Hospital for about ten years, and never during that time has there been so extensive prevalence of small-pox, nor has the percentage of mortality risen so high as during this visitation. Not only among the soldiers who have been under my care, but also among the resident population, the mortality has been fearfully great. Nor have I in any former visitation witnessed so large a percentage of confluent cases, or so many strictly malignant cases — cases in which the experienced eye would detect evidences of a necessarily early and fatal termination. Before this visitation I have never seen a case so malignant as to terminate life in less than six days from the first appearance of the eruption; while, during this prevalence of the disease, I have seen many cases ending in less time — some within three or four days. Moreover, heretofore, I have never seen a case of varioloid prove fatal; while in this visitation I have witnessed several cases terminating in death, and that, too, after the patients had apparently been doing well for days together; suddenly they would begin to give away, without manifesting any special local trouble, and, despite the use of stimulants and other sustaining treatment, gradually sink and die. I have been distressed and annoyed at these unexpected deaths, and can only account for them by supposing that the poison in this visitation is unusually malignant, overcoming the vital powers even in those cases which for a time appeared to be proceeding favorably. I have observed that the tendency to the formation of abscesses is greatly increased over former visitations — patients who had suffered moderately mild attacks, even of varioloid, scarcely escaping them. From this I infer that the poison of the visitation is with difficulty eliminated, the endermic eruption, as is usual, not accompanying it.'

"As extraordinary efforts have been made to protect by vaccinating, with pure and reliable virus, the army and all persons exposed to its influence; as the most scientific means have been taken to prevent the disease, and to treat it when incurred, by every resource known to the profession, I cannot attribute the mortality to want of care or skill in the medical officers having charge of the cases."

It is important to note, in connection with these observations of Surgeon Carrington, that the Federal prisoners confined at Andersonville brought the small-pox with them from Richmond, where they had been previously imprisoned, and where a most malignant form of the disease was prevailing, both amongst the Confederate soldiers and private citizens.

Small-pox in the Grant Hospital, Atlanta, Ga.

The following table gives the cases and deaths of variola and varioloid treated in the Grant (small-pox) Hospital, Atlanta, Ga., January, 1863, to June, 1864.

CASES OF AND DEATHS FROM SMALL-POX IN GRANT (SMALL-POX) HOSPITAL, ATLANTA, GA., JANUARY, 1863, TO JULY, 1864, CONSOLIDATED FROM MONTHLY REPORTS, BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Variola.		Varioloid.		Month and Year.	Variola.		Varioloid.	
	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.
1863.									
January	39	12	22	1	December	3	–	1	–
February	3	4	2	–	1864.				
March	1	–	–	–	January	17	5	7	–
May	–	–	3	–	February	22	3	5	–
June	1	–	2	–	March	9	4	4	–
July	–	–	–	–	April	4	1	4	–
August	–	–	1	–	May	5	–	1	–
September	–	–	1	–	June	14	1	4	–
October	–	–	–	–					
November	2	–	–	–	Totals	110	29	57	1

The mortality from variola and varioloid was much less in this hospital attached to the army of Tennessee than in the general hospitals of Virginia, and amongst the Federal prisoners at Andersonville; the ratio of fatal cases being in the cases of variola 26.3 per cent., and in the cases of varioloid only 1.7 per cent., and in both forms of small-pox combined 18 per cent.

REPORT OF THE PHYSICIAN (DR. G. GREGORY), LAID BEFORE THE GENERAL COURT OF THE HOSPITAL FOR CASUAL SMALL-POX AND VACCINATION, AT ST. PANCRAS, DECEMBER 1ST, 1825. ADMISSIONS AND DEATHS AT THE SMALL-POX HOSPITAL DURING FIFTY YEARS; NAMELY, FROM 1776 TO 1825 INCLUSIVE, WITH THE RATE OF MORTALITY PER CENT. IN EACH YEAR (OMITTING FRACTIONS).

Year.	Admissions.	Deaths.	Rate of Mortality per cent.	Year.	Admissions.	Deaths.	Rate of Mortality per cent.
1776	374	80	21	1801	177	55	31
1777	497	125	25	1802	175	68	39
1778	269	74	27	1803	98	22	22
1779	351	136	38	1804	48	8	17
1780	175	53	30	1805	280	97	35
1781	646	257	40	1806	100	35	35
1782	122	52	42	1807	172	48	28
1783	382	121	32	1808	128	36	28
1784	351	127	36	1809	146	41	28
1785	314	108	34	1810	149	51	34
1786	175	51	29	1811	94	22	23
1787	362	106	29	1812	144	54	37
1788	142	49	34	1813	69	18	26
1789	285	107	38	1814	79	26	33
1790	192	68	35	1815	101	34	34
1791	277	89	32	1816	141	29	20
1792	188	58	30	1817	160	48	30
1793	358	134	37	1818	58	14	24
1794	213	72	33	1819	193	61	32
1795	180	48	27	1820	142	34	25
1796	447	148	33	1821	117	49	42
1797	51	14	27	1822	194	57	29
1798	265	89	33	1823	151	37	24
1799	151	43	28	1824	199	54	27
1800	250	68	27	1825	419	120	29
25 years.	7,017	2,277	32½	25 years.	3,743	1,118	30

The preceding table presents valuable data for the comparison of these results with the statistics of European hospitals.

Statistics of European hospitals.

During the first period of twenty-five years vaccination was unknown, while during the second it was universally practiced; and the table shows that the ravages of natural small-pox have been diminished by the introduction of vaccination in the proportion of thirty-two and a half to thirty. The mortality during the last period is certainly very high, and greater even than amongst the Confederate troops, when it is known that in the preceding table the cases of varioloid are included with those of variola. In 1825 the rate of mortality rose as high as 41 per cent. in the unprotected, as will be seen by the following table: —

Diminution of small-pox by vaccination.

ADMISSIONS INTO THE SMALL-POX HOSPITAL AT ST. PANCRAS, DURING 1825.

	Admitted.	Cured.	Died.	Per cent. Deaths.
Casual Small-Pox in the Unprotected	263	156	107	41
Casual Small-Pox after Vaccination	147	135	12	8
Casual Small-Pox after Inoculation	2	1	1	–
Eruptive Diseases, not Variolous	7	7	–	–
Totals	419	299	120	29

A remarkable difference will be perceived between the deaths which have occurred among the unprotected and those who had obtained the advantage of previous vaccination. The records of the hospital of St. Pancras present but few instances of a rate of mortality as high as forty-one per cent.; yet it was believed by the author of this report that this would have been the average of 1825 but for the influence of vaccination. From this table it appears that more than a third of the patients admitted had been previously vaccinated. The disease, however, was so much modified, and in most instances so extremely slight, that one hundred and thirteen of the one hundred and forty-seven left the hospital, cured, within fourteen days from their admission. In a few, convalescence was protracted to three or four weeks. Twenty-five passed through the disease in its natural or unmodified form, of whom twelve died; as shown by the cicatrix

Effect of vaccination on the rate of mortality from small-pox.

on the arm, the vaccination in all these fatal cases was imperfect and nominal, and not such as an individual should have relied on.[1]

Mr. Simon has given the following valuable illustrations, selected from various sources, which not only show the extent of the security against death enjoyed by vaccination compared with unvaccinated persons, but also furnish data for the determination of the relative mortality of Andersonville.

Places and Times of Observation.	Total Number of Cases Observed.	Death-rate Per 100 Cases.	
		Among the Unprotected.	Among the Vaccinated.
France, 1816–41	16,397	16.13	1
Quebec, 1819–20	–	27	1.67
Philadelphia, 1825	240	60	–
Canton Vaud, 1825–29	5,838	24	2.17
Durkehmen (Dürkheim), 1828–29	134	18.8	–
Verona, 1828–39	909	46.25	5.67
Milan, 1830–51	10,240	38.33	7.67
Breslau, 1831–33	220	53.8	2.11
Wirtemberg, 1831–35	1,442	27.33	7.1
Carniola, 1834–35	442	16.25	4.4
Vienna Hospital, 1834	360	51.25	2.5
Carinthia, 1834–35	1,626	14.5	.5
Adriatic, 1835	1,002	15.2	2.8
Lower Austria, 1835	2,287	25.8	1.5
Bohemia, 1835–55	15,640	29.8	5.17
Galicia, 1836	1,059	25.5	5.14
Dalmatia, 1836	723	19.67	8.25
London Small-Pox Hospital, 1837–56	9,000	35	7
Kiel, 1852–53	218	32	6
Wirtemberg, no date	6,258	38.9	3.5
Malta, no date	7,570	21.07	4.2
Epidemiological Society Returns, no date	4,624	19.7	2.9
Vienna Hospital, 1837–56	6,213	30	5

Death-rate among those vaccinated.

It thus appears that the death-rate amongst the vaccinated varies from an inappreciably small mortality, to twelve and a half per cent.; that amongst the unprotected it ranges from fourteen and a half to sixty per cent.; and that the mortality from small-pox amongst the Federal prisoners confined at Andersonville was actually less than the ratio of mortality occurring at Philadelphia in 1825, and but little greater than the mortality from this disease at Verona (1828–39), Breslau (1831–33), and in the Vienna Hospital, 1834.

Arrest of small-pox at Andersonville by vaccination.

The spread of small-pox amongst the crowded Federal prisoners at Andersonville was promptly arrested by vaccination.

Untoward results of vaccination.

Untoward results followed vaccination in a number of cases; large gangrenous ulcers appeared at the points where the vaccine lymph had been inserted, causing extensive de-

[1] *London Lancet*, February 11, 1826, p. 670.

struction of the tissues, and necessitating amputation in more than one instance. During the prosecution of my investigations at Andersonville, I examined several of these cases.

These accidents led to the belief amongst some of the prisoners that the surgeons had intentionally introduced poisonous matter into their arms during vaccination.

After careful inquiry I was led to the conclusion that these accidents were, in the case of these Federal prisoners, referable in a great measure, if not wholly, to the scorbutic condition of their blood and to the crowded condition of the Stockade and Hospital.

The smallest accidental injuries and abrasions of the surface, as from splinters or bones, or bites of insects, were in a number of instances followed by such extensive gangrene as to necessitate amputation.

The gangrene following vaccination appeared to be due essentially to the same causes; and in the condition of the blood of these patients would most probably have attacked any puncture made by a lancet without any vaccine matter or any other extraneous material. It appeared also that the dried scab resulting from the vaccination of scorbutic patients frequently produced effects wholly different from the vaccine lymph of healthy individuals, and in some cases these effects were of a most potent and injurious character.

The same results occurred in the Confederate armies.

Similar accidents following vaccination occurred in the Confederate armies, and a number of deaths, both amongst the troops and citizens, were directly referable to the effects of vaccination. So great was the evil that it was made a special subject of investigation, and a number of most interesting reports were prepared by several of the corps, division, brigade, and hospital surgeons and medical inspectors, upon what was most generally called in the army "spurious vaccination." My friend, Surgeon Jackson Chambliss, in charge of Ward No. 1, Camp Winder Hospital, had examined and recorded a large number of cases of spurious vaccination, and illustrated the cases with valuable drawings of the various local diseases and skin affections. As far as my information extends, this valuable mass of matter, relating to one of the most important subjects in its bearings upon the welfare of the human race, was destroyed during the evacuation of Richmond by the Confederate forces. So common had accidents become after vaccination, and so strong was the prejudice growing both in the army and amongst citizens against its employment, that I strongly urged the inoculation of cows with small-

pox matter, in order to produce, if possible, cow-pox, from whence a supply of fresh and reliable vaccine matter might be obtained; and with the assistance of Surgeon Harden and Assistant-Surgeon Langdon Carter, of the Empire Hospital, I inoculated a cow with the matter from the perfectly developed pustules of a case of confluent small-pox. It was my design to carry out an extensive series of investigations upon the various secondary affections following vaccination; and to determine, if possible, what infectious principles could be associated with the lymph of the vaccine vesicle. These labors were brought to a sudden and unexpected close, by the disastrous close of the civil war. As far, however, as my labors amongst the Confederate troops extended, I was led to attribute the injurious effects of vaccination to the following causes: —

I. Scorbutic condition of the blood of the patients vaccinated and yielding vaccine matter. Large numbers of the Confederate soldiers manifested slight scorbutic symptoms, which were not sufficient to attract attention or to induce treatment, and as far as I could learn, no attention was paid to this condition, either in vaccination or in the selection of vaccine lymph. In scorbutic patients all injuries tended to form ulcers of an unhealthy character, and the vaccine vesicles, even when they appeared at the proper time, and manifested many of the usual symptoms of vaccine disease, were nevertheless large, and more slow in healing, and the scabs presented an enlarged, scaly, dark, unhealthy appearance. In many cases a large ulcer, covered with a large, thick, laminated crust, from one quarter to more than one inch in diameter, followed the introduction of the vaccine virus into scorbutic patients. Matter from these scabs and sores was frequently used in vaccination, and this decomposing pus and blood acted as an animal poison in some cases, and especially in constitutions debilitated by exposure, fatigue, and salt diet.

II. The employment of matter from patients who had been previously vaccinated, and who were partially protected.

Whilst it might admit of debate whether pure vaccine virus, obtained from persons never before vaccinated, and who manifested all the phenomena of the disease, and especially the characteristic febrile phenomena, ever becomes deteriorated or possessed of deleterious properties in its passage through numerous human bodies not suffering with such contagious diseases as syphilis; on the other hand, it cannot be denied that the protective power of vaccination has been impaired to a lamentable and almost incalculable extent by a succession of imperfect vaccinations.

Vaccination may be rendered imperfect by the development of febrile and other diseased states after the introduction of the virus into the system, arising from the action of cold or some other cause, producing constitutional disturbances differing essentially from the febrile phenomena which mark the progress and perfection of the vaccine disease, as well as by its imperfect and altered course in those who are partially protected by previous vaccinations.

In the isolated condition of the Southern Confederacy, cut off from the surrounding world, and denied even vaccine matter, as *contraband of war;* with the necessity of turning out the entire fighting population to repel invasion, and with the necessity of employing all the available medical aid, good, bad, and indifferent; and in view of the progressive increase of small-pox, it is not strange that the process of vaccination was not as carefully watched and tested as it should have been, and that consequently much imperfect matter circulated extensively, as *vaccine matter*, which not only afforded little or no protection against small-pox, but also proved positively deleterious.

III. Direct vaccine lymph, or scabs, in which decomposition had been excited by carrying the matter about the person for a length of time, and thus subjecting it to a warm, moist atmosphere. The effects of such putrefying matter resembled those of putrid animal matter.

IV. Dried vaccine lymph or scabs from patients who had suffered with erysipelas during the progress of the vaccine disease.

In several instances death resulted from phlegmonous erysipelas following vaccination, in apparently healthy patients, in both civil and military practice.

V. Fresh and dried vaccine lymph or scabs from patients suffering with secondary syphilis at the time and during the progress of vaccination and the vaccine disease.

I examined at different times, during the progress of the recent war, and also had under my treatment various skin affections which presented the characters of the cutaneous diseases characteristic of secondary syphilis, which were directly traceable to impure vaccine virus. In several cases enlarged buboes in the axilla and groin accompanied the peculiar skin affections induced by "spurious vaccination."

A number of the Confederate surgeons took the ground that secondary syphilis could be communicated along with the vaccine virus, and especially when the dried scabs were employed. In the

records upon this subject, which I examined in the Surgeon-General's Office in the Confederate capital, this view was clearly announced and supported by well recorded and incontrovertible facts. Up to the commencement of the present civil war, the belief was almost universal that secondary syphilis could not thus be communicated by vaccination.[1]

[1] The writer concludes this chapter with some further remarks on spurious vaccination, which are omitted, inasmuch as to this subject an entire chapter of the second section is devoted, and the writer of that chapter has availed himself of the writings of Prof. Jones on the subject. — EDITOR.

CHAPTER EIGHTH.

DISEASES OF THE FEDERAL PRISONERS DUE TO LONG CONFINEMENT, DIET, EXPOSURE, ETC.

Diseases of the Federal Prisoners due to Long Confinement, Sameness of Diet, Salt Meat, Absence of Fresh Vegetables, Milk, and Sugar. — Scurvy and its various Manifestations and Effects, Scorbutic Ulcers, Dropsy, Enlargement of Parotid Glands, etc.

Diseases Referable in a Measure to Long Confinement upon the same Diet, to Exposure without proper Shelter, and to Crowding and Personal and General Filth. — Diarrhœa and Dysentery. — Hospital Gangrene. — Illustrative Pathological Observations. — General Conclusions.

DISEASES DUE CHIEFLY TO SAMENESS OF DIET, SALT MEAT, ABSENCE OF FRESH VEGETABLES. — SCURVY AND ITS VARIOUS MANIFESTATIONS AND EFFECTS.

Number of cases of scurvy, debility, and dropsy among the prisoners at Andersonville during six months.

