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Geo A Martin MD

142/1709

PLATE I, illustrating the general Laws of Temperature throughout the United States.

THE

CLIMATE OF THE UNITED STATES

AND ITS

ENDEMIC INFLUENCES.

BASED CHIEFLY ON THE RECORDS OF THE MEDICAL DEPARTMENT AND ADJUTANT GENERAL'S OFFICE, UNITED STATES ARMY.

BY SAMUEL FORRY, M. D.

L'ensemble de toutes les circonstances naturelles et physiques, au milieu desquelles nous vivons dans chaque lieu.—CABANIS.

The best observations upon climate often lose half their value for the want of an exact description of the surface of the country.—MALTE-BRUN.

NEW-YORK:
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1842.

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TO

THOMAS LAWSON, Esq.,

SURGEON GENERAL UNITED STATES ARMY,

UNDER WHOSE OFFICIAL DIRECTION THE INVESTIGATION OF THE SUBJECTS OF THIS VOLUME WERE FIRST UNDERTAKEN BY THE AUTHOR, IN THE

"ARMY METEOROLOGICAL REGISTER;"

AND THE

"STATISTICAL REPORT ON THE SICKNESS AND MORTALITY OF THE ARMY OF THE UNITED STATES,"

THIS HUMBLE EFFORT IN THE CAUSE OF GENERAL AND MEDICAL SCIENCE

Is Most Respectfully Inscribed.

PREFACE.

THE design of this work is to exhibit a connected view of the leading phenomena of our climate, both physical and medical, comprising a condensation of all the author's observations on the subject. It is based chiefly on the "Army Meteorological Register," and the "Statistical Report on the Sickness and Mortality in the Army of the United States," embracing a period of twenty years, (from 1819 to 1839,) both of which are the result of the author's labors. Aware that statistical details are not viewed with favor by the mass of the reading public, the author has compressed within the compass of little more than one hundred pages what constituted originally five hundred, as published officially by the War Department, the remainder of this volume consisting of those general deductions which more extended investigations have enabled him to make. Of the "Meteorological Register," for example, one hundred and thirty pages of tabular matter have been so condensed, at the expense of much time and labor, into four abstracts, as to exhibit nearly every important practical result within the limits of seven pages; and upon these numerical results, constituting the Appendix to Part First, the remarks comprising this PART, are based.*

The chief objects intended to be accomplished are to present, in PART FIRST, a classification of the principal phenomena of our climate, *physically* considered; and to attempt, in PART SECOND, to trace out the *medical* relation of these laws, thus establishing in both a classification of climates having for its basis observation. In regard to the climate of our own country, we possess no treatise founded on

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* It is due to the Hon. John C. Calhoun to state that upon the organization of the medical department, during his administration of the War Office, these meteorological observations had their origin in his enlarged views.

facts. Indeed, so little effort has been made to keep pace with the progress of kindred branches of science that the work of M. Volney, written more than forty years ago, is still quoted by every writer on the subject. In relation to climate, nearly all our facts stand isolated; and inasmuch as to render such data valuable, it is necessary that they be collated, thus determining their relations to one another and to general laws, the attempt has been made to present a systematic arrangement so far as the facts collected will warrant, leaving the further prosecution of the subject to a period when new data shall have accumulated.

It is only within recent years that Meteorology has engaged the general attention of the scientific world, and that the numerical method of investigating diseases has been strictly adopted. Of late, much has been said of the value of statistics—a subject of deep importance to the physiologist and philanthropist. Numerical analysis applied to governmental objects, soon bestowed the character of a science upon political economy; and its application to the investigation of morbid actions has already proved so successful, that the doctrine of averages has been not unaptly styled the mathematics of medical science. Medical statistics, may be defined to be the application of numbers to the elucidation of the natural history of man in health and disease. As the experience of the civil practitioner is on too limited a scale, and his observations too immethodical, to warrant general conclusions, it is only by extending such observations through a series of years and over vast masses of individuals, that correct conclusions can be attained, as well as important relations disclosed discoverable in no other way. As a test of the truth of theories, statistical investigations are of vast importance. Could all medical opinions be submitted to the searching ordeal of numbers, the substance of many a ponderous folio might be condensed upon its title-page!

The numerical method, of which one of the most striking features is the induction of important principles from data, which viewed disconnectedly, appear unimportant, exhibits, to a certain degree, the true application of the Baconian philosophy to medicine, thus giving it a close approximation to the exact sciences. Many difficulties, however, are presented, when we come to investigate the principles of pathology and therapeutics, in consequence of the multiplied elements which enter into the calculation. As health and disease are only relative terms, the arrangement of phenomena into physiological and pathological is, in a measure, arbitrary, the distinguishing characters of diseases not being sufficiently marked to lead to a common classification. As morbid symptoms are the mere external manifestations or signs of disease, modified by various accidental circumstances, and especially by the structures chiefly implicated, observers will not always agree in the classification of the groups of symptoms, which, according to the artificial divisions of nosology, are regarded as constituting special diseases. Notwithstanding these objections, it may, however, be safely assumed that although difference of opinion may arise as to the precise tissue implicated, yet when we come to arrange diseases into classes, as those, for example, of the *respiratory* or *digestive organs*, the liability to error which existed in respect to the sub-divisions, no longer obtains. Having thus collected well-established facts sufficient to serve as data for generalization, and having determined, by a proper induction, general principles, these laws, in accordance with the true object of science, may be so applied to new phenomena having analogies with those already examined, as to classify in systematic harmony facts apparently incongruous.

A treatise on the climate and endemic influences of the United States, is a desideratum in medical literature; and to supply this deficiency is the object of the author.

As the subjoined prefatory remarks, taken from the "Report on the Sickness and Mortality in the Army of the United States," consisting of a collection of facts in relation to the medical topography of the military posts and the vital statistics of the troops extending over a period of twenty years, exhibit more in detail the objects of PART SECOND of this volume, devoted more especially to the investigation of endemic influences, their introduction here will not be deemed inappropriate.

To avoid erroneous inferences authorized by the text, in regard to intermittent fever in the New England States, the reader is referred to the explanatory note at the end of the volume.

SAMUEL FORRY.

NEW-YORK, No. 8 PARK PLACE,
March 1*st*, 1842.

EXTRACTS FROM THE INTRODUCTION

TO THE

STATISTICAL REPORT ON THE SICKNESS AND MORTALITY OF THE ARMY.

THE medical literature of almost every country abounds with medico-topographical descriptions of particular localities; but the mere accumulation of facts of this kind, unless systematically arranged, can avail but little in determining the operation of physical causes upon the human constitution. In observing the phenomena of nature, the view of the individual practitioner is here restricted to narrow boundaries; and as these various and complicated facts have been but partially generalized, the laws of nature in regard to these external influences upon the healthy and diseased condition of man are often sadly misinterpreted.

For the period of twenty years, quarterly reports of diseases among the regular troops have been uninterruptedly made to the Medical Bureau of the United States Army, thus affording the means, in connection with the returns in the Adjutant General's Office, not only to investigate morbid action by the numerical method, but to show its relation with climate. As these diversified facts admit of classification according to certain geographical limits, the results, it is hoped, will furnish some general laws towards the basis of a system of *medical geography*.

The diseases incident to armies present an extensive field for observation. The advantages offered in the Revolutionary war, and in our second struggle with Great Britain, were but slightly improved. Excepting the "Medical Sketches" of Surgeon Mann, and a few remarks interspersed in the works of Dr. Rush, we are almost entirely ignorant of the medical history of these two eventful periods. Military *hygiene*,—the knowledge of maintaining the health of soldiers, and of promoting their efficiency,—is another subject which should not only be carefully studied by medical and all other officers, but receive the special attention of Government.

The extent of labor in preparing these papers may be inferred from the single fact that it was necessary to examine about 4,000 quarterly sick reports, (a majority of which have been condensed into abstracts,) and to obtain from the Adjutant General's Office the mean strength for corresponding periods, compiled from the post and regimental returns. In the brief topographical descriptions of the posts, due allowance will be made by those having the personal knowledge derived from a residence at a station, for the difficulty attending a compilation from statements made by different individuals and at different periods. To the late Surgeon General, much credit pertains for having organized a system of returns, rendering it feasible to condense the results of so long a period into the form now presented.

SURGEON GENERAL'S OFFICE, *April*, 1840.

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THE

CLIMATE OF THE UNITED STATES,

AND ITS

ENDEMIC INFLUENCES.

PART FIRST.

RESEARCHES IN ELUCIDATION OF THE LAWS OF CLIMATE IN GENERAL, AND ESPECIALLY THE CLIMATIC FEATURES PECULIAR TO THE REGION OF THE UNITED STATES.

SECTION I.

General geographical description of the United States.—Character of the meteorological data upon which this treatise is based.—Benefits derivable from a complete view of the climatic features of our continent.—Connection of meteorology with medical science, political economy, the natural history of man, agriculture, and the kingdoms of nature in general.—Ancient and modern history of meteorology as a science.—Definition of the term climate.—Its connection with celestial relation and geographical position.—Particular object of the present investigation.—Summary of the principal facts known in regard to the temperature of the earth at such depths beneath its surface, and at such elevations above its level, as are within our reach.—The same in relation to the temperature of waters.

As the climate of every region has an inseparable relation with its physical characters, it follows that a geographical description becomes a preliminary step in the investigation of its climatic features; but in the present instance, the country to be described is of so vast an extent as to preclude any thing beyond the most general outlines—a description which will, however, be sufficient for the purpose designed.

The United States are bounded on the east by the British Province of New Brunswick and the Atlantic ocean; on the north, by the Russian and British Provinces; on the south, by the Gulf of Mexico and the Texan and Mexican Republics; and on the west, by the two States just named and the Pacific ocean. This vast region, comprised within the meridians of 67° and 125° W., extending on the Atlantic side from below 25° to 49° N. lat., and on the Pacific side from 42° to 54°, covers an area of about 2,300,000 square miles. Of this tract, the frontier line is about 10,000 miles long, of which about 3,600 are sea and 1,200 lake-coast. From the Atlantic to the Pacific, across the centre of the United States, the distance is about 2,500 miles; and its greatest breadth from north to south, is nearly 1,400 miles. These boundaries constitute a territory of vast extent, including the larger part of what is valuable and productive in this part of the continent.*

The portion of this immense tract which demands more especial consideration, as being the region in which the meteorological observations have been chiefly made, is that actually within the limits of the organized States and Territories. This region is bounded by a line running north from the Sabine to the Missouri, and following that river to the mouth of the White Earth river, near our northern boundary line. This tract is estimated to contain 1,300,000 square miles.

The territory of the United States is traversed by two great systems of mountains, by which the country is distinctly marked into three natural divisions, *viz.*, The Pacific Region, the Mississippi Valley, and the Atlantic Table-land and Plain. Of these two mountain-systems, the more lofty and extensive is that in the western part of the continent, known under the various names of Rocky, Oregon, and Chippewyan. It is a prolongation of the Mexican Cordilleras, and extends to the Arctic sea. The elevation of the base above the level of the ocean is about 3,000 feet, and the average height of the summits above the base is perhaps 5,000, whilst some, it is estimated, reach an altitude of 8,000 or 10,000 feet. These mountains are 500 or 600 miles from the Pacific. Farther west is the range of the Pacific coast mountains, which stretch northward from California into the Peninsula of Russian America. They are from 70 to 80 miles from the coast, and their highest summits are from 10,000 to 18,000 feet. These peaks, like those of the Rocky Mountains, are covered with snow, and ascend far into the region of perpetual congelation. East of the Rocky Mountains are the Black Hills, stretching north-east and south-west between the Upper Platte and Missouri. The Ozark Mountains, which lie about midway between the

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* In his geographical descriptions, the writer has availed himself chiefly of Bradford's Illustrated Atlas of the United States.

Rocky Mountains and the Alleghanies, extend from the Rio del Norte of Mexico to the vicinity of the Missouri. In some places they attain an altitude of 3,000 feet, but their mean elevation is much less.

The Alleghany or Apalachian system designates the whole series of mountains near our eastern coast, which might be more appropriately named the Atlantic system. It consists of four independent mountain groups, crossing the country in the same general direction, from N. E. to S. W., each obviously separable from the others by strongly marked external features, no less than by their geology. This system is less a chain of mountains than a long *plateau*, crested with chains of hills, separated from each other by wide and elevated valleys. The mean altitude is perhaps 2,500 feet, of which not more than one-half consists of the height of the mountain ridges above their bases, the adjacent country having an equal elevation above the sea. These parallel mountain-chains rise on the vast tract of table-land, which occupies the western part of the Atlantic States and the eastern portion of the adjoining States of the Mississippi valley, about midway between the Mississippi and the Atlantic. The group in New England, which passes through New Jersey into Pennsylvania, consists almost wholly of primary rocks, chiefly of the stratified class. Mount Washington, the most elevated summit, attains an altitude of 6,428 feet. In the Blue ridge group, pursuing the general south-west course from Maryland to Alabama, no rock of genuine primary character has yet been found, but formations principally of the oldest non-fossiliferous secondary group, or such as formerly would have been named *transition*. In this range, Black Mountain in North Carolina, which has an elevation of 6,476 feet, is the highest summit. The next group, lying west of the Blue Ridge and continuing parallel with it to Alabama, has a formation, which, belonging to the oldest fossiliferous groups, contains no rocks as recent apparently as the bituminous coal series. The third group, which lies to the west and north-west of that last described, presents little uniformity in its course; but when it has the character of ridges, the general direction is parallel. In this triple division south of the Hudson, the eastern may be considered as destitute of any coal formation—the middle as embracing the strata of the anthracite—and the western as containing the vast bituminous coal formation.

The face of the country consequently presents the variety of plain, mountain, valley, and table-land, having primitive, transition, secondary, and alluvial formations. From New Brunswick to the mouth of the Hudson, with a trivial interruption in the peninsula of Cape

Cod, the sea washes a coast of primary rocks often presenting bold projecting cliffs. This region, as far to the north-west as the St. Lawrence river, consists of primary rocks, if we except three narrow belts of secondary strata. This primary region, following the course of the Highlands, as just described, extends into Pennsylvania, and then continues, under formations of a more ambiguous character, as far as Alabama, having for its eastern boundary the tertiary and secondary cretaceous strata of the Atlantic Plain, and for its western the great valley lying at the base of the Blue Ridge, and farther to the south-west one of the parallel mountain groups. The great secondary deposit lies chiefly to the north-west of the Alleghanies, extending to the great lakes and westward beyond the Mississippi. The alluvial deposits cover vast tracts, the most considerable being that interposed between the Atlantic shore and the Alleghany Mountains. This extensive level tract, little elevated above the level of the sea, and gradually widening from a few miles in breadth in the north to upwards of 150 miles in the south, has been appropriately named the *Atlantic Plain.* A ledge of primary rocks, over which the rivers fall, and to which in the northern section the tide penetrates, marks very distinctly the western limits of this tract, along which line are found Trenton, Philadelphia, Baltimore, Georgetown, Fredericksburg, Richmond, Smithville, Camden, Augusta, Milledgeville, and Columbus.* At the last named point, the ledge recedes to the north-west through Alabama and Mississippi, until the Atlantic Plain is merged into the valley of the Mississippi. Among the physical features which characterize this alluvial zone, which slopes gently down to the ocean, are extensive morasses and swamps, sluggish streams, and wide arms of the sea penetrating far inland. It is composed of tertiary and secondary cretaceous deposits, the former consisting of alternating beds of sand and clay, and sometimes marl, all abounding in marine fossil shells. The geological structure is more particularly noticed, as having a close relation with endemic influences; for here, as the soil, formed of the alluvion brought down by the mountain-streams, is of a humid nature, abounding in organic remains, it follows, as will be shown in the sequel,

* The fact that nearly all the principal cities of the Atlantic States have arisen upon this boundary, from the obvious motive of seeking the head of navigation, affords a striking example of the influence of geological causes in distributing population, and thus determining political relations.

that effluvia noxious to man are copiously generated, and in a ratio with the increasing temperature of season and latitude.

The great plain which extends through the centre of the continent from the Gulf of Mexico to the Arctic sea, bounded on the west by the Rocky Mountains, and on the southern portion of the east by the Atlantic system, is comprised only in part within the United States. This section, however, constitutes the most fertile and valuable portion of this vast central plain, which, including the valley of the St. Lawrence, embraces an area estimated to contain 3,250,000 square miles. On its northern borders, where winter holds perpetual sway, vegetable life expires or survives only in some species of mosses and lichens. South of these dreary wastes, stunted trees begin to appear, forming gloomy and desolate forests; and it is not until we reach the fiftieth parallel, that the eye is cheered with the vegetation known in the temperate zone. Proceeding still farther south, we ultimately discover, in the valley of the Mississippi, the palms and splendid foliage of the tropics—a land already peopled by millions, and one destined, as a necessary consequence springing from natural adaptation, to nourish upon its fertile bosom countless multitudes. A characteristic feature of this immense basin of the Mississippi and Missouri, is the vastness of its level surface. Its tracts of fertile lands, with its great and navigable rivers terminating in one main trunk, open to it prospects of opulence and populousness to an extent incalculable. In this region, man is every where occupied in opening new lands, in building houses, in founding cities, and in subjugating nature.

The general features of the vast northerly regions of America are little varied. Few mountains rise above this savage and icy plain, which is bleak and ever chilled beneath the influence of an arctic sky. At the heads of the Arkansas, Platte, and Yellowstone, is also an arid and sandy tract, so destitute of vegetable life that it has received the name of the American Desert. Having, however, some streams at certain seasons, and being not entirely destitute of plants, the utter sterility of the burning deserts of the eastern continent is not presented.

The Alleghany or Apalachian table-land, which extends from the great lakes into Alabama, lying about equi-distant from the Atlantic and the Mississippi, has a mean height of about 1,000 feet; but in some places, it is much more elevated. Upon this plateau arise the crests of the Alleghany system. Between the sources of the Platte, Arkansas, and Missouri, and the range of Oregon mountains, lies a table-land still more elevated.

One of the most striking characteristics of the physical geography of the United States, is, that produced by those great inland basins of water which lie on our northern frontier. Of so vast an extent are these ocean-lakes, which will be more minutely described hereafter, that one of them, (Lake Superior,) has a circuit, following the sinuosities of the coast, of 1,750 miles.

The physical features of America generally have been cast in large forms ; but it is her rivers which constitute her grandest natural features, or at least those in which she claims the most decided pre-eminence over the other quarters of the globe. In the physical and economical geography of the United States, the rivers form an important characteristic. In the Eastern States, the rivers, as they all arise from the chain of the Alleghany, cannot, even by a winding course, attain any great length ; but it is in the immense basin of the Missouri-Mississippi that we find a system of rivers, reaching from the Alleghanies to the Rocky mountains, which is equalled in extent only by the Amazons, and rivalled by none in the world in regard to the benefits destined to be derived from it as a medium of commercial intercourse. The Mississippi and Missouri, which stretch their hundred giant arms over all that immense tract between the Rocky and Alleghany mountains, constituting the southern slope of the vast central plain just described, are the mightiest of these rivers. The Missouri has its origin in the Oregon mountains, not more than a mile from some of the sources of the Columbia. Its extreme length to the gulf of Mexico is 4,500 miles, of which 3,800 are navigable. It is the main stream, notwithstanding a capricious nomenclature, which cannot alter the relations of nature. The next most important tributary is the Ohio, which gathers up the waters of one of the most fertile and cultivable regions of the globe. The whole region drained by this noble river comprises an area of 200,000 square miles, rich in the most useful productions of nature, animal, vegetable, and mineral, and fortunate in the advantages of a mild and salubrious climate. The Arkansas exceeds the Ohio in dimensions, but a considerable part of its course is through barren, sandy tracts. In the dry season it is shallow, disappears in some parts, or leaves only stagnant pools. Even its floods are so uncertain, and its rise and fall so rapid, that it is almost useless for navigation. Although its estimated length is 2,500 miles, steamboats ascend with difficulty to Fort Gibson, 420 miles. As regards salubrity, the Lower Mississippi has been ever distinguished for violent epidemic visitations—diseases indissolubly connected with climate, and more especially with the influence of soil ; and the region west of this southern portion, notwithstanding the mortality may be lower, exhibits an equal degree of morbility.

From the shores of the Atlantic to the Mississippi, there is presented an immense natural forest, interspersed with open and naked plains, called *prairies*, which are numerous west of the Alleghanies, but very rare on the Atlantic side. The country west of the Mississippi is comparatively lightly wooded ; and in the arid and desert plains, occupying a breadth of 300 or 400 miles, only a few trees are seen along the margins of the rivers. In that portion of the U. States, which is inhabited, the lands cleared and cultivated do not probably exceed one-tenth part of its surface.

It may be well to state here that this attempt towards a systematic arrangement of the phenomena of our climate, is based chiefly upon the data furnished by the "Army Meteorological Register," recently published by Thomas Lawson, M. D., Surgeon General, U. States Army. This Register, collated by the writer, who was then on duty in the Surgeon General's office, comprises the general results of instrumental observations, made at our various military posts during a period of eleven years, (from 1820 to 1830 inclusive) ; and also, with the exception of the first two years, the detailed observations of the same period in the way of monthly tabular abstracts.* As the instruments provided, however, never exceeded a thermometer and a rain-gauge, the observations, including those upon the course of winds and other obvious states of the weather, have necessarily had a limited range. The results are consequently less comprehensive than the present state of meteorological science demands ; but as temperature is the most prominent, and perhaps the controlling element in the constitution of climate, and as the observations presented extend over the entire domain of our States and organized Territories, it may reasonably be assumed that the results exhibit a fair expression of the general laws of our climate,—a knowledge which further research will render more precise. As meteorology, however, has now become a subject of general interest, materials will ere long be furnished for the composition of extensive tabular statements, indi-

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* The results of the first four years had been published by Joseph Lovell, M. D., late Surgeon General.

cating the comparative character of our climate, and the phenomena of our seasons. A mass of facts thus accumulated will prove of immediate practical use to the philosopher, the physician, and the agriculturist ; and to future generations, it will serve to determine what changes, if any, time may effect upon the climate of a particular region.*

A complete meteorological chart, exhibiting, after the plan of Humboldt, a comparative view of the climatic features of both continents, promises to confer benefits of the most interesting and valuable nature. The general law of decrease of heat for each parallel, from the equator to the pole, subject as it is to modification from local causes, may be ascertained, as well as that for each vertical height in proportion to its elevation above the level of the sea. We may determine the bounds of each species of vegetation, and draw around the globe series of curves, that is, lines of equal annual temperature, *isothermal* lines,—lines of equal summer, *isotheral* curves,—and lines of equal winter temperature, *isocheimal* curves. It is pleasing to contemplate such a division of the earth, each isothermal belt, as well as those of winter and summer temperatures, representing zones in which we may trace the causes of the similarity or diversity in animal and vegetable productions. To determine the influence of these zones respectively upon the animal economy in health and the agency exercised in the causation of disease, have proved investigations still more useful and interesting. As climate not only affects the health but modifies the whole physical organization of man, and consequently influences the progress of civilization, a comparison of these systems of climate, as distinguished into constant and variable climes, or mild and extreme ones, in connection with terrestrial emanations, will reveal to the medical philosopher much that is now unknown, and to the political economist many of the circumstances that control the destinies of a people. In the present inquiry, to treat of meteorology, more especially in reference to its subsequent application to the science of medicine and its collateral branches, will be the leading object.

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* It will, doubtless, afford pleasure to every lover of science to learn that the Surgeon General of our Army, has, with commendable zeal, lately procured from Europe the instruments requisite to establish a more complete meteorological observatory at the most important points throughout the United States.

The connection between meteorology and medical science is, in truth, highly important. From the days of Hippocrates, the records of medical philosophy demonstrate that the phenomena of life are not the result of original organization only; but that the moral, intellectual, and physical capacities of man are subject to the influence of those causes, the aggregate of which constitute climate. This doctrine receives an apposite elucidation in the corporeal degeneration induced by malaria. So deep and pervading are the effects of this subtle poison on the indigenous inhabitants of marshy districts, in warm climates, that the energies of the system are sapped, and premature decrepitude induced; and when subjected to these baneful exhalations, through successive generations, the mind becomes torpid and imbecile, the moral sentiments debased, and the stature and symmetry of the body deteriorated. Again, it finds a ready illustration in the history of a recent epidemic, (*cholera asphyxia*,) which, in its wide diffusion, threatened to depopulate vast tracts of the earth's surface; but which, doubtless owing to great meteorological changes, notwithstanding inappreciable by our eudiometic instruments, suddenly ceased its ravages, and left, like many other destructive pestilences in preceding ages, scarce a trace behind but the terror of its name. It is not, however, intended here to point out the influence of climate upon the animal economy; but these examples are adduced merely to show that the complete development of the mental, moral, and physical attributes of man, even when nature has bestowed a perfect organization, is made to depend upon the physical agents which influence those functions. For full mental and corporeal development, the due succession of the seasons is requisite. Those countries which have a marked spring, summer, autumn, and winter, are best adapted, by this agreeable and favorable vicissitude, for developing the most active powers of man. It is, according to Malte-Brun, between the 40th and 60th degrees of north latitude,* that we find the nations most distinguished for knowledge and civilization, and the display of courage by sea and by land. In countries which have no summer, the inhabitants are destitute of taste and genius; whilst in the regions unfavored by winter, true

* This limitation, no doubt well adapted to Europe, is inapplicable to the United States. This is apparent from the fact, that the *isothermal* lines, in being traced around the globe, suffer great depression, as will be shown, on the Atlantic region of North America. The 32d and the 46th parallels would consequently form a reasonable boundary.

and in Scandinavia, under the polar circle. Climate, however, modifies the whole nature of man. The powerful influence of locality on human organization is apparent at once in surveying the external characters of the different nations of any quarter of the earth.* Even in casting

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* That the striking distinction among the five principal varieties of the Human Species, *viz.*, the Caucasian, Mongolian, Ethiopian, American, and Malay, cannot be explained satisfactorily by a reference to the influence of climate, is now generally conceded. Much research and erudition have been employed by anthropological writers to establish the *unity* of the human family. Instructed by authentic history in the sacred writings, we incline to the belief that there were three primary races of men, answering to the three sons of Noah—Shem, Ham, and Japheth. "Cuvier and other learned physiologists," says Murray,(*a*) "are of opinion that the *primary* varieties of the human form are only *three*, viz., the Caucasian, Mongolian, and Ethiopian. This number corresponds with that of Noah's sons: assigning, therefore, the Mongolian race to Japheth, and the Ethiopian to Ham, the Caucasian, the noblest race, will belong to Shem, the third son of Noah, himself descended from Seth, the third son of Adam." But a difficulty is here presented in tracing back these diverse varieties to the same single pair, which is attempted to be obviated by the same writer by calling in the aid of supernatural agency. "Is it not more reasonable," he says, "to conclude that, for purposes unknown to us, a supernatural agency was employed? and that the immediate descendants of the sons of Noah were as distinctly marked in their outward form as they were in their moral character!" This hypothesis is sustained by Morton, in his valuable work entitled "*Crania Americana.*" He too believes it "consistent with the known government of the universe to suppose that the same Omnipotence that created man, would adapt him at once to the physical, as well as to the moral circumstances, in which he was to dwell upon the earth." Now this supposed miracle did not of course occur until the dispersion at Babel; and inasmuch as man is endowed with a pliability of functions, by which he is rendered a cosmopolite—a faculty possessed in the highest degree by the inhabitants of the middle latitudes—there is not the slightest ground for the belief that it ever did occur. Moreover, this supposition finds little or no application in the way of explaining the cause of the variety in the primitive races; for, as it is maintained that the *chief* characteristics which distinguish these varieties, (*viz.*, the comparative development of the moral feelings and intellectual powers,) have no dependence on external causes, any special adaptation in this respect was not demanded.

So great is the antiquity of the Negro race, that some philosophers have been led to the hypothesis that this constituted the primitive stock of mankind, of which all the other varieties are mere modifications produced by physical causes. "According to accredited dates," says Caldwell,(*b*) "it is four thousand one hundred and seventy-nine years since Noah and his family came out of the ark. They are believed to have been of the Caucasian race; and the correctness of the belief there is no ground to question. We shall assume it, therefore, as a truth, without adducing the reasons which seem to sustain it. Three thousand four hundred and forty-five years ago, a nation of Ethiopians is known to have existed. Their skins, of course, were dark, and they differed widely from Caucasians in many other particulars.

(*a*) *Encyc. of Geography.*
(*b*) *Thoughts on the Unity of the Human Species.- Philad.* 1830.

one's eye over our National Legislature, the diversity of physiognomy, caused by endemico-epidemic influences, is so obvious, that the

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They migrated from a remote country, and took up their residence in the neighborhood of Egypt. Supposing that people to have been of the stock of Noah, the change must have been completed, and a new race formed, in seven hundred and thirty-three years, and probably in a much shorter period." To this argument, it is remarked by Morton, the recent discoveries in Egypt give additional force, "inasmuch as they show beyond all question that the Caucasian and Negro races were as perfectly distinct in that country upwards of three thousand years ago, as they are now; whence it is evident that if the Caucasian was derived from the Negro, or the Negro from the Caucasian, by the action of external causes, the change must have been effected in at most a thousand years; a theory which the subsequent evidence of thirty centuries proves to be a physical impossibility; and we have already ventured to insist that such a commutation could be effected by nothing short of a miracle."(a)

This ratiocination is not, however, devoid of objections. As the Caucasian and Ethiopian were in close proximity more than three thousand years ago in Egypt, the existence of different races at the era of the flood cannot be reasonably doubted. Now as the wives of the three sons of Noah *may* have had such a physical conformation as to give rise to what are now regarded as the primitive varieties of the human species, it is necessary, among those who seek for a solution of this question in Holy Writ, to go back to the time of Adam. But even the admission of this objection only partially invalidates the conclusion arrived at above; for the period during which the ante-diluvian world existed, is estimated at no more than about 1500 years.

It is further maintained, as for example in the able work of Lawrence, that the distinguishing characters of the German and French, or the Esquimaux and our Southern Indians, find no explanation in climatic influences. As the olive cast of the Esquimaux specificates the tribe as compared with our more Southern Aborigines, and betrays, no less than in the Laplander and Samoiede, their Mongolian origin, so it is said that we discover an analogous operation in the cause that makes the Briton and German of this day resemble the portraits of their ancestors drawn by Cæsar and Tacitus. Thus the French, Spanish, Portuguese, and Italians, belong to the Celtic race, whose black hair and browner complexion are distinguished from the blue eyes and fair skin of the German tribes, which include the Swedes, Norwegians, Danes, English, modern Germans, &c. It is moreover alleged that the Germans, who under the names of Saxons, Angles, Danes, and Normans, successively invaded England and gradually drove the original Celts into the most distant and inaccessible parts of the Island, have not, in the smallest degree, approximated the latter in their physiognomy.

The Jews of Malabar, however, have undoubtedly been changed in color through the influence of climate: but, though exposed for ages to the same physical circumstances, they can yet be easily distinguished from the surrounding natives. In fact, they are still Jews, and present, with the exception of color, the same physical conformation. The varieties of the human species, indeed, seem to be as distinct as the grey-hound and bull-dog, the essential distinctions of which can be blended only in their mutual offspring.

(a) *Crania Americana*, p. 88.

as an index to prognosticate future results from present appearances, and to read upon it "times and seasons." To Aristotle is due the credit of having first treated this subject systematically. Constantly employed in observing and comparing natural objects, he assigned the cause of the rainbow and the halo, and described minutely the various appearances of clouds, rain, hail, snow, meteors, and other atmospheric phenomena. Among the Romans, Pliny, Virgil, and Seneca, give us abundant meteorological observations, confounded with much that is absurd and fabulous. From the latter period to the revival of letters in Europe, meteorological science slumbered in oblivion; and it was not till the middle of the last century that men of genius again directed their energies to the investigation of aerial phenomena. No longer confined to the mere observance of casual atmospheric appearances, meteorology soon became, in the rapid advancement of human knowledge, a new and extensive branch of natural philosophy, comprising nearly the whole circle of the natural sciences, but more particularly the atmosphere and the phenomena produced by heat, light, electricity, and magnetism. Although the general laws in relation to thunder and lightning, clouds, rain, hail, snow, frost, land and water-spouts, wind, &c., have, in a measure, been established, yet the laboratory of nature is so immense and complicated in its processes, as to defy the finite powers of the human intellect. Bewildered in the inextricable mazes of causes and effects, the genius of man has never been able to grasp the vast mass of facts presented, and to generalize them in systematic harmony. But fortunately as in other departments of knowledge, so in that of meteorology, nature has found faithful interpreters content to observe facts and to trace their relations and sequences, thus bestowing upon it the characters of a true science. It is now being daily improved by the results of researches the most varied and extensive. The averages of heat under every variety of general and local causes; its distribution by isothermal, isotheral, and isocheimal lines; its mean at different depths and altitudes, and under the various influences of reflection and radiation; and the temperature of waters;—the phenomena of clouds, dew, and evaporation; of rain, hail, and snow; and the relative quantity of rain in different localities and elevations;—the electrical or magnetic states of the air; the barometrical conditions of the atmosphere; and their periodical or irregular oscillations, as influenced by heat, electricity, the ocean tides, or lunar attraction;—and the phenomena of winds and hurricanes, as regards their direction, velocity, and physical causes;—all these operations of nature both in regard to the explanation of the phenomena themselves, and their mutual relations and sequences, are at this time the subjects of active and fruitful investigation.

It is thus seen that in the investigation of the laws of climate, a range of subjects so multifarious as to comprise almost every branch of natural philosophy, is embraced; but its true province properly is restricted to a general view of these subjects, which, if based on legitimate deductions of observed phenomena, should enable us to reduce the infinite variety of appearances presented in nature, to a few general principles. It is by means of this generalization that the subject of climate will be elevated to the dignity of a science.