From the 1st of March to the 1st of September, 1864, 9501 cases and 999 deaths were recorded under the head of scorbutus on the sick reports of those Federal prisoners confined at Andersonville. We also observe during the same period the record of 1510 cases of anasarca and 315 deaths; 46 cases ascites and 4 deaths; 50 cases hydrops pericardii and 24 deaths; 53 cases marasmus and 53 deaths; 875 cases debilitas and 168 deaths.

It is probable that these cases and deaths from anasarca, ascites, hydrops pericardii, and the deaths from debility, were caused by the scorbutic condition of the blood, as well as by the deranged condition of the alimentary canal.

Deaths from morbi varii and marasmus due to scurvy.

The large number of deaths set down under the head of morbi varii and marasmus, were in like manner due chiefly, if not entirely, to scurvy and diarrhœa and dysentery. The following table will present the relations of these various diseases to the mean strength and to the period of confinement: —

TABLE OF CASES OF, AND DEATHS FROM, DIETETIC DISEASES AMONGST THE FEDERAL PRISONERS CONFINED AT ANDERSONVILLE, 1st MARCH TO 1st SEPTEMBER, 1864. — SCURVY AND ITS EFFECTS, ETC.

Month and Year.	Mean Strength.	Aggregate Cases on Sick List.	Total Cases entered during Month, and Deaths.		Scurvy.		Anasarca.		Ascites.		Hydrops Pericardii.		Marasmus.		Morbi Varii.		Debility.	
			C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
1864.																		
March . .	7,500	–	1,539	283	15	–	28	2	8	–	–	–	–	–	–	17	34	3
April . .	10,000	3,061	2,425	576	50	–	32	6	6	2	–	–	–	–	100	–	66	12
May. . .	15,000	9,605	8,583	708	1,221	14	233	50	10	1	–	–	–	–	6	3	137	10
June . .	22,291	10,590	7,968	1,201	2,097	68	248	71	16	–	–	–	–	–	9	8	80	37
July. . .	29,630	14,912	10,834	1,952	3,092	195	304	66	5	–	–	–	–	–	203	381	112	35
August .	32,899	17,758	11,346	2,992	3,026	722	665	120	1	1	50	24	53	53	156	156	446	71
Totals .	21,120	–	42,686	7,712	9,501	999	1,510	315	46	4	50	24	53	53	474	565	875	168

We observe a progressive increase of scurvy and the deaths referable to this condition of the system; thus, during the first two months, March and April, only 65 cases of scurvy were entered upon the sick reports with no deaths; whilst during the last month, August, 3026 cases and 722 deaths were recorded.

Progressive increase of the number of cases of scurvy.

Nearly one half, or 44.9 per cent. of the monthly mean strength were entered upon the sick reports with scurvy; the cases of this disease constituted 20.1 per cent. of all diseases entered during six months; the deaths from scurvy constituted 10.5 per cent. of the cases of this disease, and 12.9 per cent. of the deaths from all causes. The other diseases recorded in the table, as anasarca, ascites, hydrops pericardii, etc., numbered in the aggregate 3008 cases with 1129 deaths. The high mortality of 37.5 per cent. amongst this class of diseases can only be accounted for on the supposition that they were due to the scorbutic condition of the blood. If these cases be included with those of scurvy, then the total cases of scurvy would number 12,009 with 2128 deaths; and the ratio of deaths to the cases of this disease would be 17.7 per cent.; and the deaths from scurvy and scorbutic affections would constitute 26.2 per cent. of the deaths from all causes. This calculation, of course, yields only approximate results.

Nearly one half of the monthly mean strength on the sick reports with scurvy.

Total number of cases of, and deaths from, a scorbutic condition.

Notwithstanding that these figures represent more than one half the mean strength as having suffered with scurvy, the statement appears to be below the truth. During my investigations, it appeared that large numbers of the

Nearly all the older prisoners more or less scorbutic.

prisoners, who had never been reported sick, were suffering with scurvy, and almost every one of the older prisoners were more or less scorbutic.

We have before alluded to the various symptoms manifested by this disease at Andersonville, as the enlargement of the parotid glands, the livid, swollen, spongy, fungoid gums, loose teeth, fetid breath, dusky, unhealthy complexion, dark purple blotches upon the skin, the hard, rough feeling of the lower extremities, and the foul, spreading scorbutic ulcers.

Symptoms denoting scurvy.

The swelling of the parotid glands in these cases of scurvy was generally a fatal symptom; and in many cases this symptom appeared to precede death by only a few days.

Parotiditis generally a fatal event.

In this foul atmosphere, the scorbutic ulcers, however excited, soon took on the appearance and action of hospital gangrene.

The condition of the scorbutic patients did not differ from that given as characteristic of the disease by the oldest writers.[1]

In the description of the obvious and external phenomena of scurvy as it prevailed amongst these Federal prisoners at Andersonville, and in the determination and application of remedial and therapeutic means, I was able to add little or nothing to the elaborate descriptions of the older writers, and especially the admirable delineations of Lind and Trotter.

Feeling dissatisfied with the results of the incomplete and meagre chemical researches upon the changes of the blood, organs, tissues, and excretions in scurvy, which had been previously published, and believing that any further advance in the pathology of the disease was to be achieved mainly by careful chemical analysis of the solids and fluids, and especially of the blood, in connection with careful records of all the phenomena of the disease, and related circumstances, and of the results of *post-mortem* examinations, I earnestly desired to institute a series of analyses directed to the determination of the amounts and variations in physical and chemical properties of the fibrine, albumen, blood corpuscles, and saline constituents of the blood, in various stages of the disease, and in its various manifestations and complications with inflammatory and febrile diseases, and had provided myself with such apparatus and re-agents as could be commanded in the Confederacy for such labors; but seeing the foul ulcers and gangrene following the slightest injuries, I did not feel justified in subjecting these prison-

The condition of the patients did not admit of the abstraction of blood for analysis.

[1] Extracts, descriptive of scurvy, from the writings of Clowes, Woodall, and Gideon Harvey, are omitted. — Editor.

ers of war to the inconveniences and dangers of blood-letting for purely scientific purposes.

The scurvy referable to the character of the food rather than the amount.

The scorbutic state of these prisoners was directly referable to the character rather than to the amount of the food, or to the exhalations from the filth of the Stockade and Hospital, as was clearly shown by the remarkably healthy and strong appearance of the paroled prisoners, who were allowed an extra ration, and who were able to supply themselves with whatever vegetables the country afforded by the sums of money which they made in trade with their fellow-prisoners and the Confederate soldiers. The exhalation of the filthy quagmire of human filth appeared to exert but little or no injurious effect upon these men, although they were in many instances equally exposed with those perishing with scurvy and diarrhœa. In considering this striking contrast, I was reminded of the observation of John Woodall, made more than two hundred years ago : —

"That to any man of judgment, it may seeme a wonder, how a poore miserable man, coming on lande from a long voyage, even at the point of death, namely swolne sometimes to an exceeding greatnesse, not able to lift a legge over a straw, nor scarce to breathe, by reason of strong obstruction, yet, in a *few dayes*, shall receive the fulness of former healthe, yea, with *little* or *no medicine* at all."

Relative amounts and character of the rations issued to the prisoners and to the Confederate soldiers generally.

The following tables will enable us to form some idea of the relative amounts and character of the rations issued to these prisoners and to the Confederate soldiers generally.

By the regulations for the army of the Confederate States, as adopted by act of Congress, approved March 6th, 1861, the ration of the Confederate soldier consisted of —

"Three fourths of a pound of pork or bacon, or one and a fourth pounds of fresh or salt beef; eighteen ounces of bread or flour, or twelve ounces of hard bread, or one and a fourth pounds of corn meal; and at the rate, to one hundred rations, of eight quarts of pease or beans, or in lieu thereof, ten pounds of rice, six pounds of coffee, twelve pounds of sugar, four quarts of vinegar, one and a half pounds tallow, or one and a fourth pounds adamantine, or one pound sperm candles; four pounds of soap, and two quarts of salt. On a campaign, or on marches, or on board transports, the ration of hard bread is one pound. . . .

"When the officers of the medical department find anti-scorbutics necessary for the health of the troops, the commanding officer may order issues of fresh vegetables, pickled onions, sour krout, or molasses, with

an extra quantity of rice and vinegar. (Potatoes are usually issued at the rate of one pound per ration, and onions at the rate of three bushels, in lieu of one of beans). Occasional issues (extra) of molasses are made — two quarts to one hundred rations — and of dried apples of from one to one and a half bushels to one hundred rations. Troops at sea are recommended to draw rice and an extra issue of molasses in lieu of beans. When anti-scorbutics are issued, the medical officer will certify the necessity and the circumstances which cause it upon the abstract of extra issues."

Impossibility of supplying coffee, sugar, etc. Substitution of corn-meal for wheat-flour.

As the war progressed, cut off as the Confederacy was from the surrounding world, it was found to be impossible to supply coffee; afterwards, as the sugar-growing regions of the Confederacy fell into the hands of the enemy, this article, as well as molasses, ceased to be a component part of the ration; then from imperfect means of transportation, as well as from the almost nominal value of the currency, potatoes, beans, dried apples, and vegetables generally were only occasionally issued in very small quantity, and rice disappeared almost entirely after the occupation by the Federal forces of a large portion of the coast; and, finally, after the best grain (wheat) growing regions of the Southern States, as the Valley of Virginia, and Northern Alabama and Georgia, were overrun and devastated, indian corn-meal was necessarily substituted to a large extent, and in many parts of the Confederacy *wholly*, for wheat flour. And in 1864, during the period of these investigations at Andersonville, the Confederate ration issued to the soldiers in the field consisted of: beef, one pound, or in lieu one third pound bacon; meal, one and a quarter pounds, with an occasional issue of rice, beans, molasses, and vinegar.

Difficulty of obtaining regular supplies of beef.

It was difficult to procure regular supplies of beef, and the Confederate troops were confined for considerable periods of time to salt pork and bacon; and the small allowance of one third of a pound was frequently diminished to one half the quantity.

Scurvy did not prevail early in the war among the Confederate troops.

During the earlier periods of the war, scurvy did not prevail to any great extent amongst the Confederate troops, as will be seen from the following table: —

CASES OF SCURVY ENTERED UPON THE FIELD AND HOSPITAL REPORTS OF THE CONFEDERATE ARMIES DURING A PERIOD OF NINETEEN MONTHS, JANUARY, 1862, TO JULY 1863, CONSOLIDATED FROM MONTHLY REPORTS IN SURGEON-GENERAL'S OFFICE, C. S. A., BY JOSEPH JONES, SURGEON, P. A. C. S.

Month and Year.	Field Reports.			Hospital Reports.	
	Mean Strength, Officers and Men.	Sick and Wounded entered during Month.	Cases of Scorbutus.	Sick and Wounded (total) entered during Month.	Cases of Scorbutus.
1862.					
January	232,138	90,757	15	3,292	–
February	219,069	71,672	49	2,472	1
March	165,047	50,385	31	2,341	–
April	58,304	23,243	16	2,543	–
May	58,690	25,985	84	9,700	4
June	136,362	78,583	429	16,605	8
July	79,999	41,700	157	18,918	33
August	113,407	50,987	122	21,546	131
September	125,408	42,450	43	46,733	83
October	156,734	48,605	56	39,170	35
November	270,480	71,328	46	44,890	24
December	172,800	67,461	59	29,032	14
1863.					
January	192,776	76,620	28	12,542	3
February	215,458	60,135	75	13,378	11
March	313,848	92,788	247	12,809	17
April	190,518	60,407	184	14,884	49
May	163,711	48,589	185	41,889	318
June	107,153	33,805	227	27,389	872
July	72,396	20,849	152	37,073	465
Totals	160,231	1,056,349	2,203	398,641	2,068

It will be seen from this table that in an army with a monthly mean strength of 160,231 officers and men, and with 1,056,349 cases of sickness and wounds entered upon the field reports in nineteen months, January, 1862, to July, 1863; during this period in the early history of the war, and in this immense number of cases, only 2203 cases of scurvy were recorded upon the field reports, and in 398,641 cases of sickness and wounds entered upon the hospital reports, only 2068 cases of scurvy were recorded.

Progressive increase of scurvy among the Confederate troops.

Although I have not at hand the statistics to demonstrate the progressive increase of scurvy amongst the Confederate troops, it is nevertheless true that this disease did increase as the rations of meat became more scant, and the transportation of supplies more difficult. In General Lee's army of Northern Virginia the symptoms of scurvy were, previous to both of his invasions of Maryland and Pennsylvania, wide-spread, as manifested in the frequence of night-blindness, in the numerous accidents after vaccination, in the increase of secondary hemorrhage and hospital gangrene after wounds,

as well as in the actual manifestations of the disease, indisposition to exertion, spongy gums, uncertain and ill-defined muscular pains, and obstinate diarrhœa and dysentery. The invasions of Maryland and Pennsylvania appear to have been dictated as much by a desire to improve the condition of the army of Northern Virginia by subsisting it upon the rich fields and valleys of the enemy, as by the necessity of relieving the distressed inhabitants and bloody soil of Virginia from the desolating march of contending armies. Scurvy was beginning to manifest itself extensively in the other great army of the Confederacy, under the command of General Bragg, when it commenced its retrograde march from around Chattanooga; and during the disastrous campaign of Northern Georgia, culminating with the fall of Atlanta, hospital gangrene, pyæmia, and secondary hemorrhage prevailed to an alarming extent amongst the Confederate wounded.

Improvement of the general health of Confederate troops on short rations.

I have heard a number of Confederate surgeons affirm that the general health of the Confederate troops improved upon short rations; that is, fewer men were entered upon the sick list when the rations were reduced to one half the usual quantity. The progressive diminution of certain severe forms of disease, and the ability of the men to stand exposure with comparatively little sickness toward the close of the war, was not at all necessarily connected with the decrease of rations. The health of the Confederate soldiers, without doubt, improved as the men became enured to fatigue and exposure, and were transformed into veterans. The destruction of the feeble, also, by various diseases, as typhoid fever and pneumonia, tended to diminish the lists and number of diseases; and as only the stronger and more hardy were left, the sick list necessarily became smaller. The fact that typhoid fever is liable to attack recruits, and as a general rule affects the individual but once during life, should also be carefully considered in attempting to estimate the causes of the progressive diminution of disease amongst the soldiers.

A large amount of extra supplies received.

The bravery and tenacity with which the Confederate soldiers continued the unequal struggle to the end, until worn out by incessant marching and hunger, they were compelled to surrender to vastly superior numbers, shows that neither the courage nor the general strength was materially impaired. It is difficult, however, to correctly appreciate the full effects of the scant rations upon the Confederate troops, from the fact that throughout the entire war they received an immense

amount of extra supplies from their friends and relatives, through the ladies, and through various state agencies and benevolent institutions; and much extra food was also gathered by private foraging. The instinct of self-preservation was strongly and progressively developed by the war; and toward its close, the loose foraging of the Confederate cavalry upon friend and foe became proverbial, and some companies fairly won for themselves the distinguishing title of "Butter-milk Rangers."

Secondary hemorrhage and hospital gangrene dependent on a scorbutic condition, although the active symptoms of scurvy were not manifested.

In a country of such vast extent and of such wonderful agricultural resources, and with such immense numbers of cattle and hogs, and with such abundance of fruit, it became exceedingly difficult to determine the effects of the rations upon the soldiers. The great fact, however, was observed in numerous hospitals throughout the Southern Confederacy, that whilst well-marked symptoms of scurvy were not often observed amongst the wounded, and whilst the men from the battle-fields generally presented a hardy and strong appearance, at the same time secondary hemorrhage and hospital gangrene progressively increased during the progress of the war; and the former complication of gunshot wounds and operations fearfully increased, becoming in the various hospitals, after the last great battles, of daily and even of hourly occurrence. This marked increase of secondary hemorrhage appeared to be referable to the prolonged use of salt meat, and the consequent scorbutic condition of the blood, although the active symptoms of scurvy were not manifested. The increase of hospital gangrene may in like manner have been connected in a large measure with physical and chemical changes of the blood and organs dependent upon imperfect nutrition.

That the preceding observations present a correct explanation of the absence of scurvy in its severe and fatal forms amongst the Confederate troops, notwithstanding that the rations issued were utterly inadequate of themselves to maintain the men in health, is conclusively demonstrated by the great suffering and heavy losses from scurvy of the French and English armies during the Crimean war, notwithstanding that the two most powerful governments of Europe furnished their soldiers with greatly superior rations, both in quantity, quality, and variety.[1]

The mortality from scurvy among the

Even the American soldier, who, according to the assertion of the Surgeon-General of the United States Army, W. A. Hammond, "is better fed than any other in the world,"

[1] An account of the French and English ration, and of the occurrence of scurvy in the Crimean war, is omitted; also extracts from Woodward, Hamilton, and others. — EDITOR.

did not escape the effects of scurvy. These instances are sufficient to show that the apparently great mortality at Andersonville was actually less than that which had frequently occurred amongst seamen and soldiers similarly situated with reference to salt diet and scant supplies of vegetables. Owing to the strict blockade and the occupation of the entire sea-coast, with the exception of a few isolated points, and the possession of a large portion of Florida, and especially of the southern peninsula, by the United States forces, the Confederate medical department was utterly unable to supply citric acid and oranges and lemons, in anything like adequate quantities, to the scorbutic patients of its own armies. The fact that the mortality amongst the Federal prisoners confined at Andersonville was less than could have been reasonably expected amongst a body of men strictly confined to the rations of salt meat, beef, and cornmeal issued to the Confederate soldiers in the field, can only be referred to the efforts made by the medical staff and by the officers in charge of the commissary department to furnish the prisoners with such vegetables as could under the circumstances be commanded in a sparsely settled country. How far these efforts extended I am unable to say; neither is it possible for me fully to unfold the difficulties under which the officers in charge of these prisoners labored; of the fact, however, that efforts were made to improve the condition of these unfortunate men I was convinced, not merely by the statements of the officers, but by seeing hundreds of the prisoners in the hospital cooking green pease and beans which had been furnished them for the relief of the scurvy.

prisoners at Andersonville less than could reasonably have been expected.

DIARRHŒA AND DYSENTERY: DISEASES REFERABLE IN A MEASURE TO LONG CONFINEMENT TO THE SAME DIET, TO EXPOSURE WITHOUT PROPER SHELTER, TO CROWDING AND TO GENERAL AND PERSONAL FILTH.

During the six months 12,090 cases and 3530 deaths from acute and chronic diarrhœa, and 4682 cases and 999 deaths from acute and chronic dysentery were recorded. The cases of diarrhœa and dysentery together numbered 16,772, or nearly one half of the total number of sick and wounded. The deaths caused by these two diseases are recorded at 4529; or in other words, these diseases caused more than one half, or more exactly, 58.7 per cent. of all the deaths. These figures are below the truth. As far as my personal examinations extended, almost every prisoner was afflicted with either diarrhœa or dysentery. The former disease was the most prevalent.

Number of cases of diarrhœa and dysentery, and the fatality during six months among the prisoners at Andersonville.

Progressive increase of these diseases.

As in the case of scurvy, so also in these bowel affections we observe a progressive increase of cases and deaths, as will be seen from the following figures: —

CASES OF AND DEATHS FROM CHRONIC AND ACUTE DIARRHŒA AMONGST THE CONFEDERATE PRISONERS CONFINED AT ANDERSONVILLE.

Month and Year.	Acute Diarrhœa.		Chronic Diarrhœa.		Acute Dysentery.		Chronic Dysentery.		Total Diarrhœa and Dysentery	
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
1864.										
March	386	51	95	26	143	29	42	12	671	118
April	916	220	233	115	133	49	51	27	1,333	411
May	1,729	251	608	171	870	93	407	8	3,614	523
June	1,966	330	510	447	540	98	271	5	3,287	880
July	2,796	517	349	330	999	215	180	27	4,324	1,089
August . . .	1,982	792	520	280	859	364	187	72	3,548	1,508
Totals . .	9,775	2,161	2,315	1,369	3,544	848	1,138	151	16,772	4,529

Per cent. of deaths in cases of diarrhœa and dysentery during this period of six months, 27, or one death in 3.7 cases.

Causes of the prevalence of bowel affections.

The great prevalence of bowel affections amongst the Federal prisoners were due to several causes, as —

First. The long-continued use of salt meat and of coarse corn bread unbolted, and improperly cooked food.

Second. Scorbutic condition of the blood, scurvy and its various manifestations.

Third. The action of the gases, and especially of sulphureted hydrogen and hydro-sulphuret of ammonia, arising from the immense accumulation of fecal matters.

Fourth. Reduction of the temperature and of the forces, and irregularity induced in the action of the skin and kidneys, by exposure, without shelter and sufficient covering, to the cold ground at night, to dew and rain, and to the hot sun by day.

Fifth. Suppression to a great extent of the functions of the skin, consequent upon the accumulation of dust, smoke, and filth. The skin of those prisoners who neglected to bathe at regular intervals was so coated with the dust of the ground upon which they lay, and with the soot of the burning pine of the innumerable fires which they kindled all over the Stockade and Hospital grounds, that it resembled more nearly parchment and sand-paper — the pores being apparently completely stopped up, and the complexion in some cases so blackened that the unfortunate men looked more like Indians and Negroes than white men.

The corn bread baked and issued to the prisoners consisted of unbolted corn-meal, as did the rations issued generally to the Confederate soldiers; and the Federals, who were accustomed to wheat bread, could not abide this coarse corn bread.

Effect of bread made of unbolted corn-meal.

I saw immense piles of this corn bread, both in the Stockade and in the Hospital grounds, which had been thrown away by the prisoners.

The husk of the indian corn appeared to exert a decided irritant effect upon the intestinal canal.

Amidst the immense mass of human excrement in both localities, I did not see a single moulded stool.

The foul exhalations from the innumerable small sinks and deposits of excrements at the very tent doors, as well as from the more extensive deposits in and around the streams, must also without doubt have depressed the forces, and not only aggravated, but also caused derangements of the intestinal canal.

Bowel disorders aggravated by foul exhalations.

The effects of the diarrhœa in reducing the muscular system appeared to be very gradual. Patients whose flesh was emaciated to such a degree that they resembled living skeletons, would still continue to move about and prepare their food up to a short time before death.

Effects of diarrhœa on muscular system. — Dropsical effusions followed arrest of the diarrhœa.

In some cases, when the discharges from the bowels were checked by a change of diet and by opiates, dropsical effusions took place into the abdomen and lower extremities.

The treatment instituted appeared to have little or no beneficial effect, because the necessary diet was not furnished the sick. It was in vain to look for a recovery from chronic diarrhœa and dysentery when the patients were confined to coarse corn-bread, bacon, and beef, and whilst they were suffering with scurvy.

Treatment inefficacious.

The most efficient treatment of these cases would have been with good fresh milk, combined when necessary with lime-water, and morphine, with boiled rice and milk, beef tea, chicken soup, alcoholic stimulants, tonics (especially the preparations of iron, as the sesquichloride), and with antiscorbutics, digestible vegetables, Irish potatoes, sweet potatoes, vinegar and citric acid, and good ripe fruit in moderation.

I expressed to the medical officers my decided opinion as to the worthlessness of remedies without the proper nourishment.

It is probable that in the majority of the cases of long standing,

no treatment whatever would have availed, so thoroughly disorganized was the mucous membrane of the intestinal canal.

Appearances after death.

In those cases of diarrhœa and dysentery which I examined after death, the congestion of the mucous membrane of the small and large intestines was intense, and was often accompanied with ulceration and mortification. The mortification of the intestinal mucous membrane in many of these cases appeared to be similar in its nature, and to be due to the same causes, as that form of mortification known as hospital gangrene.

Existence of scurvy in obstinate cases of diarrhœa and dysentery.

I had no doubt of the connection of scurvy with a large number, if not with all these cases of obstinate diarrhœa and dysentery. The existence of this connection, in the relation of cause and effect, was inferred not merely from the actual existence of scurvy, but also from the highly important fact that every form of treatment which did not include anti-scorbutic remedies, and especially anti-scorbutic diet, proved utterly powerless to arrest the disease. No cures of these bowel affections were so speedy and effectual as those which were effected in the paroled prisoners, who were supplied with extra rations, and who were able to purchase vegetables in sufficient abundance to remove the scorbutic symptoms.

The dependence of these obstinate diarrhœas and dysenteries upon the scorbutic state of the system, was recognized more than two centuries ago, and is a fact of vast importance in its relations to the hygiene of armies.

It would appear, however, that the intimate relation between the obstinate diarrhœa and dysentery of the camps and scurvy was not fully recognized until the comparatively recent operations of the French and English armies in the Crimea during the war with Russia.

Diseases of the stomach and bowels in the English army in the Crimea.

The admissions into hospital from diseases of the stomach and bowels (exclusive of cholera) in the English army serving in the Crimea, April, 1854 – June, 1856, numbered 55,765, with 5950 deaths; whilst the primary admissions from all diseases, exclusive of wounds and mechanical injuries, numbered 142,616, with 16,211 deaths; of these numbers cholera numbered 7575 cases and 4513 deaths. Of the total deaths recorded in the English army during this war, the amazing proportion of nearly thirty-three per cent. occurred under the class of diseases of the bowels, and these affections rendered ineffective twenty per cent. of the men invalided to England. Extraordinary as this mortality may appear, the manner in which it

is distributed over the different months of the period is still more singular, for, of the whole number of deaths returned, 89 per cent. occurred from the period which elapsed between the opening of the siege on the 1st of October, and the termination of the following April; while in the months of December, January, and February, taken together, 4145 deaths occurred, and in January alone 2033, the latter in itself constituting a mortality considerably greater than was incurred by wounds during the whole term of the war. While the mortality caused by this class of affections, in the period embraced between the 1st of October and the end of April, 1855, was 5301, it amounted during the same months of the following year only to 128; and whereas, in January, 1855, the deaths numbered 2033, they amounted in the same month of the following year to 13, though the strength of the army in the latter year was twice as great as in the former.

Diminution of cases and deaths referable to improvement in rations and clothing.

This marked diminution in the cases of and deaths from diarrhœa and dysentery appeared to be clearly referable to the improvement of the rations and clothing of the English soldiers, as well as to modifications of the asperities of the climate.

In the earlier periods of the war, when the English soldiers were imperfectly clothed and fed —

"It may be asserted that the army, at least the infantry force, represented a stricken mass; there was indeed scarcely a sound man in the ranks, with the exception of a small number recently arrived in the country. The number admitted represented the capacity of the hospitals, rather than the necessities of the time; and if the mortality were henceforth excessive, it would be more just to estimate the proportions of deaths to strength, than of deaths to admissions, for in fact the men in the trenches and daily proceeding on fatigue duty to Balaklava were in a great proportion suitable candidates for admission into the hospitals, though these establishments could only accommodate the more grave forms of disease; and so great was the pressure that to answer even this object it was necessary to discharge men from the wards, while yet their ailments were but partially relieved. . . . . .

"The general appearance of the men indicated that the conditions essential to the persistence of human life had been rudely violated; and the scorbutic diathesis and cachectic degeneration were declared in the air of apathy and indifference, the emaciation and debility, the murky, cloudy aspect and crippled gait, and the appearance of premature decrepitude, which characterized a large proportion of the men.

"To those, indeed, who at this time were familiar with the state of the troops, and could clearly appreciate the true etiological relations of

this condition, it was rather a subject of apprehension that the causes which were thus destroying the army might be protracted in their operation, yet a little longer in full force, and still further compromise its efficiency, than of wonder that the soldier should have succumbed to agencies which at once impaired his vigor and deteriorated his blood, while the elements of healthy sanguinification were not available. And we can declare on our own behalf, and that of the medical officers, that it was with deep regret it was observed that the active sympathy of this great country was for a time frustrated in its anxiety to discover some specific cause, some panacea for the wide-spread suffering in the ranks of the British soldier. Fully were they convinced that there was nothing recondite or mysterious in the causes of the frightful losses which were being daily incurred, and the result more than justified their conclusions; for when at length the gushing sympathies of the people found a proper channel for their expression, and the supplies of clothing, bedding, and food so largely provided by the government reached the army, the soldier forthwith, under the fostering care of the nation (of which there is not on record a grander or more noble instance), advanced to a state of high efficiency, and in a few months reached a standard of health which it was the more delightful to contemplate as it was so unusual, and, *in general*, so totally unexpected." . . . . .

"*Scorbutic Diarrhœa.* — Having thus referred to the affection as it was directly induced by severe exposure to cold and wet, &c., as it occurred in an atomic state of the system, the result of some wide-spread and general influence, depressing agencies, and the nature of the food, as the effect of endemic causes in the summer months, and in its connection with cholera, we shall now, lastly, consider it in its relation to the operation of causes still more complicated, and the state of the system which these causes determined.

"The influence of constant exposure, of night-watching, of insufficient sleep, of imperfect, innutritious, and irritant food, of excessive labor, of lying on the damp ground without sufficient bedding, of tainted air, of overcrowding, and an epidemic constitution of the atmosphere, was observed when these acted alone, or in certain combinations in the occurrence of diarrhœa, etc.; but their effect was not thus limited by their direct operation, for, concurrently with the production of immediately injurious results, the operation of these agencies served to reduce the system, to impair the functions, to vitiate the blood, to lower the vitality. Diarrhœa occurring in the pathological state of the system thus induced presented important modifications, which were determined rather by such state than by any of the individual causes now mentioned, or any combination of them; and it was, of course, chiefly remarked in men who experienced great hardships, privations, and sufferings for a considerable period. In this form of the affection, the patient presented himself in a feeble, emaciated state, having previously suffered

from occasional attacks of diarrhœa, and perhaps from other complaints. There was loss of appetite, loathing of food, apathy of mind, debility, or disinclination for exertion; the pulse was small, slow, and feeble; the skin was dry and rough, often of a dusky, muddy-brown color, that of the abdomen was retracted, covered with dry, hard scales; the features assumed a worn and listless expression; the face and eyelids were edematous; the mucous membrane of the mouth and lips became exsanguined; the legs and feet were generally swollen, and there was felt in them a sense of numbness and coldness. The tongue appeared large and flabby, or was covered with a slimy mucus, and it was often indented by the teeth. The dejections were voided frequently, and sometimes with a degree of straining and pain; they were occasionally serous and watery. Sometimes they were of a clay color, or grayish, and extremely fetid; but these last characters usually occurred in the worst cases, and those attended with organic lesions. The appearance of the bile on the lesions was not constant, and it seemed rather to be periodically thrown off as an excretion, than to be expurged as an *element* which had been applied in the digestive process; it was seldom observed of a depraved quality in the evacuations, except in the complication of a low adynamic fever, which was by no means an infrequent occurrence. Notwithstanding the grave nature of the symptoms here detailed, diarrhœa was yet, under careful treatment and with suitable resources, still a very manageable disease.

"The scorbutic nature of the affection, when it presented these characters, was sufficiently apparent. The more distinct evidences of the scorbutic taint were livid and swollen gums (bleeding on slight pressure), petechial spots and ulcers on the legs; patches of ecchymosis on the calves of the legs; listlessness; dyspnœa on slight exertion; a feeling of aching pains in the limbs, with a sense of coldness; œdema of the feet, and sudden hemorrhage from the bowels; vomiting of blood, discharge of blood from the fauces, epistaxis, etc., and occasionally the scorbutic nature of the affection was expressed in fatal sinking, and effusion into the pericardium or pleuræ."[1]

Dependence of diarrhœa and dysentery on improper food and a scorbutic condition.

A large number of important observations are recorded in the valuable work just quoted, showing the intimate blending of diarrhœa and dysentery, and the dependence of the latter disease as well as the former upon improper food and the scorbutic condition of the blood.

The preceding graphic description of scorbutic diarrhœa applies so correctly to this disease as it prevailed amongst the Federal prisoners at Andersonville that we have little or nothing to add;

[1] *Medical and Surgical History of the British Army which served in Turkey and the Crimea during the War against Russia*, 1854–56, *presented to both Houses of Parliament by command of Her Majesty*, 1858, vol. ii. pp. 91–128, 171–186.

and it will be seen in the last chapter of the present inquiries that the results of my pathological investigations in diarrhœa and dysentery agree in the main with the facts recorded by the English surgeons in the Crimea.

In some instances the scorbutic character of dysentery was so marked a feature of it, that the disease was even denominated scorbutic by the English surgeons, and the grave nature of the complaint as it prevailed in the Crimea is apparent in the fact that of the three hundred and ninety-six which were so returned, one hundred and sixteen terminated fatally; and in view of the appalling mortality which attended dysentery, and the nature of the modifications which were imparted to it by the scorbutic taint of system in which it occurred, it was admitted by the medical officers of the English army that scorbutus was vastly more important in connection with this affection than in the extent to which it existed as an independent disease. Moreover, the true scorbutic nature of these bowel affections was placed beyond doubt in a very large proportion of the cases by the requirements of treatment, for it was found that this class of diseases often proved obstinate and inveterate under the use of all medicines, and only yielded to the influence of vegetable acids and a properly adopted diet.

Effects of salt diet in the production of diarrhœa and dysentery.

The effects of salt diet in the production of diarrhœa and dysentery have been conclusively shown in the British navy and army by the great diminution of the cases of and deaths from these diseases which followed the improvement of the rations, the introduction of fresh meat and vegetable diet, and the diminution of the salt-meat ration. The marked reduction which took place in the deaths from this class of diseases subsequent to the introduction of fresh-meat diet has been clearly shown by the late Sir Alexander Tulloch in his valuable statistical reports.