The term climate may consequently be defined, in view of the preceding remarks, to constitute *the aggregate of all the external physical circumstances appertaining to each locality in its relation to organic nature.*

It may be here remarked, that, in regard to many meteorological questions, much obscurity still obtains. As in other fields of investigation, genius has often gone forth upon the pinions of speculation, without bringing back any substantial trophies. Among the many questions propounded in relation to the meteorology of heat, one of the most contested is—whether climates have undergone any material change of a permanent character—a theme that will be fully discussed in the sequel. One maintains that density of population and the cultivation of the soil, render a climate warmer; another asserts his conviction that these causes exert a tendency diametrically opposite; whilst a third peremptorily denies that any change of climate has occurred. It is not unusual, for example, to institute a comparison between the climate of Europe at the present day and its supposed constitution 2,000 years ago. Now this is a question which may find a solution in the circumstances presented in the regions of the western hemisphere; for here, even within the memory of living witnesses, the physical aspect of vast districts become wholly transformed. Lo! the mountain and the valley that were yesterday untrodden save by the foot of the red man, and the river that was unnavigated save by his canoe, are to-day crowded with the life and opulence of civilization. The majestic channels that a few years ago were the scenes of border warfare, are now studded with cities and villages, and their every tributary stream applied to the useful arts. With us two centuries have effected as much as 2,000 years in many parts of Europe. The "Landing of the Pilgrims," in 1620, it has been well remarked, stands in the same historical relation as the invasion of Gaul or Britain by Julius Cæsar.

In tracing the laws which govern the superficial temperature of the earth, it will be found that there are two classes of causes, *viz.*, those resulting from celestial relation, and those depending on geographical position. The former, which may be called the primary constituents of climate, result from the globular figure of the earth, its diurnal motion upon its axis, and the obliquity of its motion in an elliptical orbit in regard to the plane of the equator. The secondary constituents are, the position of the place on the surface of the earth as regards elevation above and distance from the sea, and other causes to be hereafter considered. Now, if the phenomena of terrestrial temperature depended solely on the former class of causes, climates might be classified with mathematical precision; but the effects produced by solar heat are so much modified by local causes, that the climatic features of any region can be determined only by observation.*

As the object of the present investigation is, to exhibit a connected view of the general phenomena of our climate, more especially as regards the laws of temperature, and to trace, in subsequent inquiries, the influence of the different systems of climate on physical organization, it will be necessary to bring under notice that assemblage of laws, which, viewed together, constitute what we term *climate*. To the purely scientific reader, many of these facts may appear of too elementary a character; but this general survey is deemed appropriate, in order to be enabled to discuss with advantage several disputed points in relation to climate, and to show, in Part Second, the practicability of establishing a system of *medical geography*, that is, a classification of climates based on the meteorological phenomena arising from physical geography, independent of mere latitude.

It may be well to present here, as having a close relation with the superficial temperature of the earth, a general summary of the

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* By the ancients, the word *climate*, derived from the Greek verb, κλινω, *to incline*, was applied to signify that obliquity of the sphere with respect to the horizon from which results the inequality of day and night. The surface of our globe, from the equator to the arctic circle, was distinguished by that great astronomer and geographer, Ptolemy, into climates or parallel zones, corresponding to the successive increase of a quarter of an hour in the length of midsummer day. These zones within the tropics, are nearly of equal breadth; but, as the higher latitudes are approached they contract very much; and consequently they were here reckoned by their doubles, answering to intervals of half an hour in the extension of the longest day.

principal facts known in respect to its temperature at such depths beneath its surface and at such elevations above its level as are within our reach, as well as in regard to the temperature of waters.*

As early as 1671, it was discovered that the temperature of the cellars beneath the Royal Observatory of Paris, at the depth of 27 metres or 85 French feet, experienced no variation during the course of the year. In 1771, this fact was shown by more precise data, which were the result of a series of experiments instituted by the Count Cassini; and in 1783, the same philosopher, in conjunction with the celebrated Lavoisier, finally completely established its truth. It has now been demonstrated that the temperature of these cellars, during a period of fifty years, is constantly at 11°.82 centigrade, being about 53¼ of Fahr.† Unfortunately the want of observations in other regions precludes the possibility of determining the precise depth of this invariable stratum, which is uninfluenced by the alternations of days and nights and the succession of the seasons; but theory indicates that the invariable temperature never deviates much from the mean superficial atmospheric temperature of the corresponding place, and that the stratum is found, according to climate, at a depth of from 2 to 80 feet. To determine the movements of temperature, in accordance with the seasons, from the surface of the ground to the invariable stratum, presents an ample field for observation. The results already revealed give the promise of many other important and useful facts. In descending into the earth, the mean annual temperature augments gradually, with the exception of a stratum lying about half a foot beneath the surface. The temperature of the surface of the earth participates very much in the fluctuations of the incumbent atmosphere, being generally, however, a little above it by day, and below it by night; but these results will depend much upon the nature of the soil, as for example its radiating and conducting power. The extent of these fluctuations at the depth of thirty inches beneath the surface, as determined by a series of observations conducted by the writer, for the period of one year, on Bedlow's Island, in the harbor of New York, will be shown hereafter.

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* In the composition of this treatise, the writer, it may be well to say, is indebted for his general materials chiefly to the writings of Humboldt, Arago, Daniell, Prout, and Garnier.

† A degree of centigrade is to that of Fahrenheit as 9 is to 5. To reduce the former to the latter, multiply by 9-5ths, and then add 32, and *vice versa*.

Whilst in our excessive climate, the invariable terrestrial stratum, which experiences neither diurnal nor annual variations of temperature, is situated at a great distance beneath the surface, it lies so near to it in the equinoctial regions as to render it practicable at any time to determine the mean annual temperature of the superficial atmosphere. In his voyage to the Cordilleras, M. Boussingault observed, that at the equator and at different heights above the level of the sea, a thermometer placed merely at the depth of one-third of a metre,* (about a foot,) will constantly indicate the same point within one or two-tenths of a degree. Travellers can, consequently, determine at once, the exact mean temperature of all places within the tropics, if not too elevated. In making such observations, the thermometer, with a cord attached to it, should remain buried one or two hours. The temperature of wells, of ordinary depth, also gives an exact expression of the mean temperature on the surface of the earth.

In regard to the temperature beneath the invariable stratum, many interesting experiments have been instituted ; but the method necessarily adopted, such as plunging the thermometer into currents of water issuing from mines, or into the air which they contain, is liable to many sources of error. Humboldt was enabled to determine the temperature of the mines of Mexico to the depth of more than 1700 feet. Many observations have also been made, even at the depth of 1300 feet, on the *Artesian Wells*, so called from the circumstance that it was in the ancient province of Artois that water was first obtained by the process of boring.† M. Arago has been enabled from a great number of observations of this kind, to deduce some general laws, such as, judging of the depth of the well by the temperature of the water, and, conversely, predicting the temperature of the water from a knowledge of the depth from which it was drawn.

That the temperature increases with the depth beneath the invariable stratum, is a rule which has yet found no exception. The ratio in which temperature increases with depth is very dissimilar in different localities. To obtain an augmentation of 1° centigrade, ac-

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* A metre contains $39\frac{371}{1000}$ English inches.

† It appears that at Paris water has been recently obtained by this process, at the depth of 1837 English feet, after seven years of assiduous toil. The torrent of water, three cubic yards per minute, rises in a copious fountain and very pure. Its source is one-third of a mile below the surface, and spouts thirty feet above the ground. The temperature at the bottom is 83°. Fahr. Judging from this fact, we should have, at the depth of a mile, a boiling fountain ; and at sixty miles below the surface, rocks in a state of incandescence.

cording to M. Cordier, it is necessary to penetrate in some places 13 metres, and in others 57. The experiments of MM. Arago and Dulong, and those of M. Walferdin, give for each degree the following results :—Estimating from the surface at Paris, $30\frac{41}{100}$ metres, and estimating from the invariable stratum in the cellars of the Royal Observatory, $30\frac{11}{100}$ metres. Assuming that the law warranted by these data holds good, the heat at the depth of about a mile and a half is not below that of boiling water ; and at a very small depth, in comparison with the radius of the earth, the most of matter must be in a state of fusion. As this subject, the details of which fall within the province of the geologist, involves some of the most interesting questions connected with the physical constitution of our globe, it is to be hoped that the day is not far distant when these diversified phenomena shall be embraced in a general theory. By some of the French *savans*, many of the apparent anomalies of temperature, observed in different places, rendering the latitude of a country no index of its climate, are ascribed, with very little reason however, to the comparative thickness, or powers of conduction, of the geological strata which envelope the liquid interior in a state of incandescence.

In regard to the law of the *distribution of sensible heat through the atmosphere*, our knowledge is not precise. It is known that the temperature decreases as we ascend, but we know not whether there exist strata of invariable temperature. We are equally ignorant whether the decrease takes place uniformly, or whether it changes with latitude and the different seasons. The mean furnished by a table of thirty-eight observations by M. Garnier, shows a decrease of 1° centigrade for every $164\frac{7}{10}$ metres of elevation. According to M. Laplace, the same diminution of temperature is caused by 176 metres ; and according to Guy-Lussac, as determined by a balloon-as cension, it is 171 metres. Prout says that every hundred yards of altitude, as a general average, causes Fahrenheit's thermometer to sink one degree.

The causes upon which this diminished temperature in the higher regions chiefly depends, are—first, the perfect permeability of the atmosphere to the solar rays, and secondly, its increased capacity for caloric in proportion as it becomes more rare. As the solar rays radiate through the atmosphere almost without affecting its temperature, it follows that the temperature of its lower regions is derived more immediately from the earth. Although the atmospheric stratum immediately incumbent on the surface of the earth, owing to this rarefaction, naturally ascends, yet as its capacity for caloric at the same time increases, it loses rapidly its sensible heat. Hence, as we ascend into the atmosphere, its temperature diminishes precisely in the ratio that its latent heat, that is, its capacity for caloric as produced by rarefaction, increases.

Closely connected with this subject are, the *limits of perpetual snow* in different latitudes; and to the laws just laid down, more particular reference is made, as their application will soon become necessary. The perpetual snows which cover high mountains, are, on the one hand, the effect of decrease of atmospheric temperature, and on the other, a cause of this decrease, at least in the surrounding atmosphere. The inferior limit of this congelation, which may be naturally supposed to follow the degree of melting ice, is subject to many modifications. Reaching in different seasons and in the same season of different years, a higher or lower point, these limits, the annual oscillations of which are dependent chiefly upon those causes which influence the temperature of the hotter months of the year, vary greatly in different latitudes. Under the equator, perpetual snow exists generally at an altitude of between 15,000 and 16,000 feet, whilst in the 70th degree of N. latitude, it is found at the height of 3,300 feet. Receding from the equator, these phenomena assume a more irregular character. The difference between the limits of perpetual snow on the northern and southern sides of the Himmaleh mountains, is not less than 4000 feet; and whilst these limits are at the equator nearly 3° above, they are in the frigid zone more than 10° below, the freezing point.

To explain the diminution of temperature on the summits of high mountains, no longer, therefore, presents any difficulties to natural philosophers. As the atmosphere is rare and diaphanous, but a small portion of the heat of the solar rays which traverse it, is retained; and as the more dense inferior strata, heated by the surface of the earth, expand, rise up, and grow cold from the circumstance alone of their rarefaction, they encounter these summits, and rob them of their caloric, which passes into a latent state.

The subject of the *temperature of waters*, embracing springs, lakes, rivers, and the ocean, which would itself occupy a volume, is here merely referred to, as indicating its connection with a complete system of thermometrical observations. The remarks will be confined to a few facts in relation to *springs*. The temperature of springs, not very remote from the surface, which flow abundantly, varies in accordance with the different seasons. In the northern hemisphere, they generally reach the highest degree of heat in September, and the lowest in March. The difference between these two periods does not exceed more than 2° or 3° Fahr. In the torrid zone, the mean temperature of the air is generally a little higher than that of the springs; whilst in the temperate zone, the springs are a little warmer than the air. The excess of temperature of springs, as compared with the mean annual temperature, increases with the latitude; for, whilst from the 30th to the 50th degree of latitude, it is only 2°, it rises, between the 60th and 70th parallels, to 5°–7° of Fahr. Small springs that rise slowly take, to some extent, the temperature of the beds which they traverse; but the waters of those that flow abundantly maintain, in reaching the surface, the temperature of the strata in which they are formed. *Thermal* waters sometimes have a temperature near to ebullition. It is not always known whether this high degree arises from the depth at which they take their origin, or from some chemical action peculiar to the strata traversed. That the high temperature of thermal springs results from the depth of their sources, is an opinion generally entertained, if we exclude from this class the Gysers of Iceland and other analogous phenomena evidently dependent on volcanoes at this time in activity. In many it has been observed that the temperature remains unchanged during a long series of years. It is shown by M. Legrand, from observations extending from 1754 to 1819, made in many of the thermal springs of the Eastern Pyrenees, that the difference in temperature exceeds at no time $1\frac{2}{10}$ degree of Reaumur, and generally there is no variability. That these springs have their origin below the invariable stratum, seems obviously evident. Reference has already been made to the experiments of M. Arago on artesian wells, by which certain relations between depth and temperature were established.

SECTION II.

Mode of classification of the climates of the United States adopted.—Extent of the thermometrical data employed, and the method of making the observations.—Geographical description and meteorological details in reference to the Northern Division of the United States.—The same in regard to the Middle and Southern Divisions.

With these preliminary remarks, we are prepared to enter into a detail of the numerical results furnished in the several systems of climate pertaining to the United States. Did the phenomena of terrestrial temperature, as already remarked, depend solely on the position of the sun, climates might be classified with mathematical precision; but as the effects produced by solar heat are so much modified by lócal causes that the character of a climate can be determined only by observation, it becomes necessary to adopt a classification of climates based on physical geography, without reference to latitude. The military posts furnishing the thermometrical data, will consequently be classified as under:—

General Divisions of the United States.		*Systems of Climate.*
1. Northern.	1 Class.	Posts on the coast of New England, extending as far south as the harbor of New York.
	2 "	Posts on the northern chain of Lakes.
	3 "	Posts remote from the ocean and inland seas.
2. Middle.	1 Class.	Atlantic coast from Delaware Bay to Savannah.
	2 "	Interior Stations.
3. Southern.	1 Class.	Posts on the Lower Mississippi.
	2 "	Posts in the Peninsula of East Florida.

These general divisions, intended as well to facilitate description as to express the operation of general laws, may be regarded, in a great measure, as arbitrary. The *Northern* embraces a region characterized by the predominance of low temperature; in the *Southern*, a high temperature prevails; whilst the *Middle* exhibits phenomena vibrating to both extremes.

The tabular abstracts which will be presented, are the condensed results of the observations made at various posts, situated, with the exception of Fort Vancouver in Oregon Territory, between 24° 33′ and 46° 39′ of north latitude, and between 67° 4′ and 95° 43′ of longitude west of Greenwich, embracing an extent of 22 °6′ of latitude, and 28° 39′ of longitude. The thermometrical observations, which were made thrice daily, are confined to the superficial temperature of the earth; and as the mean of each month is calculated from 90, and of each year from 1,095 observations, the numerical ratios, it is believed, will give an approximation to the truth as near as can be realized by ordinary observation, and a mean sufficiently correct for every contemplated purpose. Rigorously, the mean temperature of a day is equal to the sum of the thermometrical temperatures observed every hour or every minute, divided by the number of hours or minutes in the day; but three observations, noted at proper periods, give an expression that scarcely differs from the exact mean of the twenty-four hours.

To determine the laws of diurnal variations of temperature, hourly observations during a whole year were made at Frankford Arsenal, five miles from Philadelphia, in 1835–6, by Captain Alfred Mordecai, of the United States Ordnance Department.* For the present purpose, it is necessary to bring under notice merely the hours of daily mean temperature before and after meridian, by which we will be enabled to ascertain the mean temperature at any place, by two observations, or even by one, during the day. As similar observations have been made by Professor Snell, at Amherst College, Massachusetts,† by Sir David Brewster, at Leith, in Scotland, and by Mr. Snow Harris, at Plymouth, England, it may be well to present the whole in a tabular form. Thus:

	Frankford.	Amherst.	Leith:	Plymouth.
Morning Mean,................	8h. 36m.	9h. 5m.	9h. 13m.	8h. 9m.
Evening Mean,................	7h. 35m.	7h. 49m.	8h. 27m.	7h.

The rule of taking observations adopted by the Regents of the University of New York, and followed in the United States Army, Prof. Snell says that he finds to agree very nearly with his own re-

* Journal of the Franklin Institute, Vol. 19, New Series.
† Silliman's Journal, Vol. 39.

sults. These are taken every morning when the mercury shows the lowest degree, every afternoon when it shows the highest, and every evening an hour after sun-set. The mean of these observations for the day is found, by adding together the first, twice the second and third, and the first of the next day, and dividing the sum by six.

According to Captain Mordecai, the mean time of minimum temperature is at 4½ A. M., and according to Prof. Snell at 5 A. M. This point varies of course with the seasons, but it will nearly always be attained during the hour preceding the rising of the sun. The maximum point may be assumed at 2½ P. M. for all seasons. Were not the maximum and minimum points important data in themselves, it would be well to record the thermometer at the following hours, as recommended by Prof. Snell :—

1st. qr., (Dec. Jan. Feb.,)	at 9 A. M	& 6 P. M.
2d. qr., (Mar. April, May,)	at 8 "	& 6 "
3d. qr., (June, July, Aug.,)	at 7 "	& 6 "
4th. qr., (Sept. Octr. Nov.,)	at 8 "	& 6 "

"As these hours of observation have a symmetrical arrangement with regard to the sun's declination, it is believed," says Prof. S., "the rule will be nearly accurate every year at this place, and at other places whose latitude does not differ widely from this."

1. The Northern Division.—As this region presents the greatest diversity of physical character, so it exhibits the most marked variety of climate. East of the chain of great lakes, there are several mountain ranges, which, with the exception of a few summits, seldom attain a height of more than 2,500 feet above the level of the sea; and of this elevation, perhaps one-half is formed by the table-lands upon which the ridges rest. Above the falls of Niagara, the region of the lakes is elevated from 600 to 700 feet above the ocean, but there are scarcely any ridges that deserve the name of mountains. This immense tract is, with the exception of the Eastern States, nearly altogether in a state of nature, being densely covered with its primeval forests. But the most striking characteristic in the physical geography of this Division, is that produced by its vast lakes or inland seas. The basin of the St. Lawrence is truly a region of "broad rivers and streams," containing, it is estimated, an area of 400,000 square miles, of which 94,000 are covered with water. From the western extremity of Lake Superior to the Gulf of St. Lawrence, the distance is about 1,900 miles. These ocean-lakes

have been estimated to contain 11,300 cubic miles of water—a quantity supposed to exceed more than half of all the fresh water on the face of the globe. The deepest chasms on the surface of either continent are presented perhaps by the depression of these lakes; for though elevated near 600 feet above, the bottom of some is as far beneath, the level of the ocean. Lakes Huron and Michigan, which have the deepest chasms, have been sounded to the amazing depth of 1,800 feet without discovering bottom.

The following table, which gives the mean length, breadth, depth, area, and elevation of these several collections of water, is taken from a recent report made by Douglas Houghton, Esq., State Geologist of Michigan:—

	Mean Length. *Miles.*	Mean breadth. *Miles.*	Mean depth. *Feet.*	Elevation above level of the sea. *Feet.*	Area in square Miles.
Lake Superior, ...	400	80	900	596	32,000
Green Bay, ...	100	20	500	578	2,000
Lake Michigan, ...	320	70	1,000	578	22,400
Lake Huron, ...	240	80	1,000	578	20,400
Lake St. Clair, ...	20	18	20	570	360
Lake Erie, ...	240	40	84	565	9,600
Lake Ontario, ...	180	35	500	232	6,300
River St. Lawrence, ...			20		940
				Aggregate,	94,000

In accordance with the diversity in the physical geography, we find that on the sea-coast of New England, the influence of the ocean modifies the range of the thermometer and the mean temperature of the seasons. Advancing into the interior, the extreme range of temperature increases, and the seasons are violently contrasted. Having come within the influence of the lakes, a climate like that of the seaboard is found; and proceeding into the region beyond the modifying agency of these inland seas, an excessive climate is again exhibited. The variations of the *isotheral* and *isocheimal* curves—the lines of equal summer and of equal winter temperature, as illustrated in the map facing the title-page—thus afford a happy illustration of the equalizing tendency of large bodies of water. Hence the former division of the surface of the earth into five zones, as regards its temperature, has been superseded, in scientific inquiries, by a more precise arrangement: places having the same mean annual temperature are connected by isothermal lines, and the spaces between them are called isothermal zones.

All the thermometrical data contained in the "Army Meteorological Register" have been condensed, so far as practical results are concerned, into three tabular abstracts, forming an Appendix to Part First, *viz.*, 1. Abstract A, exhibiting the mean temperature of each month, each season, and the whole year; 2. Abstract B, showing the difference between the mean temperature of each month and of each season; and 3. Abstract C, exhibiting the mean annual and monthly ranges of temperature. Having said that the Northern Division, notwithstanding the mean annual temperature presents little variation on the same parallels, exhibits four striking inflections of the isotheral and isocheimal lines, constituting two systems of climate on the same latitude, *viz.*, that of the ocean and lakes which pertains to the class of *mild* or *uniform*, and that of the intervening tract and the region beyond the lakes, characterized as climates emphatically *excessive*, the more important results relative to the Northern Division, as presented in detail in the Abstracts to which reference has just been made, will now be exhibited in Table [A] on the opposite page.

It is thus seen that, notwithstanding the posts on the same parallels of latitude exhibit in rapid succession four marked inflections of the isotheral and isocheimal lines, causing a great difference in the contrast of the seasons, yet the mean annual temperature presents little variation. The difference of climate is, therefore, owing to the unequal distribution of heat among the seasons. A single glance at the table, as well as the map, Plate I, serves to show these various contrasts. It will be observed that at the posts on large bodies of water, the mean temperature of winter is higher and that of summer is lower than in the opposite localities; but these results are more satisfactorily manifested by comparing the difference between the mean temperature of winter and summer, and the warmest and coldest month, in each system of climate. Thus Fort Brady, at the outlet of Lake Superior, shows a difference of only 42°.11 between the mean temperature of winter and summer, whilst Hancock Barracks, half a degree further south, in the State of Maine, distant only 150 miles from the sea-coast, exhibits a disparity of 46°.19 ; and comparing the warmest and coldest month, the difference of the former is 47°.22, and that of the latter 54°.70. Again, Forts Sullivan and Snelling, in opposite systems of climate, are very nearly in the same latitude, the former at Eastport, on the coast of Maine, and the latter at the junction of the St. Peter's and Mississippi, Iowa. At Fort Sullivan, the difference of winter and summer is 39°.15, and that of the warmest and coldest month, 43°.87 ; whilst

[A] — *Systems of Climate in the Northern Division.*

Posts on the Ocean and the Lakes, or Mild and Uniform Climates.	No. of years of observation.	Lat.	Mean Annual Temp.	Mean Temp. of Winter.	Mean Temp. of Summer.	Difference of the Mean Temp. of Winter and Summer.	Difference of the Mean Temp. of Winter and Spring.	Difference of the Mean Temp. of Warmest & coldest month.	Mean Annual Range.
Fort Brady, *Outlet of Lake Superior,*	6	46°39′	41°.39	21°.07	63°.18	42°.11	18°.42	47°.22	110°
" Vancouver, *Oregon Territory,*	1	45 37	51 .75	41 .33	65 .—	23 .67	6 .67	28 .—	78
" Sullivan, *Eastport, Maine,*	5	44 44	42 .95	22 .95	62 .10	39 .15	17 .16	43 .87	104
" Preble, *Portland, Maine,*	5	43 38	46 .67	26 .03	67 .06	41 .03	18 .42	47 .89	99
" Niagara, *Lake Ontario, New York,*	2	43 15	51 .69	30 .46	72 .19	41 .73	16 .77	49 .40	92
" Constitution, *Portsmouth, New Hampshire,*	4	43 04	47 .21	28 .39	65 .72	36 .33	16 .83	43 .39	97
" Wolcott, *Newport, Rhode Island,*	9	41 30	50 .61	32 .51	69 .06	37 .55	14 .71	41 .52	83
" Trumbull, *New London, Connecticut,*	2	41 22	55 .—	39 .33	71 .89	32 .56	11 .67	39 .37	78
" Columbus, *New York Harbor,*	9	40 42	53 .—	32 .39	73 .70	41 .31	17 .87	45 .92	95
Posts remote from the Ocean and Lakes, or Excessive Climates.									
Hancock Barracks, *Houlton, Maine,*	2	46°10′	41°.21	16°.74	62°.93	46°.19	24°.49	54°.70	118°
Fort Snelling, *at the confluence of the St. Peter's and the Mississippi,*	8	44 53	45 .83	15 .95	72 .75	56 .60	30 .83	61 .86	119
" Howard, *Green Bay, Wiskonsan,*	9	44 40	44 .92	19 .77	69 .82	50 .05	24 .10	54 .11	123
" Crawford, *Prairie du Chien, Wiskonsan.*	2	43 03	45 .52	19 .90	70 .79	50 .89	25 .38	52 .68	120
Council Bluffs, *near the junction of the Platte and Missouri.*	5	41 45	51 .02	24 .47	75 .82	51 .35	27 .47	54 .77	20
Fort Armstrong, *Rock Island, Illinois,*	4	41 28	51 .64	26 .86	75 .91	49 .05	23 .99	54 .14	06
West Point, *New York,*	4	41 22	52 .47	32 .11	72 .86	40 .75	18 .82	46 .17	91

at Fort Snelling, these ratios are respectively 56°.60 and 61°.86. Fort Howard is also in the same latitude, but as it is situated at the extreme point of one of the smaller lakes, (Green Bay, Wiskonsan,) the temperature is partially modified, these averages being 50°.05, and 54°.11. Next come four posts, all of which are nearly on the same parallel, three being of the class of *uniform* climates, and one of that of *excessive*. Of the former, two, Forts Preble and Constitution, are on the ocean, and the other, Fort Niagara, is on Lake Ontario. At these posts, in the order just named, the difference between the mean temperature of winter and summer is respectively 41°.03, 36°.33, and 41°.73; whilst, on the other hand, at the *excessive* post, Fort Crawford, Wiskonsan—a point a few minutes farther south than the three former—the difference is 50°.89. On reference to the table, it will be seen that the contrast in the difference of the mean temperature of the warmest and coldest month, is equally striking. The next points of comparison, as lying on the same parallel, are Forts Wolcott and Trumbull, on the Atlantic, and Council Bluffs, Fort Armstrong, and West Point, in the opposite localities. The difference between the mean temperature of summer and winter at Fort Wolcott, Newport, R. I. is 36°.55, and at Fort Trumbull, New London, Conn., it is 32°.56; whilst at Council Bluffs, near the junction of the Platte and Missouri, it is 51°.35—at Fort Armstrong, Ill., 49°.05—and at West Point, N. Y., 40°.75. Between the two posts on the ocean and the two far in the interior, the difference between the mean temperature of summer and winter presents a disparity of from 15° to 17°; and as respects Fort Trumbull and West Point, which are precisely on the same latitude, the difference between these two opposite seasons, notwithstanding the latter is not more than fifty miles from the ocean, is 8°.19 less at the former post. As regards the difference between the mean temperature of the warmest and coldest months, these laws find confirmation in every instance. So remarkable is the influence of large bodies of water in modifying the range of the thermometer, that although Fort Brady, at the Sault St. Marie, Michigan, is nearly 7° N. of Fort Mifflin, near Philadelphia, and notwithstanding the mean annual temperature is more than 14° less, yet the contrast, in the seasons of winter and summer, is not so great at the former as at the latter. Fort Columbus, in the harbor of New York, it is seen, offers, in some respects, an exception to the laws just developed, the range of the thermometer being greater than at some points farther north. As the results, which are based on nine years' observations, made on an island free from any agency which large towns may exercise, are, doubtless, correct, some causes of a local nature must exist to produce this effect. It is more than probable that this locality, in consequence of the configuration of the coast, does not lie in the direction of the most prevalent ocean-winds, and that hence its temperature is only partially modified.

The climate of Fort Snelling, which is the most excessive among all the military posts in the United States, resembles that of Moscow in Russia, as regards the extremes of the seasons, notwithstanding the latter is 11° farther north; but at Moscow the mean temperature both of winter and summer is lower—that of winter being as 10°.78 to 15°.95, and that of summer as 67°.10 to 72°.75. At Edinburgh, Scotland, in the same latitude as Moscow, the difference between the mean temperature of winter and summer, is, on the other hand, not one-third as great, being only 17°.90; and even at North Cape, on the island of Maggeroe, in latitude 71°, which is the most northern point of Europe, this difference between the two seasons, so great is the modifying influence of the ocean, is no more than 19°.62, while at Uleo, in the interior of Lapland, the difference between the mean temperature of summer and winter is 45°90.

In these comparisons no reference has yet been made to the second post in the table, *viz.*, Fort Vancouver, in Oregon Territory, situated on the Columbia river, about seventy miles, in a direct line, from the Pacific ocean. This region bears the same climatic relation to our coast and to that of Eastern Asia, as the western coast of Europe does. It is seen that the mean annual temperature is about 10° higher than that of the posts on the same parallel on our own coast. So mild and uniform are the seasons at Fort Vancouver, that the difference between the mean temperature of winter and summer is only 23°.67—a mean which is less than that of Italy or Southern France, and only about two-fifths of that of Fort Snelling, Iowa, notwithstanding the latter is nearly 1° farther south. This contrast is well exhibited in the map facing the title-page; for whilst the mean temperature of spring, summer, and autumn, at Fort Vancouver, is about the same as at Fort Wolcott, Rhode Island, the winter line comes nearly as far south as Fort Gibson, Arkansas. But even this comparison, at first view, falls short of the reality; for, as regards the difference between the mean temperature of winter and summer, the contrast is less at Fort Vancouver than at Cantonment Clinch near Pensacola, or Petite Coquille near New Orleans. These results, however extraordinary they may appear, find, as will be seen, an explanation in physical causes.

The next point demanding attention is the difference between the mean temperature of winter and spring. A glance at the table given above, will show that this difference is much the greater in the *excessive* climates. Taking places in the same latitude and in opposite systems of climate, it is found at Fort Brady to be 18°.42, whilst at Hancock Barracks it is 24°.49 ; at Fort Sullivan it is 17°.16, whilst at Forts Snelling and Howard, it is respectively 30°.83 and 24°.10, the latter being partially modified by Green Bay ; at Forts Preble, Niagara, and Constitution, the ratios are 18°.42, 16°.77, and 16°.83, and at Fort Crawford, on the other hand, it is 25°.83 ; and lastly at Forts Wolcott and Trumbull, it is 14°.71 and 11°.67, whilst at Council Bluffs, Fort Armstrong, and West Point, it is respectively 27°.47, 23°.99, and 18°.82. Fort Columbus, as in the preceding comparisons, stands as an exception, its ratio, notwithstanding it is lower than any one in the opposite class, being the highest in its own, with the exception of two posts. This peculiarity in the increase of the temperature of spring, as manifested in the vegetable kingdom, constitutes a feature which strongly characterizes excessive climates ; for, as Baron Humboldt remarks :—"A summer of uniform heat excites less the force of vegetation, than a great heat preceded by a cold season." Accordingly we find that in these excessive climates, (unlike the uniform ones on the ocean and lakes, in which the air is moist and the changes of the seasons slow and uncertain,) summer succeeds winter so rapidly that there is scarcely any spring, and vernal vegetation is developed with remarkable suddenness. At Fort Vancouver, the difference between the mean temperature of winter and spring is only 6°.67, which is about one-third of the difference observed at the posts in our *modified* climates on the same parallel, and little more than one-fifth of the difference exhibited in the *excessive* climate of Fort Snelling.

Another feature which characterizes these two systems of climate remains to be considered, *viz.*, the mean annual range of the thermometer. On reference to the table, this striking peculiarity is at once apparent. Comparing the posts on the same parallel, the following relations are found :—At Fort Brady, on the one hand, the range is 110°, and at Hancock Barracks, on the other, it is 118° ; at Fort Sullivan it is 104°, whilst at Forts Snelling and Howard, it is 119° and 123° ; at Forts Preble, Niagara, and Constitution, it is respectively 99°, 92°, and 97°, whilst at Fort Crawford, on the same parallel, it is 120° ; and lastly at Forts Wolcott and Trumbull, it is 83° and 78°, whilst at Council Bluffs, Fort Armstrong, and West

Point, it is 120°, 106°, and 91°. Fort Columbus, as before, presents an exception. In further elucidation of the law regulating the extremes of temperature, the four following posts, which are all nearly on the same parallel of 41° 30′, the first two being on the ocean, and the last two far in the interior, remote from large bodies of water, —may be adduced as striking examples:

	Highest.	Lowest.	Annual range.
Fort Wolcott, Newport, R. I.,	85	2	83
" Trumbull, New London, Conn.,	87	9	78
Council Bluffs, near the confluence of Platte and Missouri,	104	–16	120
Fort Armstrong, Rock Island, Ill.,	96	–10	106

These results, it may be necessary to add, exhibit the *average* range of a series of years. The *extreme* range, for example, at Fort Brady, during a period of eleven years, (from 1820 to 1830 inclusive,) is 130°, the mercury sinking in 1826 as low as –37°, and rising in 1830 to 93° Fahr. At Fort Snelling in 1821, the mercury sunk to –32°, and in 1827 rose to 96°, being a range of 128°. At Fort Howard, in 1823, it rose to 100° and sunk to –38°, being a range in the same year of 138°. At Fort Crawford we find the mercury in 1820 noted as high as 99°, and in 1821 as low as –36°, being a range of 135°; at Fort Armstrong, in 1821, as low as –28°, and in 1830 as high as 98°, being a range of 126°; and lastly at Council Bluffs as low, in 1820, as –22°, and in 1822 as high as 108°, being an extreme range of 130°. At the last named post, the thermometer rose every year above 100°. When the Southern Division of the United States comes under investigation, it will be seen that the mercury there seldom rises as high as in our northern regions.

The attention is thus directed to the more prominent deductions warranted by the numerical results furnished by the military posts of the Northern Division, as presented in Abstracts A, B, C, of Appendix—results, which are, at the majority of the posts, based on from five to ten thousand observations. The laws developed in relation to the systems of climate peculiar to our northern region, are fully established in the "Army Meteorological Register." These details are continued through five years, each of which confirms the law that the *isotheral* and *isocheimal* lines, on leaving the coast of New England, gradually diverge until they come within the influence of the great lakes, when they again converge; and that, having passed beyond the controlling power of these inland seas, their inflections are once more in opposite directions. Hence it follows that latitude alone constitutes a very uncertain index of the character of climate; for, as has been abundantly demonstrated, although two places may have the same mean annual temperature, and thus be on the same *isothermal* line, yet as the seasons of one may be nearly uniform and those of the other violently contrasted, the climates will be correspondingly different. As these annual details in the "Army Meteorological Register," merely illustrate the meteorological phenomena already sufficiently demonstrated, it is deemed sufficient to present here a condensed view of all the results. Table [B] on the opposite page exhibits the modifying influence of the sea-coast compared with the interior remote from the agency of inland seas, based on an average of five years and calculated from the data of two posts in each system of climate, the mean latitude of the posts on the ocean being 43° 18′, and that of those in the opposite locality, 43° 10′.

On the ocean, the mean temperature of winter is 6°.05 higher than in the latter locality; that of spring is 4°.13 lower; that of summer is 8°.71 lower; and that of autumn is 0°.40 lower. But this contrast is more strikingly shown by comparing the difference between the mean temperature of winter and summer, it being on the sea-coast 38°.61, and in the opposite locality 53°.37; also by the difference between the mean temperature of winter and spring, the former being only 16°.84, whilst the latter is 27°.02; as well as by the difference in the extreme range of the thermometer, the former being 122° and the latter 134°. That a classification of climates having for its basis mere latitude, is wholly inadmissible, is thus most conclusively demonstrated; for although there may be little difference in the mean annual temperature on the same parallel, yet the distribution of heat among the seasons may be extraordinarily unequal.

These facts are illustrated in an equally marked degree in Table [C] on the following page, which exhibits a comparison between posts on the lakes and those of the same region situated beyond their influence.

It thus appears that the winter of the former, notwithstanding it is 1° 46′ north of the latter, has a mean temperature 2°.54 higher, whilst that of summer is 10°.40 lower. In the latter, the mean temperature of spring is 6°.65 higher, and that of autumn is 2°.04 higher. The difference between the mean temperature of summer and winter, making due allowance for difference of latitude, is even greater than in the comparison with the Atlantic coast, that of the Lakes being 43°, and that of the opposite locality 55°.84. Between

[B]

Comparative View of the Climate of the Sea-Coast and the Region beyond the Lakes, in relation to Temperature.

Locality.	Latitude.	Mean Annual Temp.	Extreme range of the Therm.			WINTER.			SPRING.			SUMMER.			AUTUMN.		
						Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
Sea-coast.	43° 18′	47°.19	98	−24	122	33.20	24.18	26.45	34.21	44.76	55.37	63.26	68.96	67.43	59.85	50.42	39.73
							27.94			44.78			66.55			50.00	
Region beyond the Lakes.	43° 10′	48°.99	104	−30	134	25.07	18.82	21.78	34.20	48.05	64.49	75.04	76.81	73.92	60.85	52.92	37.43
							21.89			48.91			75.26			50.40	

[C]

Comparative View of the Climate of the Lakes and the same Region lying beyond their Influence, in relation to Temperature.

Locality.	Latitude.	Mean Annual Temp.	Extreme range of the Therm.			WINTER.			SPRING.			SUMMER.			AUTUMN.		
						Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
Lakes.	46° 27′	42°.22	93	−26	119	23.04	16.98	19.85	27.20	39.44	52.56	58.24	67.13	63.51	55.94	47.19	36.33
							19.96			39.73			62.96			46.49	
Remote from the Lakes.	44° 53′	46° .47	96	−26	122	18.07	13.74	20.35	31.90	44.81	62.42	71.53	76.49	72.07	58.47	50.81	36.31
							17.42			46.38			73.26			48.53	

the mean temperature of winter and spring, the difference on the Lakes is only 19°.77, whilst in the positions in the same region beyond their influence, it is 28°.96.

These laws of temperature are confirmed by the results given in the Reports of the "Regents of the University of the State of New York," based on observations made at fifty-four different points and on an average of ten years, (from 1826 to 1836.) At Albany, for example, the mean temperature of January is 23°.38, and of August 69°.60; whilst at Lewiston, between Lakes Erie and Ontario, the former is 27°.70 and the latter 64°.46. Thus the difference between the mean temperature of these two months, is at Albany 46°.22, and at Lewiston only 36°.76. The mean annual temperature of the State of New York, on the average above mentioned, is 46°.31.

It is thus seen that the climatic features of the coast of New England and of the region of the great lakes, exhibit a striking resemblance, whilst those of the third class of the same Division are very dissimilar. In the climate of the third class, distinguished by great extremes of temperature, by seasons strongly contrasted, and a corresponding dryness of the atmosphere, (unlike the first two classes, in which the air is moist and the changes of the seasons slow and uncertain,) a constant and rapid succession is observed among the seasons. Summer, for example, succeeds winter so rapidly that there is scarcely any spring, the influence of which is surprisingly manifested in the vegetable kingdom. As the summers of the third class are remarkable for extremes of temperature, the mercury often rising in June, July, and August, to 100° Fahr. in the shade, so the winters are equally characterized by extreme severity. From November to May, cold weather prevails, the ground being often covered with snow to the depth of three or four feet, and the general range of the thermometer being from the freezing point to 30° below zero.

The lowest temperature, taking the mean of a month, occurred at Forts Howard and Snelling. At the former, the mean of the month of February, 1829, at 7 o'clock A. M. is −3°.17, and the mean of December, 1822, at Fort Snelling is −3°.61. This, it is to be observed, is merely the average of the morning observations for the month. Although the extreme severity of the winters at the posts remote from large bodies of water, has been already fully illustrated; yet the following remarks, made by Surgeon Beaumont when stationed in 1829 at Fort Crawford, Wiskonsan, which is in the latitude of Fort Wolcott, R. I., may be added in further elucidation:—"The month of January was remarkably mild and pleasant, the ground dry and free from snow, and the Mississippi unusually low and unfrozen. February was extremely cold, the weather clear and dry, and the thermometer ranging during the month from the freezing point to 23° below zero. From the 1st to the 16th, the mercury stood every morning, with the exception of three, (the 6th, 7th, and 8th,) between –4° and –23°, and did not rise above 20° above zero during these days. On the 2d, 3d, 4th, 5th, 9th, 10th, 11th, 12th, 13th, 14th, and 15th, the mercury at sun-rise stood respectively at 14°, 16°, 4°, 16°, 23°, 18° 20°, 18°, 10°, 6°, and 4° below 0; and on the 9th and 11th, it continued under –8° during the 24 hours. During the month the prevailing winds were northerly and dry, and the proportion of fair and cloudy weather was—clear twenty-two days, cloudy three, variable one, and snowy two. The mean depth of snow was about six inches. The month of March has been unusually cold and dry, with one or two light falls of snow, which, with the previous coat, has just been dissolved by the warmth of the solar rays without any rain. The ice on the Mississippi, which broke yesterday, [March 30th,] is now moving off *en masse*."

In the winter of 1779–80, the temperature at the city of New York was so low that cavalry and artillery were transported over the ice in the harbor to Staten Island. In the interior of the State, the cold was correspondingly intense. All streams were so completely locked up that no grain could be ground in grist-mills, and the inhabitants were obliged to bruise it in mortars; the snow was so deep that no efforts were made for weeks to reclaim the roads; in narrow ravines it became so drifted as to cover the tops of the highest trees; even many habitations were so buried that their inmates were obliged to tunnel their way to the light of heaven; and lastly, for the period of forty days, no water dropped from the eaves of houses. So say not only the chronicles of the day, but witnesses are yet living to testify to these facts. In the absence of the precise knowledge derived from thermometrical observations, we can at least infer that it was, even on our coast, a truly Russian winter; and the imagination is left to figure to itself the condition of things at the present sites of Forts Snelling, Howard, and Crawford. In this winter, as well as 1742, Long Island Sound was frozen over.

Scarcely does a winter elapse that the Hudson River is not frozen over even in the vicinity of the city of New York;* whilst Philadel-

* During the last winter, (1840-1,) the river, at the distance of 100 miles above

phia, and even Baltimore, lying on the same parallels which in Europe produce the olive and the orange, have their commerce often interrupted from the same cause. The Delaware, which is in the latitude of Madrid and Naples, is generally frozen over five or six weeks each winter. Even the Potomac becomes so much obstructed by ice that all communication with the District of Columbia by this means, is suspended for weeks. Further north, the mouth of the St. Lawrence is shut up by ice during five months of the year; and Hudson's Bay, notwithstanding it is in the same latitude as the Baltic sea, and of more than twice the extent, is so much obstructed by ice, even in the summer months, as to be comparatively of little value as a navigable basin.

The duration of winter at the city of New York is exhibited in the following table:—

	First Ice formed.	First Snow fell.	Last Ice formed.	Last Snow fell.
1831	Oct. 20	Nov. 3	April 10	April 30.
1832	Nov. 3	Dec. 12	April 10	Mar. 17.
1833	Oct. 31	Dec. 15	Mar. 29	Mar. 1.
1834	Oct. 30	Nov. 15	May 15	April 25.
1835	Nov. 13	Nov. 27	April 18	April 16.
1836	Oct. 26	Nov. 24	April 12	April 13.
1837	Oct. 14	Nov. 14	May 1	April 4.
1838	Oct. 31	Oct. 31	April 17	April 24.
1839	Nov. 20	Nov. 10	Mar. 31	April 17.
1840	Oct. 26	Nov. 18	Mar. 26	April 1.

Consequently the mean continuance of winter is 164 days, or about 5½ months; and as the earliest formed ice, in the ten years, was on the 14th of October, and the latest on the 15th of May, the extreme duration of frost is 213 days, or about seven months. In the more excessive climate of the interior of the State of New York, however, as for example at Albany, no month of the year is exempt from frost.

We find, however, even on our northern coast, a climate comparatively mild. As Nova Scotia is perfectly insular, with the exception of a neck of land eight miles wide, and is so much intersected by lakes and bays, that nearly one-third of its surface is under water, the mercury seldom rises above 88° in summer, or sinks lower than 6° or 8° below zero in winter. In addition to this, some influence must be exercised by the gulf-stream, which strikes upon this part of the coast, "in tides of from 60 to 70 feet, overflows the country to the

New York, was frozen over more than three months, viz., from the latter part of December to nearly the first of April.

distance of several miles, and converts the mouths of streams, fordable at low water, into extensive arms of the sea, where whole fleets might ride at anchor."

Here it may be observed, that the meteorological phenomena of Canada, Nova Scotia, New Brunswick, and Newfoundland, according to the data furnished in the British Army statistics, are in perfect harmony with the laws of climate developed in the United States. The climate of Nova Scotia, from the causes just stated, exhibits a marked contrast to that of Lower Canada on the same parallels. In Newfoundland, the climate is similar to that of Nova Scotia; but the summers, owing to the melting of the icebergs on the coast, are less warm, of shorter duration, and subject to more sudden vicissitudes. In Canada, remote from the Lakes, the climate is of the most excessive character. At Quebec, when walking along the streets, the sleet and snow frequently freeze in striking against the face; and here too the alternations of temperature are so sudden, that the mercury has been known to fall 70° in the course of twelve hours. Cold weather sets in as early as November, from the end of which month till May the ground remains covered with snow, to the depth of three or four feet. When the windsblow with violence from the north-east, the cold becomes so excessively intense, that the mercury congealed in the thermometer serves no longer to indicate the reduction of temperature. Wine and even ardent spirits, become congealed into a spongy mass of ice; and as the cold still augments, there follows congelation of the trees, which occasionally burst from this internal expansion, with tremendous noise. During winter, the general range is from the freezing point to 30° below zero. The seasons do not, as in more temperate regions, glide imperceptibly into each other. In June, July, and August, the heat, which often attains 95° of Fahr., is frequently as oppressive as in the West Indies.

On our western coast, the extremely modified climate of the region of Oregon, on a parallel five degrees north of the city of New York, has been already illustrated. During a year's observations at Fort Vancouver, the lowest point is 17°, and the whole number of days below the freezing point, are only nine, all of which are noted in January. We are told by Mr. Ball, of the State of New York, by whom these observations were made, that he commenced ploughing in January, of the year 1833. "The vegetables of the preceding season," he says, "were still standing in gardens untouched by the frost. New grass had sprung up sufficiently for excellent pasture. * * * Though the latitude is nearly that of Montreal, mowing

5

and curing hay are unnecessary, for cattle graze on fresh-growing grass through the winter. * * * Winters on the Columbia River are remarkably mild, there being no snow, and the river being obstructed by ice but a few days during the first part of January. Grass remained in sufficient perfection to afford good feed; and garden vegetables, such as turnips and carrots, were not destroyed, but no trees blossomed till March, except willow, alders," &c.

In regard to the course of winds and other states of the weather, abstracts for the same five years, embraced in the Tables [B] and [C], will be now presented, the proportion of each being calculated for the average of a month. *See Tables* [D] *and* [E] *page* 51.

As our military posts have never been supplied with an instrument, (*anemometer*,) required for ascertaining correctly the direction of winds, it is not to be expected that these observations are characterized by much precision. As winds are currents of air occasioned by the disturbance of the equilibrium of the atmosphere by the unequal distribution of heat, it follows that each variety of climate must have a system of winds correspondently modified. The data furnished in these tables do not, however, admit of systematic classification. Along the course of the great Lakes, a strong breeze blows during most of the summer, setting in about 10 A. M., and continuing till 4 P. M. During spring and autumn, the wind generally comes from the same quarter. In winter, winds from the north, varying from east to west, mostly prevail. It has been observed that the number of days in a year during which the winds blow from a certain point of the compass, at a given place, preserves a pretty constant ratio—a result arising from the fact that the force and direction of winds depend on causes peculiar to the locality, such as the declination of the sun, the configuration of the coast, the position of neighboring continents, the vicinity of great seas, and, in a word, all those physical causes which modify temperature. This fact is generally illustrated throughout the United States. By way of example, the results of five posts, selected at random, in different regions of our vast territory, are annexed. *See Table* [F] *page* 52.

At Fort Brady, it is seen that the highest ratios of winds each year are the S. E. and the W., and the lowest ratios, the N. and N. E. At West Point, the highest average each year is given by the S. W. winds and the lowest by those from the E. At Washington city, the prevailing winds each year are the N. W., and the opposite ratios are the N. and W. At Cantonment Clinch, the S. W. winds give the

[F]

Table showing that the course of Winds and the proportion of fair and cloudy Weather, preserve a constant ratio in a particular locality.

POINTS OF OBSERVATION.	Years of Observation.	WINDS.									WEATHER.				
		N.	N.W.	N.E.	E.	S.E.	S.	S.W.	W.	Prevailing.	Fair.	Cl'dy.	Rain.	Snow.	Prevailing
		Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.		Days.	Days.	Days.	Days.	
Fort Brady, *Michigan.*	1823	3.08	4.08	0.75	2.50	6.41	3.58	1.58	7.75	W.	12.83	3.08	7.83	6.66	Cl'dy.
	1824	1.33	5.25	0.83	2.16	7.33	2.08	2.16	9.33	W.	13.58	3.16	7.75	6.00	Cl'dy.
	1825	0.83	5.00	1.58	2.08	8.00	2.16	3.08	7.66	S.E.	13.50	3.58	7.91	5.41	Cl'dy.
West Point, *N. Y.*	1827	4.50	8.25	2.17	0.50	4.83	4.00	3.92	2.25	N.W.	17.83	7.00	4.33	1.16	Fair.
	1828	2.67	8.67	1.58	0.75	3.83	5.50	5.08	2.42	N.W.	18.50	6.58	4.58	0.83	Fair.
	1829	2.42	9.79	1.25	0.92	5.67	3.17	4.33	2.92	N.W.	17.59	7.58	4.50	1.67	Fair.
Washington, *D. C.*	1826	1.58	8.—	7.25	0.25	2.75	2.58	7.—	1.16	N.W.	17.33	8.50	5.—	0.50	Fair.
	1827	1.75	9.—	5.25	0.58	4.—	2.58	6.—	1.—	N.W.	14.75	9.08	6.25	0.33	Cl'dy.
	1828	0.58	9.50	4.—	0.33	4.75	6.58	4.17	0.58	N.W.	14.42	8.92	6.75	0.42	Cl'dy.
	1829	0.50	10.83	3.08	0.75	5.—	5.67	4.50	0.08	N.W.	14.—	9.58	6.—	0.83	Cl'dy.
Cantonment Clinch, *near Pensacola.*	1824	1.50	5.33	3.41	0.91	6.16	3.50	8.58	1.08	S.W.	19.08	1.00	10.41	—	Fair.
	1827	3.50	3.16	1.75	0.67	5.58	5.08	9.58	1.08	S.W.	19.67	4.67	6.08	—	Fair.
	1828	2.25	4.33	2.50	1.08	3.92	4.75	10.58	1.08	S.W.	19.50	3.25	7.75	—	Fair.
Fort Gibson, *Arkansas.*	1828	2.80	3.25	1.67	1.50	20.42	0.50	1.00	0.08	S.E.	19.—	9.25	2.08	0.17	Fair.
	1829	2.67	3.08	4.83	1.58	13.50	1.17	2.58	1.00	S.E.	18.92	6.67	4.50	0.18	Fair.
	1830	1.75	3.08	4.92	2.83	15.—	0.83	1.42	0.58	S.E.	19.17	6.67	4.17	0.42	Fair.

highest ratios, and the E. the lowest. Lastly, the annual results at Fort Gibson, invariably show the ratio of the S. E. to be the highest, and the W. the lowest. In regard to the annual proportion of fair and cloudy weather in each of these localities, the results are still more uniform.

In the State of New York, according to the "Report of the Regents of the University," the prevailing wind is N. W.—a result based on observations made at fifty-four places and on an average of ten years. This might have been inferred *a priori* from the general law of heat, by which a current of air is established towards the point where the greatest rarefaction exists. As the regions on the same parallel, remote from large bodies of water, are relatively colder in winter and hotter in summer, the winds will be correspondently various; but as the region lying N. W. of the State of New York is the coldest point of the compass, the prevailing winds will necessarily be from that quarter.

But to return to the table relative to the Northern Division. Although fair weather prevails both on the sea-coast and the interior remote from large bodies of water, yet a marked difference obtains in regard to the relative proportion. Thus, during the year, the proportion of days is—

	Fair	*Cloudy*	*Rain*	*Snow*
Sea-coast, ...	202	108	45	9
Interior, remote from Lakes,	240	77	31	16

Comparing the climate of the Lakes with that of the same region beyond their influence, the contrast is yet more striking, the prevailing weather of the former being cloudy, and the latter fair; thus, during the year, the proportion of days is—

	Fair	*Cloudy*	*Rain*	*Snow*
Lakes, ...	117	139	63	45
Remote from Lakes, .	216	73	46	29

The relative proportion of rainy and cloudy days during the year is, therefore, in the former locality 247, and in the latter 148. We possess no exact measurement of the comparative quantity of rain that falls in our different systems of climate*; and as no observations have been made upon the hygrometer,† their relative degree of humidity cannot be determined. It is evident that the annual quantity of rain

* Vide Abstract **D**. of Appendix.

† This instrument (Daniell's) is now furnished to the Army.

that falls upon any point of the earth's surface, depending, as it does, upon the amount of evaporation and the prevailing winds, is very intimately connected with the character of climate. As a general rule, the annual quantity increases in proportion as the equator is approached, more especially in maritime localities, and places in which elevated tracts skirt the sea-coast; and as regards the seasons, the greatest amount falls when the mean monthly temperature is highest. As this augmented quantity in warm maritime countries falls at a particular season and in a shorter space of time than in colder regions, the annual number of dry days, particularly in inland districts, is proportionally increased. On the contrary, in the cold or temperate maritime localities now under consideration, the rain, notwithstanding much less in annual quantity, descends much more frequently, but in slighter showers; and hence, a ready explanation is afforded of the fact that the ratio of wet and foggy days on the great lakes and coast of New England, is so much higher than in the climates on the same parallels characterized as excessive.

2. The Middle Division.—The numerical results furnished by this Division are, as in the Northern, presented in the condensed summary, Table [G], on the opposite page.

It has not been deemed fitting to arrange these posts into the two classes of uniform and excessive climes, as the majority of them are of a mixed character. The first two are slightly under the influence of the Atlantic, whilst the south-western stations experience the powerful agency of the Gulf of Mexico. The laws of climate developed in the preceding Division, do not find so happy an illustration in this one; for as the physical causes act less prominently, the effects are less marked. As we proceed south, the seasons become, as a general rule, more uniform in proportion as the mean annual temperature increases. Fort Mifflin and Washington city do not properly pertain to either class, being in a measure under the influence of the ocean; but as we possess no thermometrical observations made directly on the Atlantic on the same parallel, we are unable to determine the difference of climate. Fort Mifflin, near Philadelphia, shows a greater contrast in the opposite seasons than any one of the following posts, *viz.*, Brady, Sullivan, Preble, Niagara, West Point, Constitution, Wolcott, and Trumbull; and Washington city exhibits greater extremes than the three last named. Although the results given at Washington city fairly place it in the class of excessive climes, yet on following the same parallel westward, a still greater

[G]

Meteorological results of the Middle Division.

Posts of the Middle Division.	No of years of Observation.	Latitude.	Mean Annual Temp.	Mean Temp. of Winter.	Mean Temp. of Summer.	Difference of the Mean Temp. of Winter & Summer.	Difference of the Mean Temp. of Winter & Spring.	Difference of the Mean Temp. of Warmest & coldest Month	Mean Annual Range.
FORT MIFFLIN, *near Philadelphia.* - -	2	39°51′	55°.28	33°.11	77°.93	44°.82	18°.33	48°.03	87°
WASHINGTON CITY, *D. C.* - - -	8	38 53	56 .57	37 .76	76 .74	38 .98	18 .43	42 .40	84
JEFFERSON BARRACKS, *near St. Louis.* -	4	38 28	58 .14	37 .67	78 .45	40 .78	21 .08	45 .15	89
FORT MONROE, *Old Point Comfort, Va.* -	5	37 02	61 .43	45 .17	78 .31	33 .14	13 .74	36 .82	73
FORT GIBSON, *Arkansas.* - - - -	3	35 47	62 .90	44 .31	81 .14	36 .83	18 .18	42 .03	89
" JOHNSTON, *Coast of North Carolina.* -	5	34 —	66 .96	52 .48	80 .31	27 .83	14 .02	30. 15	62
AUGUSTA ARSENAL, *Georgia.* - - -	5	33 28	66 .01	51 .43	81 .06	29 .63	14 .46	32 .54	73
FORT MOULTRIE, *Charleston Harbor.* -	2	32 42	65 .78	49 .93	80 .27	30 .34	16 .35	35 .73	69
" JESUP, *near Sabine River, La.* - -	8	31 30	68 .03	53 .19	82 .48	29 .29	14 .74	31 .24	77

[H]

Meteorological results of the Southern Division.

Posts of the Southern Division.	No. of years of Observation.	Latitude.	Mean Annual Temp.	Mean Temp. of Winter.	Mean Temp. of Summer.	Difference of the Mean Temp. of Winter & Summer.	Difference of the Mean Temp. of Winter & Spring.	Difference of the Mean Temp. of Warmest & coldest Month.	Mean Annual Range.
CANTONMENT CLINCH, *near Pensacola,* -	7	30°24′	69°.44	56°.14	82°.24	26°.10	13°.12	28°.60	70°
PETITE COQUILLE, *near New Orleans,* -	4	30 10	71 .25	59 .26	83 .46	24 .20	10 .71	27 .97	64
FORT MARION, *St. Augustine,* - - -	4	29 50	72 .66	62 .21	82 .30	20 .09	9 .29	22 .08	53
" KING, *interior of East Florida,* -	3	29 12	72 .66	61 .78	84 .20	22 .42	10 .78	25 .69	78
" BROOKE, *Tampa Bay,* - - -	5	27 57	73 .42	64 .76	81 .25	16 .49	8 .35	18 .66	59
KEY WEST OR THOMPSON'S ISLAND, - -	3	24 33	76 .09	70 .05	81 .39	11 .34	5 .99	14 .66	37

contrast is exhibited. Thus the difference between the mean temperature of winter and summer at Jefferson Barracks, near St. Louis, notwithstanding it is about half a degree farther south than Washington city, is 1°.80 greater; and on comparing Fort Gibson, Arkansas, with Fort Monroe on the coast of Virginia, though the latter is 1° 15′ north of the former, the difference at Fort Gibson, in the same respect, is 3°.69 greater. Fort Johnston, on the coast of North Carolina, which is 0° 32′ north of Augusta Arsenal, Georgia, also exhibits a less extreme in the opposite seasons.

In casting one's eye over the column showing the difference between the mean temperature of winter and spring, the general laws already revealed are apparent. Jefferson Barracks shows a greater inequality than Washington city, and Fort Gibson than Fort Monroe. Fort Jesup cannot be fairly compared, by way of contrast, with a position in the same latitude on the Atlantic, as the warm atmospheric currents from the Gulf of Mexico exercise there a very appreciable influence.

As respects the mean annual range of the thermometer, it is found that the laws developed in the Northern Division are here corroborated. Washington city has a mean annual range of 84°, whilst that of Jefferson Barracks is 89°; the ratio of Fort Monroe, on the one hand, is 73°, and that of Fort Gibson, on the other, is 89°; and lastly, the range at Fort Johnston is 62°, whilst that of Augusta Arsenal is 73°.

It is thus seen that the climate of the region of the lakes on our northern frontier is not more contrasted than that of Philadelphia—an inference long since deduced from the fact that similar vegetable productions are found in each, whilst the same plants will not flourish in the interior of New York, Vermont, and New Hampshire. The region of Pennsylvania, as though it were the battle-ground on which Boreas and Auster struggle for mastery, experiences, indeed, the extremes of heat and cold. But proceeding south along the Atlantic Plain, climate soon undergoes a striking modification, of which the Potomac river forms the line of demarcation. Here the domain of snow terminates. Beyond this point, the sledge is no more seen in the farmer's barn-yard. The table-lands of Kentucky and Tennessee, on the other hand, carry, several degrees farther south, a mild and temperate clime. Although very few thermometrical observations have been made upon the table-land lying in the centre of the Middle Division or upon the ridges which crest this long plateau, thus rendering it impracticable to determine fully the interesting question of their influence upon temperature ; yet we are enabled to supply this deficiency, in some measure, by observations made upon the differences in vegetable geography. Thus in Virginia, as the limits of the State extend quite across the great Apalachian chains, four natural divisions are presented, *viz.*, 1. The Atlantic Plain or tide-water region, below the falls of the rivers ; 2. The Middle region, between the falls and the Blue Ridge ; 3. The Great Valley, between the Blue Ridge and the Alleghany Mountains ; and 4. The Trans-Alleghany region, west of that chain. In each of these, the phenomena of vegetation are modified in accordance with the climatic features. On the Atlantic Plain, tobacco is the principal staple ; in the Great Valley, it is cultivated only in the southern portion ; and beyond the Alleghany, its culture is unknown. In the first only is cotton cultivated, and in its southern part quite extensively. In North Carolina, the Atlantic Plain extends 60 or 70 miles from the coast, whilst the Middle region, corresponding to that described in Virginia, gradually merges into the mountainous regions farther west. As these table-lands are elevated from 1,000 to 1,200 feet above the sea, upon which rise many high crests, one of which (Black Mountain) is the highest summit of the Alleghany system, the diversity of climate on the same parallels causes a corresponding difference in the vegetable productions. Whilst the Low-lands yield cotton, rice, and indigo, the western high country produces wheat, hemp, tobacco, and Indian corn. In South Carolina, three strongly marked regions are also presented ; but as the temperature increases, as a general law, in proportion as we approach the equator, cotton is cultivated throughout the State generally. Georgia, Alabama, and Mississippi, like the Carolinas, are divided into three well-defined belts, exhibiting similar diversities in vegetable geography. Cotton and rice, more especially the former, are the great agricultural staples ; and on the Atlantic Plain of these three States, as well as its continuation into Florida and Louisiana, (which last two will be more particularly adverted to in the Southern Division,) sugar may be advantageously cultivated. In North Carolina and Virginia, the Atlantic Plain forms, as it were, a chaos of land and water, consisting of vast swamps, traversed by sluggish streams, expanding frequently into broad basins with argillaceous bottoms. Throughout its whole extent, as already remarked, it is characterized by similar features, besides being furrowed with deep ravines in which the streams wind their devious way. The hot and sultry atmosphere of these Low-lands, in which malarial diseases in every form are dominant, contrasts strongly with the mild and salubrious climate of the mountain regions—results that will be developed more fully in the investigation of endemic influences.

It may not be amiss, as illustrative of the comparative temperature of the Atlantic Plain and the adjacent mountain region, to present here a few thermometrical data, however limited in extent, noted, during the summers of 1839 and 1840 at Flat Rock, Buncombe County, North Carolina.

Places of Observation.	Lat.	Mean Temperature.			
		July.	Aug.	Sept.	Oct.
Fort Monroe, Coast of Virginia,	37° 00'	80°	70°	72°	64°
Flat Rock, Buncombe, N. C.,	35° 30'	69°	70°	62°	61°
Charleston, South Carolina,	32° 45'	81°	81°	77°	71°

Flat Rock is about 250 miles from the Atlantic, and is elevated perhaps 2,500 feet above the level of the ocean, whilst the latitude given is also a mere approximation derived from general knowledge. The observations made at Charleston embrace the same years as those at Flat Rock, but the data at Fort Monroe comprise the years 1828, 29, and 30. It is thus seen that the difference of temperature at Flat Rock and the other two points, taking an average of the latter, is in July 11°, August 10°, September 13°, and October 6°. As regards the monthly range of the thermometer, little difference is presented.

3. The Southern Division, which is characterized by the predominance of high temperature, remains to be considered. The climate of this region is fully illustrated by the posts contained in Table [H] p. 55.

On approaching the southern coast, climate undergoes a most remarkable modification. The seasons glide imperceptibly into each other, exhibiting no great extremes. This is strikingly illustrated on comparing the difference between the mean temperature of summer and winter at Fort Snelling, Iowa, and at Key West, at the southern point of Florida, the former being 56°.60, and the latter only 11°.34. Compared with the other regions of the United States, the Peninsula of Florida has a climate wholly peculiar. The lime, the orange, and the fig, find there a genial temperature; the course of vegetable is unceasing; culinary vegetables are cultivated, and wild flowers spring up and flourish in the month of January; and so little is the temperature of the lakes and rivers diminished during the winter months, that one may almost at any time bathe in their waters. The climate is so exceedingly mild and uniform, that besides the vegetable productions of the Southern States generally, many of a tropical character are produced. The palmetto or cabbage palm, the live-oak, the deciduous cypress, and some varieties of the pine, are common farther north; but the lignumvitæ, mahogany, logwood, mangrove, cocoa-nut, &c., are found only in the southern portion of the Peninsula. In contemplating the scenery of East Florida in the month of January, the northern man is apt to forget that it is a winter landscape. To him all nature is changed; even the birds of the air—the pelican and flamingo—indicate to him a climate entirely new. The author being attached, in January, 1838, to a boat expedition, the double object of which was to operate against the Seminoles and to explore the sources of the St. John's, found, in the midst of winter, the high cane-grass, which covers its banks, intertwined with a variety of blooming morning-glory, (*convolvulus*). The thermometer at mid-day in the shade, stood at 84° Fahr., and in the sun rose to 100°; and at night we pitched no tents, but lay beneath the canopy of heaven, with a screen perhaps over the face as a protection against the heavy dews. Notwithstanding the day attains such a high temperature, the mercury just before day-light often sinks to 45°, causing a very uncomfortable sensation of cold. Along the south-eastern coast, at Key Biscayno for example, frost is never known, nor is it ever so cold as to require the use of fire. In this system of climate, the rigors of winter are unknown, and smiling verdure never ceases to reign.

The first two posts in the table, Cantonment Clinch near Pensacola, and Petite Coquille near New Orleans, both influenced by the agency of the Gulf of Mexico, and the latter being also environed by large lakes, exhibit climates almost as much modified as that of East Florida. The remaining stations may be considered as all belonging to the Peninsula of Florida, Key West being an island at the southern point. Fort Marion is at St. Augustine on the eastern coast; Fort Brooke is at the head of Tampa Bay,* about thirty miles from the Gulf of Mexico; Fort King is intermediate to these two points; and Key West belongs to the Archipelago, about sixty miles south-west of Cape Sable. As Fort King is situated in the interior, and the other three posts are on the coast, we have an additional illustration, even in a climate characterized by very little distinction of the seasons, of the modifying agency of large bodies of water; for the mean

* The old Spanish appellation was Espiritu Santo, or bay of the Holy Ghost, the name Tampa being then restricted to an arm.