Diarrhœa and dysentery have at all times proved severe scourges of fleets in active service, and of armies in the field, and of crowded filthy prisons with their depressed and poorly-fed inmates, and of beleaguered forts and cities. Diarrhœa and dysentery contributed largely to the destruction of the British army in Holland in 1748; they decimated the French, Prussian, and Austrian armies in 1792; they constituted the most fatal disease in the British army during the Peninsular War, when with an effective force of 61,500 men, only 42.4 per 1000 were lost by wounds, while 118.6 were lost by disease; they were the chief cause of death in the ill-fated Walcheren expedition in 1809, when the British army, numbering

40,000, lost 332 in the 1000 by disease, and only 16.7 by wounds; and these diseases have followed the tracks of all the great armies which have traversed Europe during the continental wars of the past two hundred years.

Prevalence of diarrhœa and dysentery in the Confederate army during the first two years of the war.

In the Confederate army, during the first two years of the war, 1861 and 1862, the whole number of cases exhibited in the field reports numbered 848,555, with 16,220 deaths, and 10,455 discharges; the admissions into hospitals for the same period numbered 447,689 cases, of which 19,359 died, and 6485 were discharged; the cases of diarrhœa and dysentery numbered upon the field reports 226,828, with 1696 deaths, and upon the hospital reports 86,506 cases, and 1658 deaths.

Diarrhœa and dysentery constituted 26.7 per cent. of all cases entered upon the field reports, and 19.3 per cent. of the cases admitted into the general hospitals, during the first two years of the Confederate struggle.

The deaths entered upon the field and hospital reports do not represent the entire number caused by diarrhœa and dysentery, for a large number of those suffering from the graver forms of this disease were either discharged or sent home on furlough, and subsequently died.

The following tables will illustrate the relations (numerical) of diarrhœa and dysentery, to several diseases, and to the total cases treated in some of the largest hospitals in the Confederate States.

CASES OF, AND DEATHS FROM, DIARRHŒA AND DYSENTERY, AND SEVERAL OTHER DISEASES, AND OF GUNSHOT WOUNDS, TOGETHER WITH TOTAL SICK AND WOUNDED TREATED IN GENERAL HOSPITAL AT CHARLOTTESVILLE, VIRGINIA.

Month and Year.	Diarrhœa and Dysentery.		Typhoid Fever.		Measles.		Pneumonia.		Gunshot Wounds.		Total Sick and Wounded.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1861.												
July	178	6	284	75	656	8	48	18	300	35	2,608	147
August . . .	16	3	74	46	116	4	6	10	6	21	329	87
September . .	43	–	150	24	104	–	12	2	9	6	511	32
October . . .	31	–	195	27	51	–	14	2	15	–	556	33
November . .	31	–	100	15	22	2	41	7	–	–	448	31
December . .	19	1	63	6	7	–	22	3	7	–	329	12
1862.												
January . . .	18	1	30	4	–	–	24	15	2	–	226	21
February . .	66	–	34	5	1	–	21	–	1	–	300	6
March . . .	56	–	14	1	1	–	21	4	2	–	290	9

(*Continued on next page.*)

CASES OF, AND DEATHS FROM, DIARRHŒA AND DYSENTERY, AND SEVERAL OTHER DISEASES, AND OF GUNSHOT WOUNDS, TOGETHER WITH TOTAL SICK AND WOUNDED TREATED IN GENERAL HOSPITAL AT CHARLOTTESVILLE, VA.

(*Continued.*)

Month and Year.	Diarrhœa and Dysentery.		Typhoid Fever.		Measles.		Pneumonia.		Gunshot Wounds.		Total Sick and Wounded.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
April	61	2	60	8	48	1	80	25	3	–	539	44
May	67	3	32	20	20	–	35	36	16	–	429	67
June	95	–	23	13	14	–	20	12	266	12	754	53
July	73	–	33	11	–	–	9	3	41	7	337	26
August . . .	45	2	19	10	–	–	2	–	380	21	682	35
September . .	9	–	7	2	1	–	1	–	764	18	886	23
October . . .	12	1	5	3	1	–	1	1	56	3	340	11
November . .	54	2	21	7	8	–	38	15	46	2	916	32
December . .	45	3	21	7	2	–	118	27	158	8	993	54
1863.												
January . . .	42	4	16	4	1	–	49	11	42	7	601	41
February . .	35	3	12	5	2	–	23	7	24	3	312	26
March . . .	27	1	6	2	–	–	15	6	31	4	198	17
April	21	–	3	3	–	–	6	8	14	1	124	14
May	115	1	15	5	1	–	14	2	66	1	572	11
June	100	1	14	3	2	–	13	2	77	1	417	8
July	49	2	11	1	–	–	6	–	444	4	821	7
August . . .	51	4	55	5	2	–	8	1	93	1	449	11
September . .	67	1	20	7	–	–	2	–	47	2	271	10
October . . .	34	2	18	2	–	–	9	1	176	2	397	7
November . .	44	2	5	3	–	–	16	2	68	1	301	10
December . .	72	5	15	3	3	–	29	6	84	9	469	27
1864.												
January . . .	46	9	22	13	9	–	30	8	60	1	401	35
February . .	5	3	2	1	5	–	11	3	50	–	145	9
March . . .	5	–	2	1	3	–	13	2	75	–	249	6
April	67	3	7	2	12	–	30	3	91	–	481	11
May	51	5	4	3	7	–	27	6	738	52	1,152	68
June	323	3	15	5	27	3	8	2	479	35	1,344	50
July	–	–	–	–	–	–	–	–	–	–	–	–
August . . .	–	–	–	–	–	–	–	–	–	–	–	–
September . .	–	–	–	–	–	–	–	–	–	–	–	–
October . . .	31	3	6	3	2	–	3	1	310	5	490	13
November . .	27	2	10	2	5	–	11	2	168	1	321	7
December . .	27	3	3	–	3	1	10	1	76	2	267	9

CASES OF, AND DEATHS FROM, DIARRHŒA AND DYSENTERY, AND OTHER DISEASES IN THE GENERAL HOSPITALS OF VIRGINIA, EXCLUSIVE OF HOSPITALS IN AND AROUND RICHMOND, FORMERLY UNDER THE SUPERVISION OF SURGEON H. WILLIAMS, MEDICAL DIRECTOR, INCLUDING CONFEDERATE HOSPITALS AT MANASSAS JUNCTION, FRONT ROYAL, STAUNTON, LYNCHBURG, DANVILLE, FARMVILLE, PETERSBURG, ETC.

Month and Year.	Diarrhœa and Dysentery.		Typhoid Fever.		Measles.		Pneumonia.		Gunshot Wounds.		Total Cases and Deaths from all Causes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1862.												
January .	130	7	168	70	19	1	367	127	19	6	*4,011	244
February .	250	6	168	34	2	–	220	79	17	1	1,508	144
March . . .	263	1	89	40	4	–	187	59	30	–	1,302	122
April . . .	–	–	–	–	–	–	–	–	–	–	–	–
May . . .	994	26	239	93	453	24	376	128	157	2	6,048	326
June . . .	1,919	59	339	109	593	36	310	74	795	26	8,811	405
July . . .	1,769	75	693	256	183	7	177	48	966	24	9,446	556
August . .	2,304	66	852	332	157	4	231	17	1,431	59	17,318	635
September	1,692	65	461	136	186	11	69	10	956	238	18,055	560
October . .	906	68	407	102	89	5	68	16	1,880	84	8,255	378
November .	1,808	57	376	156	113	3	816	153	840	23	14,131	510
December .	707	45	159	80	57	–	581	156	1,400	21	8,113	451
1863.												
January . .	596	40	218	93	50	2	438	182	511	14	5,557	479
February .	450	49	244	60	40	3	419	113	345	4	4,792	380
March . .	692	23	306	58	60	6	515	99	449	14	5,567	326
Totals .	14,470	587	4,749	1,619	–	–	4,774	1,261	9,796	516	113,914	5,516

* This number represents the aggregate sick and wounded this month; the number received during January being 1691, and the number remaining from December, 1861, 2321; all the other numbers relate to the cases entered each month.

CASES OF, AND DEATHS FROM, DIARRHŒA AND DYSENTERY AND OTHER DISEASES IN THE GENERAL HOSPITALS IN AND AROUND RICHMOND, VA., SEPTEMBER, 1862, TO MARCH, 1863, A PERIOD OF SEVEN MONTHS.

Month and Year.	Diarrhœa and Dysentery.		Typhoid Fever.		Measles.		Pneumonia.		Gunshot Wounds.		Total Cases and Deaths from all Causes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1862.												
September .	2,501	*	775	240	234	*	89	20	773	*	†24,771	535
October . .	2,419	*	674	127	274	*	172	*	2,924	*	20,199	340
November .	1,361	*	380	123	230	*	457	*	845	*	14,990	448
December . .	853	*	330	*	80	*	869	*	3,110	*	15,546	954
1863.												
January . .	327	19	203	77	88	3	552	248	632	27	5,585	787
February . .	652	23	161	57	52	3	461	91	480	14	7,177	390
March . . .	624	32	101	99	76	4	425	46	224	10	5,484	395
Totals . .	8,737	–	2,624	723	1,034	–	3,025	405	8,988	–	93,852	3,849

* Returns of deaths incomplete.

† This number represents the aggregate for September. Number received during this month, 13,113; number remaining from August, 11,658.

CASES OF, AND DEATHS FROM, DIARRHŒA AND DYSENTERY AND OTHER DISEASES IN THE GENERAL HOSPITALS OF VIRGINIA, INCLUDING THOSE IN AND AROUND RICHMOND, UNDER THE SUPERVISION OF SURGEON WM. A. CARRINGTON, MEDICAL DIRECTOR, APRIL, MAY, JUNE, AND JULY, 1863.

Month and Year.	Diarrhœa and Dysentery.		Typhoid Fever.		Measles.		Pneumonia.		Gunshot Wounds.		Total Cases and Deaths from all Causes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1863.												
April . . .	1,261	*	350	110	80	*	951	264	1,096	*	†20,784	694
May. . . .	3,488	*	589	134	132	*	767	181	9,722	*	32,112	890
June . . .	4,990	*	471	200	91	*	406	104	2,660	*	23,217	692
July . . .	4,019	*	521	65	48	*	220	28	11,334	*	32,052	429
Totals . .	–	–	1,932	509	–	–	2,344	576	–	–	108,165	2,705

* Returns of deaths incomplete.

† This number represents the aggregate cases treated for April, and includes the number received during the month, 10,970, and the number remaining from last report, 9908.

Progressive increase of diarrhœa and dysentery among Confederate soldiers during the war.

In these hospitals, as well as in many others throughout the Confederate States, chronic diarrhœa and dysentery were the most abundant and most difficult of cure amongst army diseases; and whilst the more fatal diseases, as typhoid fever, progressively diminished, chronic diarrhœa and dysentery progressively increased, and not only destroyed more soldiers than gunshot wounds, but more soldiers were permanently disabled and lost to the service from these diseases than from the disability following the accidents of battle.

Character of the discharges in cases of chronic diarrhœa and dysentery.

The cases of chronic diarrhœa and dysentery as they presented themselves in the Confederate hospitals were characterized by frequent yellow and dark watery discharges, varying in number from four to twelve during the twenty-four hours; in the state in which the patients were received into the general hospitals, the discharges, as a general rule, contained no blood; but upon inquiry into the previous history, it was found that in most cases the disease had commenced with dysenteric symptoms, accompanied with straining and bloody mucoid discharges, and after a varying period these dysenteric evacuations had been replaced by the thin watery discharges of chronic diarrhœa, unattended with pain or straining. The appearance of these patients was highly characteristic, — nerveless relaxation, depressed spirits, indisposition to exertion, but little apparent vitality, feeble circulation, sunken cheeks and eyes,

clear complexion, never jaundiced, with exceedingly emaciated limbs. The most emaciated subjects which I have ever seen were these poor soldiers suffering with chronic diarrhœa and dysentery.

In some cases ulceration of the cornea was observed, generally in the form of a crescentic transparent ulceration of the lower part of the cornea. As a general rule, the disease was slow in its progress, the patients at the time of their reception into the various hospitals having suffered with the disease from three to eighteen months.

Ulceration of the cornea.

In the large majority of cases, the mind continued clear up to the moment of death, and the patients retained strength sufficient to get up to stool to the close of life.

Condition of the mind.

In most cases which I have had an opportunity of examining after death extensive ulceration existed in the mucous membrane of both the colon and rectum, and the small intestines, especially in the lower portions toward the ileo-cæcal valve, were inflamed and greatly congested. The results of my *post-mortem* examinations will be fully given and considered in the concluding chapter of these labors upon Andersonville.[1]

Ulcerations in the intestinal canal found after death.

In the treatment of chronic diarrhœa and dysentery, Surgeon J. S. Davis, professor of anatomy and materia medica in the University of Virginia, found injections of nitrate of silver to be the most efficacious remedy. The nitrate of silver was employed in the strength of from one half to one grain to each fluid ounce of water or thin starch.

Experience of Surgeon J. S. Davis in the use of the nitrate of silver.

From six to eight grains of the nitrate of silver was dissolved in ten ounces of water, and thrown up into the rectum. After many trials it was found that it was impossible to introduce and retain for any length of time much more than ten ounces of this solution, and this quantity did not appear to reach more than one foot or eighteen inches into the colon.

One drachm of laudanum was generally given with each injection, and the hips elevated so as to retain the injection; and strict rest enjoined on the ground that the erect posture caused an injurious gravitation of the fluids to the diseased structures.

Post-mortem examinations revealed the interesting result that in those cases in which the nitrate of silver had been used, the ulcerations diminished in number and severity from the rectum upward —just the reverse of the condition which existed in those cases in which the nitrate had not been used.

[1] A report of several cases illustrative of chronic diarrhœa and dysentery are omitted. EDITOR.

The line to which the nitrate of silver injection had reached could be distinguished by a grayish discoloration of the mucous membrane. Within the range of the nitrate of silver injections, the ulcerations were invariably either healed or greatly improved, and it was fair to assume that if it had been possible to throw the solution of the nitrate of silver throughout the whole tract of the large intestines, all the ulcers would have been cured, and a great number of these otherwise incurable cases relieved.

The results of this mode of treatment of the chronic diarrhœa and dysentery of the camps, even with the impossibility of introducing the solution of nitrate of silver high up into the bowels, were considered most satisfactory by Dr. Davis.

According to this view, the chronic diarrhœa and dysentery of the camps is a local affection; and in fact Dr. Davis did not adopt the view that this disease was due in a considerable number of cases to a scorbutic condition of the system.

It does not appear by a comparison of the statistics of the General Hospital of Charlottesville that there was any material diminution of the mortality after the institution of this mode of treatment, or that this hospital exhibits a smaller rate of mortality than many other Confederate hospitals.

The proper treatment of the scorbutic state is dietetic rather than medicinal.

I am not acquainted with any series of observations during the present civil war instituted with the design of testing effectually the remedies adapted to a scorbutic state of the system; the great fact, however, was recognized by some surgeons, that the cure of the disease depended more upon the diet than upon the medicines employed. When sent to private quarters and abandoned simply to the kind attention of friends, with little or no treatment beyond domestic remedies and good diet, and an abundance of fresh eggs and milk, the results were most happy, and many soldiers recovered from chronic diarrhœa and dysentery, who to all appearances would have died if kept in the hospitals. It is probable that almost every case of chronic diarrhœa and dysentery from the camps, which had not extensive ulceration and destruction of the mucous membrane of the colon and rectum, would have been greatly benefited and cured by the proper diet.

The great fact that diarrhœa and dysentery arise and prevail with fatal effect whenever the food is diminished in quantity and deteriorated in quality, as happens universally in times of scarcity and famine, in beleagured forts and cities, and to a greater or less extent in all armies, should excite the attention of medical officers

in the treatment of these diseases in the camp, and should cause them to direct their most strenuous efforts primarily to the diet of the well and of those actually laboring under these great scourges of armies.

Diarrhœa and dysentery avoided by proper clothing and diet.

In this and in the preceding chapter we have presented facts to show that these diseases are to be attributed in their origin and spread, to a comparatively small extent, to the exhalations arising from human excrements and decomposing animal matters. The well-clothed army, supplied with a sufficient variety of vegetable and animal food, will, as a general rule, escape the desolating effects of diarrhœa and dysentery, under almost every circumstance of perfect and imperfect hygiene. In the Confederate army, as has been the case in all other armies, those companies and regiments exhibited the smallest mortality, and especially from such diseases as diarrhœa and dysentery and pneumonia, which were most carefully clothed and fed by their officers.