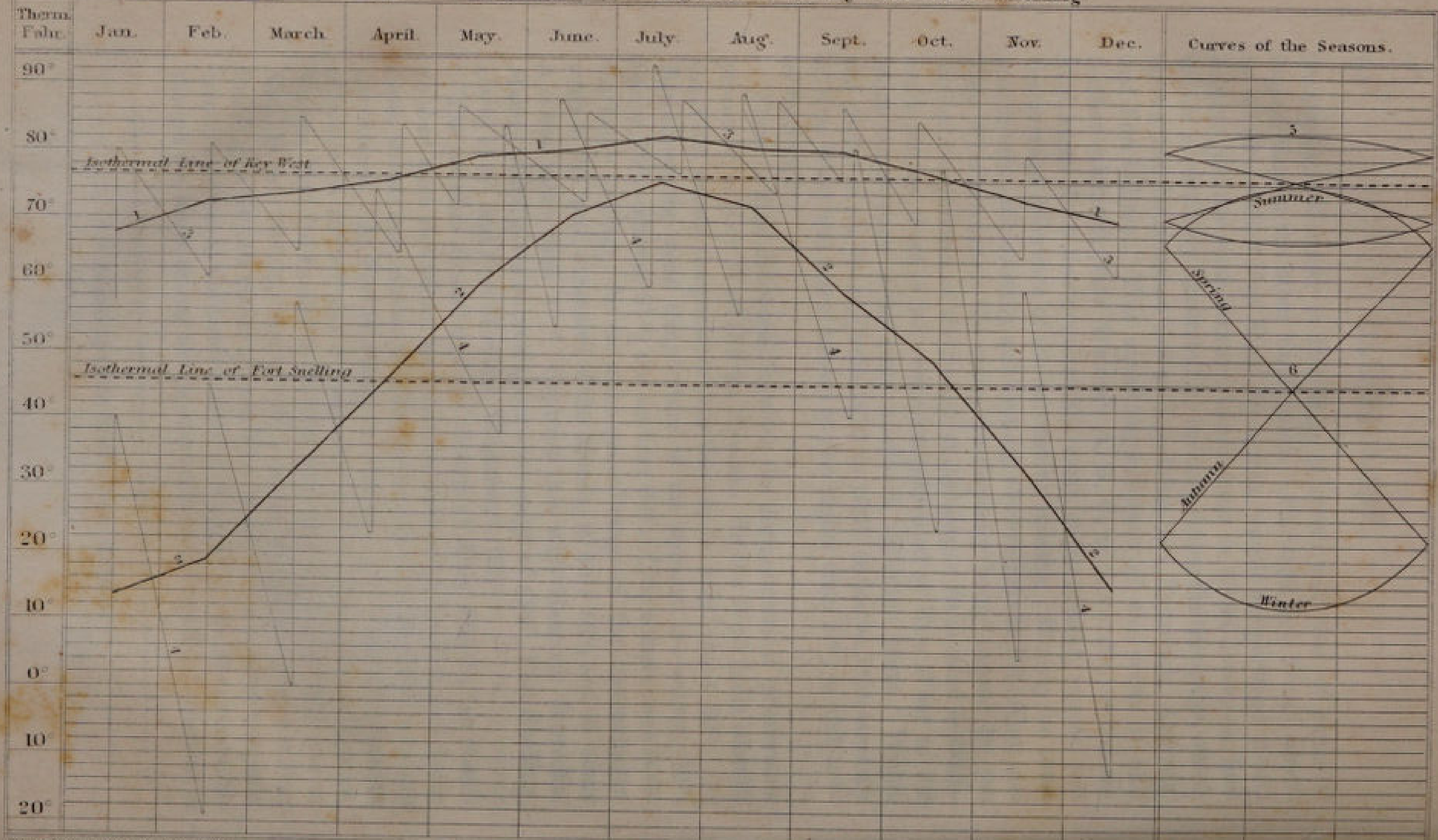
temperature of winter at Fort King is lower, and that of summer higher, than at the other three posts. Although Key West, which is 4° 39′ south of Fort King, has a mean annual temperature 3°.43 higher, yet the mean summer temperature is 2°.81 lower—a law which is strikingly illustrated on the map facing the title-page, which shows that the isotheral line of Key West cuts Savannah, Augusta, and Fort Gibson. This equalizing influence of the ocean is still further exhibited, (vide Abstracts A, B, C, of Appendix,) in the annual range of the thermometer, the mean of the monthly ranges, and the average difference of the successive months. During the summer months, the morning and evening observations at Fort King and Key West are nearly the same, the disparity being caused by the exalted temperature of the former at mid-day. As is usual in southern latitudes, there is little variation presented at Key West in the mean temperature of the same month in different years. Within the period of six years, (from 1830 to 1835 inclusive,) the mercury at Key West was never known to rise higher than 90°, or sink lower than 44°.

There is little difference between the thermometrical phenomena presented at Key West and the Havana. In the West India islands, the mean annual temperature near the sea is only about 80°. At Barbadoes, the mean temperature of the seasons is—winter, 76°, spring 79°, summer 81°, and autumn 80°. The temperature is remarkably uniform; for the mean annual range of the thermometer, even in the most excessive of the islands, is only 13°, and in some it is not more than 4°.* Contrast this with Hancock Barracks, Maine, which gives an average annual range of 118°, Fort Snelling, Iowa, 119°, and Fort Howard, Wiskonsan, 123°!

The peculiar character of the climate of East Florida, as distinguished from that of our more northern latitudes, consists less in the mean annual temperature than in the manner of its distribution among the seasons. At Fort Snelling, for example, the mean temperature of winter is 15°.95, and of summer 72°.75, whilst at Fort Brooke, Tampa Bay, the former is 64°.76, and the latter 81°.25, and at Key West, 70°.05, and 81°.39. Thus though the winter at Fort Snelling is 54°.10 colder than at Key West, yet the mean temperature of summer at the latter is only 8°.64 higher. In like-manner, although the mean annual temperature of Petite Coquille, Louisiana, is

* According to the British Army Statistics.

PLATE II, exhibiting the different Laws of Temperature at Key West & Fort Snelling.



For Explanation see page 380.

nearly 2° lower—that of Augusta Arsenal, Georgia, nearly 8°—and that of Fort Gibson, Arkansas, upwards of 10° lower,—than that of Fort Brooke; yet at all, the mean summer temperature is higher. Between Fort Snelling, on the one hand, and Fort Brooke and Key West on the other, the relative distribution of temperature stands thus: Difference between the mean temperature of summer and winter at the former 56°.60, and at the two latter 16°.49 and 11°.34; difference between the mean temperature of the warmest and coldest month, 61°.86 compared with 18°.66 and 14°.66; difference between the mean temperature of winter and spring, 30°.83 to 8°.35 and 5°.99; and the mean difference of successive months, 10°.29 to 3°.09 and 2°.44.

The diverse climatic peculiarities of Fort Snelling and Key West are delineated in the opposite engraving. (*Plate II.*) The contrast in the curves of the mean annual temperature of these two posts, as traced through each month, is, indeed, striking, whilst the variation of temperature on each of these monthly lines, is still more marked. Although the average minimum temperature at Fort Snelling in January is as low as 22° below zero, whilst that of Key West is 57° above; yet, strange to say, we find the mean maximum temperature of July at the former 5° higher than at the latter. The curves of the seasons are equally marked in their contrast; for whilst those of Key West all cut one another, those of Fort Snelling are so opposite that spring and autumn traverse each other at right angles, and summer and winter are so remote that the one is truly hyperborean, and the other tropical.

A reference to Abstracts A, B, C, of Appendix, will enable any one to trace much farther this remarkable equality in the distribution of temperature among the seasons in Florida, and to institute, at the same time, a comparison with the most favored situations on the continent of Europe and the islands held in highest estimation for mildness and equability of climate. A comparison of the mean temperature of winter and summer, that of the warmest and coldest month, and that of successive months and seasons, results generally in favor of peninsular Florida. The mean difference of successive months stands thus: Pisa 5°.75, Naples 5°.08, Nice 4°.74, Rome 4°.39, Fort King, 4°.28. Fort Marion, at St. Augustine 3°.68, Fort Brooke 3°.09, Penzance, England, 3°.05, Key West, 2°.44, and Madeira 2°.41. The mean annual range thus: Fort King 78°, Naples 64°, Rome 62°, Nice 60°, Montpelier

59°, Fort Brooke 57°, St. Augustine 53°, Penzance 49°, Key West 37°, and Madeira 23°.

The state of the weather as indicated by the course of the winds and the proportion of fair and cloudy days, based upon three years' observations, is shown in the following table :

Places of Observation.	WINDS.								Prevailing.	WEATHER.			Prevailing.
	N	NW	NE	E	SE	S	SW	W		fair	cl'dy	rain	
	days	days	days	days	days	days	days	days		days	days	days	
FT. MARION,	1.55	2.86	9.08	1.03	10.83	1.11	2.64	1.33	S E	19.02	5.19	6.22	Fair
" KING,	1.62	2.79	3.46	3.54	4.37	5.63	5.96	3.08	S W	25.75	2.88	1.89	Fair
" BROOKE,	1.53	3.72	5.58	2.89	4.44	2,75	6.42	3.17	S W	20.33	4.47	5.64	Fair
KEY WEST,	3.20	3.13	10.50	5.37	5.37	0.54	1.67	0.38	N E	21.54	3.08	5.92	Fair

The want of hygrometrical observations to indicate the actual or comparative humidity of the atmosphere is to be regretted. That the air is much more humid than in our more northern regions is sufficiently cognizable to the senses. The dews, even in the winter, are generally very heavy. To guard against the oxidation of metals, as for example surgical instruments, is a matter of extreme difficulty. During the summer, books become covered with mould, and keys rust in one's pocket. *Fungi* flourish luxuriantly. The author has known a substance of this kind spring up in one night, and so incorporate itself with the tissue of a woollen garment, as to render separation impracticable. As the rains, however, generally fall at a particular season, the atmosphere in winter is comparatively dry and serene. The following abstract of the monthly fall of rain at Key West, is the mean result of five years' observations :—

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An. Average
1.82	1.34	1.98	1.09	6.34	2.39	2.84	3.30	4.35	3.33	1.49	1.13	31.40

It will be observed that during six months, from November to May, the proportion of rain is but 8.84 inches. It has been already remarked that in tropical climates a portion of the year is known as the rainy season, and that the same quantity descends in a much shorter space of time than in the temperate zone ; and that, consequently, the proportion of fair days and clear skies is infinitely in favor of the former. In the two tables just given, in which the ratios are monthly averages, these results are strikingly evidenced. At Fort King, the annual number of fair days is 309, whilst on the northern

Lakes it is only 117. On the coast of Florida, however, the average is not more than 250 days.

Other meteorological phenomena are similarly modified, but upon these points no precise observations have been made. Thus in countries and seasons in which solar action is most intense, electrical phenomena are most frequent and energetic ; and whilst atmospheric moisture favors the passage of electricity from the earth to the clouds, the opposite condition causes its accumulation in objects on its surface. Consequently, in the excessive climates of the Northern Division, thunder and lightning are of rare occurrence, and terrestrial objects are charged with an unusual portion of electricity ; whereas in the warm and moist atmosphere of the alluvial zone which skirts our southern coast, opposite phenomena are witnessed. In warm countries, likewise, the influence of the solar beams, and consequently of light, is very influential in modifying directly the animal and vegetable creation, as well as many of the physical phenomena which make up the character of climate.

In regard to the climate of peninsular Florida—an evergreen land in which wild flowers never cease to unfold their petals—it has been deemed necessary to enter somewhat into detail, inasmuch as the climatic laws developed, as will be shown in Part Second, have an intimate relation with pulmonary diseases ; and, indeed, it has been just demonstrated that invalids requiring a mild winter residence, have gone to foreign lands in search of what might have been found at home.

SECTION III.

The same isothermal line presents on the east side of both continents, concave, and on the west side, convex summits.—Difference between the mean temperature of the west of Europe and eastern coast of America on the same parallels.—Comparative difference of the seasons from the equator to the polar circle, between Europe and America.—The law that the same causes which produce the greatest convexity of the isothermal line, also equalize the temperature of the seasons, not confirmed in the Northern Division of the United States.—Explanation of the fact why the elevation of our north-western country, 800 or 1000 feet above the level of the ocean, causes no perceptible diminution of temperature.—The general law that the contrast in the seasons from Florida to Canada increases in proportion as the mean annual temperature decreases, is subject to modification on every parallel in accordance with difference in physical geography.—These laws compared with those determined in Europe by Humboldt.—Laws in reference to the geographical distribution of plants and animals.—The influence of the unequal distribution of heat upon vegetable geography on the same parallels in the United States, demonstrated, and a comparison made with the laws determined in Europe.—The extremes of heat and cold do not occur at our most northern and southern posts.—Reason why, notwithstanding the mercury may be 15° or 20° higher here than in England, we suffer little more from the effects of heat.—The fact that the highest temperature in northern latitudes occurs in June, and as we approach the equator in July and August, explained by the laws which regulate the earth's motion.—The mooted point whether April or October expresses a nearer equivalent to the mean annual temperature satisfactorily settled.—Thermometrical observations made by the writer at the depth of thirty inches beneath the surface of the earth.—Observations on the pluviometer throughout the United States, and general law of the mean annual quantity of rain from the equator to the pole.—The general laws of temperature as modified by physical geography investigated at length.—The climate of Eastern North America, so far from being an exception to the general rule, demonstrates the harmony of the laws of climate throughout the globe.—The western coasts of Europe and of America resemble each other in climate to a certain point.—The same true in regard to the Eastern coasts of the two continents.—The question, whether the old continent is warmer than the new, shown to involve an absurdity.—The questions, whether the climate of a locality in a series of years, undergoes any permanent changes, and whether the climate of our north-western frontier resembles that of the Eastern States on their first settlement, discussed.—The opinion of Volney and others that the climate west of the Alleghanies is hotter by 3° of latitude than that east, shown to be the result of hasty generalization.—All thermometrical observations tend to establish the position that the climate of a region is equally stable with its physical characters.—The opinion of Malte-Brun that the climate of France, Germany, and England, not more than twenty centuries ago, resembled that of Canada and Chinese Tartary, shown to be fallacious.—Any change in the present relation of the earth's surface, will induce a corresponding modification of climate.—Geological discoveries prove that such changes have occurred.

Having completed the details in reference to each division of the United States, the consideration of questions of a more general character will now engage attention.

In tracing the same isothermal line around the northern hemisphere beyond the tropic, it presents on the east side of both continents, concave, and on the west side, convex summits. Following the mean annual temperature of 55°.40 Fahr. around the whole globe, we find it passes on the—

Eastern coast of Old World,	in N. Lat. 39° 54′,	E. Long. 116° 27′,	near Pekin.
Eastern coast of New World,	" 39° 56′,	W. " 75° 16′,	Philadelphia.
Western coast of Old World,	" 45° 46′,	" " 0° 37′,	near Bordeaux.
Western coast of New World,	" 44° 40′,	" " 104° —′,	Cape Foulweather, south of the mouth of Columbia.

On comparing the two systems, the concave and convex summits of the same isothermal line, "we find," says Humboldt, "at New York the summer of Rome and the winter of Copenhagen; and at Quebec, the summer of Paris and the winter of Petersburg. In China, at Pekin, for example, where the mean temperature of the year is that of the coast of Brittany, the scorching heats of summer are greater than at Cairo, and the winters are as rigorous as at Upsal."

The difference of climate between Europe and Eastern America, as determined by Humboldt in a paper on *Isothermal Lines and the Distribution of Heat over the Globe*, is as follows:

The isothermal line of 32° passes in—		
Europe, between Uleo and Enontakies, Lapland,	Lat. 66° to 68°,	E. Long. 19° 22′
America, through Table Bay, Labrador,	" 54°.	W. " 58°.
The isothermal line of 41° passes in—		
Europe, near Stockholm,	Lat. 60°.	E. Long. 18°.
America, the Bay of St. George, Newfoundland,	" 48°.	W. " 59°.
The isothermal line of 50° passes in—		
Europe, through Belgium,	Lat. 51°.	E. Long. 2°
America, near Boston,	" 42° 30′	W. " 70° 59′
The isothermal line of 59° passes in—		
Europe, between Rome and Florence,	Lat. 43°.	E. Long. 11° 40′
America, near Raleigh, North Carolina,	" 36°,	W. " 76° 30′

Between the western part of Europe and the eastern coast of North America, the following differences generally obtain:

Lat.	Mean Temp. of West of Europe.	Mean Temp. of Eastern Coast of N. America.	Difference.
30°	70°.52	66°.92	3°.60
40°	63°.14	54°.50	8°.64
50°	50°.90	37°.94	12°.96
60°	40°.60	23°.72	16°.92

It is thus seen that the difference increases in proportion as high latitudes are attained. On the opposite coasts of the two hemispheres, the mean annual temperature decreases in the following ratio :—

Lat.		*Temp.*		*Temp.*
From 0° to 20°	West of the Old World.	3°.60	East of the New World.	3°.60
20 — 30		7 .20		10 .80
30 — 40		7 .20		12 .60
40 — 50		12 .60		16 .20
50 — 60		9 .90		13 .30
0. — 60		40 .50		56 .50

The comparative difference of the seasons from the equator to the polar circle, is exhibited in the following table :—

Isothermal Lines.	Europe, Long. 1° W. to 17° E.			America, 58° to 72° W. Long.		
	Mean Temperature.			Mean Temperature.		
	Winter.	Summer.	Differ-ence.	Winter.	Summer.	Difference.
68°	59°.—	80°.60	21°.60	53°.60	80°.60	27°.—
59°	44 .60	73 .40	28 .80	39 .20	78 .80	39 .60
50°	35 .60	68 .—	32 .40	30 .20	71 .60	41 .40
41°	24 .80	60 .80	36 .—	14 .00	66 .20	52 .20
32°	14 .—	53 .60	39 .60	1 .40	55 .40	54 .—

These various relations determined by Humboldt, are as correct as his data would warrant. The isothermal line of 41°, which, according to this philosopher, passes through the Bay of St. George in Newfoundland, in latitude 48°, if correctly ascertained, sinks as it penetrates towards the interior of the continent; for at Hancock Barracks, Maine, in latitude 46° 10′, at the distance of 150 miles from the Atlantic, the mean annual temperature is 41°.21, and at Fort Brady, at the outlet of Lake Superior, in latitude 46° 39′, it is 41°.39; and proceeding to the western coast of America, we find that at Fort Vancouver, Oregon Territory, in latitude 45° 37′, the mean temperature, like similar parallels in western Europe, is as high as 51°.75. As it has been demonstrated that the difference between the mean temperature of summer and winter increases on the same parallel in proportion as the interior of a continent is approached, unless in climates modified by inland seas, and as it has also been proved that at the convex summits of the isothermal curves on the western coasts of the Old and the New World, this difference is less than at the concave inflections on the eastern coasts, the inference that the annual temperature is lower in the Territory of Iowa than in the same latitude on the Atlantic coast, would naturally follow. But this deduction, based on the law that the same causes which produce the greatest convexity of the line, also equalize the temperature of the seasons, as is shown in the annexed summary, is not authorized by the data furnished in the "Army Meteorological Register." Thus the annual mean temperature being equal to the fourth part of the total of the winter, spring, summer, and autumnal temperatures, the same isothermal line of 53°.60, as given by Humboldt, shows—

At the *concave* summit in America, 74° 40′ west long.	*Winter. Spring. Summer. Autumn.* $53^\circ.60 = \frac{32^\circ — + 52^\circ.30 + 75^\circ\ 60 + 54^\circ.50}{4}$
At the *convex* summit in Europe, 2° 20′ west long.	$53^\circ.60 = \frac{40^\circ.10 + 51^\circ.80 + 68^\circ.40 + 54^\circ.10}{4}$
At the *concave* summit in Asia, 116°.20′ east long.	$53^\circ.60 = \frac{24^\circ.80 + 54^\circ.70 + 80^\circ.60 + 54^\circ.30}{4}$
And the *convex* summit in America, at Fort Vancouver, in lat. 45° 37′ and long. 122° 37′, according to the "Army Meteorological Register," is equally modified. Thus—	$51^\circ.75 = \frac{41^\circ.33 + 48^\circ.00 + 65^\circ.00 + 52^\circ.67}{4}$

Now, on comparing the modified climate of the coast of New England with the excessive climate of the interior, it is found that the mean annual temperature of the latter is generally higher. Forts Sullivan, Snelling, and Howard, for example, have very nearly the same latitude: the first, on the ocean, has a mean annual temperature of 42°.95, whilst the two last, in the opposite system of climate, have a mean respectively of 45°.83 and 44°.92—a result the more unexpected, at first sight, as the latter are elevated 600—800 feet above the level of the sea. Comparing Fort Wolcott, on the ocean, with Fort Armstrong, West Point, and Council Bluffs, in the interior, the same relation is found. Fort Trumbull, it is true, offers an exception; but it is necessary to bear in mind that the results of this post are based on two years' observations only, whilst those of Fort Wolcott are calculated from ten. Although the mean annual temperature of Fort Snelling, Iowa, is 2°.88 higher than that of Fort Sullivan on the Atlantic, yet the contrast between the mean temperature of winter and summer is 17°.45 greater—a law which holds good in respect to the other posts to which reference has just been made. Even when we come to compare Forts Snelling and Howard with positions in the modified climate of the lakes, the same relation is discovered; for although the mean latitude of the latter, (Forts Brady and Mackinac,) is only 1°34′ north of Fort Snelling, yet the mean annual temperature is 4°.25 lower, whilst the contrast between summer and winter is 12°.84 less.

These facts, then, would seem to contradict the generally admitted law, that the same causes which equalize the temperature of the seasons, also increase the mean annual temperature. These results appear the more extraordinary, as some reduction of temperature, by reason of the elevation of these interior posts, would be *a priori* inferred; for, according to Humboldt, "elevations of 400 metres, (1,312 feet,) appear to have a very sensible influence on the mean temperature, *even when great portions of countries rise progressively*." That high table-lands have a more exalted temperature than isolated mountains of the same height, is well known; for the elevated plains on which the towns of Bogota, Popayan, Quito, and Mexico are built, have a much warmer climate than they would have, if elevation above the sea were the only element that determines the temperature when the latitude is given. That our western table-lands rising gradually to the height of eight hundred feet cause no diminution of temperature, has been already proved by comparing, on the one hand, Forts Snelling and Howard, and on the other Forts Brady and Mackinac. Although at Fort Mackinac, situated on the island of the same name, the temperature of the seasons is much equalized, yet the annual temperature, notwithstanding it is only 1° farther north than Fort Snelling, is 5°.27 lower. Moreover, as Fort Mackinac is elevated about one hundred and fifty feet above the surface of the lake, its height above the sea is probably the same as that of Fort Snelling.

Although unable to give an explanation of the fact that the modified climate of the lakes and the sea-coast, unlike the equalized seasons on the western coasts of Europe and America, has a lower annual temperature than the excessive climates in the same region; yet we do not find a similar difficulty in the attempt to explain why the elevation of eight hundred feet above the level of the sea should not cause a perceptible diminution of temperature. Although the question finds satisfactory elucidation in the preliminary remarks contained in Section I., yet the preciseness of the following explanation by M. Arago in regard to the production of perpetual snow, will serve as an apology for its introduction:—"L'atmosphere est tres peu echauffee par le passage des rayons solaires: elle doit donc etre plus froide que la surface de la terre; et, par la meme raison, les hautes montagnes et les terres les plus exposees a l'action de l'atmosphere, doivent toujours etre plus froides que les lieux situes a peu pres au niveau de la mer. L'atmosphere doit aussi, comme l'experience l'a prouve, etre d'autant plus froide qu'on s'y eleve davantage : en effet, tous les corps renferment une certaine quantite de calorique rendu latent et insensible : la grande chaleur emise par la vapeur d'eau qui se condense, en est une preuve evidente : or l'air contient d'autant plus de calorique latent, qu'il est plus rarefie ; ce que demontre aussi *le briquet a air* en rendant libre, lorsqu'on le comprime, assez de chaleur pour enflammer un morceau d'amadou : l'air absorbant peu de chaleur par rayonnement, et, au contraire, beaucoup par le contact, il en resulte qu'il doit s'etablir un courant ascendant d'air que se dilate, lors qu'il est parvenu a une certaine hauteur, et produit du froid, en absorbant une quantitie de calorique necessaire pour maintenir cette dilatation. Il devra donc, si des corps plus chauds se rencontrent dans ces regions elevees, les refroidir beaucoup en leur enlevant le calorique qui lui manque." (*Traite de Meteorologie, ou Physique du Globe, par Garnier.*)

Now it is apparent that these causes cannot be in operation when a large region of country rises very slowly and progressively to a height less than 1000 feet. It is only when lands are considerably and suddenly elevated, and exposed to the action of the atmosphere laterally, that this rapid conduction of heat and rarefaction of the atmosphere can take place. To decide the question mooted conclusively, however, it is necessary that the absolute mean temperature of a great number of places be established ; and to determine these averages requires years of patient industry, as the result approximates the truth in proportion only as the observations are multiplied.

The most striking examples of the impropriety of deducing general inferences from the law that in a certain latitude, "no trees are found at the height of 2000 toises, (12,790 English feet) and that at 2300 toises, (14,708 English feet,) there is no trace of vegetation," —a law applicable to lands which rise suddenly—are afforded in the elevated regions of Asia. On the ridges and in the valleys of the lofty Himmaleh mountains, immense tracts, which theory would place in the region of perpetual congelation, are found richly clothed in vegetation and abounding in animals. At the village of Zonching, 14,700 feet above the level of the sea, in lat. 31° 36′ N., Mr. Colebrook found flocks of sheep browsing on verdant hills ; and at the village of Pui, at about the same elevation, there are produced, according to Captain Gerard, the most luxuriant crops of barley, wheat, and turnips, whilst a little lower the ground was covered with vineyards, groves of apricots, and many aromatic plants.

In the table, as arranged by Humboldt, of the comparative difference of the seasons in Western Europe and Eastern America, from the equator to the polar circle, given on a preceding page, the results, owing of course to the paucity of his data, are not characterized by much precision. As the region of the United States exhibits very diverse systems of climate even on the same parallels, such comparative tables can present only the most general laws. For instance, it shows that on the isothermal line of 41°, the mean temperature of winter is 14°, and that of summer 66°.20—a result obtained from observations made in lat. 48°, on the Bay of St. George, Newfoundland. Now, according to the "Army Meteorological Register," this isothermal line is again found in the comparatively equalized climate of Fort Brady, at the outlet of Lake Superior, in lat. 46° 39′, where the mean temperature of winter is as high as 21°.07, whilst that of summer is only 63°.18. Again, the table shows that on the isothermal line of 50°, the mean temperature of winter is 30°.20, and that of summer 71°.60; but this too gives only a partial view, as at Fort Wolcott, Rhode Island, the former is 32°.51 and the latter 69°.06, and at Council Bluffs, near the junction of the Platte and Missouri, 24°.47 and 75°.82, thus showing that on the same isothermal line the disparity in the mean temperature of winter and summer is 14°.80 greater in an excessive than in a uniform climate.

It is only within the temperate zone, from about 30° to 60° of N. latitude, that the year exhibits the grateful vicissitudes of the four seasons,—the varied charms of spring and autumn, the tempered fires of summer, and the healthful rigors of winter. Wisdom desires not that "eternal spring," the want of which poets affect to deplore. At the equator, there is no difference between the mean temperature of summer and winter, but it increases, as a general rule, with the latitude. From Florida to Canada, the contrast in the seasons increases in proportion as the mean annual temperature decreases—a general law subject to modification on every parallel in accordance with the varieties in physical geography. The greatest and the least contrasts of winter and summer are exhibited at Fort Snelling and Key West; but as this point has been elucidated on every page, and as its various relations are presented in Abstracts A, B, C, of Appendix, it may be well to bring at once under notice a few of the laws determined by Humboldt.

"The winters of the isothermal curve of 68°," he says, "are not found upon that of 51°, and the winters of 51° are not met with on the curve of 42°. In considering separately what may be regarded as the same systems of climate, for example, the European Region, the Transatlantic Region, or that of Eastern Asia, the limits of variation become still more narrow. Wherever in Europe, in 40° of longitude, the mean temperature rises—

To 59°.—	The winters are from	44°.60 to	46°.40	And the summers from	73°.— to	75°.—
54 .50		36 .50	41 .—		68 .—	73 .—
50 .—		31 .10	37 .40		62 .60	69 .80
45 .50		28 .40	36 .10		57 .20	68 .—
41 .—		20 .30	26 .80		55 .40	66.20"

In the United States, if the comparison is confined to the same system of climates, as for example the posts on the ocean or lakes, or those remote from the agency of large bodies of water, the limits of variation, as in Europe, are also narrow ; but if the whole extent of our domain is embraced, the results are strikingly diverse. Thus :

	Mean Temperature.		
	Annual.	Winter.	Summer.
Fort Vancouver, Oregon Territory.	51°.75	41°.33	65°.00
Council Bluffs, junction of Platte and Missouri,	51°.02	24°.47	75°.82
Difference,	0°.73	+16°.86	—10°.82

But this contrast is exhibited in a still more marked degree by comparing the difference between the mean temperature of winter and summer, the former being 23°.67, whilst the latter is 51°.35.

"In tracing five isothermal lines between the parallels of Rome and St. Petersburg," continues Humboldt, "the coldest winter presented by one of these lines is not found again on the preceding line. In this part of the globe, those places whose annual temperature is 54°.50, have not a winter below 32°, which is already felt upon the isothermal line of 50°"

In the European climate, two points having the same winter temperature may differ as much as 11° in latitude. Thus in Scotland, in latitude 57°, and isothermal line 45°.50, the winters are more mild than at Milan, in latitude 45°28′, and isothermal line 55°.80. Consequently the lines of equal winter, cut isothermal lines which differ 10°. At the isle of Mangeroe, at the northern extremity of Europe, under the parallel of 71°, the winters are 7° milder than at St. Petersburg, latitude 59°56′. In the United States, embracing the whole region between the Atlantic and the Pacific, as great a contrast no doubt exists. The mean winter temperature of Fort Vancouver, Oregon Territory, latitude 45°37′, is found about 9° farther south at a point intermediate to Fort Gibson and Jefferson Barracks ; but if the observations, like those in Scotland just referred to, were made on the Pacific coast, (Fort Vancouver being seventy miles distant from the ocean,) the winter temperature would necessarily be still higher. As the mean annual temperature of Fort Vancouver is 51°.75, and that of the assumed point between Fort Gibson and Jefferson Barracks is about 61°, it follows that the lines of equal winter, cut isothermal lines which differ more than 9° Fahr. [*See Plate I.*]

In Europe a greater deviation from the terrestrial parallels is caused by the inflections of the isocheimal than by the isothermal lines ; for whilst two points having the same winter temperature may differ as much as 11° in latitude, a difference of not more than 5° is found between any two places having an equal annual temperature—disparities which increase as the eastern coast of Asia is approached. In the United States, the same law obtains ; for between the isothermal line of Fort Vancouver and the same in the Atlantic region, the difference is only about 4° of latitude. (*See Plate I.*)

The isotheral curves or lines of equal summer follow a direction opposite to that of the isocheimal lines. The region about Moscow and that about the mouth of the Loire, notwithstanding differing 11° in latitude, present the same summer temperature. Although this result as regards difference of latitude, is not discovered in the United States, yet the most extraordinary results in this respect have been demonstrated upon the same parallel running from the Atlantic through the great lakes. In the United States, the heats of summer are intense everywhere. At Fort Snelling, notwithstanding the isocheimal line is 54° lower than at Key West, the isotheral is only 8° lower. (*See Plate II.*) At Fort Vancouver, the mean summer temperature is 2° or 3° higher than on the same parallel in the region of the Atlantic and the great lakes, and about 7° lower than in the excessive climates of the same region. In tracing an isothermal line around the globe, we find that the same causes which, on the Atlantic coast of North America and in the north of China, depress the curves of equal annual heat, tend to elevate the isotheral curves or lines of equal summer.

The general and partial inflections of isothermal, isocheimal, and isotheral lines, might be profitably represented on charts, as shown in the two engravings of this volume. These graphical representations, as already observed, would throw light upon phenomena having a close relation to agriculture and the physical and political condition of mankind. Instead of tracing all these curves on the same chart, it would be advisable merely to add the indication of the mean temperature of summer and winter to the isothermal lines at their summits and depressions. Thus, in following the line of 51°, we find it marked in England $\frac{37^{\circ}.90}{62.\ 80}$, in Hungary $\frac{31^{\circ}.80}{70.\ 10}$, in China $\frac{21^{\circ}.10}{79.\ 20}$, in Western America, at Fort Vancouver, $\frac{41^{\circ}.33}{65.\ 00}$, and in Eastern America, at Council Bluffs, $\frac{24^{\circ}.47}{75.\ 82}$, and at Fort Wolcott, Rhode Island, $\frac{32^{\circ}.51}{69.\ 06}$.

As the geographical distribution of plants and animals appears to be chiefly regulated by the temperature of the atmosphere, there are many other relations developed in Abstracts A, B, C, of Appendix, useful to him disposed to classify facts of this kind. July, taking the mean of a series of years, is, throughout the United States, the hottest month in the year, with scarcely an exception ; and January, generally speaking, is the coldest month, but sometimes December or February gives a lower temperature. The least difference between the mean temperature of any two successive months, is that of July and August, and the next lowest is that between January and February. Between October and November, the difference is greatest at the southern posts ; but at the northern, on the ocean and the lakes, the difference between March and April, and between April and May, is about the same as that between October and November, whilst in the localities remote from large bodies of water, in these northern regions, the difference between October and November, is generally less than that of either of the two former. This last result arises from the circumstance that in excessive climes the increase of vernal temperature is very great.

The influence of temperature on the geography of plants, is ably pointed out by M. de Candolle. In considering its relation with the organic life of plants, it is necessary to keep in view three objects :—1. The mean temperature of the year ; 2. The extreme of temperature both in regard to heat and cold ; and 3. The distribution of temperature among the different months of the year. The last is the most important ; but in the investigation of vegetable geography, it is requisite to estimate the simultaneous influence of all physical causes,—soil, heat, light, and the state of the atmosphere as regards its humidity, serenity, and variable pressure. Each plant has generally a particular climate in which it thrives best, and beyond certain limits it ceases to exist. Hence, having seen the great variations of summer and winter temperature on the same isothermal line, the absurdity of limiting a vegetable production to a certain latitude or mean annual temperature, is apparent. To say that the vine, the olive, and the coffee-tree, require, in order to be productive, annual temperatures of 53°.60, 60°.80, and 64°.40, is true only of the same system of climate. As the annual quantity of heat which any point of the globe receives, varies very little during a long series of years, the variable product of our harvests depends less on changes in the mean annual temperature, than in its distribution throughout the year. Thus climates in regard to vegetable productions, are strongly characterized by the variations which the temperature of months and seasons experience. The cotton plant finds its most favorite climate between the equator and latitude 34° ; but it succeeds with a mean summer temperature of 75° or 73°, if that of winter do not descend below 36° or 38°. In the United States, it is cultivated in latitude 37°, and in Europe in latitude 40°. Whilst the sugar cane is cultivated in Europe as far north as latitude 36°, in a mean annual temperature of about 67°, its cultivation in the United States, on account of the low winter temperature, is prevented beyond latitude 31° ; but it succeeds on the great table-plain of Mexico and Guatimala, where an altitude of 6000 feet converts a tropical into a temperate climate. In Europe, the olive ranges between latitude 36° and 44°, that is, in a mean annual temperature from 66° down to 58°, provided the mean temperature of summer is not below 71°, nor that of the coldest month below 42°, which last excludes all the United States beyond latitude 35°. For the same reason, the date, palm, and sweet orange, grow in Louisiana only to latitude 30°. In Europe, the favorite climate of the vine is between latitude 36° and 48°, that is, between the isothermal lines of 62° and 47°.50, provided the winter line is not below 33°, nor the summer under 66° or 68°. Such is the case in Europe to latitude 50°, and in the United States to latitude 40° ; but on the Pacific coast of our territory, the requisite temperature is found at Fort Vancouver, which is in the latitude of Montreal Indeed, we know that on our western coast, the olive is successfully cultivated in about latitude 38° ; and that cotton and sugar cane would succeed on parallels corresponding to Europe, is an opinion that has for its basis the fundamental truth that the laws of nature never vary.*

The influence of the unequal distribution of heat upon vegetable geography is beautifully illustrated in the four systems of climate demonstrated on the same parallels in the Northern Division of the United States; and if we extend the comparison to the Pacific coast, a fifth system may be enumerated on the same latitude. Taking the coast of New England, the region of the Lakes, and the Pacific coast, the difference between the mean temperature of winter and spring varies from 6°.67 to 18°.42; whilst in the excessive climate of the regions west of the Lakes, and intermediate to them and the Atlantic, this difference ranges from 18°.82 to 30°.83; and accordingly we find, as already explained, that spring and summer are confounded with each other, and that the sudden excess of heat renders the progress of vegetation almost perceptible. It is necessary, however, to add, that the low ratio of 6°.67 occurs on the Pacific coast, the lowest average in the Northern Division of the United States being 11°.67. In the Middle and Southern Divisions, this vernal increase of temperature gradually diminishes, until finally at Key West it is only 5°.99. But there is another important feature to be observed. Not only is the vernal increase greater in excessive climes; but, as it supervenes upon a lower winter temperature, the effect produced on the development of vegetation is in an inverse ratio. The vernal increase of 30°.83, for example, at Fort Snelling comes upon a mean winter temperature of 15°.95, whilst at Fort Sullivan, on the same parallel, the increase of only 17°.16 follows a winter temperature as high as 22°.95. In Abstract B of Appendix, showing the difference between the mean temperature of each month and each season, the relations of this subject may be traced out in detail. Between northern and southern latitudes, this contrast is still more marked; for, whilst at Fort Snelling there is a difference of 13°.46 between the months of February and March, and at Key West only 1°.56, the temperature of February at the former is 18°.66 and at the latter 72°.15.

This subject too has been set in a clear light by that oracle of nature, Humboldt. In regard to the climate of Europe, he determined

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* The author has recently seen it stated, on the authority of a traveller, that as high as the 45th°, the fig, citron, orange, lemon, pomegranate, and cotton plant, flourish.

—1. That whenever the division of the annual heat among the seasons is very unequal, the increase in the vernal temperature is very great, (from 14°.40 to 16°.20 in the space of a month,) and equally prolonged; 2. That in the temperate portion of Europe, the vernal increase is great, (from 9° to 10°.80,) but little prolonged; 3. That in an insular climate, the increase of the vernal temperature is small, (scarcely 7°.20,) and equally prolonged; and 4. That the vernal increase, in every system of climate, is smaller and less equally prolonged in low than in high latitudes.

Upon this subject, *viz.*, The Physical Distribution of Plants—Humboldt seems to have bestowed much attention. His subjoined division of the northern hemisphere into six isothermal bands, conveys, however, very erroneous impressions, from the circumstance mostly that his limits of the Old World are confined to Western Europe, and of the New World to Eastern America:—

I. This Isothermal band is the region of Palms and Bananas, with a mean temperature above 77° Fahr.; limits in Old World, lat. 32°—in New World, lat. 23° 30′.

II. Region of the Citron, with a mean temperature from 77° to 68°; limits in Old World, lat. 37° to 38°—in New World, lat. 29°.

III. Region of the Olive and Vine, with a mean temperature from 68° to 59°.

IV. Region of Wheat and the Evergreen Oak, with a mean temperature from 59° to 50°.71; limits in Old World, (Europe,) lat. 52° 25′, (China,) lat. 40°—in New World, lat. 42° 25′.

V. Region of Cerealia, with a mean temperature from 50° to 41°; limits in Old World, lat. 60°—in New World, lat. 48° to 50°.

VI. Region of the Pine, Birch, and Willow, with a mean temperature from 41° to 32°; limits in Old World, (Europe,) lat. 71°, (Asia,) lat. 66°—in New World, lat. 57° 8′.

It has been already abundantly shown that this distinction of the Old and the New World has no foundation in nature, inasmuch as the climatic features of the western coasts of both continents on the one hand, and of the eastern coasts on the other, exhibit a striking analogy. This general law is, in truth, proved by the above classification; for we find that when Humboldt extends his limits of the Old World as far as China, the isothermal band is lower than in Eastern America; and were the Pacific coast of America included in this comparison, it would be seen, as already demonstrated, that the isothermal zone would rise as high as in Western Europe. Moreover, no reference is made to the influence of the unequal distribution of the annual heat upon vegetation—a subject which is beautifully illustrated in the Northern Division of the United States.

It has been seen that the extremes of heat and cold do not occur at our most northern and southern posts, as these are situated on large bodies of water; but that the western stations, Snelling, Gibson, Council Bluffs, *etc.*, remote from inland seas, are remarkable for extremes of temperature. It is here that the mercury rises the highest and sinks the lowest, whilst Forts Brady and Mackinac, the most northern stations, as well as those on the southern coast, exhibit a lesser range of the thermometer; and in accordance with the same law, we find that the mean summer temperature is greater at Augusta, Georgia, than along the coast of Florida. Whilst at Key West, during a period of six years, the thermometer never rose above 90°, it attained at Council Bluffs, a point 17° 12′ farther north, a height every year varying from 102° to 108°. The highest temperature in the shade noted at our various posts, was at Fort Gibson, on the 15th of August, 1834, being 116°.* In Africa, the mercury is sometimes seen at 125°, and in British India it is said to have been as high as 130°. It has been remarked, that on the coast of Senegal the human body supports a heat which causes spirits of wine to boil, and that in the north-east of Asia, it resists a cold which renders mercury solid and malleable. Although the mean annual temperature, in proceeding from the equator towards the poles, gradually diminishes, yet the thermometer scarcely mounts higher at the equinoctial line than under the polar circle.† Hence it follows

* It may be worthy of remark, that when this observation was made by Dr. J. B. J. Wright, of the Army, he had the benefit of two thermometers, one of which indicated 117°. Moreover, the instruments were in a situation unaffected, as much as possible, either by the direct or reflected rays of the sun, or by radiation of heat from surrounding bodies.

† The ancients believed that at the equator there existed an impassable zone of scorching heat, and that although the temperate zone of the southern hemisphere might contain inhabitants, yet that this burning intervening zone precluded all communication. This opinion of Aristotle was supported by Pliny, who makes the following observation :—"The temperature of the central region of the earth, where the sun runs his course, is burnt up as with fire. The temperate zones which lie on either side can have no communication with each other in consequence of the fervent heat of this region." Until the time of Christopher Columbus, this theory was not wholly disproved by modern discovery.

that the climate of the tropics is characterized much more by the duration of heat than its intensity.

Although the thermometer may be 15° or 20° higher here than in England, during the heats of summer, yet we suffer but little more from its effects; for, as the air of the latter country is more loaded with humidity, causing a diminution of the cutaneous and pulmonary transpiration—the evaporation of which constitutes a cooling process—a languor and a listlessness, with an indisposition to mental and corporeal exertion, are induced. In the transition of the air from a state of dryness to humidity, the indication of the barometer is distinctly at variance with our ordinary feelings. In damp weather, individuals of a delicate and enfeebled constitution, are wont to complain of the heaviness and inelasticity of the atmosphere; but moisture, so far from loading the air by its weight, causes, like heat, increased expansion and elasticity.

It is a generally received opinion, that in latitudes above 60°, the month that has the highest temperature is June, that in the more temperate regions it is July, and in more southern ones, August. Although July, with the exception of Jefferson Barracks and Fort Gibson, (see Abstract A of Appendix,) is the hottest month in the year at all the military posts of the United States, yet the law receives corroboration in the fact that the excess diminishes with the decrease of latitude. This result finds an explanation in the laws which regulate the earth's motion; for in latitudes beyond 60°, the sun's power is greatest at the summer solstice; whilst below this point, the parallels continue to receive additional heat for some time during his decline in the ecliptic, which tends to augment the temperature of the atmosphere. This subject is ingeniously explained by Garnier. To comprehend the influence of the sun, it is necessary to observe that its action is not manifested instantaneously, but that the heat produced is the effect of this action prolonged. The heat of day does not attain its maximum until some time after the sun has passed the meridian; and in regard to the year, the same fact obtains, for the greatest solstitial height is in June. The solar rays, at this period, continuously strike the earth almost perpendicularly during sixteen hours; and the heat thus accumulated during the day, cannot dissipate itself by radiation during the eight hours of the night. As this accumulation continues until the length of the night counterbalances that of the day, the maximum of heat is attained in July and August. As the torrid zone has nearly at all times a vertical sun, the temperature is there continuously high. In the frigid zones, as the solar rays are received very obliquely, and as the days and nights are alternately of long duration, the cold is excessive; whilst the temperate zones, which receive the sun under a mediate inclination, and are not exposed to long alternations of day and night, preserve a mean temperature.

In regard to the month that expresses the nearest equivalent to the mean annual temperature, there is considerable diversity of sentiment. According to Kirwan, it is the month of April, whilst Humboldt shows by tabular statements that October is better entitled to this characteristic. As the laws of nature are universal, these phenomena, like all others, must be susceptible of systematic arrangement; and lest it may be thought presumptuous in the author to attempt to decide between such high authorities, he may be permitted to say, that the diverse systems of climate presented in the United States, more especially on the same parallels in the Northern Division, afford a means of comparison doubtless heretofore unequalled. A careful examination of Abstract A of Appendix, will show that in *excessive* climates the mean temperature of April is generally as high as that of the year, whilst that of October is considerably higher; and in regard to *modified* climes, it will be found that the former is generally as much lower as the latter is higher. Now this relation is precisely what might have been anticipated, because the vernal increase of temperature is always much greater in excessive than in modified climates. Hence it follows that, in the former system of climates, April expresses a nearer equivalent, whilst, in the latter, October gives an approximation equally close—a decision of this long-mooted question which illustrates the ancient axiom that truth is never found in extremes.

There are of course two periods in the year when an equality with the annual temperature occurs. It has been ascertained by thermometers placed at different depths, from one to eight feet, that there exists a regular current of heat into the earth during the summer, as long as the mean temperature of the atmosphere is more elevated than that of the interior; and, on the contrary, that this current, during the winter, directs itself towards the surface to compensate the want of heat produced by the exterior cold. Thus, at a certain depth, an equilibrium of temperature is gradually established twice a year, that is, at the periods referred to in the preceding paragraph, perhaps generally in April and October.

Reference has already been made to a series of observations extending through the period of a year, under the direction of the author, on Bedloe's Island, in the harbor of New York. These observations consist in noting the temperature of the earth at the depth of thirty inches. They were made in a loose sandy soil, in which the thermometer, at each observation, was kept buried about two hours. In the summer, it was found that the mean temperature of the earth is lower than that of the superincumbent atmosphere, and that in winter it is higher; whilst at two periods in the year, about April and October, there is an equilibrium. Taking the mean of these subterranean observations for the year, it was ascertained that the result was the same as that given by the usual thermometrical observations made in the atmosphere. In the summer months, the variations of temperature beneath the surface, judging from observations made in the morning, at noon, and in the evening, seem to be as great as in the atmosphere; but as the former are uninfluenced by every change of wind, they are of course not so fluctuating during the twenty-four hours. In dry summer weather, there is little difference between the ground and atmosphere; but just after a rain, as the sandy soil becomes saturated with moisture, an observation beneath the surface at noon shows a temperature five degrees lower than that of the atmosphere. The surface of the earth to the depth of perhaps an inch has always a temperature very different from that of the air, being much higher during the day, and much lower during the night.

Occasional reference has been made to observations on the pluviometer; but the data furnished in the "Army Meteorological Register," as exhibited in Abstract D of Appendix, are not sufficiently extensive to authorize general conclusions. To determine the quantity of rain than falls upon any point of the earth's surface is an important element in meteorology. That the average quantity of rain, as a general rule, diminishes from the equator to the poles, is proved by the magnitude of the rivers within the tropics; for rivers are but the conduits along which a certain portion of the precipitated water is borne to the sea. From Uleaborg, Lapland, to St. Domingo, the annual quantity, though subject to great irregularity, varies from $13\frac{5}{10}$ to 150 inches. There is no regular average throughout a parallel; but nature has so arranged it that it is most copious in those latitudes in which evaporation is most rapid. There are, however, exceptions to this rule; for on several tracts of the earth's surface, as the Great Desert of Africa and the arid shores of Peru, it seldom or

tion; 3. The elevation of the place above the level of the sea; 4. The prevalent winds; 5. The form of lands, their mass, their prolongation towards the poles, their temperature and reflection in summer, and the quantity of snow which covers them in winter; 6. The position of mountains relatively to the cardinal points, whether favoring the play of descending currents or affording shelter against particular winds; 7. The color, chemical nature, and radiating power of soil, and the evaporation from its surface; 8. The degree of cultivation and the density of population; and 9. Fields of ice, which form, as it were, circumpolar continents, or drift into low latitudes.

A principal cause of the rise of the isothermal line on the western coast of continents, is, the steady prevalence of westerly winds between the parallels of 30° and 40° of latitude; for there is thus swept from the ocean, which never sinks below the freezing point, a humid atmosphere, which, in its passage over the land, has a constant tendency to establish an equilibrium of temperature, and as its vapor is gradually condensed, it also evolves its latent heat. The influence of the ocean in modifying climate, as has been seen, is all-controlling—a fact strongly illustrated by the circumstance that the decrease of heat, as we recede from the equator, follows different laws in the two hemispheres. In the austral division of the globe, the annual temperature is lower. This arises from the circumstance that it contains less land—a cause which also produces a disparity in the duration of the seasons in the two hemispheres. The northern summer is eight days longer, and the winter is eight days shorter, than the southern. In the former, the heat of summer is, therefore, augmented, whilst the cold of winter is diminished. Intimately connected with this subject are land and sea-breezes, which are constant phenomena, especially in hot climates. The surface of the water is converted into vapor, which, having an increased capacity for caloric, abstracts it from all surrounding nature. Hence during the day, a current towards land is established; for the colder and more dense atmosphere will naturally assume the place of the warmer and more rarified. At night, on the contrary, as the land cools much more rapidly than the adjacent deep water, the reverse action obtains.

As the surface of deep collections of water, from the peculiar constitution of fluids, has a temperature different from that of the adjacent land, a great modification of climate is induced from this cause. Although capable, like solids, of conducting heat slowly through their mass, yet it is transferred principally in a copious flow by their internal mobility. As the heated portions of a fluid float on the surface, whilst the colder will sink by their superior gravity, it follows that the bed of a very deep pool is always excessively cold. Few or no experiments have yet been made on the lakes of the United States. According to Saussure, the bottoms of the majestic basins of the Alps, whether in the lower plains or elevated regions, are nearly all equally cold, being only a few degrees above the point of congelation. In Lake Geneva, at the depth of 1,000 feet, this accurate observer found the temperature to be 42°; and beyond 160 feet beneath the surface, he could discover no monthly variation. In the lakes of Scotland, the variable impression of the seasons would appear not to penetrate more than fifteen or twenty fathoms; and consequently, below this point, a uniform coldness prevails. Hence it is that the deep lakes of our northern latitudes are not, during the most rigorous winters, completely frozen over; and hence, too, it follows that when in winter the temperature of the superincumbent air of these lakes approximates the freezing point, as the surface of the water exposed to the atmosphere descends, whilst the deep subjacent strata, by the law of specific gravity, ascends, the atmosphere, as our meteorological data demonstrate, must have a higher mean temperature than over land; and in the summer, on the other hand, as water accumulates less heat than land, opposite phenomena, independent of the agency of the vapor adverted to above, are evidenced.

Even in the process of freezing, the evolution of heat checks the decline of temperature. Thus in Artic regions, the inequality of the seasons is being constantly tempered by the freezing of the water and the melting of the ice. As the rigor of winter, when darkness resumes her reign, is mitigated by the heat evolved as congelation spreads over the watery surface, the land animals and plants are thus saved from destruction. On the contrary, the fields of ice and vast beds of snow, which cover the land and the sea in those dreary wastes, absorb, in the act of thawing or returning to the liquid state, the intense heat produced by a nightless summer. In the Arctic regions, were they entirely of land, neither plants nor animals could exist.

The temperature of the air during a thaw is generally colder than when the ground is actually covered with ice—an effect produced by the absorption of heat from the atmosphere. Upon the same principle, a frost raises the temperature; for when water assumes the solid state, it gives out as much heat as it receives during the process of liquefaction. A mass of ice, for example, at 32° Fahr., must absorb 140° of caloric, that is, 140° inappreciable by the thermometer and the sensation of touch, before it can be liquefied.

When it is considered that seven-tenths of the superficies of our globe are covered with water, the mind is apt to dwell upon it as "a dreary waste of waters." But the earth without an ocean would be an arid and unfruitful desert; and hence incapable of producing any vegetable substance, it would be unfit for the residence of man as well as subordinate animals.

The influence of currents of air, by mixing the temperature of different localities, in modifying climate and causing variations of weather, is well known. The direction, the intensity, and the nature of winds, as already observed, depend upon local and general exposure, the vicinity of seas, the elevation and relative position of mountains, and other circumstances. Localities having a southern exposure, will have a much higher temperature than places lying north or to the windward of a chain of mountains. As regards the effects of winds on the temperature of a place, there is a great difference between the lower and the higher latitudes. In the former, a change of wind rarely raises or depresses the thermometer more than a few degrees; while in the higher latitudes, it frequently happens that in several hours a change of 10° or 12°, and even more, takes place. Captain Scoresby mentions an instance near the polar ice, in which the mercury fell in sixteen hours 34°, namely from +32° to −2°; and in our northern states, intense cold is felt when the winds blow from the frozen regions around Hudson's Bay. From snow-clad mountains, gusts of cold air, called snow-winds, rush down and cool the adjacent plains, whilst currents of air traversing extensive deserts of burning sand, accumulate an astonishing degree of heat. The effects of winds combine utility and pleasure. By maintaining a perpetual agitation of the atmosphere, the miasmata exhaled from the earth are dissipated; whilst the clouds destined to fertilize the soil, are transported upon their wings. As nature adapts means to the accomplishment of her ends, so myriads of seeds, furnished with their little pinions, ride upon the tempest and extend afar the empire of vegetation. Nor has man, in his ingenuity, neglected to avail himself of this agent; for, as the ocean is the highway of nations, the winds are the untiring coursers which impel our ships from shore to shore.

Nor are clouds less important in the economy of nature. Water is thus transported from the ocean to inland countries, which would otherwise suffer from deprivation. They greatly mitigate the extremes of temperature. By day, they not only produce the agreeable vicissitude of shade and sunshine, but protect vegetation from the scorching influence of solar heat; and at night, the earth wrapt in its mantle of clouds, retains the caloric that it would otherwise lose by radiation, causing an extreme of temperature prejudicial to vegetation. We thus discover, in addition to the reasons already assigned, another cause of the modified temperature of positions on large bodies of water; for, as the sky is more subject to be overcast by clouds than in the opposite localities, the radiation of heat to the heavens at night will be correspondently diminished.

The agency of snow in affording protection to vegetable substances on the surface of the earth, may be explained in the same way. Instead of acting merely as a shield against the cold of the atmosphere, it obviates the occurrence of the low temperature which bodies on the surface of the earth acquire, during still and clear nights, by the radiation of their heat to the heavens. Although a thick covering of snow causes the surface of the earth to be warmer; yet, as the radiation and conduction of heat from the ground are prevented, a greater degree of cold must necessarily occur in the lower atmosphere. The agency of layers of straw, *etc.*, in preserving vegetation from the injurious effects of a low temperature, is thus in part to be explained.*

Climate is influenced also by the chemical and geological character of the earth. One soil quickly parts with its acquired heat, whilst another retains it tenaciously. The temperature of regions whose surface is covered with sand is higher than that of those in which it consists of clay or some other compact earth; and rocky soils and barren deserts are much warmer in summer than countries covered with vegetation on the same parallels.

Currents in the ocean and the accumulation of ice which drifts into comparatively low latitudes, tend, likewise, to produce an unequal distribution of heat. The oceanic current, which flows by the east-

* The researches of Dr. W. C. Wells on this subject, in his "Essay on Dew," are exceedingly valuable.

ern coast of North America, is a cold polar stream, sweeping immense masses of ice into lower latitudes, thus cooling the surrounding seas, and giving to the winds which blow from them a harsh and chilling influence. As some of these ice-islands tower two hundred feet above the surface of the sea, and as we know that floating ice never shows more than one-eighth of its bulk above the surface, the conclusion that they have the vast magnitude of sixteen hundred feet in thickness, is warranted.* The Gulf-stream, the most powerful

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* Some conception of the character and extent of these immense fields of ice, observed during the last year, may be formed from the subjoined extract from the log-book of the packet ship "South America":—

April 18, 9 A. M.—Began to make the floating ice. We immediately shortened sail, and hove to, as it was snowing at the time. In the course of half an hour, the weather cleared up. The first officer went aloft with a spy-glass, and as far north as he could see, there was nothing but a solid mass of ice. We then put the ship before the wind, and run down SSW., at the rate of seven miles per hour, until three o'clock in the afternoon, constantly passing between immense islands of ice, full two hundred feet high. A large ship was astern of us, standing in the same direction, distant about two miles. So high were the icebergs, that she would frequently entirely disappear from our sight behind some one of them. We ran along the immense body of ice fifty miles, looking for an opening, when we discovered immediately ahead two barks, two brigs, a French lugger, and a large American ship, which afterwards proved to be the packet Gladiator, from London. They were steering at the time more to the westward. We immediately hauled up, in hopes they had found an opening, but soon discovered that they were fast in the ice. We then kept more to the south, constantly passing between the islands, luffing and keeping away from the cakes of ice, as the occasion required. The first officer being aloft, reported, that as far south and south-east as he could see from the fore-top gallant yard, nothing but immense icebergs and floating ice appeared. We then hauled up west, and run our ship into the smaller cakes of ice, till she nearly stopped. During this time there was a heavy swell from the eastward, which greatly helped to force the ship through into clear water, which we then distinctly saw about three-fourths of a mile ahead. We left in the ice the two barks, two brigs, and the French lugger, lying perfectly still, but as the wind came out SSE the next day, they no doubt got through.

On the 18th and 19th of April, the steamship "Great Western," encountered a field of ice perhaps 100 miles in extent. The largest iceberg was three quarters of a mile long, and the highest one was 100 feet above the surface of the water. About 300 were seen by this vessel. The field-ice varied in thickness from two to four and a half feet. The lowest temperature of the water was 25°, and of the air, 28° of Fahr. Some icebergs were met as low as 42° of latitude—a point at which it is not usual to see them before May or June. By different vessels, the ice was encountered over an extent of seven degrees of latitude, that is, from the fortieth to the forty-seventh degree. In May, extensive fields of ice were still encountered, often carrying plump seals in considerable numbers. Many vessels were injured and several lost by coming in contact with icebergs or being encompassed by these floating fields—the probable fate of the Steamship "President." That the unseasonableness of the weather in our middle and northern States, the latter part of last April and the early portion of May having the aspect of March, is attributable, at least partially, to this cause, will scarcely admit of doubt.

of known currents, has its source in the Gulf of Mexico, the waters of which, according to Major Rennell, are 7° warmer than those of the Atlantic in the same latitude. Pouring forth an unceasing current through the straits of Bahama at the rate of three or four miles an hour, this great cauldron of warm water, which is one of the most singular phenomena in hydrography, exercises an opposite influence to that of the prodigious ice-bergs, which, driven down into Hudson's Bay or into the wide Atlantic, diffuse excessive cold over the adjoining continent; but this influence of the gulf-stream, it will be shown, is nearly altogether expended on the European shores. The gulf-stream, as it skirts the great bank of Newfoundland, still retains a temperature of 9° above that of the adjacent sea. At this point, it is deflected south-eastward by a southerly current from Baffin's Bay, and passing the Azores and Canary Isles, it returns, in a great measure, into itself, and repeats its circumgyration. The Azores, it reaches in about seventy-eight days; and having extended its course to the Bay of Biscay, it still retains, after flowing nearly 4000 geographical miles, an excess of 5° above the mean temperature of the surrounding waters.

From this general survey, as well as the preceding and subsequent application of these laws, we cannot fail to observe in a department of creation in which the designs of Providence have been regarded as most obscure, the harmonious results of operations apparently the most conflicting. The causes of climate constitute together a circle, of which we can designate neither the first nor the last concatenation. The general evaporation of water and its subsequent condensation, for example, play an important part in regulating the temperature of climates. Tropical countries, by the cold produced in the formation of vapor, are rendered habitable; whilst the latent heat given out to the ambient medium, as the vapor becomes condensed and descends in rain over the temperate and frigid zones, meliorates their rigor.

Where, indeed, do we not meet the evidences of design? As temperature decreases progressively with the elevation of land, great varieties of vegetation are presented in the same region. Whilst the flowers of Spring are unfolding their petals on the plains of Northern France, Winter continues his icy reign upon the Alps and Pyrenees. By this beneficent appointment of Nature, the torrid zone presents many habitable climates. On the great table-plain of Mexico and Guatimala, a tropical is converted into a temperate clime. As the vernal valley of Quito lies in the same latitude as the destructive coasts of French Guiana, so the interior of Africa may possess many localities gifted with the same advantages. In our own country, reference has already been made to the marked contrast between the Atlantic Plain and the parallel mountain ridges; but it is in the geographical features of Columbia, in South America, that we find most strikingly displayed the physical phenomenon of *height* producing the effect of *latitude*—a change of climate with all the consequent revolutions of animal and vegetable life, induced by local position. It is on the mountain slopes of from 3,000 to 7,000 feet, beyond the influence of the noxious miasmata, that man dwells in perpetual summer amid the richest vegetable productions of nature. In the mountains of Jamaica, at the height of 4,200 feet, the vegetation of the tropics gives place to that of temperate regions; and here, while thousands are cut off annually along the coast by yellow fever, a complete exemption exists. In these elevated regions, the inhabitants exhibit the ruddy glow of health which tinges the countenance in northern climes, forming a striking contrast to the pallid and sickly aspect of those that dwell below. In ascending a lofty mountain of the torrid zone, the greatest variety in vegetation is displayed. At its foot, under the burning sun, ananas and plantains flourish; the region of limes and oranges succeeds; then follow fields of maize and luxuriant wheat; and still higher, the series of plants known in the temperate zone. The mountains of temperate regions exhibit perhaps less variety, but the change is equally striking. In the ascent of the Alps, having once passed the vine-clad belt, we traverse in succession those of oaks, sweet chesnuts, and beeches, till we gain the region of the more hardy pines and stunted birches. Beyond the elevation of 6,000 feet, no tree appears. Immense tracts are then covered with herbaceous vegetation, the variety in which ultimately dwindles down to mosses and lichens, which struggle up to the barrier of eternal snow. In the United States proper, we have at least two summits, the rocky pinnacles of which shoot up to the altitude perhaps of 6,500 feet. Of these, Mount Washington, in New Hampshire, is one. Encircling the base is a heavy forest—then succeeds a belt of stunted firs—next a growth of low bushes—and still further up only moss or lichens, or lastly a naked surface, the summits of which are covered, during ten months of the year, with snow. Of the snow-capt peaks of Oregon, we possess no precise knowledge.

Several subjects of a general character remain to be brought under notice, *viz.*, 1. An inquiry into the causes why the western coasts of both hemispheres have a higher annual temperature than the eastern. 2. Whether the climate of a locality undergoes any permanent changes in a series of years. 3. Whether the climate of our north-western frontier resembles that of the Atlantic States on their first settlement.

As those who first observed the difference of climate between western Europe and eastern North America, were natives of the former, they of course regarded the climate of their own country as constituting the rule, and that of America as the exception; but when men of science came to generalize these facts, it was discovered that the eastern coasts of both continents have a lower annual temperature than the western in corresponding latitudes. These results find a satisfactory explanation in physical causes, thus demonstrating the harmony of the laws of climate throughout the globe. Europe is separated from the polar circle by an ocean, whilst eastern America stretches northward at least to the 82° of latitude. The former, intersected by seas, which temper the climate, moderating alike the excess of heat and cold, may be considered a mere prolongation of the Old World; whilst the northern lands of the latter, elevated from 3,000 to 5,000 feet, become a great reservoir of ice and snow, which diminish the temperature of adjoining regions. Thus Lapland, under the 72d°, experiences a less rigorous climate than Greenland under the 60th parallel. On the other hand, between the 40th parallel and the equator, the influence of land, if not very elevated, produces effects diametrically opposite; for, the surface of the earth absorbs a large quantity of caloric, which is diffused by radiation into the atmosphere. Thus Africa, as Malte Brun observes, " like an immense furnace, distributes its heat to Arabia, to Turkey in Asia, and to Europe." On the contrary, the north-eastern extremity of Asia, which extends between the 60th and 70th parallel and is bounded on the south by water, experiences extreme cold in corresponding latitudes.

Another cause of the higher temperature of Europe is, the gulf-stream, which stretches across the Atlantic between Cape Hatteras and the Azores, forming, nearly in the middle of the northern Atlantic, a lake of warm water, which, according to Rennell, is not inferior to the Mediterranean in extent. Whilst a cold polar stream sweeping immense masses of ice into lower latitudes, is directed upon the coast of North America, the warm air of this ocean-lake is wafted over the whole of the coasts of western Europe, from Cape Finisterre to North Cape; and these winds even penetrate through the wide gate between the Hartz mountains and the Scandinavian ranges, into the recess of the Baltic.

As the gulf-stream approaches much nearer to the coast of North America than that of Europe, and the temperature of its waters is also higher near the former, it may be objected that the effect here described, applies rather to the New than to the Old World. But this ocean-current along the coast of America is of comparatively inconsiderable width, being opposite Charleston only from sixty to sixty-three miles across. At Cape Hatteras it turns to the east, and opposite the great bank of Newfoundland, after a course of 1,300 miles, its waters have lost only 5°, the temperature being from 8° to 10° above that of the adjacent seas. It is in these colder regions that the most marked influence of the gulf-stream upon temperature is manifested; and when we consider that here westerly winds prevail, it follows that by far the greater portion of the warm air arising from this source, must be wafted to countries lying to the leeward of these winds.

The western coasts of the two worlds, it appears, resemble each other only to a certain point. The coast of New California and the embouchure of the Columbia, according to Humboldt, are like that of Europe as far as 50° or 52° of latitude. From the same writer as well as Anglo-American travellers, we learn that at Nootka, in the island of Quadra and Vancouver, and almost in the latitude of Labrador, the smallest rivers do not freeze before the month of January. Near the mouth of the Columbia, Captain Lewis saw the first frosts on the 7th of January, and the rest of the winter he represents as mild and rainy. The climate of this region, however, has been fully investigated in the preceding pages—an investigation based chiefly on observations made by John Ball, Esq., of Troy, New York, at Fort Vancouver, on the Columbia River.* These observations, it is true, embrace but a single year; but as the results confirm those of Humboldt and others, and as constant climes exhibit comparatively little annual variation in the phenomena of temperature, they are entitled to every consideration. Moreover, the region of Oregon having come within a few years to be regarded as a very important part of

* See Silliman's Journal, Volume xxv. and xxviii.

our national domain, the inquiries instituted by Congress in regard to its climate and productions, all coincide in the same results.

The following comparative view shows the difference between the mean temperature of winter and summer on the eastern and western coasts of the two continents :—

Points of Comparison.	Isothermal Line.	Difference between the mean temp. of Winter and Summer.
America, eastern coast,............	53°.60	43°.60
Asia, eastern coast,...............	53°.60	55°.80
Europe, western coast,.............	53°.60	28°.30
America, western coast,............	51°.75	23°.70

The first three results on the same isothermal line are furnished by Humboldt. Unable to obtain the same annual temperature on our Pacific coast, it becomes necessary to take a lower isothermal line, (that of Fort Vancouver,) which of course gives a contrast in the seasons correspondently greater. The table, however, shows conclusively that the climate of the New World, viewed in its general features, is, contrary to general opinion, less excessive than that of the Old. Comparing our eastern coast with that of Asia, the difference between the mean temperature of winter and summer is found to be 12°.20 less ; and comparing our western coast, notwithstanding the isothermal line is lower, with that of Europe, a difference of 4°.60 less is exhibited. It may be necessary to add that, with the exception of the last, the author is not aware of the local position of these points of comparison—a consideration of some importance, inasmuch as the Northern Division of the United States presents, on the same isothermal line, a difference between the mean temperature of winter and summer, varying from 38° to 54°.

In attempting to account for the extraordinary dissimilitude in the climate of our two coasts, we observe on the eastern side an unascertained prolongation of the continent towards the pole and an oceanic current sweeping immense masses of ice southwardly ; whilst on the western side, the great range of Rocky Mountains shelter Oregon from the polar winds, and the projecting mass of Russian America protects it from the polar ice. Reference has already been made to the westerly winds, which transport the tempered atmosphere of the Pacific over the land ; and conversely, the same winds in traversing the continent, bear upon their wings the accumulating cold towards our eastern shores.