Whilst it is difficult, if not impossible, to prevent the introduction and spread, amongst recruits and newly raised armies, of typhoid fever and measles, much may be done to prevent the origin and spread of diarrhœa and dysentery by careful attention to the clothing and diet of the men. When the muscular and nervous forces have been depressed, the digestion impaired, the blood impoverished and radically altered in its constitution and relations, and the whole chemistry and nutrition of the system perverted by insufficient and improper food, it is impossible to prevent the appearance and spread of diarrhœa and dysentery by any mere police arrangements; and it is equally impossible to check their increase in the army, or to control their ravages in the hospital amongst the sick, without the most scrupulous attention to the food and diet. In the treatment of these diseases, attention to the diet of the well and of the sick should be the first and the last care of the surgeon; for it often happens, as we have shown in the case of the English army in the Crimea, that the constitutions of the men are slowly, and imperceptibly almost, undermined by exposure and bad diet, so that when the system most nearly connected with assimilation, and consequently with the preservation of the health and strength, gives way, the ruin of the army is speedy and all but irremediable.

CHAPTER NINTH.

GENERAL CONCLUSIONS.

General Conclusions drawn from the Preceding Investigations upon the Diseases of the Federal Prisoners confined at Andersonville.

I. *The great mortality amongst the Federal prisoners confined in the Military Prison at Andersonville was not referable to climatic causes, or to the nature of the soil and waters.*

The Confederate States Military Prison at Camp Sumpter was located by the Confederate authorities in an elevated, dry, and healthy region, supplied with pure and wholesome water.

The effects of malaria, which acts with greater or less intensity, according to the character of the soil, the elevation of the country, and the presence or absence of marshes and swamps, and according to the season and temperature and the amount of rain and of moisture in the atmosphere, throughout the entire belt of the Southern Atlantic and Gulf States, appear in the case of these prisoners to have been neutralized to a great extent by the artificial atmosphere generated within the crowded Stockade and Hospital.

II. *Not only were malarial fevers of infrequent occurrence amongst the Federal prisoners, but typhoid fever was rare, and typhus fever was unknown.*

The Confederate guard camped around the Military Prison and Hospital suffered much more heavily both from malarial and typhoid fevers. I observed a number of severe cases of genuine typhoid fever amongst the Confederate reserves, composed almost entirely of recruits — boys and old men; whilst on the other hand, I did not observe a single case of either typhoid or typhus fever amongst the Federal prisoners. Amongst the Confederate troops in all parts of the Southern Confederacy, typhoid fever prevailed to the greatest extent in the earliest periods of the war and amongst the recruits who had never before seen service, and especially amongst the recruits from the country. As the war progressed this disease gradually disappeared from amongst the veterans, and its prolonged existence in the army appeared to be due to the constant addition of fresh recruits.

The infrequent occurrence of typhoid fever amongst these Federal prisoners, notwithstanding the existence of all the causes which are so dogmatically affirmed by a host of writers to be sufficient and essential to the development and rapid spread of this disease, may be explained by the fact that these prisoners had been long in confinement, and had probably passed through the diseases incident to camps and prisons, and the majority had had typhoid fever (which, as a general rule, attacks but once during a lifetime) before coming to Andersonville.

Here we have in the dirty tents and mud hovels, and crowded, filthy condition of the prisoners, in an atmosphere loaded with the foul exhalations of human excrements, fermentation of bread, and all other imaginable kinds of filth, all the apparent conditions for the generation of typhus fever, and of all the various contagious fevers. But still typhus fever was absent; and this disease had prevailed neither in the Confederate nor in the Federal armies and military prisons. The absence of typhus fever, notwithstanding the existence of every circumstance — as filth, bad diet, crowding, mental depression, bad and scant food, which has been declared as sufficient to cause its generation — would seem to show that the conditions for the origin of this disease are not so defined and well known as many writers would make them to appear by dogmatical assertions and superficial reasoning. This great experiment of Andersonville, perhaps the greatest and most remarkable of modern times, strongly sustains the view that typhus and typhoid fevers are dependent upon the action of special poisons, the conditions for the origin and action of which are as definite and as limited as in the case of the poisons of smallpox and measles. It would appear from the results of the experiment of Andersonville, as well as from the large number of well established facts presented during the course of the present inquiry, that neither typhoid nor typhus fevers can be generated by animal exhalations from putrefying excrements or bodies; but that these diseases are propagated by a special poison emitted by the living body, either directly or through the excretions and secretions. Thus, if the excrements from a person suffering with typhoid fever are capable of communicating the disease, they do so not in virtue of any decomposition set up in them after their removal from the body, but in virtue of the presence of the poison received from the living body. According to this view, the excrements from the diseased bowels of the typhoid patient resemble in their contagious power the poisonous secretions and scabs of the skin of

the small-pox patient. However, whilst admitting that there is nothing unreasonable in the supposition that typhoid fever may be propagated through the matters thrown off from the diseased bowels, at the same time we are constrained to acknowledge that there are no experiments to prove that the excrements of typhoid fever will generate the disease if transported to a perfectly healthy locality, and allowed to contaminate a certain definite confined portion of air inhabited by healthy individuals, not otherwise exposed to the poison of typhoid fever.

The absence of typhus fever from the Confederate armies and prisoners would seem to sustain the view that this disease does not arise *de novo*, but must be imported from some existing source of infection, as from those great places of its permanent abode, the mud-hovels and crowded cities of Europe, and especially of Ireland and Hungary. Whilst certain circumstances favor the rapid spread of typhus and typhoid fevers, when once introduced, it is illogical and erroneous to assign those conditions without absolute experimental proof, as the causes for the origin of these diseases *de novo*.

III. *The chief causes of death amongst the Federal prisoners of Andersonville were scurvy and its results, and bowel affections, chronic and acute diarrhœa and dysentery.*

Notwithstanding the exposure of these prisoners without shelter, the diseases referable more directly to this cause, as pneumonia, bronchitis, catarrh, and rheumatism, did not prevail to a greater extent amongst the Federal prisoners than amongst the Confederate soldiers in the field, who were in like manner exposed to the cold of winter and the heat of summer, without tents, and without any other shelter than that which they were able to construct with their hands.

IV. *The effects of salt meat and of farinaceous food without fresh vegetables, were manifested in the great prevalence of scurvy.*

The scorbutic condition thus induced, modified the course of every disease, poisoned every wound, however slight, and lay at the foundation of those obstinate and exhausting diarrhœas and dysenteries which swept off thousands of these unfortunate men.

The Federal prisoners received the same rations in kind, quality, and amount issued to the Confederate soldiers in the field. These rations were insufficient, and without that variety of fresh meat and vegetables which would ward off scurvy from soldiers as well as prisoners.

As far as my experience extended, no body of troops could be confined exclusively to the Confederate ration without suffering materially in their health, and without manifesting symptoms of the scurvy. The Confederate ration grew worse and worse as the war progressed, and as portion after portion of the most fertile regions of the Confederate States were overrun and devastated by the Federal armies. In the straitened condition of the Confederate States, the support of an army of fifty thousand prisoners, forced upon their hands by a relentless policy, was a great and distressing burden, which consumed their scant resources and exhausted their over-taxed energies. It was the belief of the army as well as of the people, that the Confederate government not only earnestly desired the exchange of all prisoners of war in their hands, but also that the Confederate authorities charged with the exchange of prisoners had used every effort in their power, consistent with their views of national honor and rectitude, to effect an exchange of all prisoners in their hands, and to establish definite rules by which all prisoners of war might be continuously exchanged as soon as possible after capture. Whatever the feelings of resentment on the part of the Confederates may have been against those who were invading and desolating their native land, which had been purchased by the blood of their ancestors from the Indians and English, the desire for the speedy exchange and return of the great army of veterans held captive in Northern prisons, was earnest and universal; and this desire for speedy and continuous exchange on the part of the government as well as on the part of the people, sprang not merely from motives of compassion for their unfortunate kindred and fellow-soldiers, but also from the dictates of that policy which would exchange on the part of a weak and struggling people a large army of prisoners (consumers and non-combatants, requiring an army for their guard) for an army of tried veterans. Apart from the real facts of the case, it is impossible to conceive that any government in the distressed and struggling state of the Confederate States could deliberately advocate any policy which would deprive it of a large army of veterans, and compel it to waste its scant supplies, already insufficient for the support of its struggling and retreating armies, upon an immense number of prisoners. And, as the result has shown, the destruction of the Confederate government was accomplished as much by the persistent retention in captivity of the Confederate soldiers, as by the emancipation and arming of the slaves.

V. *From the sameness of the food, and from the action of the poisonous gases in the densely crowded and filthy Stockade and Hospital, the blood was altered in its constitution, even before the manifestation of actual disease.*

In both the well and the sick, the red corpuscles were diminished; and in all diseases uncomplicated with inflammation, the fibrinous element was deficient. In cases of ulceration of the mucous membrane of the intestinal canal, the fibrinous element of the blood appeared to be increased; whilst in simple diarrhœa, uncomplicated with ulceration, and dependent upon the character of the food and the existence of scurvy, it was either diminished or remained stationary. Heart clots were very common, if not universally present, in the cases of ulceration of the intestinal mucous membrane; whilst in the uncomplicated cases of diarrhœa and scurvy the blood was fluid and did not coagulate readily, and the heart clots and fibrinous concretions were almost universally absent.

From the watery condition of the blood, there resulted various serous effusions into the pericardium, into the ventricles of the brain, and into the abdominal cavity.

In almost all the cases which I examined after death, even in the most emaciated, there was more or less serous effusion into the abdominal cavity.

In cases of hospital gangrene of the extremities, and in cases of gangrene of the intestines, heart clots and firm coagula were universally present. The presence of these clots, in the cases of hospital gangrene, whilst they were absent in the cases in which there were no inflammatory symptoms, appears to sustain the conclusion that hospital gangrene is a species of inflammation (imperfect and irregular though it may be in its progress), in which the fibrinous element and coagulability of the blood are increased, even in those who are suffering from such a condition of the blood and from such diseases as are naturally accompanied with a decrease in the fibrinous constituent.

VI. *The impoverished condition of the blood, which led to serous effusions within the ventricles of the brain, and around the brain and spinal cord, and into the pericardial and abdominal cavities, was gradually induced by the action of several causes, but chiefly by the character of the food.*

The Federal prisoners, as a general rule, had been reared upon wheat bread and Irish potatoes; and the indian corn, so extensively used at the South, was almost unknown to them as an article

of diet previous to their capture. Owing to the impossibility of obtaining the necessary sieves in the Confederacy for the separation of the husk from the corn-meal, the rations of the Confederate soldiers, as well as of the Federal prisoners, consisted of unbolted corn-flour and meal and grist: this circumstance rendered the corn-bread still more disagreeable and distasteful to the Federal prisoners. Whilst indian meal, even when prepared with the husk, is one of the most wholesome and nutritious forms of food, as has been clearly shown by the health and rapid increase of the Southern population, and especially of the Negroes, previous to the present war, and by the strength, endurance, and activity of the Confederate soldiers, who were throughout the war confined to a great extent to unbolted corn-meal, it is nevertheless true that those who have not been reared upon corn-meal, or who have not accustomed themselves to its use gradually, become excessively tired of this kind of diet when suddenly confined to it without a due proportion of wheat bread. Large numbers of the Federal prisoners appeared to be utterly disgusted with indian corn, and immense piles of corn-bread could be seen in the Stockade and Hospital inclosures. Those who were so disgusted with this form of food that they had no appetite to partake of it, except in quantities insufficient to supply the waste of the tissues, were of course in the condition of men slowly starving, notwithstanding that the only farinaceous form of food which the Confederate States produced in sufficient abundance for the maintenance of armies was not withheld from them. In such cases, an urgent feeling of hunger was not a prominent symptom, and even when it existed at first, it soon disappeared, and was succeeded by an actual loathing of food. In this state the muscular strength was rapidly diminished, the tissues wasted, and the thin, skeleton-like forms moved about with the appearance of utter exhaustion and dejection. The mental condition connected with long confinement, with the most miserable surroundings, and with no hope for the future, also depressed all the nervous and vital actions, and was especially active in destroying the appetite. The effects of mental depression and of defective nutrition, was manifested not only in the slow, feeble motions of the wasted, skeleton-like forms, but also in such lethargy, listlessness, and torpor of the mental faculties as rendered these unfortunate men oblivious and indifferent to their afflicted condition. In many cases even of the greatest apparent suffering and distress, instead of showing any anxiety to communicate the causes of their distress, or to relate their privations and

their longings for their homes and their friends and relatives, they lay in a listless, lethargic, uncomplaining state, taking no notice either of their own distressed condition or of the gigantic mass of human misery by which they were surrounded. Nothing appalled and depressed me so much as this silent, uncomplaining misery.

It is a fact of great interest, that notwithstanding this defective nutrition in men subjected to crowding and filth, contagious fevers were rare; and typhus fever, which is supposed to be generated in just such a state of things as existed at Andersonville, was unknown. These facts, established by my investigations, stand in striking contrast with such a statement as the following by a recent English writer: —

"A deficiency of food, especially of the nitrogenous part, quickly leads to the breaking up of the animal frame. Plague, pestilence, and famine are associated with each other in the public mind, and the records of every country show how closely they are related. The medical history of Ireland is remarkable for the illustrations of how much mischief may be occasioned by a general deficiency of food. Always the habitat of fever, it every now and then becomes the very hotbed of its propagation and development. Let there be but a small failure in the usual imperfect supply of food, and the lurking seeds of pestilence are ready to burst into frightful activity. The famine of the present century is but too forcible an illustration of this. It fostered epidemics which had not been witnessed in this generation, and gave rise to scenes of devastation and misery which are not surpassed by the most appalling epidemics of the Middle Ages. The principal form of the scourge was known as the contagious famine fever (typhus), and it spread, not merely from end to end of the country in which it had originated, but, breaking through all boundaries, it crossed the broad ocean, and made itself painfully manifest in localities where it was previously unknown. Thousands fell under the virulence of its action, for wherever it came, it struck down a seventh of the people, and of those whom it attacked one out of nine perished. Even those who escaped the fatal influence of it, were left the miserable victims of scurvy and low fever."

Whilst we readily admit that famine induces that state of the system which is most susceptible to the action of fever poisons, and thus induces the state of the entire population which is most favorable for the rapid and destructive spread of all contagious fevers, at the same time we are forced by the facts established by the present war, as well as by a host of others, both old and new, to admit that we are still ignorant of the causes necessary for the origin of typhus fever.

Added to the imperfect nature of the rations issued to the Federal prisoners, the difficulties of their situation were at times greatly increased by the sudden and desolating Federal raids in Virginia, Georgia, and other States, which necessitated the sudden transportation from Richmond and other points threatened of large bodies of prisoners, without the possibility of much previous preparation; and not only did these men suffer much in transition upon the dilapidated and overburdened line of railroad communication, but, after arriving at Andersonville, the rations were frequently insufficient to supply the sudden addition of several thousand men. And as the Confederacy became more and more pressed, and when powerful hostile armies were plunging through her bosom, the Federal prisoners of Andersonville suffered incredibly during the hasty removals to Millen, Savannah, Charleston, and other points supposed at the time to be secure from the enemy.

Each one of these causes must be weighed when an attempt is made to estimate the unusual mortality amongst these prisoners of war.

VII. *Scurvy, arising from sameness of food and imperfect nutrition, caused, either directly or indirectly, nine tenths of the deaths amongst the Federal prisoners at Andersonville.*

Not only were the deaths referred to unknown causes, to apoplexy, to anasarca, and to debility traceable to scurvy and its effects; and not only was the mortality in small-pox, pneumonia, and typhoid fever, and in all acute diseases, more than doubled by the scorbutic taint, but even those all but universal and deadly bowel affections arose from the same causes, and derived their fatal character from the same conditions which produced the scurvy.

In truth these men at Andersonville were in the condition of a crew at sea, confined upon a foul ship upon salt meat and unvarying food, and without fresh vegetables. Not only so, but these unfortunate prisoners were like men forcibly confined and crowded upon a ship tossed about on a stormy ocean, without a rudder, without a compass, without a guiding star, and without any apparent boundary or end to their voyage; and they reflected, in their steadily increasing miseries, the distressed condition and waning fortunes of a devastated and bleeding country which was compelled, in justice to her own unfortunate sons, to hold these men in this most distressing captivity.

I saw nothing in the scurvy which prevailed so universally at

Andersonville at all different from this disease as described by various standard writers; the mortality was no greater than that which has afflicted a hundred ships upon long voyages, and it did not exceed the mortality which has, upon more than one occasion, and in a much shorter period of time, annihilated large armies, and desolated beleaguered cities.

VIII. *The bowel affections, which were classed under the heads of diarrhœa and dysentery, were due to several causes, but chiefly to the same causes which induced the scurvy; and these diseases were accompanied with profound lesions of the intestinal mucous membrane located more especially in the ileum, colon, and rectum; and these lesions were characterized chiefly by thickening and softening of the mucous membrane, congestion and enlargement of the villi, intense congestion of the tubular glands, attended with hemorrhage, intense congestion and ulceration of the lower portion of the ileum and of the colon and rectum.*

Ulceration of the lower portions of the bowels existed in chronic diarrhœa as well as in dysentery; and in fact the diarrhœa appeared in many cases to be dependent upon the ulcerations of the ileum, colon, and rectum. The division of the cases into chronic diarrhœa and dysentery appeared to be arbitrary in most cases; for the two diseases were intimately blended, and appeared to depend upon the same causes and lesions.