Connected with this subject is the question frequently agitated, whether the Old Continent is warmer than the New. Volney and others have attempted its solution by a comparison of the mean annual temperatures of different places on both sides of the Atlantic; but to this mode of determining it, the objection at once presents itself, that the points of comparison represent opposite extremes in the climate of each continent. Indeed, the question in itself involves an absurdity; for, as the laws of nature are unvarying in their operation, and as similar physical conditions obtain in corresponding parallels of both continents, the same meteorological phenomena will be induced. It shows in lively colors the truth of the remark, that every physical science bears the impress of the place at which it received earliest cultivation. In geology, for example, all volcanic phenomena were long referred to those of Italy; and in meteorology, the climate of Europe has been assumed as the type by which to estimate that of all corresponding latitudes. In making a comparison of the two continents, it is, therefore, necessary that both points have the same relative position. Fort Sullivan, Maine, notwithstanding it is more than 11° south of Edinburg, Scotland, exhibits a mean annual temperature 5½° lower; Bordeaux, which is parallel with Fort Sullivan, has an annual temperature 15° higher; and the mean of Stockholm, in lat. 59° 20′, is about the same as that of Fort Sullivan, in lat. 44° 44′. These are not, however, legitimate points of comparison. Pekin and Philadelphia, each on the eastern coast of its respective continent, are fair examples, having the same latitude, a similar relative position, and consequently the same mean annual temperature. The same coasts of each northern hemisphere, it has been seen, present little difference as regards annual temperature; but in the New World, by the same comparison, the seasons are less contrasted.

Does the climate of a locality, in a series of years, undergo any permanent changes? Does the climate of our north-western frontier resemble that of the Eastern States on their first settlement?

In regard to the former and present temperature of the surface of the earth, M. Arago, in an article inserted in the *Annales de Chimie et de Physique*, arrives at the conclusion that in Europe in general, and in France in particular, the winters were, in former ages, at least as cold as at present. This opinion is founded upon the alleged fact of the congelation of rivers and seas at a very ancient period. He thinks that the conquests of agriculture, such as the opening of forests and the draining of marshes, as well as the confinement of water courses to their channels, have caused a sensible elevation of the mean temperature.

The winters of the south of Europe, in the time of the first Roman Emperors, were, according to the concurring testimony of many authors, much more severe than now. That the rivers of Gaul and Germany were always frozen during winter, is mentioned by Diodorus Siculus. Juvenal, in recording the ceremony of a superstitious rite performed by a female, refers to the necessity of breaking the ice of the Tiber:

> Hybernum fracta glacie descendet in amnem,
> Ter matutino Tiberi mergetur.—*Sat. vi. line* 521.

Virgil recommends great attention to young sheep, lest the cold should destroy them:

> ——Glacies ne frigida lædat
> Molle pecus.—*Geo. lib. iii. l.* 298.

Again, Ovid, in lamenting, in pathetic strains, his banishment, takes notice of the freezing of the Euxine, and of the congelation of wine in its vicinity:

> Ipse vides certe glacie concrescere Pontum;
> Ipse vides rigido stantia vina gelu.—*Ex Ponto, lib. iv. Epist.* 7.

As much importance has been attached to these classic records by many, with the view to establish the opinion that the climate of Europe, two thousand years ago, was much more rigorous than now, the author has been at some pains to collect historical facts enough to disprove this conclusion, which is, moreover, adverse to the deductions warranted by the laws of climate established by these researches. As we have no exact instrumental observations of temperature that go back much farther than a century, our information in regard to more remote periods being derived from loose notices scattered through the old chronicles, relative to the state of the harvest, the quality of the vintage, or the endurance of frost and snow in the winter, great allowance must be made for the spirit of exaggeration which tinges all rude historical monuments. The facts stated by the Roman poets, if not exaggerated, doubtless stand isolated, not unlike that recorded in relation to the Baltic, which, in 1688, was so firmly frozen that Charles XI. of Sweden crossed it with his army, or the similar circumstance that in 1780, horse and artillery were transported over the ice in the harbor of New York. It appears, indeed, from historical evidence, that the most remarkable extremes of heat and cold have been frequently recurring ever since the time of the Romans referred to above. A few examples will be here adduced :*—In A. D. 401, the Black Sea was entirely frozen over. In 763, the same occurred both in regard to the Black Sea and the Straits of Dardanelles. In some places, the snow rose fifty feet in height, and the ice was so heaped up in the cities as to push down the walls. In 1133, the Po was frozen from Cremona to the sea. In many parts of Italy, the roads were rendered impassable by the heaps of snow ; and by the action of the frost, wine-casks burst in the cellars, and even trees split with immense noise. In 1234, the Po was again so firmly frozen, that loaded wagons crossed the Adriatic to Venice ; and at Ravenna, a pine forest was killed by the frost. In 1408, not only was the Danube frozen over, but also the sea between Gothland and Zeland, and between Norway and Denmark ; and in France, the vineyards and orchards were destroyed. In both 1468 and 1544, the winter in Flanders was so severe, that the wine distributed to the soldiers was cut into pieces with a hatchet. In 1571, all the rivers in France were covered with solid ice, and the fruit trees, even in Languedoc, perished. In 1621–2, the rivers of Europe were mostly frozen, and even the Zuyder Zee. The Hellespont was covered with a sheet of ice, and the Venetian fleet became blocked up in the lagoons of the Adriatic. The winters of 1658, 9, and 60 were intensely cold throughout Europe. In Italy, the rivers bore heavy carriages, and so much snow had not fallen at Rome for several centuries. It was in 1658 that Charles X. of Sweden crossed the Little Belt over the ice, from Holstein to Denmark, with his whole army, horse and foot, with a train of baggage and artillery. In 1670, the cold was most intense in England and Denmark ; both the Little and Great Belt were frozen. Again in 1684, in England, many forest trees, and even oaks, were split by the intensity of the frosts. In 1709 occurred what has been called by distinction, "the cold winter." In Europe, all the rivers and lakes, and even the seas to the distance of several miles from the shore, were frozen. It is

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* These facts are taken from a volume published in London in 1830, by Taylor, who says that he extracted them from the work of Offeffor of Germany, entitled "*The History of Climates and Changes*," compiled from an old work published by Pilgram at Vienna, in 1788, combined with the observations made by Professor Plaffof Keil

said that the ground was penetrated by the frost to the depth of three yards. The more tender vegetation in England was killed, and wheat rose in price from two to four pounds a quarter. In the south of France, the olive plantations were almost all destroyed. The Adriatic was quite frozen over, and even the coasts of the Mediterranean about Genoa; and in the mildest parts of Italy, the citron and orange trees suffered severely. In 1740, the cold was scarcely less intense than in 1709. In Spain and Portugal, the snow lay eight or ten feet deep. The Zuyder Zee was frozen over, and many thousand persons walked or skated on it. At Leyden, the thermometer fell ten degrees below the zero of Fahrenheit's scale. All the lakes in England were covered with ice; a whole ox was roasted on the Thames; many trees were killed by the frost; and postillions were benumbed on their saddles. In both the years 1709 and 1740, the General Assembly of the Church of Scotland, on account of the dearth which then prevailed, ordained a national fast to be held.

These examples might be much multiplied and continued up to the present day, reference having already been made to the rigorous winter of 1780 in the United States.

In regard to high summer heats, during the same period, a similar series of facts might be presented. In one year, the springs dried up; in another, the reapers dropped dead in the field; in a third, eggs were roasted in the sand; again, the heat and drought were so great, that not only were the springs dried up, but the Rhine and Danube exposed their dry beds.

By those that maintain that climates have become more uniform, it is stated, on the contrary, that Pliny, the younger, had a country seat in Tuscany, where he could not raise olives, myrtles, and similar plants, which now attain the greatest perfection. Cæsar, when he invaded Britain, found the climate milder than that of Gaul. He mentions that corn did not come to maturity in the northern provinces of the latter, and that the inhabitants of the former went about unclothed. As an evidence of the views entertained of the climate of Britain, it may be stated that the Emperor Probus promulgated special instructions in regard to the planting of vines and the making of wine. The highest hills of Scotland, it is said, were formerly covered with trees, which have disappeared probably with the diminished temperature of the climate. The culture of the vine, in the twelfth century, had attained such perfection in England, especially in the Vale of Gloster, that wine was made in abundance, and of a quality little inferior to that of France. The statistical records of Scotland show that wheat was formerly paid to religious institutions from lands, on which the raising of that grain is now impracticable; and it appears that there was carried on, even during the sixteenth century, a considerable export trade in corn. That the vine was cultivated as a common plant in Scotland, is evident from the provident regulations passed in the reign of the earlier Jameses.*

It is thus seen that historical testimony neutralizes itself. One alleges that the climate of Europe has become colder, asserting, by way of evidence, that grain and fruit will no longer come to perfection in regions in which they formerly flourished and were perhaps indigenous; whilst another maintains the contrary, affirming that plants are now cultivated in the North of Italy, which formerly could not be preserved during the winter. So far from meliorating the climate of England and Scotland, cultivation of the soil, it might be inferred from the facts stated, has exerted an opposite tendency. And as regards Italy, was it not in as high and general a state of cultivation in the days of Augustus as at any period since his reign? In viewing the contradictory statements made in reference to these early periods, it must be borne in mind that the discovery of the thermometer dates back only to the year 1590, and that it was not until the year 1700 that the instrument became sufficiently improved to warrant a comparison of observations. Although the mean annual temperatures, as has been ascertained, vary from one another irregularly, either a few degrees above or below the *absolute* mean temperature of the place; yet, it has not been found that the temperature of a locality undergoes changes in any ratio of progression. So far, then, all observations confirm the belief in the stability of climates. As regards the seasons, it will be shown, however, that in countries covered with dense forests, the winters are longer and more uniform than in dry, cultivated regions, and that in summer, the mean temperature of the latter is higher.

In regard to the opinion generally entertained, that the climate of Europe has been very much meliorated since the days of Julius Cæsar, it is then clearly apparent, from the foregoing facts, that it is far from being sustained by evidence sufficient to enforce conviction.

Changes of climate in the New World also are alleged to have

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* These historical facts are taken chiefly from a curious book by Foster on "Atmospheric Phenomena."

supervened. Mr. Jefferson, in his Notes on Virginia, makes the following observation:—"A change in our climate, however, is taking place very sensibly. Both heats and colds are becoming much more moderate within the memory of even the middle-aged. Snows are less frequent and less deep; they do not lie below the mountains more than one, two, or three days, and very rarely a week. They are remembered to have been formerly frequent, deep, and of long continuance. The elderly inform me that the earth used to be covered with snow about three months in every year. The rivers which seldom failed to freeze over in the course of the winter, scarcely ever do so now. This change has produced an unfortunate fluctuation between heat and cold in the spring of the year, which is very fatal to fruits."

Upon this subject, Dr. Rush remarks:—"From the accounts which have been handed down to us by our ancestors, there is reason to believe that the climate of Pennsylvania has undergone a material change. * * * The springs are much colder, and the autumns more temperate, insomuch that cattle are not housed so soon by one month, as they were in former years. * * * Rivers freeze later, and do not remain so long covered with ice."

By Williams, the historian of Vermont, the following observations are made:—"When our ancestors came to New England, the seasons and the weather were uniform and regular; the winter set in about the end of November, and continued till the middle of February. During this period, a cold, dry, and clear atmosphere prevailed, with little variation. Winter ended with the month of February: and when spring came, it came at once, without our sudden and repeated variations from cold to heat, and from heat to cold. The summer was suffocatingly hot; but it was confined to the space of six weeks. Autumn began with September, and the whole of the harvest was got in by the end of that month. The state of things is now very different in the part of New England inhabited since that time: the seasons are totally altered; the weather is infinitely more changeable; the winter is grown shorter, and interrupted by great and sudden thaws. Spring now offers us a perpetual fluctuation from cold to hot and from hot to cold, extremely injurious to vegetation: the heat of summer is less intense, but of longer continuance: autumn begins and ends later, and the harvest is not finished before the first week in November: in fine, winter does not display its severity before the end of December."

These opinions were quoted, more than forty years ago, by the celebrated Volney, in his "View of the Climate and Soil of the United States of America," to show that this climate, like that of Europe, grows more mild in proportion to the extent of cultivation. Now, admitting that such a change has occurred in the European climate, it were no easy matter to determine this question in respect to our own country by reference to these quotations. Instead of confirming, they may be just as aptly cited to disprove his position; for, it is remarked by Jefferson that the change "is very fatal to fruits," and by Williams, that it is "extremely injurious to all vegetation."

It has been further asserted, after the loose manner of the foregoing quotations, that on comparing the results of recent observations on our frontier with the best authenticated accounts we have of the climate of the Eastern States in their early settlement, a close similitude is found. The winters, it is said, have grown less cold and the summers less warm—consequences, which are ascribed to the clearing of the forest and the cultivation of the soil. That the climate of the Lakes resembles that of the sea-coast, is very apparent; but that the region intermediate or the one beyond, ever maintained such a relation, is an assumption contrary to the laws of nature.

Dense forests and all growing vegetables doubtless tend considerably to diminish the temperature of summer, by affording evaporation from the surface of their leaves, and preventing the calorific rays from reaching the ground. It is a fact equally well known that snow lies longer in forests than on plains, because, in the former locality, it is less exposed to the action of the sun; and hence, the winters, in former years, may have been longer and more uniform. As the clearing away of the forest, causes the waters to evaporate and the soil to become dry, some increase in the mean summer temperature, diametrically contrary to the opinion of Jefferson and others, necessarily follows. It is remarked by Umfreville that, at Hudson's Bay, the ground in open places thaws to the depth of four feet, and in the woods to the depth only of two. Moreover, it has been determined by thermometrical experiments that the temperature of the forest, at the distance of twelve inches below the surface of the earth, is, compared with an adjacent open field, at least 10° lower, during the summer months; whilst no difference is observable during the season of winter.

It may, therefore, be assumed that although cultivation of the soil may not be productive of a sensible change in the mean annual temperature, yet such a modification in the distribution of heat among the seasons may be induced as will greatly influence vegetation.

As heat and cold applied to our senses, are only relative terms, it follows that nothing short of thermometrical data will serve to determine the question of change of climate. In elucidation of this point, Table [I], on the following page, which gives a comparative view of the temperature of Philadelphia at intervals of about a quarter of a century, is presented.

So far as these observations extend, no support is given to the opinion of Jefferson, that "both heats and colds have become more moderate;" on the contrary, there appears a successive increase in the mean annual temperature, the range of the thermometer, and the mean temperature of summer and winter. On the supposition that these observations were made within the city proper, the increased temperature may be referred to the rapid growth of Philadelphia; for, a comparison of London and its environs shows that the annual temperature of the former is 1°.58 greater—a law observed in all the seasons.

The annexed abstract of observations, Table [K], page 100, made at Salem, Massachusetts,—a point free from any agency which a large town may exercise,—shows a most remarkable uniformity in the seasons during a period of thirty-three years. These observations, which were noted by the venerable Dr. Holyoke, have been transcribed from the original manuscript. The first four series give each a mean of seven years, and the last an average of five years. These observations, notwithstanding the rapid agricultural improvement of this region, show no permanent change of climate and very little variation in the same season.

In regard to this table, it may be added that the results confirm all the laws established in the preceding pages in reference to the difference between the mean temperature of winter and summer, between winter and spring, and between the warmest and coldest month, as well as the mean annual range of the thermometer. Compared with similar latitudes in the interior remote from the agency of large bodies of water, the contrasts are very marked.

Has the earth, in regard to its temperature, arrived at a permanent state? This is a question asked by the learned M. Arago, in his instructions to the officers of the exploring ship, *la Bonite*. The solution of this question, he says, seems to require only a direct compa-

[I]

Table of Thermometrical Observations at Philadelphia at intervals of twenty-five years.

Philadelphia.	Mean Annual Temperature.	Extreme Range of the Thermometer.			Mean temperature of the seasons. Winter.	Spring.	Summer.	Autumn.	Mean temperature of each month. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1771, 1772, and 1775,	52°.72	90	3	87	34.06	50.88	71.62	54.32	33 44	34.35	39.68	49.73	63.23	68.02	75.02	71.83	62.84	56.28	43.84	34.38
1798, 1799, and 1800,	53 .92	96	5	91	33.02	52.44	75.03	55.21	32.86	32 20	40.25	54.36	62.70	72.33	76.27	76.50	67.20	55.70	42.73	34.00
1822, 1823, and 1824,	54 .90	96	-7	103	32.23	52.11	76.16	59.10	31.12	29.94	40.26	51,98	64.09	73.88	79.49	75.11	71.28	57.19	48.83	35.64

[K]

Table of Thermometrical Observations during thirty-three years, at Salem, Massachusetts, Latitude 42° 34′, Longitude 70° 54′.

Salem.	Mean Annual Temperature.	Extreme Range of the Thermometer.			Mean temperature of the seasons. Winter.	Spring.	Summer.	Autumn.	Mean temperature of each month. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1st Series,	47°.92	96	-11	107	29.21	46.09	69.42	50.31	24.80	25.07	36.25	45.15	56 .87	67.21	71.29	69.75	61.31	49.54	40.09	27.77
2d "	49 .49	99	-11	110	28.00	47.30	71.57	51.10	26.62	27.99	36.16	47.44	58 .29	68.42	73.45	72.85	63.65	50.90	38.74	29.40
3d "	49 .79	99	- 3	102	29.73	46.71	70.69	52.04	26.94	29.56	36.18	46.62	57 .32	67.80	72.94	71 32	64.14	51.99	40.00	32 68
4th "	48 .22	100	- 7	107	27.68	45.11	68.70	51.40	24.23	27.22	33.75	46.32	55 .26	66.00	70.48	69.63	62.57	52.28	39.36	31.58
5th "	47 .65	101	-11	112	25.85	44.64	68.45	51.68	24.24	24.16	33.82	44.55	55 .54	65.06	71.83	68.45	61.47	50.95	42.61	29.15
Mean of 33 years,	48 .61	101	-11	112	28.09	45.97	69.77	51.31	25.44	26.96	35.32	46.11	56.28	67.01	72.01	70.52	62.70	51.15	40.01	30.18

rison between the mean temperatures of the same place, taken at two remote periods. But in reflecting upon the effect of local circumstances—in seeing to what a degree the vicinity of a lake, a forest, a mountain naked or wooded, a plain sandy or covered with grass, will modify temperature, it is apparent that thermometrical data alone will not suffice, unless we can be assured that between the two periods, this tract of land, and even the surrounding country, have not, either in their physical aspect or mode of culture, undergone any material change. This, as is seen, complicates the question very much; for, with positive data susceptible of exact appreciation, there become mixed up collateral circumstances before which the philosophic mind rests in suspense. M. Arago, therefore, suggests another mode, which is free from complication. This consists in observing the temperature in the open sea, remote from continents. Were such meteorological data bequeathed from age to age, the question would admit of solution.

As the earth is continually receiving heat from the sun, it follows that, if no caloric is thrown off into surrounding space, its mean temperature must be continually augmenting. It has been accordingly inferred that the increase of temperature is at the rate of 1° in 80 years. The changes of climate alleged to have gradually supervened during successive ages in many countries, and particularly in the west of Europe, might be thus explained. But the celebrated La Place has attempted to show, from astronomical observations, that the mean temperature of the earth has undergone no sensible change during the last 2000 years.

In regard to the region west of the Alleghanies, the opinion was early entertained that the climate is milder than that of the district east. Mr. Jefferson estimated the difference equivalent to 3° of latitude, as similar vegetable productions are found so many degrees farther north. These phenomena, M. Volney ascribed to the influence of the south-west winds, which carry the warm air of the Gulf of Mexico up the valley of the Mississippi. As North America has two mountain chains, extending from north-east to south-west, and from north-west to south-east, nearly parallel to the coasts, and forming almost equal angles with the meridian, Humboldt endeavored to explain the migration of vegetables towards the north, by the form and direction of this great valley which opens from the north to the south; whilst the Atlantic coast presents valleys of a transverse direction, which opposes great obstacles to the passage of plants from one valley to another. The tropical current or trade-wind, it is said, deflected by the Mexican elevations, enters the great basin of the Mississippi and sweeps over the extensive country lying east of the Rocky Mountains; and that when this current continues for some days, such extraordinary heat prevails even through the basin of the St. Lawrence, that the thermometer at Montreal sometimes rises to 98° of Fahr. In winter, on the contrary, when the locality of this great circuit is changed to more southern latitudes, succeeded by the cold winds which sweep across the continent from the Rocky Mountains or descend from high latitudes, this region becomes subject to all the rigors of a Siberian winter.

Upon the fallacy of these views, it is deemed unnecessary to dilate. It is proved by thermometrical data, as shown in Abstracts A, B, C, of Appendix, that the climate west of the Alleghany is more excessive than that on the Atlantic side—a condition that would seem unfriendly to the migration of plants. Thus Jefferson Barracks, on the Mississippi, exhibits a greater difference in the seasons than Washington city; and the same is true in regard to Fort Gibson and Fort Monroe, notwithstanding the former is 1° 32′ farther south. That the climate of the peninsula of Michigan encompassed by ocean-lakes, should prove genial to plants that will not flourish in the same latitudes in the interior of New York, seems consonant with the laws of nature; and hence the fact contained in the following extract from a letter to Sir Humphry Davy by Chancellor De Witt of New York, seems in no wise extraordinary :—" There is evidently a considerable difference between the climates of the eastern and western parts of our State. The Cayuga and Seneca lakes are situated about 150 miles in a direct line west of Hudson's river, and each is nearly forty miles long and from one to three and a half miles wide, both having their centres very nearly in the latitude of Albany, and yet they have hardly ever been known to be frozen over, excepting at their extreme ends, whilst Hudson's river never fails being frozen, commonly for two or three months in the year, for many miles to the south of Albany, not unfrequently to the distance of 100 miles, so as to bear the travelling of horses and carriages on it. While peaches and nectarines are raised here with some difficulty, they flourish nowhere better than in the western part of our State."

As the author has found the opinions of M. Volney, as well as those of Rush and Jefferson, quoted as oracular in every work professing to treat of our climate, it may not be amiss to examine this subject a little more in detail. This French philosopher has the singularly bad fortune of adopting the errors of Dr. Rush and Mr. Jefferson. For example, according to the former, as we recede from the ocean into the interior of Pennsylvania, "the heat in summer is less intense,"—a phenomenon contrary to every law of nature, unless reference was had to the Alleghany elevations; and, in accordance with the latter, the climate becomes colder as we proceed westward on the same parallel until the summit of the Alleghany is attained, when this law is reversed until we reach the Mississippi, *where it is even warmer than the same latitude on the sea-board.* This theory, by the way, is based upon the *testimony of travellers;* and "their testimony," says Jefferson, "is strengthened by the vegetables and animals which subsist and multiply there naturally, and do not on our sea-board." "As a traveller," adds Volney, "I can confirm and enlarge upon the assertion of Mr. Jefferson;" and in regard to the temperature of the regions lying east and west of the Alleghanies, he concurs in the opinion, "that there is a general and uniform difference equivalent to 3° of latitude in favor of the basin of the Ohio and the Mississippi." This conclusion, which is not deduced from thermometrical data, rests, it will be observed, upon the phenomena of temperature and of vegetation exhibited in the region of the great Lakes. "Even as high up as Niagara," he continues, "it is still so temperate that the cold does not continue with any severity more than two months, though this is the most elevated point of the great platform—a circumstance totally inconsistent with the law of elevations." He proceeds to say that this climate does not correspond with similar parallels in Vermont and New Hampshire, "but rather with the climate of Philadelphia, 3° farther south. * * At Albany, no month of the year is exempt from frost, and neither peaches nor cherries will ripen." The influence of the great Lakes in modifying temperature has been already so abundantly demonstrated, that further illustration is deemed supererogatory. The phenomena observed by Volney are truly facts; but the causes being unknown, the theory in regard to the difference of temperature east and west of the Alleghanies, was naturally suggested. Instead of deducing general laws from universal facts, it is thus seen that the theory of Volney and Jefferson was a premature deduction—the result of hasty and partial generalization.

The difference of climate, according to Volney, is not discovered south of latitude 36°, or north of 44° or 45°, thus modifying the

the theory of Jefferson. "Scarcely have you passed," he says, "the south shore of Lake Erie, when the climate grows colder every minute in an astonishing degree." This remark expresses only a partial truth; for this modified temperature is found along the whole course of the great lakes, whereas, proceed in any other direction, north or south, east or west, and you discover the seasons more strongly contrasted. "It is evident then," he continues, "that beyond a certain latitude the climate west of the Alleghanies is not less cold than its parallels on the east; and this latitude, the mean term of which appears to be about 44° or 45°, taking for its limits the great lakes, and more particularly the chain of the Canadian or Algonquin mountains, from this very circumstance confines the hot climate of the western country to a space of 9 or 10 degrees, which is surrounded on three sides by mountains."

M. Volney next enters upon an extended investigation of the system of winds in the United States; and the ignorance of this celebrated traveller in thus attempting to explain the meteorological phenomena peculiar to the region of the Lakes, shows how little was known forty years ago of the laws of meteorology. In reference to the Trans-Alleghany region, he thus remarks:—"I think I have clearly demonstrated, that the south-west wind of the United States is nothing but the trade-wind of the tropics turned out of its direction and modified, and that consequently the air of the Western Country is the same as that of the Gulf of Mexico, and previously of the West Indies, conveyed to Kentucky. From this datum flows a natural and simple solution of the problem, which at first must have appeared perplexing, *why the temperature of the Western Country is hotter by* 3° *of latitude than that of the Atlantic coast*, though only separated from it by the Alleghany mountains. The reasons of this are so palpable that it would only be wearying the reader to give them. Another consequence of this datum is, that the south-west winds being the cause of a higher temperature, it will extend the sphere of this temperature so much the farther, the greater the facility with which it can pervade the country; and this affords a very favorable presage for the parts that lie in its way, and are exposed to its influence, namely those in the vicinity of Lakes Erie and Ontario, and even all the basin of the river St. Lawrence, into which the south-west wind penetrates."

Now these are the opinions still maintained at the present day, to account for the supposed fact of the higher temperature of our tramontane region. It is a good rule in philosophy to ascertain the truth of a fact before attempting its explanation—a truism, the observance of which would have saved M. Volney the labor of constructing his complex theory of the winds. All thermometrical observations confirm the law that in proportion as we recede from the ocean or inland seas, the climate grows more excessive ; and that the meteorological phenomena of the region of the great lakes do not arise from the agency of tropical winds, is apparent from the single fact, that the winters are several degrees warmer, and the summers at least ten degrees cooler, as regards the mean temperature of these seasons, than positions 100 miles distant, notwithstanding on the same parallel or even directly south, and consequently equally exposed to the current from the Gulf of Mexico. Volney's theory, in truth, bears a contradiction upon its own face ; for, whilst he ascribes the modified climate of the lakes to the agency of tropical winds, he admits that the intermediate country traversed by these winds has a much more rigorous climate.

The influence of predominant winds is manifest, however, throughout the United States ; for, one prevailing wind, the south-west, blows from a warm sea,—another, the north-east, from a frigid ocean,—and a third, the north-west, from frozen deserts.

The modification in the climate of the valley of the Mississippi, whatever may be its degree, arises from the combined agency of the Gulf of Mexico and the great lakes ; for, if land were substituted for the area of the latter, (93,000 square miles,) that region would become, so far as the social state of man is concerned, scarcely habitable. This is well illustrated in Lyell's Geology, in which are given maps of the world, showing that change in the position of land and sea might produce the extremes of heat and cold in the climates of the globe, though having the same shape and relative dimensions as now. Upon the same principle, a partial change would induce a corresponding modification of temperature. "Let us suppose," says Lyell, " those hills of the Italian peninsula and of Sicily, which are of comparatively modern origin, and contain many fossil shells identical with living species, to subside again into the sea, from which they have been raised, and that an extent of land of equal area and height, (varying from 1,000 to 3,000 feet,) should rise up in the Arctic Ocean, between Siberia and the North Pole. * * The alteration now supposed in the physical geography of the northern regions, would cause additional snow and ice to accumulate where now there is usually an open sea ; and the temperature of the greater part of Europe would be somewhat lowered, so as to resemble more nearly that of corresponding latitudes of North America : or, in other words, it might be necessary to travel about 10° farther south in order to meet with the same climate which we now enjoy. No compensation would be derived from the disappearance of land in the Mediterranean countries ; but the contrary, since the mean heat of the soil in those latitudes is probably far above that which would belong to the sea, by which we imagine it to be replaced."

The opinion that the climate west of the Alleghany range is milder by 3° of latitude than that east,—an opinion quoted generally by writers as an established fact,—arose from the circumstance that the United States present on the same parallel different systems of climate—causes upon which the geographical distribution of plants depend. The influence of the unequal distribution of heat among the seasons upon vegetable geography, has already been fully noticed. In reference to the organic life of plants, it is well known that to some, entirely different constitutions of the atmosphere are adapted. In respect to the culture of vegetables, it is necessary to keep in view three objects,—the mean temperature of the summer, that of the warmest month, and that of the coldest month ; for some plants, indifferent to high summer temperature, cannot endure the rigors of winter ; others, slightly sensible to low temperature, require very warm but not long summers ; whilst to others, a continuous rather than a warm summer seems best adapted. The development of vegetation in the same mean temperature, is also retarded or accelerated, according as it is struck by the direct rays of the sun, or receives the diffuse light of a foggy atmosphere. On these causes depend, in a great degree, those contrasts of vegetable life observed in islands, in the interior of continents, in plains, and on the summits of mountains. As the region of the great Lakes does not exhibit a greater contrast in the opposite seasons than that of Philadelphia, it follows that plants which, from not being adapted to extremes of temperature, cannot endure the severe winter of Albany, will flourish in the more equalized climate of the two former regions.

Thus, as Volney and Jefferson saw that the vegetation of Philadelphia is found in the modified climate of our northern Lakes, whilst similar plants will not flourish on the same parallels in the interior of New York, Vermont, and New Hampshire, the theory in regard to the difference of temperature, east and west of the Alleghanies, was naturally suggested. If, however, these philosophers had chanced to observe the vegetation, by way of comparison, along the coast of Rhode Island or Connecticut, and on the same parallel in Illinois or farther westward, instead of the Lakes and Albany, the world would, *of course*, have been edified with the opposite theory, *viz.*, that the climate east of the Alleghanies is milder by 3° of latitude than that west. Whilst at Fort Trumbull, Connecticut, the mean winter temperature is 39°.33, at Council Bluffs it is as low as 24°.47. Hence plants sensible to a low temperature, which flourish in the climate of the former, will perish in the latter; for whilst the mean temperature of the coldest month at Fort Trumbull is only 34°.50, at Council Bluffs it is 22°.61. This is also demonstrated by the average annual minimum temperature, that of the former being 9°, and that of the latter –16°; and equally so by the minimum temperature of the winter months, that of December, January, and February, being at Fort Trumbull respectively 20°, 10°, and 16°, and at Council Bluffs –4°, –13°, and –11°. On the other hand, it will be found that the vegetables which can endure the rigorous climate of Council Bluffs, will flourish more vigorously than in the region of Connecticut; for at the former, the vernal increase is 27°.47, and at the latter only 11°.67. Moreover the latter increase is added to a winter temperature of 39°.33; whilst the former, added to 24°.47, more than doubles itself, the influence of which upon the sudden development of vegetation has been already pointed out. These relations, as developed in Abstracts A, B, C, of Appendix, might be traced out much farther. At Council Bluffs, the extreme of temperature in summer is also much greater than at Fort Trumbull, the mean maximum of the former being 104°, and of the latter 87°, and consequently the average annual range stands respectively as 120° to 78°. In addition to these facts, it may be observed, that so far as elevation is concerned, that of the Lakes being six hundred feet, and that of Albany only one hundred and thirty feet above the sea, the advantages of the comparison are on the side of the latter; but this gradual elevation, it has been shown, exerts no perceptible influence.*

The opinion that the climate of the States bordering the Atlantic on their first settlement, resembled that now exhibited by Fort Snelling and Council Bluffs, has been shown, it is believed, to be wholly

* This examination into the opinions of Volney and Jefferson would not have been deemed necessary, did those who so freely quote their writings state the collateral fact, that much of the evidence upon which their theory is based, consists of the casual observations of travellers.

gratuitous and unsustained by facts. No accurate thermometrical observations yet made in any part of the world, warrant the conclusion that the temperature of a locality undergoes changes in any ratio of progression; but conversely, as all facts tend to establish the position that climates are stable, we are led to believe that the changes or perturbations of temperature to which a locality is subject, are produced by some regular oscillations, the periods of which are to us unknown. That climates are susceptible of melioration by the extensive changes produced on the surface of the earth by the labors of man, has been pointed out already; but these effects are extremely subordinate, compared with the modification induced by the striking features of physical geography—the ocean, lakes, mountains, the opposite coasts of continents, and their prolongation and enlargement towards the poles.

But even Malte-Brun has ventured the assertion, that "France, Germany, and England, not more than twenty centuries ago, resembled Canada and Chinese Tartary—countries situated, as well as our Europe, at a mean distance between the equator and the pole." This illustration is certainly very unhappy; for, rejecting the pretended antiquity of the Chinese—the fables in relation to Fohi and Hoang-Ti, the former of whom, we are told, founded the empire of China about five thousand years ago, we must with Malte-Brun, date its origin at least eight or nine centuries before Christ. China should, therefore, possess a milder climate than Europe, inasmuch as agriculture is represented to have been always in the most flourishing condition. As the practice of fallowing is unknown, almost the whole arable land is constantly tilled, and even the steepest mountains, cut into terraces, are brought under cultivation. Now, as this country still presents a climate as austere as that of Canada in the same latitudes, the conclusion is irresistible, that in proportion as the leading physical characters of a region are immutable in their nature, does error pervade the remark of Malte-Brun—"That vanquished nature yields its empire to man, who thus creates a country for himself."