The general results of my investigations upon the chronic diarrhœa and dysentery of the Federal prisoners of Andersonville, were similar to those of the English surgeons during the war against Russia.[1]

IX. *Drugs exercised but little influence over the progress and fatal termination of chronic diarrhœa and dysentery in the Military Prison and Hospital at Andersonville, chiefly because the proper form of nourishment (milk, rice, vegetables, anti-scorbutics, and nourishing animal and vegetable soups) was not issued, and could not be procured in sufficient quantities for these sick prisoners.*

Opium allayed pain and checked the bowels temporarily, but the frail dam was soon swept away, and the patient appeared to be but little better, if not the worse, for this merely palliative treatment.

The root of the difficulty could not be reached by drugs; nothing short of the wanting elements of nutrition would have

[1] Extracts here introduced from writings by Dr. Crawford and others are omitted. — EDITOR.

tended in any manner to restore the tone of the digestive system, and of all the wasted and degenerated organs and tissues. My opinion to this effect was expressed most decidedly to the medical officers in charge of these unfortunate men.

The correctness of this view was sustained by the healthy and robust condition of the paroled prisoners, who received an extra ration, and who were able to make considerable sums by trading, and who supplied themselves with a varied and liberal diet.

In addition to the facts already presented in a former portion of these investigations, we will present two other remarkable examples of the effects of an insufficient supply of food.[1]

X. *The fact that hospital gangrene appeared in the Stockade first, and originated spontaneously without any previous contagion, and occurred sporadically all over the Stockade and Prison Hospital, was proof positive that this disease will arise whenever the conditions of crowding, filth, foul air, and bad diet are present.*

The exhalations from the Hospital and Stockade appeared to exert their effects to a considerable distance outside of these localities. The origin of gangrene amongst these prisoners appeared clearly to depend in great measure upon the state of the general system, induced by diet, exposure, neglect of personal cleanliness, and by various external noxious influences. The rapidity of the appearance and action of the gangrene depended upon the powers and state of the constitution, as well as upon the intensity of the poison in the atmosphere, or upon the direct application of poisonous matter to the wounded surface. This was further illustrated by the important fact, that hospital gangrene, or a disease resembling this form of gangrene, attacked the intestinal canal of patients laboring under ulceration of the bowels, although there were no local manifestations of gangrene upon the surface of the body. This mode of termination in cases of dysentery was quite common in the foul atmosphere of the Confederate States Military Prison Hospital, and in the depressed, depraved condition of the system of these Federal prisoners. Death ensued very rapidly after the gangrenous state of the intestines was established.

XI. *A scorbutic condition of the system appeared to favor the origin of foul ulcers, which frequently took on true hospital gangrene.*

Scurvy and hospital gangrene frequently existed in the same in-

[1] An extract from Carpenter's Physiology giving an account of prisoners at the Millbank Penitentiary, is omitted. — EDITOR.

dividual. In such cases vegetable diet, with vegetable acids, would remove the scorbutic condition without curing the hospital gangrene. From the observations recorded by Sir Gilbert Blane, Dr. Trotter, and others, which we presented in the ninth chapter, it appears that the scorbutic condition of the system, especially in crowded camps, ships, hospitals, and beleaguered cities, is most favorable to the spread and origin of foul ulcers and hospital gangrene. In many cases occurring amongst the Federal prisoners at Andersonville, it was difficult to decide at first whether the ulcer was a simple result of the scorbutic state or of the action of the poison of hospital gangrene, for there was a great similarity in the appearance of scorbutic ulcers and genuine hospital gangrene. So commonly have these two diseases been combined, that the description of scorbutic ulcers by many authors evidently includes also many of the prominent characteristics of hospital gangrene, as will be seen by a reference to the observations of Lind, Trotter, Blane, and others, already given in the ninth chapter.

Scurvy consists not only in an alteration in the constitution of the blood, which leads to passive hemorrhages from the bowels, and the effusion into the various tissues of a deeply-colored fibrinous exudation ; but, as we have conclusively shown by *post-mortem* examinations, this state is also attended with profound alterations in the appearance and consistence of the muscles of the heart, and of the mucous membrane of the alimentary canal, and of the solid parts generally. We have, according to the extent of the deficiency of certain articles of food, every degree of scorbutic derangement, from the most fearful depravation of the blood and the perversion of every function subserved by the blood, to those slight derangements which are scarcely distinguishable from a state of health.

We are as yet ignorant of the true nature of the changes of the blood and tissues in scurvy, and a wide field for investigation is open for the determination of the characteristic changes — physical, chemical, and physiological — of the blood and tissues, and of the secretions and excretions in scurvy. Such inquiries would be of great value in their bearing upon the origin of hospital gangrene. Up to the present war, the results of chemical investigations upon the pathology of the blood in scurvy were not only contradictory, but meagre and wanting in that careful detail of the cases from which the blood was abstracted which would enable us to explain the cause of the apparent discrepancies in different analyses. Thus it is not yet settled whether the fibrin is increased or diminished in

this disease ; and the differences which exist in the statements of different writers appear to be referable to the neglect of a critical examination and record of all the symptoms of the cases from which the blood was abstracted. The true nature of the changes of the blood in scurvy can be established only by numerous analyses during different stages of the disease, and followed up by carefully performed and recorded *post-mortem* examinations. With such data we could settle such important questions as whether the increase of fibrin in scurvy was invariably dependent upon some local inflammation.

XII. *Gangrenous spots, followed by rapid destruction of tissue, appeared in some cases in which there had been no previous or existing wound or abrasion ; and, without such well-established facts, it might be assumed that the disease was propagated from one patient to another in every case, either by exhalations from the gangrenous surface, or by direct contact.*

In such a filthy and crowded hospital as that of the Confederate States Military Prison of Camp Sumpter, Andersonville, it was impossible to isolate the wounded from the sources of actual contact of the gangrenous matter — the flies swarming over the wounds and over filth of every description ; the filthy, imperfectly washed, and scanty rags ; the limited number of sponges and wash-bowls (the same wash-bowl and sponge serving for a score or more of patients), were one and all sources of such constant circulation of the gangrenous matter, that the disease might rapidly be propagated from a single gangrenous wound. Whilst the fact already considered, that a form of moist gangrene, resembling hospital gangrene, was quite common in this foul atmosphere, in cases of dysentery, both with and without the existence of hospital gangrene upon the surface, demonstrates the dependence of the disease upon the state of the constitution, and proves in a clear manner that neither the contact of the poisonous matter of gangrene, nor the direct action of the poisoned atmosphere upon the ulcerated surface is necessary to the development of the disease ; on the other hand, it is equally well established that the disease may be communicated by the various ways just mentioned. It is impossible to determine the length of time which rags and clothing saturated with gangrenous matter will retain the power of reproducing the disease when applied to healthy wounds. Professor Brugmans, as quoted by Guthrie in his "Commentaries on the Surgery of the War in Portugal, Spain, France, and the

Netherlands," says, that in 1797, in Holland, charpie, composed of linen threads cut of different lengths, which on inquiry it was found had been already used in the great hospitals in France, and had been subsequently washed and bleached, caused every ulcer to which it was applied to be affected by hospital gangrene. Guthrie affirms in the same work, that the fact that this disease was readily communicated by the application of instruments, lint, or bandages which had been in contact with infected parts, was too firmly established by the experience of every one in Portugal and Spain to be a matter of doubt.

There are facts to show that flies may be the means of communicating malignant pustules. Dr. Wagner, who has related several cases of malignant pustule produced in man and beasts, both by contact and by eating the flesh of diseased animals, which happened in the village of Striesa in Saxony in 1834, gives two very remarkable cases, which occurred eight days after any beast had been affected with the disease. Both were women, one of twenty-six, and the other of fifty years, and in them the pustules were well marked, and the general symptoms similar to the other cases. The latter patient said she had been bitten by a fly upon the back of the neck, at which part the carbuncle appeared; and the former that she also had been bitten on the right upper arm by a gnat. Upon inquiry, Wagner found that the skin of one of the infected beasts had been hung on a neighboring wall, and thought it very possible that the insects might have been attracted to them by the smell, and had thence conveyed the poison.

XIII. *The unfortunate accidents which followed vaccination in certain cases, were referable chiefly to the scorbutic state of the patients, and the tendency of all abrasions and wounds, however slight, to assume gangrenous ulceration.*

The charge that the Confederate surgeons willfully introduced poisonous vaccine matter into the arms of these prisoners, was as malicious as it was false. In every collection of officers and men it may be possible to find some unprincipled individual; and I cannot say that the Confederate officers of Andersonville formed an exception to the general frailties of mankind; but this I do know, by personal observation, that they deplored the distressing fate of these unfortunate victims to a relentless policy, and earnestly desired to do their duty in the cause of suffering humanity.

XIV. *In the depraved condition of these prisoners, and in the*

foul atmosphere of the Military Prison Hospital of Andersonville, amputation did not arrest hospital gangrene; the disease almost invariably returned.

Almost every amputation was followed finally by death, either from the effects of gangrene, or from the prevailing diarrhœa and dysentery.

Nitric acid and local applications generally, in this crowded atmosphere, loaded with noxious effluvia, exerted only a temporary effect; the gangrene would frequently return with redoubled energy after its application; and even after the gangrene had been entirely removed by local and constitutional treatment, it would return and destroy the patient. The progress of the cases of amputation was frequently very deceptive: I have observed after death the most extensive disorganization of the structures of the stump, when during life there was but little swelling, and the patient was apparently doing well.

Great as the rate of mortality from hospital gangrene appears to be amongst these Federal prisoners, it was equaled by the mortality from this disease before its treatment was well known, and when, as in the present instance, the medical officers did not have the necessary medicines and diet. The truth of this assertion will be readily comprehended by the following document given by Guthrie in his Commentaries: —

RETURN OF THE NUMBER OF CASES OF HOSPITAL GANGRENE WHICH HAD APPEARED AT THE HOSPITAL STATIONS ON THE PENINSULA, BETWEEN THE 21ST JUNE AND 24TH DECEMBER, 1813.

Stations.	No. of Cases.	Discharged Cured.	Died.	Under Treatment.	Number Operated on.
Santandi . . .	160	72	35	53	25
Bilbao	972	557	387	28	183
Vittoria . . .	441	349	88	4	74
Passages . . .	41	2	2	–	–
Vera	–	–	–	–	–
Totals . .	1,614	980	512	85	282

It will be seen from this return that five hundred and twelve deaths occurred amongst the British wounded during this short period, and near one third of all the cases of hospital gangrene occurring in the hospital stations on the Peninsula died.

INDEX.

Abbott, Surgeon Samuel W., on rations in the army and navy, 109.
on malaria, 210.
Adams, Surgeon Samuel L., on measles, 228.
on whisky ration, 117.
Age best suited for military service, 6, 95.
Albuminoid compounds in food, 70.
Alimentation faulty in the armies of the United States, 65.
importance of the laws of, 66.
a standard of, 67.
deficient, effects of, in prisons and alms-houses, 77.
summary of errors of, in the U. S. army ration, 90.
means of remedying errors of, 91.
Altitude, effects of, 105.
Ambulance organization in the army of the Ohio, 59.
Ammonia, carbonate of, in the treatment of pneumonia, 331.
Amyloid, degeneration caused by malarial poisoning, 125.
Anæsthesia and analgesia resulting from injuries of nerves, 435.
Anderson, Surgeon H., on measles, 228.
Andersonville, prison at, mortality in, 303.
investigations upon the diseases of prisoners at, 469.
topography and climate of, 483.
elevation of, 483.
character of soil at, 484.
geological position of, 485.
character of waters at, 493.
vegetation at, 495.
animals at, 496.
climate of, 498.
conclusions respecting the topography of, 500.
Military Prison, Stockade at, 501.
Stockade, relation of prisoners to area of, 502.
internal police of, 503.
filthy condition of, 506.
state of, in Sept. 1864, 507.
disposition of the dead in, 507.
diseases prevailing in, 508.
daily number of deaths in, 511.
deficient medical attendance in, 512.
character of food in, 515.
appearance of prisoners in, 516.
Andersonville, complaints, by the prisoners, of the United States Government, 516.
Military Prison Hospital 519.
accumulation of filth in, 519.
number of patients and attendants in, 520.
flies and maggots in, 520.
police hygiene of, 520.
dressing of wounds, etc., in, 520.
manner of disposing of the dead in, 521.
receptacles for excrements in, 522.
cooking arrangements in, 522.
food issued to the sick in, 523.
consolidated report of sick and wounded Federal prisoners at, 524.
table giving mean strength, total diseases, and deaths, etc., among Federal prisoners at, 531.
explanation of large number of deaths at, from *morbi varii*, 532.
death of one fourth of prisoners at, in seven months, 532.
difficulties in the way of relief of prisoners at, 533.
conditions suggested as essential to relief of prisoners at, 535.
reports on the condition of Military Prison at, by Confederate surgeons, 535.
report of sick and wounded Confederate soldiers acting as guard to Federal prisoners at, 553.
extent of suffering of Confederate troops from diseases prevailing at, 563.
prevalence of typhoid fever greater among Confederate soldiers than among prisoners confined at, 563.
greater prevalence of malarial fever among Confederate soldiers than among prisoners at, 564.
Confederate troops at, affected by emanations from the Stockade and Hospital, 564.

Andersonville, prisoners at, diseases of, referable to climatic changes, etc., 566.
table showing cases of malarial fever and deaths among Federal prisoners confined at, 567.
cases of sun-stroke among prisoners at, 581.
table showing diseases referable to exposure among prisoners at, 583.
table showing diseases referable to exposure among Confederate forces at, 581.
prevalence of diseases referable to exposure not greater among prisoners at, than among Confederate troops, 594.
prevalence among prisoners at, of diseases dependent on specific poisons arising from crowding and foul exhalations, 600.
table showing prevalence at, of diseases caused by special poisons, 601.
typhoid fever among the prisoners at, 601.
small-pox among the prisoners at, 608.
prevalence among the prisoners at, of diseases due to long confinement, diet, etc., 619.
cases of scurvy among prisoners at, 619.
table of cases of, and deaths from, dietetic disease among the prisoners at, 620.
prevalence of diarrhœa and dysentery among the prisoners at, 627.
causes of the prevalence of diarrhœa and dysentery at, 628.
general conclusions drawn from the investigations upon the diseases of the prisoners confined at, 642.
Andrews, Surgeon G. L., on the whisky ration, 117.
on scurvy, 289.
Aphonia feigned by malingerers, 33.
Assimilation, lesions of, due to malarial poisoning, 121.
Association, moral effects of, 13.

Bailhache, Surgeon P. H., on the relation of the period of service to physical endurance, 97.
on the influence of service, climate, and locality on physical endurance, 99.
on the influence on physical endurance of residence in city and country previous to enlistment, 100.
on the whisky ration, 115.
on camp measles, 230.
on diarrhœa, 315.
Bartholow, Surgeon Roberts, on the various influences affecting the physical endurance, the power of resisting disease, etc., of the men composing the volunteer army of the United States, 3.
on malaria, 118.
on camp fevers, 193.
on camp measles, 218.
on acute rheumatism of the troops in New Mexico, 269.
on mountain fever, 202.
Barton's classification of the causes of epidemics, 256.
Batman, Surgeon, on vaccination, 152.
Batwell, Surgeon E., on the age most favorable for physical endurance, 96.
on the relation of period of service to physical endurance, 97.
on deficiency of rations, 111.
on the whisky ration, 115.
on diarrhœa and dysentery, 309, 314.
Beef, fresh or salt, in army ration, 88.
Benedict, Surgeon, on diarrhœa, 313.
Bidwell, Surgeon Edward C., on the age most favorable for physical endurance, 96.
on the utility of coffee and of warm food and beverages, 112.
on the whisky ration, 116.
Blood, healthy, analysis of, 69.
and flesh of ox, analysis of, 70.
Bowen, Gen. James, on the sanitary police of New Orleans, 257.
Bread, hard and soft, in army ration, 89.
hard, objection to, 89.

Camp police in army of the Ohio, 58.
long repose in, unfavorable to health, 47.
convalescent, in Virginia, experience in, with regard to alimentation, 79.
Carrington, Confederate Surgeon Wm. A., report on the eruptive fevers, 609.
Casualties, comparison of enlisted men and officers as regards, 173.
of the United States army in the Mexican War, 176.
in armies of the United States from the commencement of the Rebellion to August, 1865, 180.
proportional, by States, 185, 186.
of regulars, volunteers, and colored troops, 186.
Causalgia, or burning pain after injuries of nerves, 439, 447.
Causes of disease in recruits anterior to enlistment, 7.
dietetic, 9, 16.
climatic, 15.
from over-crowding, 17.
from dampness and impure water, 17.
from sieges and long marches, 18.
specific, 18.
malarial, 19.
compound and moral, 20.
Cerebro-spinal meningitis, by Surgeon S. B. Hunt, 383.
See *Meningitis, cerebro-spinal.*
Certificates of disability, granting of, on insufficient ground, 40.

Chambliss, Confederate Surgeon Jackson, on spurious vaccination, 615.
Chattanooga, siege of, 60.
Chlorides in the urine absent in cases of pneumonia, 321.
Choreal affections after injuries of nerves, 415.
Christison, Prof., on diet of soldiers, 70, 75.
on salt meat, 88.
City and country residence as regards influence on physical endurance, 100.
Clark, Surgeon A. L., on influence of previous habits of life on endurance, 101.
on intermittent and remittent fever, 208.
Cleanliness, lack of, as a cause of disease, 11.
Climate, influence of, on physical endurance, 99.
Coagula in the heart in autopsies in cases of sudden death, 51.
Coe, Surgeon A. S., on typho-malarial fever, 215.
Coffee and tea in army ration, 90.
use of, 108.
Commissariat, deficient, sufferings from, by British and French armies in the Crimea, 65.
Cook, Surgeon G. M., on vaccination, 152.
Corinth, bad management of the army before, 49.
observations on camp diseases in the field near, 50.
Crawford, S. P., on vaccination, 159.
Crimean War, casualties of the English forces in, 170.
consolidated table of the losses of the English army in, 172.
losses of the French army in, 174.
Crowd-poisoning, 17.
associated with malaria, 129.

Da Costa, Dr. J. M., observation on the diseases of the heart noticed among soldiers, particularly the organic diseases, 360.
Deafness feigned by malingerers, 32.
Debility feigned by malingerers, 38.
Denig, Surgeon C. E., on the age most favorable to physical endurance, 95.
on the relation of period of service to physical endurance, 97, 98.
on the whisky ration, 114.
Diarrhœa and dysentery, 291.
in the army before Corinth, 50.
frequency and importance of, 291.
prevalence of, in the Confederate prisons, 293.
symptomatology of, 293.
pathology of, 294.
relations, geographical, of, 295.
Forry's geographical divisions and statistics of, 295.
Woodward's statistics of, 296.
Woodward's statistics showing relations with intermittent fever, 296.
influence of altitude in causation of, 298.
Diarrhœa and dysentery, special causes of, 299.
dietetic causes of, 299.
agency of scurvy in producing, 300.
advantage of New England hospitals in the treatment of, 299.
influence of previous attacks, crowd-poison, filth, and starvation, in producing, 301.
treatment of, 304.
importance of removal to the North, 305.
value of drugs in, and the dietetic treatment of, 305.
experience in Selma, Ala. 305.
importance of hygienic measures, 306.
extracts from communications by medical officers respecting, 306.
cured by rations of green corn, 53.
prevalence of, at Andersonville, 628, 650.
causes of, at Andersonville, 628.
treatment of, inefficacious, 629.
appearances after death from, 630, 639.
prevalence of, in the English army in the Crimea, 630.
diminution of cases of, after improvement in rations and clothing, in the Crimea, 631.
dependence of, on improper food and a scorbutic condition, 633.
effect of salt meat in production of, 634.
prevalence of, in the Confederate army during the first two years of the war, 635.
table showing cases of, and deaths from, in Confederate hospital at Charlottesville, Va., 635.
table showing cases of, and deaths from, in general hospitals in Virginia, 637.
progressive increase of, among Confederate soldiers during the war, 638.
character of discharges in cases of, 638.
ulceration of cornea in cases of, 639.
use of nitrate of silver in cases of, 639.
treatment of, 640.
Diarrhœal maladies, relation of malaria to, 127.
Dibble, Surgeon Frederick L., on malaria, 211.
Diet, nitrogenous, conclusions respecting, 82.
in the United States military prisons, 80.
Dietaries of prisons and alms-houses, 77.
showing quantity of carbon required, 84.

Dietary for soldiers, scheme of, by Col. Sir A. M. Tulloch, 75.
Disability, importance of stating the degree of, in certificates of discharge, 41.
Discharges on surgeon's certificate, 40.
Disease, feigned, 23.
occult causes of, in recruits previous to enlistment, 7.
type of, in army before Corinth, 50.
mortality from, in the different arms of the service in the Crimean War, 173.
comparative mortality from, and from wounds, in the French army in the Crimean War, 175.
and wounds, losses from, in the regular and volunteer armies, and among colored troops, during the Rebellion, 181.
dietetic causes of, 9, 16.
climatic causes of, 14.
accidental causes of, 17.
specific causes of, 18.
Diseases, enthetic, in first two years of the war, 20.
contributions relating to, 166.
Dunster, Assistant-Surgeon Edward S., on the comparative mortality in armies from wounds and disease, 169.
Dwyer, Surgeon R. A., on the relation of period of service to physical endurance, 97.
on influence of season, climate, and locality on physical endurance, 99.
on vaccination, 151.
on diarrhœa, 316.
Dysentery. See *Diarrhœa and dysentery.*
Dyspepsia, feigned, 34.

Egg, nutritive elements in, 71.
Electricity in the treatment of the effects of injuries of nerves, 451.
applied to the diagnosis and prognosis of nerve injuries, 454.
Electro-galvanic machines, 453.
Electro-muscular contractility and sensibility, 452.
Endurance, physical, various influences affecting the, 3.
Epidemics, Barton's classification of the causes of, 256.
Epilepsy feigned by malingerers, 31.
Eve, Prof. Paul F., on measles, 231.
on the classes of men manifesting most endurance, 101.
Everts, Surgeon O., on the relation of period of service to physical endurance, 97.
on the influence of season, climate, and locality on physical endurance, 99.
on the whisky ration, 114.
on typho-malarial fever, 215.
Ewing, Surgeon George C., on diarrhœa and dysentery, 309.

Farmers, as material for the army, 102.
Fat and starches, proper relative proportion of, in alimentation, 84.
Fever, camp, essentially typhoid, 19.
periodical, frequency of, in traumatic cases, 134.
camp, scorbutic element in, 195.
remittent and typhoid, statistics of, 197.
Fever, army remittent and typhoid, comparison of, 198.
alterations in, characteristic of malarial poisoning, 199.
typhoid, causes of, 200.
emanations from excreta the chief determining cause, 200.
frequency of, in the armies of the United States, 212.
walking cases of, 212.
facts showing contagiousness of, 201.
fatality and prevalence of, in the Confederate army, 335.
table showing deaths from, in hospitals in and around Richmond, 340–347.
table showing deaths from, in hospital at Charlottesville, 351.
table showing deaths from, in Virginia and Georgia hospitals, 355.
table showing numerical relations of deaths from, with deaths from pneumonia, 357.
progressive and marked diminution of cases of, among the Confederate troops during the war, 359.
among the prisoners at Andersonville, 601, 642.
discussion of the theory of Budd, attributing origin to excreta, 602.
facts respecting, established by Dr. Robert Angus, 605.
among Confederate troops, 607, 642.
veterans exempt from, 607.
and typhus not prevailing among prisoners at Andersonville, 514, 642.
prevalence of, among the Confederate troops acting as guard to prisoners at Andersonville, 563.
simple continued, definition of, 202.
identical with typhoid fever, 345.
typhus, infrequency of, in armies of the United States, 211.
typho-malarial, Dr. Woodward's theory of, considered, 193, 196, 214.
Fevers, camp, by Surgeon Bartholow, 193.
conditions modifying the symtomatology and morbid anatomy of, 193.
classification of, 195.
conclusions respecting, by Surgeon Bartholow, 206.
replies of medical officers to questions respecting, 207.
remittent and intermittent, replies of medical officers to questions respecting, 207.
malarial, table of cases of, and deaths from, among the prisoners at Andersonville, 567.
cases of, and of all diseases in the Confederate com-

Fevers, *continued.*
mand serving in and around Fort Jackson, on the Savannah River, 569.
relations of cases of, and deaths from, to the mean strength, etc., among the Confederate troops, 570.
tables giving cases of, and deaths from, with the number of officers and men, the total cases of all diseases and wounds, the number of deaths from all causes, among the Confederate troops serving in South Carolina, Georgia, and Florida, 571.
table giving cases of, and deaths from, etc., among the Confederate troops serving in and around Mobile, 574.
table giving cases of, and deaths from, etc., in Confederate army of Tennessee, 575.
table giving cases of, and deaths from, etc., in the army of the Valley of Virginia, 578.
more prevalent among the United States forces than among the prisoners at Andersonville, 579.
typhoid, malarial, and typho-malarial, number of cases of, in the first two years of the war, 19.
in the army before Corinth, 51.
yellow, on the Atlantic coast and at the South during the war, 236.
predictions concerning, 236.
assurances of hygienic protection against, 237.
capture of New Orleans did not open a highway for, 237.
epidemic of, at Wilmington, N. C., 238.
epidemic of, at Matagorda, Texas, 240.
epidemic of, at Key West and the Dry Tortugas, 241.
epidemic of, at Hilton Head, 242.
map of district infected by, at Hilton Head, 246.
epidemic of, at Newbern, N. C., 247.
prevalence of, in Gulf ports, 249.
experience in New Orleans in 1862–65, 251.
records of naval epidemic of, in New Orleans in 1864, 260.
conclusions respecting epidemic of, in New Orleans, 264.
conclusions respecting the prevalence of, during the war, 267.
pathological inquiries respecting, 267.
therapeutical experience, 268.
Fevers, mountain, 202.
variola. See *Small-pox.*
eruptive, in the Confederate general hospitals in Virginia, 609.
Flagg, Surgeon Samuel, on measles, 230.
on the whisky ration, 116.
on malaria, 210.
Fomites, 61.
Foods, classification of, 68.
nitrogenetic or calorifacient, 68.
albuminoid, starchy, and fatty, 69.
proportion of carbon and hydrogen to nitrogen in elements of, 70.
carbonaceous, 83.
normal proportion of fat and starch or its products in, 83.
error of substituting carbonaceous for nitrogenous, 78.

Galloupe, Surgeon J. F., on the relation of period of service to physical endurance, 96.
on the influence of season, climate, and locality, 99.
on the whisky ration, 115.
on the prophylactic employment of quinine, 135.
on vaccination, 152.
Galvanism, direct, in the treatment of paralysis, etc., 453.
Gangrene, hospital, after the battle of Lookout Mountain and of Mission Ridge, 61.
progressive increase of, during the war. 66, 133.
in Stockade at Andersonville, 515, 651.
dependent on scorbutic condition, 626.
number of cases in British hospital stations on the Peninsula in 1813, 655.
Gay, Surgeon Norman, on diarrhœa, 311.
Gennet, Assistant-Surgeon, on malaria, 210.
Gill, Surgeon H. Z., on measles, 228.
on the whisky ration, 117.
Gravel feigned by malingerers, 36.
"Great Plains," health on the, 105.
Green, Surgeon Samuel A., on the want of a proper system of cooking, 111.
on the whisky ration, 114.

Habersham, Surgeon, on vaccination, 154.
Hæmoptysis, without cardiac or pulmonary disease, 372.
Hamilton, Medical Inspector F. H., on effects of vaccination, 151.
on gangrene of the toes in fever, 216.
on scurvy, 286.
Hammer, Dr., on spurious vaccination, 148.
Hand, Surgeon, on the whisky ration, 116.
Harris, Dr. Elisha, on vaccination in the army, re-vaccination, and spurious vaccination, 137.
on yellow fever on the Atlantic coast, and at the South during the war, 236.
Harvey, Surgeon Wm. A., on typho-malarial fever, 216.
Headache, feigned by malingerers, 29.

Health of troops, effect of marching orders on, 47.
Heart, disease of, feigned by malingerers, 33.
hypertrophy of, produced by carrying heavy equipments on long marches, 18.
sudden death from coagula in, 51.
observation on the diseases of, among soldiers, by Dr. Da Costa, 360.
valvular diseases of, 360.
table of diseases of, 361.
diseases of, following rheumatism, 362.
not preceded by rheumatism, 362.
attributed to violent exertion, 365.
cases of, in which they did not prevent the performance of military duty, 367.
enlargement of, dependent on endocarditis, or pericarditis, 370.
hypertrophy of, from persistent functional disorder, and after fevers, 373.
enlargement of, due to rheumatic diathesis prior to enlistment, 374.
hypertrophy of, without valvular lesions, amenable to treatment, 375.
hypertrophy of, without valvular lesions, treatment of, 378.
enlargement of, with predominant dilatation. infrequency of, 380.
irritable, 380.
diseases of, conclusions respecting, 381.
Heise, Surgeon A. W., on the influence of residence in city and country, prior to enlistment, 100.
on the whisky ration, 117.
Hematuria, feigned by malingerers, 35.
Hemorrhage, secondary, 133.
Hill-stations in the British army in India, 298.
Horsford's Prof., efforts to diminish the weight and bulk of the United States army ration, 92.
Hospital, first general field, in the army of Ohio, 48.
Hospitals, General State, bad effects of, 27.
tent, superiority of, 46.
Houston, Surgeon W. M., on the whisky ration, 116.
on vaccination, 152.
Howard, Surgeon B., on diarrhœa and dysentery, 307.
Hunt, Surgeon Sanford B., on the physical characteristics of the different classes of volunteers, 101.
remarks by, on the effects of altitude, 105.
on alimentation in relation to the causation and prevention of disease, 64.
on spurious vaccination, 149, 152.
on scurvy, 276.
camp diarrhœa and dysentery, 291.
on cerebro-spinal meningitis, 383.
Hydrocele, feigned by malingerers, 36.

Infirmities, concealed at enlistment, 28.
Innervation, lesions of, due to malarial poisoning, 122.
Insanity, feigned by malingerers, 30.
Insolation. See *Sun-stroke.*
Intestines, morbid appearances of, in cases of malarial poisoning, 127.
Intussusception, found after death, 52.

Jenner's evidence before the committee of the House of Commons, 161.
Jewett, Surgeon C. C., on relation of period of service to physical endurance, 96.
on the whisky ration, 116.
on diarrhœa, 315.
Jones, Surgeon Amos S., on malaria, 209.
on measles, 228.
Surgeon Joseph, on the prevalence and fatality of pneumonia and of typhoid fever in the Confederate army, 335.
on cerebro-spinal meningitis, 393, 399.
investigations upon the diseases of the Federal prisoners confined in Camp Sumpter, Andersonville, Ga., 469.

Keith, Surgeon Price, on the whisky ration, 116.
Kidney, disease of, feigned by malingerers, 36.

Laborers from the country as material for the army, 102.
Lameness, feigned by malingerers, 37.
Leavitt, Surgeon D. F., on measles, 229.
Lee, Prof. Charles A., on diarrhœa caused by fresh mutton, 317.
on scurvy, 288.
Lidell, Surgeon John A., on camp fevers, 209.
on walking cases of typhoid fever, 212.
Liver, disease of, feigned by malingerers, 34.
Locality, influence of, on physical endurance, 99.
Logan, Dr. Thos. M., on mountain fever, 203.
Long, Surgeon O. M., on measles, 228.
Lookout Mountain, battle of, 61.
Lungs, disease of, feigned by malingerers, 34.

Malaria, slow absorption of, as contrasted with sudden poisoning by, 118.
action of, irrespective of fever, 119.
conditions under which the absorption of occurs, 120.
variations in the intensity of, 120.
susceptibility to, 121.
hygienic circumstances unfavorable to the absorption of, 121.
effects of, on endurance, 121.
relation of, to diarrhœal maladies, 127.
conclusions respecting, 134.
Malarial poisoning, 19.
by Surgeon Roberts Bartholow, 118.
chronic, morbid anatomy of, 122.
symptoms denoting effect on functions, and on endurance, 124.
danger of intercurrent diseases in, 125.
agency of, upon diseases, and the results of surgery, 125.
interference of, with repair of fractures, etc., 130.
action of, in predisposing to acute pyæmia, 131.