A partial view of this question, indeed, not unfrequently leads to the most absurd conclusions. In a respectable journal, several years ago, a writer, in an article on the "Climate and Vegetation of the Fortieth Degree of North Latitude," concludes his essay with the following remark:—"But there will doubtless be an amelioration in this particular, when Canada and the United States shall become thickly peopled and generally cultivated. In this latitude, then, like the same parallels in Europe at present, *snow and ice will become rare phenomena, and the orange, the olive, and other vegetables of the same class, now strangers to the soil, will become objects of the labor and solicitude of the agriculturist.*"

The fallacy of the opinion which ascribes the mild climate of Europe to the influence of agricultural improvement, becomes at once apparent, when it is considered that the region of Oregon, lying west of the Rocky Mountains, which continues in a state of nature, has a climate less contrasted than that of Europe in similar latitudes; and consequently it is in a proportionate degree milder than the climate of our own region, in which the labors of man, in a few ages, have almost wrought miracles, as well as that of the eastern coast of Asia, which has been under cultivation for several thousand years.

As any change in the present relation of the earth's surface would induce a corresponding alteration of climate, followed by modifications in the animal and vegetable kingdoms, great changes in the distribution of heat over the globe, have doubtless occurred at various periods in its physical history. It is believed by geologists, that the earth's surface has experienced great variations of climate since the deposition of the older sedimentary strata; but as a few thousand years are insufficient, except by a violent convulsion of nature, to affect the prominent features of physical geography, the history of man shows no well authenticated change in the general climate of any zone. It is manifest, however, that those causes are still in operation, by which regions once submerged are delivered up to man; whilst it is equally obvious that the sea makes rapid encroachments upon that which has for ages been his patrimony. The physical agents most active in altering the relative distribution of land and water, are, heat, air, and water itself, acting both chemically and mechanically. The soft breeze and gentle shower effect more in producing the series of changes constantly observed, than the devastating impetuosity of the volcano.

Of the superficies of the earth, it has been already remarked that seven-tenths are covered with water. The dry land in the northern hemisphere compared with that of the southern, according to Humboldt, stands in the ratio of three to one, and the land without the tropics as thirteen to one.* It is evident that this relation between land and

* The recent discovery of an Antarctic Continent modifies this relation.

water has not always existed. The presence of organic remains in rocks demonstrates that the loftiest elevations upon the surface of the globe were at some period beneath the surface of the ocean.

The doctrine of a permanent change, at uncertain periods, in the climate of a particular region, is confirmed by the existence in northern countries of organic remains, both animal and vegetable, possessing a close generic affinity with species now existing in warmer latitudes; and this opinion, reasoning from analogy, receives further corroboration from the fossil remains of extinct species. The vegetable geology of the coal regions of Pennsylvania, for example, show that, at the period of their formation, a climate entirely different from the present, existed. Many of the fossils found are different from any plants now known, being mostly of the cryptogamous class, including arborescent ferns of gigantic growth, all peculiar to tropical, or rather ultra-tropical, regions. Vegetables pertaining to families which are now mere herbs, attained at this epoch the dimensions of the largest trees. At Wilkesbarre, Pennsylvania, fern-leaves more than four feet across have been found. And in the basins of London and Paris, the fossil flora consists of palms, spice-bearing laurels, and other plants, from which the existence in those temperate latitudes, of a tropical climate, is obviously manifested. As the geologist contemplates, at different epochs, far greater alterations in sea and land than those which now cause countries on the same parallels to differ in climate, he can readily account for the existence, in northern latitudes, of fossil remains consisting mostly of genera now confined to warmer regions.

In regard to the coal-mines of Bohemia, the following eloquent language is used by Dr. Buckland :—"The most elaborate imitations of living foliage on the painted ceilings of Italian palaces, bear no comparison with the beautiful profusion of extinct vegetable forms with which the galleries of these instructive coal mines are overhung. The roof is covered as with a canopy of gorgeous tapestry enriched with festoons of most graceful foliage, flung in wild, irregular profusion over every portion of its surface. The effect is heightened by the contrast of the coal-black color of these vegetables, with the light ground-work of the rock to which they are attached. The spectator feels transported as if by enchantment, into the forests of another world; he beholds trees of form and character, now unknown upon the surface of the earth, presented to his senses almost in the beauty and vigor of their primeval life; their scaly stems and bending branches, with their delicate apparatus of foliage, are all spread before him, little impaired by the lapse of indefinite ages, and bearing faithful records of distinct systems of vegetation, which began and terminated in times of which these relics are the infallible historians. Such are the grand natural herbaria wherein these most ancient remains of the vegetable kingdom are preserved in a state of integrity little short of their living perfection, under conditions of our planet which exist no more."

Reference has already been made to the fact that mere change in the position of the land and sea of our globe, without altering their present shape and relative dimensions, would cause the extremes of heat and cold in climates now habitable. Hence, in surveying the physical revolutions by which our mountains have been upheaved, and the different groups of animal and vegetable fossil remains found embedded at different depths, each unlike all the others, the conclusion is obvious that there exists an inseparable relation between these successive groups and the corresponding periods of the earth's condition. How many of these groups have been successively created, or how long a period elapsed between the era of the creation of our globe and that of the formation of man,—opinions which do not necessarily conflict with the Mosaic account of the present race,—we know not; but we cannot resist the solemn conviction that we tread upon the wrecks of anterior worlds—the monuments upon which the hand of Time has engraven the history of this terraqueous globe!

NOTE TO PART FIRST IN REFERENCE TO THE HYGROMETER.

Dr. S. Forry:—

Dear Sir,—Agreeably to your request, I send you the following facts and remarks in relation to the *dew-point*, which, I trust, may not prove entirely destitute of interest, connected as they intimately are, with the influence of climate, whose laws and phenomena you have so admirably illustrated. By the dew-point is understood that degree of temperature, at which moisture begins to be deposited; and this is ascertained by an instrument called the Hygrometer. The quantity of vapor, or invisible steam in the atmosphere, is constantly varying, from variations in the temperature, and it even varies, when the temperature continues the same. When the air is nearly saturated, a very slight diminution of temperature is attended with the formation of dew; but if the air be dry, a body must be considerably colder, before moisture is deposited upon it; in short, the drier the atmosphere, the greater will be the difference between its temperature and the dew-point. It also follows, that when the dew-point is but slightly below the temperature, evaporation goes on very feebly, but then it increases in proportion to the number of degrees between the two. The drying power of the atmosphere has been expressed by Dr. Dalton, in numbers, but it is only another form of expressing the energy of evaporation. The same philosopher has constructed a very valuable table of the elastic force of vapor at different temperatures, by which it appears, that while at 32° it is only equal to 0.200, at 90° it is equal to a pressure of 1.36 inches of mercury. The important physiological consequences growing out of this law, I shall endeavor on another occasion to point out, but my limits at present, do not permit me to dwell upon them. I will however remark, that I have no doubt whatever, that the state of the dew-point, exerts far greater influence upon animal bodies, especially in the production of disease, than temperature itself. This arises chiefly from the circumstance, that a high state of the dew-point interrupts to a greater or less extent, the healthy function of the skin and lungs, two of the most important organs in the body. I maintain that perfect decarbonization of the blood, cannot take place in the lungs with a high dew-point, and consequently that the vital fluid cannot receive a sufficient quantity of oxygen, to fit it for those various offices, which it is designed to perform in the animal economy. An atmosphere with a high dew-point, moreover, rapidly carries off the vitreous electricity, which is doubtless intended to subserve an important end, as a vital stimulus. We find accordingly, that highly malignant fevers do not prevail where the dew-point is below 60°. The same is true of malaria. If we seek for the cause of the excessive fatality of tropical diseases, we shall find it in a dew-point of 70° or 80°. Evaporation from the surface of the body, is either checked, or the 53 ounces of fluid given off from the skin every 24 hours, in a moderate dew-point, is disposed of through some different channel, constituting a material derangement of the animal economy.

The dew-point in our climate, is fortunately, as a general rule, many degrees below the temperature of the atmosphere. It is but rare indeed, that they nearly or quite coincide; such weather is then called *close*, *sultry*, or *muggy*; and its depressing influence on the system, is too well known, to be described. The very color of the skin, to say nothing of the languor of the mind, and the debility of the muscular system, shows that the blood does not undergo the proper change in the lungs. The baleful *sirocco*, is nothing but an atmosphere set in motion, possessing a high dew-point.

It is to be regretted that so few observations have been made in the United States, in relation to the hygrometric condition of the air. The vast importance of the subject as connected with the health of our army and navy, has been, until recently, entirely overlooked. Permit me to congratulate the friends of science and humanity, that through the exertions of the able Surgeon General of the United States Army, this deficiency will no longer exist, at least, in one department of the public service.

The following abstract of a register of the Hygrometer, kept at Albany, N. Y., in 1836, by M. H. Webster, will convey a generally correct idea of the mean state of the dew-point in our latitude, remote from large bodies of water:—Jan. 18°.34, Feb. 12°.26, March 17°.23, April 31°.46, May 46°.49, June 59°.40, July 64°.14, August 56°.67, Sept. 54°.82, Oct. 35°.58, Nov. 91°.20.

These results are the mean of two daily observations for each month, the maximum and mimimum. On comparing these results with those obtained at Schenectady, for the corresponding months of the same year, I find but a very slight difference, not exceeding two degrees in any month, which can readily be explained from local causes. The same remark will apply to the relative state of the dew-point in the city of New York. It appears that the mean dew-point for the year, was 38.7; now in the city of Quebec, in the year 1829, the mean annual dew-point was 39.3, differing only 6-10ths of a degree, from the result obtained in Albany, in 1836. The mean dew-point for some of the months was as follows: April 31°.0, May 44°.6, June 51°.0, July 54°.0, Aug. 51°.5, Sept. 42°.5, Oct. 37°.7, Nov. 25°.6, Dec. 19°.0. This corresponds very nearly with the following estimate of the quantity of evaporation, at Ogdensburgh, N. Y., 1838, from actual experiment, by J. H. Coffin, Esq.: January 1.652, February .817, March 2.067, April 1.625, May 7.100, June 6.745, July 7.788, Aug. 5.475, Sept. 7.400, Oct. 3.948, Nov. 3.659, Dec. 1.446. Total for the year, 49.362.

By comparing the daily rate of evaporation with the hygrometer, it is readily seen that it does not correspond merely to the temperature, but to that and the low state of the dew-point. The best hours for taking the dew-point are 10 A. M. and 10 P. M. The dew-point in England, as shown by the results of the observations of the Meteorological Society of London, corresponds during the spring and summer months very closely with that obtained in New York, Canada, and New England; but during the winter months, the mean hygrometer is much higher. For example, the mean at London and Albany respectively was in November 38°.5 and 18°.34, December 35°.7 and 14°.26, January 33°.5 and 18°.34, February 35°.0 and 12°.26, March 36°.1 and 17°.23, April 37°.9 and 31°.46, May 45°.3 and 46°.46, June 56°.4 and 57°.40, July 58°.0 and 64°.14, August 57°.5 and 56°.67, September 55°.2 and 54°.82, October 47°.7 and 35°.58, November 38°.5 and 31°.20. In high northern latitudes, the dew-point and the temperature during the summer months, are often nearly or quite coincident. Thus Captain Parry, on board the Hecla, in 1824, found the dew-point June 6th 51°, the temperature, 52°; 10th dew-point 52°, thermometer 52°; July 9th dew-point 36°, thermometer 36°; 10th dew-point 32°, thermometer 34°; 11th dew-point 33°, thermometer 33°.

The *daily range* of the hygrometer in the United States, is much greater than in Great Britain, and the other European countries, and to this I attribute our greater liability to febrile disorders. Thus from hourly observations made by Professor Joslin, at Schenectady, during the 21st and 22d of March, 1836, the range of the hygrometer was found to be 17°. During the 21st and 22d of June, it was 4°; during the 21st and 22d of October, it was 15°; during the 21st and 22d of December, it was 36°. During the same hours, at Gardner, Maine, the range of the dew-point was 14°. At Columbia College, N. Y., during the 21st and 22d of June, 1838, Professor Renwick, found the range of the hygrometer to be 48°, (from 23° to 71°,) and approaching within 3° of the temperature of the atmosphere. According to the observations of the Meteorological Society of London, the range of the dew-point, during the same time, in that city, was but 2°. (the mean hygrometer, 58°.52, mean thermometer, 59°.64.) These hours have been taken, because they are those at which hourly meteorological observations have been made in different parts of the world, according to the recommendation of Sir John F. Herschell. The results of other periods of the year would undoubtedly be similar.

Such is a general view of the state of the dew-point north of the Tropics, liable, however, to certain modifications, from various local causes. Within the tropics, we find, as a general rule, a hygrometric condition of the atmosphere, vastly different from that which prevails within the temperate zones. With a high temperature, we have also a high dew-point. Captain Alexander states, that during his voyage to the river Gambia, Africa, the thermometer on the 6th of October, stood at 80° in the shade, while the Hygrometer stood at 70° ; on the next day during a *sirocco*,* the thermometer was 86°, the hygrometer 76°. In the Bight of Benin, the thermometer was 84°, the hygrometer 79°.

At the Island of St. Vincent, latitude 12° N. according to the Meteorological Report of the British Army Surgeons, the mean state of the dew-point was as follows:—January 68°.1, February 67°.1, March 67°.9, April 67°.9, May 69°.3°, June 69°.2, July 70°.2, August 69°.6, September 69°.6, October 69°.3, November 69°.4, December 67°.3 ; the mean dew-point for the year, in this Island, was 68°.8, the lowest monthly mean being 67°.1, in February ; the highest, 70°.2, in July. We need seek no other cause for the extreme unhealthiness of that station. On the table-lands of Columbia, under the Equator and in Mexico, the dew-point corresponds very nearly with that in our own latitude, as does also the mean annual temperature, and the inhabitants enjoy an equal degree of health. In Havana, Vera Cruz, and all places where the yellow fever and other high grades of bilious fever are prevalent, the mean state of the dew-point is very high.

The attention of scientific men has lately been called to this subject by T. Hopkins, Esq., in the London and Edinburgh Philosophical Magazine for February 1839, who attempts to identify *malaria*, and a high dew-point, and to account for the production of malignant fevers solely by the check thus given to evaporation from the surface of the body. Its *modus operandi*, however, appears to me to be different; a high dew-point not only gives efficiency to malaria by checking its elimination from the system, but it acts chiefly by preventing the separation of carbon by cutaneous and pulmonary transpiration ; hence the increased biliary secretion in hot climates. From experiments which I have in progress, I hope soon to be able to present to the public a table, showing the exact amount of carbonic acid thrown off by the skin and lungs, at each degree of the dew-point and the temperature of the atmosphere, which, I trust, may throw some light upon many of the hitherto hidden causes of disease. I am, very truly, yours, &c.

CHARLES A. LEE.

New York, Feb. 2nd, 1842.

* Dr. Miller, of the British Army states, (Mem. Wernerian Soc., vol. 5.) that when the *sirocco* prevailed at Corfu, the dew-point always rose high, often to 76°, while during the north winds it stood low, sometimes down to 5°. "Leslie's hygrometer," he remarks, "has explained some of the phenomena attending the *sirocco* wind, which is the S. W. and S. E., but more particularly the S. W. You will observe by the Register, the *extreme moisture* of all the south winds, and the no less remarkable dryness of the north winds. Meat will not cure, nor paint dry, during the prevalence of the sirocco."

ABSTRACT A, *exhibiting the mean temperature*

PLACES OF OBSERVATION.	Latitude.	Longitude.	No. of years of Observation.	Mean Annual Temp.	MEAN OF THE Winter.	Spring.
FORT VANCOUVER, *Oregon Territory*, . .	45°37′	122°37′	1	51.75	41.33	48.—
" BRADY, *Outlet of Lake Superior*, . .	46 39	84 43	6	41.39	21.07	39.49
HANCOCK BARRACKS, *Houlton, Maine*, . .	46 10	67 50	2	41.21	16.74	41.23
FORT SNELLING, *at the confluence of the St. Peter's and Mississippi*, ...	44 53	93 8	8	45.83	15.95	46.78
FORT SULLIVAN, *Eastport, Maine*, . . .	44 44	67 4	5	42.95	22.95	40.11
" HOWARD, *Green Bay, Wiskonsan*, .	44 40	87 . .	9	44.92	19.77	43.87
" PREBLE, *Portland, Maine*, ...	43 38	70 18	5	46.67	26.03	44.45
" NIAGARA, *Youngstown, N. Y.*, . .	43 15	79 5	2	51.69	30.46	47.23
" CONSTITUTION, *Portsmouth, N. H.*, .	43 4	70 49	4	47.21	28.39	45.22
" CRAWFORD, *Prairie du Chien*, . . .	43 3	90 53	2	45.52	19.90	45.28
COUNCIL BLUFFS, *near the junction of the Platte and Missouri*, ...	41 45	96 . .	5	51.02	24.47	51.94
FORT WOLCOTT, *Newport, R. I.*, - . . .	41 30	71 18	9	50.61	32.51	47.22
" ARMSTRONG, *Rock Island, Illinois*, .	41 28	90 33	4	51.64	26.86	50.85
WEST POINT, *New York*, ...	41 22	73 57	4	52.47	32.11	50.93
FORT TRUMBULL, *New London, Conn.*, .	41 22	72 5	2	55.—	39.33	51.—
" COLUMBUS, *New York Harbor*, . .	40 42	74 2	9	53.—	32.39	50.26
" MIFFLIN, *near Philadelphia*, . . .	39 51	75 12	2	55.28	33.11	51.44
WASHINGTON CITY, *D. C.*, ...	38 53	76 55	8	56.57	37.76	56.19
JEFFERSON BARRACKS, *near St. Louis*, . .	38 28	90 8	4	58.14	37 67	58.75
FORT MONROE, *Old Point Comfort, Va.*, .	37 2	76 12	5	61.43	45.17	58.91
" GIBSON, *Arkansas*, ...	35 47	95 10	3	62.90	44.31	62.49
" JOHNSTON, *Coast of North Carolina*, .	34 . .	78 5	5	66.96	52.48	66.50
AUGUSTA ARSENAL, *Georgia*, ...	33 28	81 53	5	66.01	51.43	65.89
FORT MOULTRIE, *Charleston Harbor*, . .	32 42	79 56	2	65.78	49 93	66.46
" JESUP, *near Sabine River, Louisiana*, .	31 30	93 47	8	68.03	53.19	67.93
CANTONMENT CLINCH, *near Pensacola*, . .	30 24	87 14	7	69.44	56.14	69.26
PETITE COQUILLE, *near New Orleans*, . .	30 10	89 38	4	71.25	59 26	69.97
FORT MARION, *St. Augustine, Florida*, . .	29 50	81 27	4	72.66	62 21	71.50
" KING, *Interior of East Florida*, . .	29 12	82 12	3	72.66	61.78	72.56
" BROOKE, *Tampa Bay, Florida*, . . .	27 57	82 35	5	73.42	64 76	73.11
KEY WEST *or Thompson's Island*, . . .	24 33	81 52	3	76.09	70.05	76.04
FOREIGN CLIMATES DESIGNED FOR THE PURPOSE OF COMPARISON.						
NORTH CAPE, *Norway*, ...	71°—	25°57′	.	32.—	23 72	29.66
ULEO, *Lapland*, ...	65 03	24 40	.	35.08	11.84	27.14
EDINBURGH, *Scotland*, ...	55 58	3 12	.	47.31	39.40	44.70
MOSCOW, *Russia*, ...	55 45	37 33	.	40.10	10.78	44.06
LONDON, *England*, ...	51 31	. 5	.	50.39	39.12	48.76
ENVIRONS OF LONDON, ...	. . .	. . .	.	48.81	37.20	48.06
PENZANCE, *England*, ...	50 7	5 20	.	52.16	44.66	49.66
PARIS, *France*, ...	48 50	2 20	.	51.50	38.43	50.40
NICE, *Italy*, ...	43 41	7 20	.	59.48	47 82	56.23
MONTPELIER, *France*, ...	43 36	3 58	.	57.60	44.20	53.33
ROME, *Italy*, ...	41 54	12 29	.	60.70	48.90	57.65
NAPLES, *Italy*, ...	40 50	14 20	.	61.40	48 50	58.50
MADEIRA, *Island of*	32 37	. . . .	.	64.56	59.50	62.20
CAIRO, *Egypt*	30 2	31 20	.	72.12	58.25	73.58
CUMANA, *South America*, ...	10 27	64 24	.	81.86	80.24	83.66

of each month, each season, and the whole year.

TEMP. SEASONS.		MEAN TEMPERATURE OF EACH MONTH.											
Summ'r.	Autumn.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
65.—	52.67	38.—	43.—	44.—	46.—	54.—	63.—	66.—	66 —	61.—	54.—	43.—	43.—
63.18	45.22	18.68	19.80	27.37	38.50	52.56	59.13	65.90	64.52	56.25	45.52	33.91	22.28
62.93	43.41	9.40	14.35	26.39	43.85	53.45	61.25	64.10	63.43	51.58	45.84	32.80	26.48
72.75	47.35	13.58	18.66	32.12	46.—	62.11	70.83	75.47	71.98	59.41	49.27	33.36	15.60
62.10	46.78	20.83	20.68	30.98	39.69	49.65	57.92	64.55	63.82	57.28	47.22	35.83	27.35
69.82	46.47	18.14	20.16	31.19	43.28	57.13	68.38	72 25	68.83	57.61	47.51	34.29	21 —
67.06	48.91	21.82	24.94	33.41	45.44	54·49	64.29	69.71	67.19	59.—	49.28	38.45	31.32
72.19	56 98	26.86	25.20	34.39	47.52	59.77	68 90	74.60	73.06	63.85	58.94	48 12	39.32
65.72	49.95	24 50	27.10	34 60	45.31	55.55	62.80	67.89	66.47	59.09	50.43	40.32	33.58
70,79	46.67	19.72	21.93	32.48	43.92	59.45	68.57	72.40	71.41	61.50	45.45	33.06	18.04
75 82	52.46	22 61	26.59	37.43	51.82	66.56	73.98	77.38	76.11	65.24	53.65	38.50	24.21
69·06	53.84	29.93	31.06	37.94	46 41	57.32	65.54	71.45	70.18	63.68	54.45	43.39	36,53
75·91	52.69	23.78	26.28	37.47	51.26	63.83	73 59	77.92	76 21	63.67	54.58	39.82	30,53
72·86	53.21	27.97	30.27	39.30	51.57	61.91	70.48	74.14	73.96	62.87	53.11	43.64	38,10
71·89	57.61	34.50	39,53	42.77	51.—	59.22	68.67	73.87	73.12	68.02	58.10	46.70	43.95
73·70	55.53	30.08	31.22	39.61	49.89	61.27	70.52	76.—	74 58	66.72	55.82	44.05	35,86
77·93	58.32	23.54	28.67	38.69	52.16	63.46	75.23	81.57	77.—	73.35	57.20	44.40	37.16
76·74	56.87	36.11	37.81	45.96	55.73	66.88	75.07	78.51	76 63	68.50	57.17	44.93	39.36
78·45	57.59	34.59	36 36	47.76	59.69	68.90	76.58	79.04	79.74	68.57	56.84	47.37	42.07
78·31	63.33	42.83	44.85	50.67	58.24	67.83	75.78	79.65	79.50	72.72	63.78	53.49	47.82
81·14	64.90	45.47	41.25	53.51	61.28	72.69	78.65	81.49	83.28	74.61	65.95	54.12	46.20
80 31	68.52	51.42	52.19	60 52	65.28	73.70	78.98	81 57	80.39	76.32	69.11	60.13	53.83
81.06	65.49	48.63	53.16	58.57	65.78	73.31	79.88	82.17	81.14	74.26	65.84	56 36	52.49
80.27	67.02	50.73	46.24	59.—	65.47	74.92	78.86	81.99	79 96	76.19	67.32	57.56	52.81
82 48	67.99	52 30	54.09	61.79	66.81	75.20	80.95	83.54	82.96	77.14	68.29	58.55	53.17
82.24	69.98	54.36	55.98	62.92	68.62	76.24	81.59	82.96	82.27	78.35	70.27	61.13	58 07
83.46	71.60	55.98	60.12	63.56	70.—	76.35	82.95	83.95	83.47	80.58	72.12	62.09	61.68
82.30	72.51	60.73	64.97	67.55	70.06	76.89	81.41	82 81	82.67	80.16	73.83	63.55	60.92
84.20	72.08	60.81	65.28	65.56	73.31	78.81	84.94	84.03	83.63	81.52	72.81	61.98	59.25
81.25	71.41	63.08	65 78	68.56	72.79	77.99	80.79	81 74	81.23	79.95	75.23	69.06	64.42
81.39	76.96	67.93	72.15	73.71	75.69	79.22	80.51	82.59	81.06	80.89	76.76	73 23	70.08
43.34	32.08												
57.74	35.96												
57.30	47.86	40.17	39.54	39.60	45.84	48.67	54.85	59.31	57.74	55.61	48.37	39.60	38.50
67.10	38.30												
62 32	51.35	37.36	40,44	42.64	48.—	55.64	60.—	63.43	63.52	58.80	51.78	43.47	39.58
60.80	49.13	34.16	39.78	41 51	46 89	55 79	58 66	62.40	61.35	56.22	50.24	40.93	37.66
60.50	53 83	43.—	44.50	46.50	48.50	54.—	59.—	61.—	61.50	58.—	54.50	49.—	46.50
64.47	52.30	35.60	40.50	43.50	49.60	58.10	62.50	65.70	65.20	60.40	52.40	44.20	39.20
72.26	61.63	45.85	49.—	51.45	57.—	63.—	69.—	73.50	74.30	69.35	61.85	53.70	48.60
71.39	61.30	42.—	45.—	47.—	53.—	60.—	67.—	72.—	75.—	71.—	61.—	52.—	46.—
72.16	63.96	47.65	49.45	52.05	56.40	64.50	69.17	73.30	74.02	69.50	63.60	58.80	49.62
70.83	64.50	46.50	54.50	52 —	57.—	66.50	71.—	75.—	76.50	72.50	65.—	54.50	50.50
69.33	67.23	59.50	58.50	61.06	62.50	63 —	65.—	70.—	73.—	71.50	67.50	62.70	60.50
85.10	71.48	58.10	56.12	64.58	77.90	78.26	83.66	85.82	85.82	79.16	72.32	62.96	61.34
82.04	80.24												

ABSTRACT B, *showing the difference between the*

PLACES OF OBSERVATION.	Mean Annual Temp.	Difference of the Mean Temp. of winter & sum'er.	Diff. of the Mean Temp. of warmest & coldest m'ths.	Mean difference of the successive months.	DIFFERENCE SUCCESSIVE of winter and spr'g.	of spring and sum'r.
FORT VANCOUVER, *Oregon Territory*,	51.75	23.67	28.—	4.67	6.67	17.—
" BRADY, *Outlet of Lake Superior*,	41.39	42.11	47.22	7.79	18.42	23.69
HANCOCK BARRACKS, *Houlton, Maine*,	41.21	49.16	54.70	9.03	24.49	21.60
FORT SNELLING, *at the confluence of the St. Peter's and Mississippi*,	45.83	56.60	61.86	10.29	30.83	25.97
FORT SULLIVAN, *Eastport, Maine*,	42.95	39.15	43.87	7.22	17.16	21.99
" HOWARD, *Green Bay, Wiskonsan*,	44.92	50.05	54.11	9.02	24.10	25.95
" PREBLE, *Portland, Maine*,	46.67	41.03	47.89	7.98	18.42	22.16
" NIAGARA, *Lake Ontario, New York*,	51.69	41.73	49.40	8.22	16.77	24.96
" CONSTITUTION, *Portsmouth, N. H.*,	47.21	36.33	43.39	7.22	16.83	20.50
" CRAWFORD, *Prairie du Chien*,	45.52	50.89	52.68	9.06	25.38	25.51
COUNCIL BLUFFS, *near the junction of Platte and Missouri*,	51.02	51.35	54.77	9.14	27.47	23.88
FORT WOLCOTT, *Newport, Rhode Island*,	50.61	36.55	41.52	6.92	14.71	21.84
" ARMSTRONG, *Rock Island, Illinois*,	51.64	49.05	54.14	9.02	23.99	25.06
WEST POINT, *New York*,	52.47	40.75	46.17	7.69	18.82	21.93
FORT TRUMBULL, *New London, Conn.*,	55.—	32.56	39.37	6.39	11.67	20.89
" COLUMBUS, *New York Harbor*,	53.—	41.31	45.92	7.65	17.87	23.44
" MIFFLIN, *near Philadelphia*,	55.28	44.82	48.03	8.81	18.33	26.49
WASHINGTON CITY, *D. C.*,	56.57	38.98	42.40	7.07	18.43	20.55
JEFFERSON BARRACKS, *near St. Louis*,	58.14	40.78	45.15	7.53	21.08	19.70
FORT MONROE, *Old Point Comfort, Virginia*,	61.43	33.14	36.82	6.13	13.74	19.40
" GIBSON, *Arkansas*,	62.90	36.83	42.03	7.—	18.18	18.65
" JOHNSTON, *Coast of North Carolina*,	66.96	27.83	30.15	5.02	14.02	13.81
AUGUSTA ARSENAL, *Georgia*,	66.01	29.63	32.54	5.53	14.46	15.17
FORT MOULTRIE, *Charleston Harbor*,	65.78	30.34	35.73	6.25	16.53	13.81
" JESUP, *near Sabine River, Louisiana*,	68.03	29.29	31.24	5.21	14.74	14.55
CANTONMENT CLINCH, *near Pensacola*,	69.44	26.10	28.60	4.76	13.12	12.98
PETITE COQUILLE, *near New Orleans*,	71.25	24.20	27.97	4.66	10.71	13.49
FORT MARION, *St. Augustine, Florida*,	72.66	20.09	22.08	3.68	9.29	10.80
" KING, *Interior of East Florida*,	72.66	22.42	25.69	4.28	10.78	11.64
" BROOKE, *Tampa Bay, Florida*,	73.42	16.49	18.66	3.09	8.35	8.13
KEY WEST *or Thompson's Island*,	76.09	11.34	14.66	2.44	5.39	5.35
FOREIGN CLIMATES.						
NORTH CAPE, *Norway*,	32.—	19.62	24.28	. .	5.94	13.68
ULEO, *Lapland*,	35.08	45.90	53.82	. .	15.30	30.60
EDINBURGH, *Scotland*,	47.31	17.90	20.81	3.65	5.30	12.60
MOSCOW, *Russia*,	40.10	56.32	64.44	. .	33,28	23.24
LONDON, *England*,	50.39	23.20	26.17	4.36	9.64	13.56
ENVIRONS OF LONDON,	48.81	23.60	28.24	4.87	10.86	12.74
PENZANCE, *England*,	52.16	15.84	18.50	3.05	5.—	10.84
SOUTH WEST OF FRANCE,	55.29	26.42	30.87	4.47	12.08	14.59
ITALY,	59.46	27.56	32.10	5.75	11.53	16.03
MADEIRIA,	64.56	9.83	14.50	2.41	2.70	7.13
CAIRO, *Egypt*,	72.17	26.58	27.72	5.50	15.06	11.58
CUMANA, *South America*,	81.86	1.80	5.22	. .	3.42	1.62

mean temperature of each month and of each season.