Malarial fever. See *Fever, malarial.*
Malingering, 24.
causes of, 24.
prevalence of, 27.
forms of, 29.
diagnosis and treatment of, 39.
Manfred, Surgeon Henry, on the relation of period of service to physical endurance, 97.
on the influence of residence in city or country, previous to enlistment, 100.
Marching more favorable than the camp for health, 17, 46.
on the "Great Plains," showing effect of climate on the efficiency of troops, 106.
McDonald, Dr. A., on scurvy, 290.
Measles, camp, 13, 20, 218.
prevalence of, and mortality from, 218.
liability to, of recruits, 219.
Dr. Salisbury's theory of, 219.
eruption in one hundred cases of, 221.
desquamation in, 222.
delirium in fatal cases of, 222.
symptoms of, referable to the respiratory system, 222.
to heart, 223.
to mouth and fauces, 223.
to kidneys, 224.
sequelæ of, 224.
typhoid state in, 225.
pneumonia and diarrhœa in, 225.
methods of treatment of, 225.
rational treatment of, 226.
testimony of medical officers respecting fatality and prevalence of, 226.
means of protection against losses by death, and discharge from, 227.
Medical officers, complaints of the harshness and severity of, 40.
newly appointed, their early embarrassments, 43.
their first duty, the examination of recruits, 43.
department, organization of, for the field of battle, by Surgeon A. J. Phelps, 54.
department, organization of, for the field of battle, by Surgeon G. Perin, 54.
Meningitis, cerebro-spinal, 383.
historical and geographical sketch of, 383.
prevalence of, in America, and during the war, 384.
occurrence of, at Little Rock, Arkansas, 385.
occurrence at Benton Barracks, 385.
occurrence at Newbern, N. C., 386.
occurrence near Fredericksburg, Va., 386.
occurrence in the Lower Vistula, 386.
favored by cold and overcrowding, 387.
age and constitution of those attacked by, 387.
symptoms of, 387.
Meningitis, cerebro-spinal, premonitions of, 387.
period of invasion of, 388.
the intellect in, 388.
muscular contractions in, 389.
pain in, 389.
decubitus in, 390.
petechiæ in, 390, 398.
temperature in, etc., 390.
phenomena preceding death from, 391.
summary of symptoms of, 391.
duration and mortality of, 392.
post-mortem appearances of, 393.
autopsy in case reported by Prof. Joseph Jones, 393.
division of, by Dr. Webber, into three orders, 396.
post-mortem examinations in cases of, by Surgeon Ira Russell, 397.
autopsies by Surgeon Upham, 398, 400.
treatment of, 401.
remarks on, by Surgeon Ira Russell, 402.
remarks by Surgeon Upham, 403.
remarks by Dr. Webber, 404.
remarks by Dr. Sanderson, 404.
ætiology of, 406.
non-contagiousness of, 409.
in the army of Ohio, 58.
Mexican War, consolidated table of the United States army in, 177.
Military service, qualifications for, 3.
Milk, nutritive elements in, 71.
Miller, Surgeon George D., on malaria, 209.
Milligan, Surgeon F. H., on the prophylactic employment of quinine, 136.
Mission Ridge, battle of, 61.
Mitchell, S. Weir, on the diseases of nerves resulting from injuries, 412.
Mortality in the United States army in eighteen years of peace service; in the Mexican War, and in the first year of the rebellion, 15.
Mortality, influence of seasons on, 15.
comparative, in armies, from wounds and disease, 169.
in armies, the principal cause of, incorrectly supposed to be the casualties of battle, 169.
total, of the French army in the Crimean War, 174.
comparative, among enlisted men and officers in the French army in the Crimean War, 176.
total, of the United States army in the Mexican War, 176.
comparative, from disease and wounds in the Mexican War, 177.
among enlisted men and officers in the Mexican War, 178.
in the recent rebellion, 178, 181.

Mortality, comparative, from disease and wounds, 182.
among enlisted men and officers, 182.
large, among colored troops, 184.
in the different arms of the service, 184.
in Kansas, 186.
variations in, explained by the nature of the service, 186.
comparison of, among regular volunteer and colored troops, 187.
comparison of, among troops of different States, 187.
comparison of, in other notable campaigns, 188.
in the Confederate army, 187.
in the Sardinian army in the Crimean War, 189.
in the French army in Africa, 189.
in the English army in Spain, 190.
in the expedition to Walcheren, 190.
in the English navy, 191.
in the Russian army in Turkey, 191.
from disease and wounds, conclusions respecting, 192.
Muscles, contraction of, feigned by malingerers, 39.

Negro, physical qualities of, 5.
liability of, to pulmonary disease, 332.
weight of the lungs of, less than in the white man, 333.
efficiency of the treatment of pneumonia affecting the, 332.
Nerves, diseases of, resulting from injuries, 412.
primary symptoms of, 413.
tetanus and tremor, 415.
neuralgia, 417.
classification of injuries of, 417.
contusion of, and pressure on, 418.
injury of, by commotion, 421.
from dislocation or attempt at reduction, 421.
propagated disease of, 422.
local symptoms of wounds of, 424.
changes of nutrition resulting from injuries of, 426.
effects of injuries of, on skin, 427.
glossy skin resulting from injuries of, 428.
muscular contractions resulting from injuries of, 426.
eczema resulting from injuries of, 429.
effects of injuries of, on the nails and hair, 430.
paralysis after injuries of, 442.
treatment of paralysis resulting from injuries of, 451.
hypertrophy of areolar tissue resulting from wounds of, 433.
inflammation of joints resulting from effect of injury of on secretions, 434.
lesions of sensation resulting from injuries of, 435.
delay in transmission of sensations and volitions after injuries of, 437.
causalgia, or burning pain, resulting from injuries of, 439.
Nerves, defects of motion from injuries of, 441.
diagnosis of wounds of, 443.
prognosis of wounds of, 443.
treatment of pain following injuries of, 446.
treatment of nutritive changes and paralysis following injuries of, 451.
cases illustrative of injuries of, 455.
Nervous affections dependent on malarial poisoning, 128.
Neuralgia, small number of cases of, among the prisoners at Andersonville, 579.
cases of, on field reports of the Confederate armies serving in South Carolina, Georgia, Florida, etc., 580.
New Orleans, experience in, as regards yellow fever, 251.
sanitary police of, 252.
temperature and humidity in, 254.
sanitary condition of, before the war, 255.
appliances and means of sanitary reform in, 257.
quarantine records of, in 1863 and 1864, 259.
records of medical experience in, 260.
New, Surgeon Geo. W., on measles, 229.
Nostalgia, 21.

Ohio volunteers, 33d regiment of, early history of the, 45.
army of, first general hospital of the, 48.
march of, after the evacuation of Corinth, 52.
field hospital of, at Corinth, 53.
reinforcement of the, 53.
long rest of the, 54.
organization of the medical department of, for the battle-field, 54.
appointment of a board of medical examiners for, 55.
soup order for, 56.
march of, to Chattanooga, 59.
at siege of Chattanooga, 60.
at battles of Mission Ridge and Lookout Mountain, 61.
march of, to the relief of Knoxville, 62.
Overcrowding of tents and quarters as causing disease, 11.
of steamboats, evils of, 100.

Page, Dr. J. W., on yellow fever at Newbern, N. C., 248.
Paralysis, feigned by malingerers, 31.
crutch, 419.
from pressure of snaffle rein, 419.
from carrying huge jars of water, 420.
after injuries of nerves, 442, 444.
treatment of, 451.
Pease and beans in army ration, 90.
Pericardium, infrequency of disease of, 369.
Phelps, Surgeon A. J., remarks on various circumstances relating to the causation of disease, based on personal observations in the field during the years 1861–65, 42.

Phillips, Surgeon James, on measles, 229.
Phthisis, agency of malaria in the development of, 126.
Piles, feigned by malingerers, 35.
Pittsburg Landing, battle of, 47.
Pneumonia, peculiarities of, caused by malaria, 126.
as it appeared among the colored troops at Benton Barracks, Mo., in the winter of 1864, 319.
congestive form of, 320.
typhoid, 321.
pleuro, 322.
occurrence of, after the measles, 323.
table showing number of days in hospital, the affection of one or both lungs, the stage of the disease at time of death, and the weight of the lungs in one hundred cases of, 325.
table showing dates of deaths in one hundred cases of; the duration of the disease, the amount of effusion, etc., in fifty cases of pleuro-pneumonia, 328.
table showing duration of, and measles, 328.
table showing order in which the lungs and several lobes were attacked, etc., 329.
table showing number of days in hospital of cases of, and of measles, ending in recovery, 330.
treatment of, 330.
general observations respecting, as affecting colored troops, 332.
note respecting prevalence and fatality of, among the United States troops during the war, 333.
prevalence and fatality of, in the Confederate army, 335, 591.
prevalence and fatality of, in the armies serving in the different sections of the States in rebellion, 338.
the most fatal of diseases among the Confederate troops, 342.
cases of, and deaths from, in the Confederate hospitals in and around Richmond, 346.
cases of, and deaths from, in Charlottesville hospital, 351.
cases of, and deaths from, in Virginia and Georgia hospitals, 356.
numerical relations of deaths from, and from typhoid fever, in the Confederate armies, 357, 358.
table showing cases of, and deaths from, in Staunton, Va., hospital, 592.
statistics of, in hospitals of Virginia, 593.
Pork or bacon in the army ration, 89.
not a substitute for beef, 89.
Powers, Acting Assistant-Surgeon Cyrus, on the relation of period of service to physical endurance, 97
on the whisky ration, 116.
Prisons, U. S. military, diet in, 80.
Pyæmia, acute, 131.
chronic, 132.
metastatic, 132.
differential diagnosis of, and of periodical fever, 133.

Quinia, prophylactic employment of, 134.
as a prophylactic against pneumonia, 331.

Races composing the volunteer army of the United States, 4, 5.
Ramsay, Surgeon A. W., on vaccination, 157.
Ration of the U. S. army a fruitful source of disease, 66.
amount of carbon in, 85.
fresh vegetables and salts in, 86.
notes on the special components of, 88.
pork or bacon in the, 89.
flour in the, 89.
pease and beans in the, 90.
coffee and tea in the, 90.
whisky in the, 90.
summary of errors in the, 90.
Prof. Horsford's efforts to diminish weight and bulk of, 92.
Rations, short, effect of, on the 4th Corps of the army of Ohio, in marching to the relief of Knoxville, 62.
army, of several different nations, 72.
notes on, 73.
nutritive value of, 76.
of the United States, effects of a deficiency of nitrogenous food in, 77.
experience of, at Convalescent Camp, Va., 79.
in the United States military prisons, 79.
in the Confederate army, 80.
experience of, in 16th Army Corps, 81.
in the army of the frontier at Fort Smith, Ark., 81.
different quantity of carbonaceous foods in, 83.
in French, Russian, Turkish, East Indian, and British armies, 74.
issued to the prisoners at Andersonville and to the Confederate soldiers, 622.
Recruiting, looseness of, 44.
volunteer, bad effects of, 44.
Recruits, life at depots of, 8.
size of, best suited for the service, 47.
diseases affecting, at depots, 12.
examination of, at Binghampton, N. Y., 102.
from the country, management of the, 103.

Regiments, new, early history of, as represented by the early history of an Ohio regiment, 45.
Reports of sick and of discharges as showing malingering, 28.
Rheumatism feigned by malingerers, 38.
acute, of troops in New Mexico, 269.
relation of climate to the production of, 270.
agency of the so-called rheumatic diathesis in the causation of, 271.
a substitute for epidemic erysipelas, 272.
special characters of, in New Mexico, 272.
analogy of, to erysipelas, 273.
conclusions respecting, 274.
note respecting the prevalence of, in the United States armies, 274.
cases of, at Andersonville and among the Confederate troops, 595.
table showing cases of, in several Confederate general hospitals, 596.
Rosecrans, Gen., soup-order by, 56.
Russell, Surgeon Ira, on spurious vaccination, 144.
on pneumonia as it appeared among the colored troops at Benton Barracks, Mo., in the winter of 1864, 319.
on cerebro-spinal meningitis, 397, 402.

Salisbury, Prof., theory of the fungous origin of measles by, 219.
on excess of starches as causing diarrhœa and dysentery, 300, 310.
" Salt horse," 89.
Sanborn, Surgeon J. E., on the whisky ration, 117.
on measles, 228.
Sanitary measures, effect of, in the Crimean War, 172.
Scorbutus. See *Scurvy*.
Scurvy, 18.
in the army of the Ohio, 58.
associated with malaria, 129.
in its medical aspect, 276.
first appearance of, during the war, 276.
prevalence of, during the war, 277.
causation of, 278.
dietetic origin of, shown by history, 279.
discrepancies as regards theories of causation of, 279.
dependence of, on lack of albuminoids and salts, 280.
fresh blood in, 280.
relative value of albuminoids and salts in, 282.
acids in, 283.
symptoms and pathology of, 283.
treatment of, 286.
saline remedies in, 286.
phosphate of lime in, 287.
object in the treatment of, 287.
Scurvy, agency of, in producing diarrhœa and dysentery, 300.
sudden deaths in the Andersonville Prison attributable to, 508.
sudden death from, statements of authors respecting, 509.
effects of, in prison at Andersonville, 514.
cases of, among prisoners at Andersonville, 619, 649.
at Andersonville, referable to the character, rather than the amount of food, 622.
cases of, entered on the field and hospital reports of the Confederate armies, 624.
progressive increase of, among the Confederate troops, 624.
Seal, Surgeon Norman, on measles, 229.
Season, influence of, on physical endurance, 99.
in causing disease, 15.
Sensation, explanation of, the speedy recovery from after injuries of nerves, 414.
Service, period of, in relation to physical endurance, 96.
Shiloh, battle of, 47.
Sieges, effects of, on health, 18.
Skin, certain diseases of, to be ranked among the neuroses, 431.
Small-pox among the prisoners at Andersonville, 608.
table, showing cases of, in the Confederate hospital at Atlanta, 612.
statistics of, in European hospitals, 613.
effect of vaccination on rate of mortality from, 613.
arrest of, at Andersonville, by vaccination, 614.
amount of, in the first year of the war, 139.
Soldiers, western, superior marching qualities of, 104.
Soup-order of Gen. Rosecrans, 56.
Southworth, Surgeon Charles, on the use of coffee, 113.
Spermatorrhœa, feigned by malingerers, 35.
Starches and sugar, proper relative proportion of, in alimentation, 84.
waste of, in the United States army, 85.
Starvation-semi, of British laborers, 78.
sense of the term, 87.
Stevenson, Surgeon B. F., on the age most favorable to physical endurance, 95.
on relation of period of service to physical endurance, 97.
on the influence of residence in city or country, previous to enlistment, 100.
on the evils of over-feeding, 110.
on the whisky ration, 117.
on vaccination, 152.
on diarrhœa, 317.
Confederate Surgeon R. R., report of sick in Stockade at Andersonville, 513.
Confederate Surgeon, R. R., on condition of prison at Andersonville, 549.

Sun-stroke among the prisoners at Andersonville, 581.
among Confederate troops, 581.
Surgeons, newly appointed, their early embarrassments, 43.
their first duty, 43.
want of coöperation between, and commanding officers, 48.

Thrall, Surgeon S. B., on the prophylactic employment of quinia, 135.
Typhoid and typhus fever. See *Fever, typhoid and typhus.*

Upham, Surgeon J. Baxter, on cerebro-spinal meningitis, 398, 400, 403.
Urine, incontinence of, feigned, 35.

Vaccination, 137.
of volunteers delayed, 138.
much of, in civil life not effectual, 138.
self, consequences of, 138.
statistics of protection by, 141.
experience of, in Prussian army, 141.
genuine, importance of, 141.
urged by the United States Sanitary Commission, 142.
spurious, 142.
experience of in St. Louis, 143.
and impure pathological history of, 160.
recapitulatory propositions respecting, 162.
syphilitic, conclusions of physicians of St. Louis respecting, 148.
spurious, prevalence of morbid effects of, 150.
experience of, among prisoners at the North, 153.
in the Confederate army, 154.
in East Tennessee, 157.
effect of, on mortality from small-pox, 613.
untoward results of, among the prisoners at Andersonville, 614, 654.
untoward results of, in the Confederate armies, 615.
Vaccine virus, amount of, supplied by the United States Sanitary Commission, 142.
Van Buren, Prof. Wm. H., on the prophylactic employment of quinia, 134.
Vanderpoel, Surgeon-General, results of inquiry by, concerning vaccination, 139, 140.
Varian, Surgeon Wm., on scurvy, 289.
Varicose veins, 38.
Varicocele, feigned by malingerers, 36.
Vegetables fresh, importance of, in army rations, 86.
desiccated, 87.
salts of blood derived from, 87.
Vertigo, feigned by malingerers, 30.
Vision, loss of, feigned by malingerers, 32.

Walton, Surgeon J. C., on measles, 228.
Weight of body, average diurnal loss and gain in the, 67.
average, of seventeen hundred soldiers of the army of the Potomac, 67.
French chasseurs, 67.
recruits of British army, 67.
the human male, 67.
Wells, Confederate Assistant-Surgeon, report of sick at Andersonville, 513.
Western soldiers, superior marching qualities of, 104.
Whisky, after great fatigue, 90.
ration, use of, 113.
White, Confederate Surgeon Isaiah H., reports on condition of prison at Andersonville, 535.
Whittaker, Assistant-Surgeon John, on the use of tea, 113.
on measles, 230.
Wilbur, Surgeon George D., on measles, 229.
Williams, Surgeon G. H., on vaccination, 152.
Windsor, Surgeon F. H., on malaria, 210.
Woodward, Surgeon B., on the relation of period of service to physical endurance, 98.
on measles, 231.
on scurvy, 290.
on diarrhœa and dysentery, 308.
on cryptogamic formations in the fæces, in diarrhœa and dysentery, 310, 313.
Wounds, malarial poisoning antecedent to, 129.
Wragg, Dr. Wm. T., report on yellow fever at Wilmington, N. C., 239.

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