OF THE SEASONS.		DIFFERENCE OF THE SUCCESSIVE MONTHS.											
of sum'er and aut'n.	of autu'n and wint'r.	of Jan. and Feb.	of Feb. and March	of March and April.	of April and May.	of May and June.	of June and July.	of July and Aug.	of Aug. and Sept.	of Sept. and Oct.	of Oct. and Nov.	of Nov. and Dec.	of Dec. and Jan.
12.33	11.33	5.—	1.—	2.—	8.—	9.—	3.—	0.—	5.—	7.—	11.	0.—	5.—
17.96	24.15	1.12	7.57	11.13	14.06	6.57	6.77	1.48	8.27	9.73	11.61	11.63	3.60
19.52	26.27	3.95	12.04	17.46	9.60	7.80	2.85	0.67	11.85	5.74	13.04	6.32	17.08
25.40	31.40	5.08	13.46	13.88	15.89	8.72	4.61	3.46	12.57	10.14	15.91	17.76	2.02
15.32	23.83	0.15	10.30	8.71	9.96	7.27	6.63	0.73	6.54	10.06	11.39	8.48	6.42
23.35	26.70	2.02	11.03	12.09	13.85	11.25	3.87	3.42	11.21	10.10	13.22	13.29	2.86
18.15	22.88	3.12	8.47	12.03	9.04	9.80	5.42	2.51	8.19	9.72	10.83	7.13	9.50
15.21	26.52	1.66	9.19	13.13	12.25	9.13	5.50	1.54	9.21	4.91	10.82	8.80	12.46
15.77	21.56	2.60	7.50	10.71	10.24	7.15	5.09	1.42	7.38	8.66	10.11	6.74	9.08
24.12	26.57	2.21	10.55	11.44	15.53	9.12	3.83	0.99	9.91	16.05	12.39	15.02	1.68
23.36	27.99	3.98	10.84	14.39	14.74	7.42	3.40	1.27	10.97	11.59	15.15	14.29	1.60
15.22	21.33	1.13	6.88	8.47	10.91	8.22	5.91	1.27	6.50	9.23	11.06	6.86	6.60
23.22	25.83	2.50	11.19	13.79	12.57	9.76	4.33	1.71	12.54	9.09	14.76	9.29	6.75
19.65	21.10	2.30	9.03	12.27	10.34	8.57	3.66	0.18	11.09	9.76	9.47	5.44	10.13
14.28	18.28	5.03	3.24	8.23	8.22	9.45	5.20	0.75	5.10	7.92	11.40	2.75	9.45
18.17	23.14	1.14	8.39	10.28	11.36	9.25	5.48	1.42	7.86	10.90	11.77	8.19	5.78
19.61	25.21	4.87	10.02	13.47	11.30	11.77	6.34	4.57	3.65	16.15	12.80	7.22	3.62
19.87	19.11	1.70	8.15	9.77	11.15	8.19	3.44	1.88	8.13	11.33	12.24	5.57	3.25
20.86	19.92	1.77	11.40	11.93	9.21	7.68	2.46	0.70	11.17	11.73	9.47	5.30	7.48
14.98	18.16	2.02	5.82	7.57	9.59	7.95	3.77	0.15	6.82	8.94	10.29	5.67	4.99
16.24	20.59	4.22	12.26	7.77	11.41	5.96	2.84	1.79	8.67	8.65	11.83	7.92	0.73
11.79	16.04	0.77	8.33	4.76	8.42	5.28	2.59	1.18	4.07	7.21	8.98	6.30	2.41
15.57	14.06	4.53	5.41	7.21	7.53	6.57	2.29	1.03	6.88	8.82	8.48	3.87	3.76
13.25	17.09	3.49	12.76	6.47	9.45	3.94	3.13	2.03	3.77	8.87	9.76	4.75	6.57
14.49	14.80	1.79	7.70	5.02	8.39	5.75	2.59	0.58	5.82	8.85	9.74	5.38	0.87
13.26	13.84	1.62	6.94	5.70	7.62	5.26	1.46	0.69	3.92	8.08	8.94	3.26	3.61
11.86	12.34	4.16	3.44	6.44	6.35	6.60	1.00	0.48	2.89	8.46	10.03	0.41	5.70
9.79	10.30	4.24	2.58	2.51	6.83	4.52	1.40	0.14	2.51	6.33	10.28	2.63	0.19
12.12	10.30	4.47	0.28	7.75	5.50	6.13	0.91	0.40	2.11	8.71	10.83	2.73	1.56
9.84	6.65	2.70	2.78	4.23	5.02	2.80	0.95	0.51	1.28	4.72	6.17	4.64	1.34
4.43	6.91	4.22	1.56	1.98	3.53	1.29	2.08	1.53	0.17	4.13	3.53	3.15	2.15
11.26	8.36												
21.78	24.12												
9.44	8.46	0.63	0 06	6.24	3.17	6.18	4.48	1.57	2.13	7.24	8.77	1.10	1.67
28.80	27.52												
11.—	12.22	3.08	2.20	5.36	7.64	4.36	3 43	0.10	4.73	7.—	8.31	3.89	2.22
11.67	11.93	5.62	1.73	5.38	9.90	2.87	3.74	1.05	5.13	6.—	9.31	3.27	3.50
6.67	9.17	1.50	2.—	2.—	5.50	5.00	2.00	0.50	3.50	3.10	5.50	2.50	3.50
12.74	14.—	4.55	1.45	8.52	7.33	4.52	6.80	3.72	3.22	11.08	6.27	5.27	3.94
11.33	16.70	3.50	4.33	6.21	7.63	5.80	5.12	0.80	4.30	9.53	9.06	5.85	3.40
2.10	7.73	1.—	2.56	1.44	0.50	2.—	5.—	3.—	1.50	4.—	4.80	2.20	1.—
13.62	13.—	2.—	8.46	13.32	0.36	5.40	2.16	0.—	6.66	6.84	10.64	1.61	3.24
1.80													

ABSTRACT C, *exhibiting the mean*

PLACES OF OBSERVATION.	Mean annual Temp.	ANNUAL RANGE. Max.	Min.	Range.	Mean of the monthly range.	JAN. Max.	Min.	Range.	FEB. Max.	Min.	Range.	MARCH. Max.	Min.	Range.
FORT VANCOUVER, *Oregon Territory*,	51.75	95	17	78	37	58	17	39	55	32	23	60	32	28
" BRADY, *Outlet of L. Superior*,	41.39	87	-23	110	48	40	-21	61	44	-22	76	51	-7	58
HANCOCK BARRACKS, *Houlton, Maine*,	41.21	94	-24	118	52	41	-24	65	42	-11	53	54	-1	55
FORT SNELLING, *at the confluence of the St. Peter's and Mississippi*,	45.83	93	-26	119	49	40	-22	62	45	-19	64	57	0	57
FORT SULLIVAN, *Eastport, Maine*, .	42.95	91	-13	104	44	43	-12	55	44	-14	58	52	5	47
" HOWARD, *Green Bay, Wis.*, .	44.92	98	-25	123	53	44	-16	60	47	-18	65	61	-1	62
" PREBLE, *Portland, Maine*, .	46.67	92	-7	99	40	44	-7	51	45	-2	47	58	8	50
" NIAGARA, *Lake Ontario, N. Y.*,	51.69	93	1	92	38	53	1	52	52	3	49	57	15	42
" CONSTITUTION, *Portsmouth, N.H.*	47.21	91	-6	97	40	46	-6	52	50	2	48	64	13	51
" CRAWFORD, *Prairie du Chien*,	45.52	95	-25	120	54	52	-17	69	55	-23	78	59	-3	56
COUNCIL BLUFFS, *near the junction of Platte and Missouri*, . . .	51.02	104	-16	120	59	59	-13	72	60	-11	71	71	10	61
FORT WOLCOTT, *Newport, R. I.*, .	50.61	85	2	83	34	48	5	43	49	8	41	56	19	37
" ARMSTRONG, *Rock Island, Ill.*,	51.64	96	-10	106	48	48	-10	58	56	-6	62	70	13	57
WEST POINT, *New York*, ...	52.47	90	-1	91	42	53	-1	54	56	2	54	72	16	56
FORT TRUMBULL, *New London, Conn.*	55.—	87	9	78	29	57	10	47	52	16	36	62	26	36
" COLUMBUS, *New York Harbor*,	53.—	97	2	95	41	50	6	44	53	7	46	69	20	49
" MIFFLIN, *near Philadelphia*, .	55.28	95	8	87	39	47	16	31	52	8	44	58	18	40
WASHINGTON CITY, *D. C.*, . . .	56.57	93	9	84	39	57	14	43	62	16	46	70	28	42
JEFFERSON BARRACKS, *near St. Louis*,	58.14	96	7	89	43	60	10	50	70	11	59	76	31	45
FORT MONROE, *Old Point Comfort, Va.*	61.43	93	20	73	31	61	22	39	61	28	33	69	31	38
" GIBSON, *Arkansas*, ...	62.90	104	15	89	49	77	18	59	71	15	56	82	28	54
" JOHNSTON, *Coast of North C.*, .	66.96	90	28	62	27	66	31	35	66	34	32	72	42	30
AUGUSTA ARSENAL, *Georgia*, . . .	66.01	98	25	73	40	68	26	42	73	35	38	78	34	44
FORT MOULTRIE, *Charleston Harbor*,	65.78	90	21	69	28	68	23	45	63	25	38	73	37	36
" JESUP, *near Sabine River, La.*,	68.03	96	19	77	40	76	25	51	79	28	51	81	39	42
CANTONMENT CLINCH, *near Pensacola*,	69.44	94	24	70	32	73	27	46	73	32	41	76	41	35
PETITE COQUILLE, *near New Orleans*,	71.25	94	30	64	32	77	30	47	77	38	39	82	45	37
FORT MARION, *St. Augustine, Florida*,	72.66	92	39	53	23	75	43	32	78	50	28	78	55	23
" KING, *Interior of East Florida*,	72.66	105	27	78	40	83	33	50	84	43	41	87	39	48
" BROOKE, *Tampa Bay, Florida*,	73.43	92	35	57	29	78	39	39	83	49	34	85	51	34
KEY WEST *or Thompson's Island*, .	76.09	89	52	37	16	80	57	23	81	61	20	85	65	20
FOREIGN CLIMATES.														
*LONDON, ...	50.39	86	22	64	34	50	22	28	52	25	27	61	29	32
*ENVIRONS OF LONDON, . . .	48.81	83	16	67	38	49	16	33	54	19	35	60	24	36
*PENZANCE, ...	52.16	76	27	49	24	54	28	26	55	33	22	59	34	25
MONTPELIER, ...	57.60	86	27	59	23	53	27	26	55	30	25	58	35	23
NICE, ...	59.48	87	27	60	21	58	27	31	58	37	21	65	41	24
ROME, ...	60.70	91	29	62	28	58	29	29	60	33	27	65	37	28
NAPLES, ...	61.40	93	29	64	29	58	29	29	60	31	29	69	38	31
MADEIRA, ...	64.56	77	54	23	12	68	56	12	68	57	11	67	54	13

* Observations made with the Register Thermometer.

annual and monthly ranges of temperature.

APRIL.			MAY.			JUNE.			JULY.			AUGUST.			SEPT.			OCTOBER.			NOV.			DEC.		
Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.
70	32	38	75	32	43	95	45	50	95	40	55	95	44	51	88	43	45	66	50	16	58	32	26	55	32	23
62	18	44	79	32	47	86	41	45	84	39	45	84	49	35	75	40	35	70	27	43	58	15	43	42	-7	49
74	24	50	83	31	52	90	38	52	90	45	45	85	46	39	78	33	45	72	24	48	60	4	56	53	-4	57
74	23	51	84	38	46	88	54	35	93	60	33	89	56	33	81	40	41	78	24	54	60	5	55	45	-12	57
64	19	43	75	34	41	85	44	41	89	51	38	87	51	36	80	39	41	71	28	43	56	15	41	51	0	51
75	19	56	89	33	56	95	44	51	96	54	42	90	52	38	84	34	50	77	22	55	58	9	49	46	-10	56
70	34	36	75	38	37	83	48	35	90	56	34	88	55	33	77	44	33	68	30	38	56	21	35	52	2	50
79	33	46	85	42	43	86	58	29	93	59	34	87	61	26	83	48	35	76	44	32	61	34	27	61	16	45
68	34	34	81	41	40	82	50	32	87	54	33	84	55	29	77	45	32	71	31	40	60	24	36	55	5	50
76	20	56	85	35	50	88	47	41	95	64	31	93	53	40	84	39	45	77	18	59	60	-6	66	45	-7	52
88	24	64	93	39	54	97	55	42	101	61	40	102	57	45	92	45	57	88	20	68	76	7	69	55	-4	59
65	31	34	76	40	36	82	52	30	84	60	24	82	59	23	80	49	31	71	35	36	61	25	36	56	13	43
78	29	49	87	42	45	93	54	39	95	61	34	93	60	33	88	44	44	82	33	49	66	19	47	61	4	57
78	33	45	84	44	40	89	57	32	95	62	33	91	60	31	87	51	36	73	32	41	64	26	38	62	15	47
62	40	22	72	47	25	79	57	22	86	64	22	87	62	25	83	56	27	69	42	27	63	36	27	56	20	36
76	31	45	86	42	44	92	55	37	97	63	34	93	62	31	88	49	39	77	36	41	64	26	38	55	14	41
80	34	46	88	39	49	95	51	44	92	68	24	91	60	31	86	52	44	75	34	41	68	23	45	56	21	35
78	36	42	85	50	35	92	59	33	94	64	30	93	63	30	88	51	37	77	33	44	66	28	38	61	17	44
83	38	45	88	45	43	95	59	36	96	50	36	96	66	30	88	51	37	80	38	42	69	27	42	64	14	50
78	40	38	82	53	29	89	64	25	93	69	24	91	70	21	88	60	28	75	48	27	71	36	35	64	27	37
87	34	53	91	48	43	100	62	38	100	69	31	104	65	39	98	53	45	92	37	55	84	30	54	82	20	62
77	47	30	83	62	21	88	69	19	88	73	15	87	72	15	85	63	22	81	49	32	74	41	33	70	33	37
85	42	43	90	54	36	94	63	51	98	69	29	95	69	26	91	53	38	84	44	40	75	34	41	74	26	48
78	49	29	87	63	24	87	69	18	90	78	12	86	73	13	76	63	23	80	50	30	72	37	35	77	34	33
85	43	42	92	55	37	94	65	29	96	72	24	96	70	26	92	58	34	87	44	43	80	31	49	76	27	49
80	48	32	88	61	27	92	73	19	93	74	19	92	73	19	90	61	29	85	48	37	78	34	44	75	33	42
86	51	35	89	62	27	92	71	21	93	75	18	94	74	20	92	64	28	86	52	34	81	42	39	80	39	41
81	52	29	87	70	17	90	74	16	92	78	14	90	78	12	87	72	15	82	60	22	79	50	29	77	38	39
93	54	39	97	64	33	105	73	32	102	73	29	104	72	32	99	70	29	91	41	50	82	30	52	79	36	43
87	56	31	90	65	25	91	70	21	92	72	20	92	73	19	91	69	22	88	56	32	85	48	37	79	38	41
84	65	19	87	72	15	86	73	13	88	77	11	88	74	14	87	76	11	85	70	15	80	65	15	78	62	16
69	32	37	75	36	39	86	38	48	77	44	33	82	44	38	75	40	35	65	32	33	57	27	30	54	24	30
69	26	43	78	33	45	80	39	41	83	41	42	79	42	37	75	34	41	68	30	38	56	22	34	53	20	33
62	36	26	68	41	27	72	46	26	73	51	22	73	51	22	69	46	23	64	40	24	57	36	21	56	34	22
64	41	23	71	49	22	80	56	24	85	62	23	86	65	21	75	55	20	71	48	23	62	40	22	57	32	25
69	46	23	77	41	26	78	58	20	81	66	15	87	69	18	82	61	21	70	48	22	61	43	18	59	40	19
74	44	30	80	52	28	88	60	28	91	64	27	91	62	29	85	55	30	77	46	31	67	39	28	60	31	29
78	43	45	86	51	35	88	56	32	93	64	29	91	62	29	88	60	28	79	51	28	64	44	20	61	34	27
71	58	13	75	60	15	76	62	14	77	65	12	77	67	10	77	66	11	76	65	11	71	59	12	69	50	11

ABSTRACT D, *exhibiting the mean annual quantity of rain.*

PLACES OF OBSERVATION.	Latitude.	Long.	1836.	1837.	1838.	1839.	Mean annual quantity in inches.
FORT BRADY, *Outlet of Lake Superior*,	46°39′	84°43′	. .	36.93	34.73	24.01	31.89
HANCOCK BARRACKS, *Maine*,	46 10	67 50	. .	33.68	38.37	38.70	36.92
FORT SNELLING, *at the confluence of St. Peter's and Mississippi*,	44 53	93 8	. .	41.57	28.21	21.19	30.32
" HOWARD, *Green Bay, Wiskonsan*,	44 40	87 —	37.64	41.55	42.83	31.32	38.83
" WINNEBAGO, *between the Fox and Wiskonsan, Wiskon. Ter.*	43 35	89 30	. .	31.32	27.85	36.47	31.88
" CONSTITUTION, *Portsmouth, New Hampshire*,	43 5	70 45	28.10	28.16	31.84	27.28	28.85
" CRAWFORD, *Prairie du Chien, Wiskonsan*,	43 3	90 53	. .	33.65	23.31	31.66	29.54
WATERVLIET ARSENAL, *Watervliet, New York*,	42 30	73 13	44.30	32.06	30.80	29.73	34.22
DEARBORNVILLE " *Michigan*,	42 22	82 55	40.—	. .	29.84	24.05	31.30
WATERTOWN " *Massachusetts*,	42 21	72 12	. .	32.16	44.01	42.99	39.69
WEST POINT, *New York*,	41 22	73 57	50.14	44.88	44.00	55.80	48.70
FORT WOOD, *Harbor of New York*,	40 43	74 01	49.09	51.—	41.51	50.03	47.90
" HAMILTON, *Harbor of New York*,	40 43	73 56	. .	. .	39.70	51.72	45.71
ALLEGHANY ARSENAL, *Pittsburgh, Pennsylvania*,	40 26	80 02	. .	35.67	23.10	25.64	28.14
FORT LEAVENWORTH, *Missouri*,	39 20	95 05	. .	38.45	26.28	33.32	32.68
" MCHENRY, *Baltimore, Maryland*,	39 17	76 36	39.50	45.—	39.10	39.60	40.80
WASHINGTON CITY, *D. C.*,	38 53	76 55	. .	. .	. .	. .	34.62*
ST. LOUIS ARSENAL, *Missouri*,	38 40	80 10	. .	26.33	21.90	. .	24.12
FORT MONROE, *Old Point Comfort, Virginia*,	37 2	76 12	. .	40.70	44.74	72.20	52.55
" GIBSON, *Arkansas*,	35 47	95 10	. .	31.05	18.49	42.39	30.64
" SMITH, *Arkansas*,	35 30	94 25	. .	37.—	27.30	42.62	35.64
" TOWSON, *Arkansas*,	33 33	94 55	. .	43.80	34.40	62.—	46.73
" JESUP, *Louisiana*,	31 30	93 47	48.85	48.54	47.32	45.—	47.43
NEW ORLEANS, *Louisiana*,	29 57	90 14	. .	. .	70.89	50.82	51.85†
KEY WEST, *near Cape Sable*,	24 33	81 52	. .	. .	. .	. .	31.39‡

* As this is the mean of 16 years, from 1824 to 1839 inclusive, it may be well to present the monthly averages:

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Result.
2.41	2.37	2.39	3.00	3.36	4.11	3.19	3.15	2.35	3.07	2.34	2.88	34.62

Average of six years, including 1833, 1834, 1835, and 1836. ‡ Mean of five years, ending with 1836.

PART SECOND.

RESEARCHES ELUCIDATING THE ENDEMIC INFLUENCES PECULIAR TO THE SYSTEMS OF CLIMATE DEVELOPED IN PART FIRST.

SECTION I.

Having in the preceding pages developed, so far as the data sufficed, the laws of climate throughout the United States, the object aimed at in this Part will be the application of these laws to the elucidation of disease. In the arrangement of these statistical materials as published officially, the subject was divided into two parts, each embracing the period of ten years; but in the former, in default of the requisite data relative to the mean strength of each post prior to 1829, the numerical mode of investigating morbid actions is carried out only in part, whilst in the latter period, from 1829 to 1838 inclusive, this method of analysis is successfully adopted. Having had access, so far as the investigation extends, to data as precise as the nature of the subject will admit, the conclusions warranted by the numerical results may be regarded as a fair exposition of the relative influences of our various systems of climate, constituting some general laws towards the basis of a system of *medical geography*.

Conformably to the plan proposed, it is designed to present, within as narrow a compass as practicable, the more general results contained in the official publication, divested of all tedious statistical details. To facilitate description, as well as the application of the laws of climate developed in Part First, these details of the Military Posts of the United States, statistical and topographical, will be investigated in the same order of classification, *viz.*, the Northern, Middle, and Southern Divisions, with their respective sub-divisions.

1.—THE NORTHERN DIVISION OF THE UNITED STATES.

Its sub-divisions.—Topography of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Michigan, Wiskonsan, and Iowa.

This Division, as in Part First, will embrace three classes of posts, *viz.*, 1. The region of the Great Lakes; 2. The coast of New England; and 3. The interior posts remote from large bodies of water. This immense tract, the physical characters of which have been already described in a general way, is, with the exception of the Eastern States, almost wholly in a state of nature, being still covered with its dense primeval forests; but as the physical aspect of a country, the nature of the soil, and its vegetable productions, are intimately connected with the character of climate, a more detailed description becomes necessary, to be enabled to estimate properly its endemic influences.

Maine. In this State, there is no connected ridge of mountains, but the north-western part contains numerous detached elevations. A characteristic feature is its numerous lakes, it being estimated that one-sixth part of its surface is covered with water. A large portion of the State is yet clothed with the primitive forests, which furnish the most important articles of commerce. The larch, red and white pine, hemlock, white oak, white cedar, spruce, sugar-maple, &c., are found abundantly. Although a great portion of the soil is fertile and well adapted to the culture of wheat, Indian corn, and other grain, yet little attention has been paid to the developing of the agricultural resources of the State. With the exception of the Acadian or French settlement on the St. John's, the whole population is concentrated on a comparatively narrow strip in the southern portion.

New Hampshire. With the exception of the south-eastern angle of the State, the surface is hilly or mountainous, the elevations rising in height as they recede from the sea, until they finally swell into the lofty grandeur of the White Mountains. The great central knot consists of rocky pinnacles shooting up to the altitude of from 5000 to upwards of 6000 feet. On these summits, the ascent to which discovers several striking changes in vegetation, as already described in Part First, snow lies during ten months of the year. A large part of the State is yet covered with native forests, which are still haunted, in some places, by the larger kind of wild animals. Of the population, nearly four-fifths live in the southern portion of the State, much of the northern being too rugged and sterile to be susceptible of cultivation. In addition to the forest trees mentioned in the description of Maine, we find the sycamore, ash, oak, locust, hickory, chesnut, &c. Reference has already been made to the severity of the winters, which are long and rigorous, the prevailing winds being from the north-west. Whilst in winter, the mercury sinks to 15° or 20°, and sometimes 30° and even 40° below zero, in summer it often rises to 96° of Fahr. Towards the end of October, ice begins to form, and snow generally lies till late in April. Cattle are housed from about the first of November until the middle of May, when vegetation is generally sufficiently advanced for them to live abroad.

Vermont. The most striking natural feature is the range of the Green Mountains, traversing the State from north to south. Lake Champlain, covering an area of 500 square miles, and elevated nearly 100 feet above tide-water, lies chiefly within its limits. Originally clothed with a dense forest, a large part of the State still continues in its primeval condition. The mountains produce hemlock, spruce, fir, &c., and the lower grounds, the trees found in similar localities in New Hampshire. There is much good arable land, particularly between the mountains and Lake Champlain, but the country in general is better adapted for grazing.

Massachusetts. Although the face of the country is generally hilly, and in some places rugged, yet it nowhere attains a very great elevation. Of the western sections, some portions are too rough, and of the eastern, some too sandy, for profitable cultivation; but there are both fertile and extensive tracts on the Housatonic, Connecticut, and Merrimack. The fine agricultural district in the central part of the State, contains many flourishing towns.

Rhode Island lies on both sides of Narraganset Bay, which covers about one-tenth of its surface. It contains no mountains, but the surface is hilly and rocky, the soil being but moderately productive.

Connecticut. Mostly hilly or undulating, but never mountainous, much of this State is too rough for cultivation. On all the rivers, however, particularly the Connecticut and Housatonic, there are rich alluvial tracts; and along the shore of Long Island Sound, between the mouths of these two rivers, a narrow alluvial flat extends. Rye, maize, hemp, and tobacco, are cultivated.

New York. The surface of this State, for the most part, is considerably elevated, but it is rarely rugged. The greater part lies in fact on the great Alleghany table-land. Most of the soil is of a useful quality, and much of it is highly fertile, particularly in the central part of the State, extending from the valley of the Mohawk westward to the great lakes. This is the district of wheat, which is the great agricultural staple.

Michigan. The *Lower Peninsula* is in general slightly undulating. The ridge dividing the waters flowing into Lakes Huron and Erie from those running into Lake Michigan, rises gradually until it reaches in the north an elevation of about 300 feet above the surface of these lakes. There are some marshy tracts in the southern part, and some swamps near the margin of the River Detroit and Lake St. Clair. A great portion of the surface is densely covered with oak of several varieties, walnut, hickory, poplar, sugar-maple, &c., intermixed, particularly in the northern part, with white and yellow pine. The forest is interspersed with "oak-openings," plains, and occasionally prairies, which last are not so extensive as those in Illinois. This peninsula, in point of fertility, is not perhaps surpassed by any other tract of equal extent in the world. The alluvial lands in the southern part consist of a rich vegetable mould, from three to six feet in depth. Wheat and Indian corn are chiefly cultivated. The *Upper Peninsula*, which appears to have been very imperfectly examined, appears to be much more hilly and rugged than the *Lower*. There are some lofty ridges, which are said to rise to an elevation of nearly 2000 feet above the level of Lake Superior.

Wiskonsan and Iowa.—This vast tract, exceeding in dimensions, by one third, the whole kingdom of France, is a part of the great central table-land of North America. It has a general elevation of 800—1200 feet above the level of the ocean, but it does not rise, even on the loftiest summits of its mountain ridges, perhaps more than 2000 feet above the general level. In the northern part, much of the soil is of an inferior quality; but in the southern section, the general features of the country resemble those of the adjoining States. Here are fertile prairies, which, forming wide expanses stretching as far as the eye can reach, are only here and there interrupted by a belt of woodland skirting a river, or by a small grove or clump of trees resting like an island in the midst of the ocean. The whole unwooded tract of the north-western States, constitutes one vast prairie, partially intersected by strips of woodland, forming a striking contrast to the immense forest, which, extending from Hudson's Bay to the Gulf of Mexico, and from the Atlantic to beyond the Mississippi, is even now but slightly encroached upon by the labors of man.

1st CLASS.—POSTS ON THE NORTHERN CHAIN OF LAKES.

The posts comprised in this class.—Summary of the climatic features peculiar to the region of these ocean-lakes.—Medical definition of climate.—Its complex relations. —Our positive knowledge upon the subject very limited.—Medical topography and statistical details in reference to Forts Brady, Mackinac, Gratiot, Dearborn, Niagara, Madison Barracks, and Fort Howard.—General results.

The class of posts now under examination, comprising those situated on the inland seas along our northern boundary, consists of the seven following :—Forts Brady, Mackinac, Gratiot, Dearborn, Niagara, Howard, and Madison Barracks. In regard to the topography of these posts, a general description of each will be presented under its appropriate head. It is not deemed necessary to enter into minute detail relative to the climate of this class, but merely to present a summary of the meteorological phenomena peculiar to the region of these ocean-lakes as illustrated in Part First. These vast lakes constitute a striking characteristic in the physical geography of this region; and the character of the climate is consequently so modified, as has been seen, that it bears a close similitude to that of the Atlantic coast. But to illustrate the subject advantageously, a connected consideration of the three classes of the Northern Division, is here requisite. The great variety of climate presented in this Division, comprising four distinct climatic systems, affords a happy illustration of the equalizing tendency of large bodies of water upon temperature. The general laws that localities under the influence of the ocean or inland seas, do not exhibit great extremes of temperature, whilst the air is moist, and the changes of season slow, uncertain, and variable, are here evidenced, in the most marked degree; and equally striking, on the other hand, are the laws relative to the climate of localities removed from such equalizing influences, characterized by a great range of the thermometer, and a corresponding dryness of the atmosphere, whilst the mean temperature of winter and summer is strongly contrasted, and the seasons change in constant and rapid succession.

Conformably to these laws, it is found that the climatic features, as regards the distribution of heat among the seasons, of the region of the Lakes, as well as that of the coasts of New England, are very dissimilar from those of the third class of posts, comprising those situated in the intervening region and that beyond the Lakes. This difference is as follows:

Localities.	*Latitude.*	*Difference between the Mean. Temp. of winter and summer.*
Sea-coast, - -	43° 18′ - - - - - -	38°.61
Lakes, - - -	46° 27′ - - - - - -	43°.00
Region beyond the Lakes,	44° 53′ - - - - - -	55°.84

Making due allowance for difference of latitude, it may reasonably be assumed that the climate of the Lakes is equally modified with that of the Atlantic coast. Hence, it is obvious that the phenomena of terrestrial temperature as depending on the position of the sun, are so much influenced by local causes, that a classification of climates, or a system of medical geography, having for their bases mere latitude, is wholly inadmissible.

The influence of this unequal distribution of heat on the same parallels upon vegetable geography, has also been fully illustrated. On the Lakes and the Atlantic, the seasons do not glide so rapidly into each other as in the third class, in which summer succeeds winter so rapidly that there is scarcely any spring, and vernal vegetation is developed with remarkable suddenness. The difference between the mean temperature of winter and spring in the *uniform* climate of the Lakes and the Ocean, varies from 11°.67 to 18°.42; whilst this disparity, in the *excessive* climates of the regions west of the Lakes and intermediate to them and the Atlantic, ranges from 18°.82 to 30°.83; and if the comparison is extended to the extremely modified climate on the Pacific coast on the same parallel, we find a difference of only 6°.67. Moreover, as the vernal increase supervenes upon a lower winter temperature in excessive than in uniform climates, the development of vegetation is in an inverse ratio.

It is to be regretted that we do not possess more exact and numerous results in reference to the rain-gauge; and as few observations have been made upon the hygrometer, the ratios of fair and cloudy weather present the chief means of determining the comparative degree of atmospheric humidity.* The results obtained by five years' observations, discover a remarkable contrast between localities on the Lakes and those not within their influence. In the former, the prevailing weather is *cloudy*, the relative proportion of rainy and cloudy days, during the year, being 247, and in the lat-

* Since these pages have been in type, the author has been kindly furnished by Dr. Lee of this city, with the statistics and remarks connected with the hygrometric condition of the atmosphere, not only in the United States but in other parts of the world, contained in the note appended to Part First.

ter, *fair*, the annual ratio being only 148. The annual quantity of rain, on an average of three years, is at Fort Brady, 31.89 inches, and at Fort Snelling 30.32. Contrasted with the relative number of rainy and cloudy days, the difference in the annual amount of rain is small; but it has been already remarked that in cold or temperate maritime localities, rain descends more frequently, but in much slighter showers than in warm or inland regions. In a comparison with the Atlantic coast, however, this contrast is less marked.

Having thus brought under view the meteorological facts determined by observation, which may be supposed to exercise an agency in the causation of morbid action, it will be practicable to establish certain relations between these causes and the statistical results furnished by diseases.

The term *climate*, which is limited, in its rigorous acceptation, to a mere geographical division, and in ordinary parlance to the temperature only of a region, possesses, in medical science, a wider signification. It embraces not only the temperature of the atmosphere, but all those modifications of it which produce a sensible effect on our organs, such as its serenity and humidity, changes of electric tension, variations of barometric pressure, the admixture of terrestrial emanations dissolved in its moisture, and its tranquillity as respects both horizontal and vertical currents. Climate, in a word, as already defined, constitutes the aggregate of all the external physical circumstances appertaining to each locality in its relation to organic nature. "To observe," says Professor Rostan, "the simultaneous effects of light, heat, electricity, of the winds, &c., on the organic productions of the different zones of the earth, to explore the nature of this earth, to deduce from this knowledge the influence which they exercise on the physical and moral state of man, such is the wide field which climates present to our investigation."

The little knowledge that we possess upon these various points, is far from being precise. On the one hand, we are ignorant what constitute the real elements of climate; and, on the other hand, these complex agents act upon living organs still more complex in their functions. Our knowledge heretofore has consisted mainly of the unexplained results of experience. As the subject does not admit of the precision of the exact sciences, the aid of induction and analogy must be invoked. Having once acquired a knowledge of the distinctive characters of different systems of climate and of their effects upon the animal economy both in health and disease, the general laws regulating such influences may be readily ascertained. In the present inquiry, (notwithstanding it is necessary, in attempting to determine the relation subsisting between climate and vital action, to take into view the simultaneous influence of all meteorological causes,) the temperature of the air and its hygrometrical state will be more especially considered. In regard to the remaining elements of climate, such as the admixture of terrestrial emanations dissolved in atmospheric moisture, our positive knowledge is still more limited. That mysterious agent—malaria—though too well recognized in its deleterious effects on the human frame, has hitherto remained inscrutable in its nature.

It is thus seen that there are many circumstances besides mere temperature, which enter into the constitution of climate. Amongst these, as influencing organized beings, one of the most important is the nature of *soil*, the formation of which has apparently been the result of the gradual attrition of the solid materials composing the crust of the globe. As all animals and vegetables, at least all land animals, are dependent for existence on this stratum of comminuted mineral substances and organic remains, its influence in regard, not only to mere health, but the organic modifications which the human frame experiences, constitutes an interesting subject of inquiry.

We come now to a description of special posts:

FORT BRADY.—Latitude, 46° 39′, Longitude, 84° 43′ W.

Fort Brady, situated at the Sault St. Marie, Michigan, is on the southern bank of that river. It is distant from Lake Superior fifteen miles, from Lake Huron fifty, and from the Atlantic ocean about eight hundred miles. The river at this point is eighteen feet below the surface of Lake Superior, and nearly six hundred feet above the level of the ocean. The physical aspect of the surrounding country exhibits considerable variety. The bank of the St. Marie, which is here three-fourths of a mile in width, presents a gradual slope for the distance of two hundred and fifty feet, gaining in that space an elevation of fourteen feet, in the rear of which the surface of the country approximates a level. For three hundred yards from the bank of the river, the soil is cleared of timber, and is, although not very productive, in a state of cultivation. Immediately adjoining this cultivated ground, is a marsh half a mile wide, beyond which high lands appear. This marsh extends five or six miles down the river in a south-east direction, and west and south-west for fifteen or twenty miles. It is covered with some large forest trees, and a thick growth of underwood. On the opposite side of the river, the country is undulating and mountainous, and covered with a dense forest. The falls in the river at this point, form an obstruction to the ship navigation of the upper lakes.

The prevailing winds are the west, north-west, and south-east. The north-west winds descend from mountain chains, traversing Lake Superior; and the west and south-east winds pass over the marshes already described. The annual quantity of rain, on an average of three years, is 31.89 inches.

The barrack and hospital accommodations are as good as we find them at our posts generally. They were built in 1824. The materials being wood, the lower logs, which were placed directly upon the ground, are now (1839) undergoing rapid decomposition. It has been with truth remarked, that whilst our troops are better paid, fed, and clothed, they are worse quartered than those of any other nation.

As the forms of tabular arrangement adopted in reference to this post, which were presented in detail in the official Report, are equally applicable to all subsequent ones, a few explanatory remarks are here required. Under the head of *synochal* fever are condensed the cases reported as synocha, synochus, common continued, ephemeral, and inflammatory; but the majority of cases are reported under the last name. As the term *typhus* is subject to vague and arbitrary employment, diseases of a very diverse character, are, doubtless, often registered under this head. Under the class of diseases of the *respiratory organs*, are included the following specific diseases: pneumonia, pleuritis, phthisis pulmonalis, hæmoptysis, catarrhus, asthma, dyspnœa, laryngitis, pertussis, *etc.* Under the class of diseases of the *digestive organs*, the following: tonsillitis, gastritis, hæmatemesis, enteritis, peritonitis, dyspepsia, colica, cholera, constipatio, diarrhœa, dysenteria, hepatitis, icterus, *etc.* Under the class of *brain and nervous system*, the following: meningitis, apoplexia, paralysis, epilepsia, cephalalgia, ictus solis, mania, delirium tremens, nyctalopia, *etc.* In regard to the other classes, it is deemed unnecessary to state the specific diseases. The general results of these tables, which are excluded from this volume, will appear in the "General Deductions," forming Section II. The details of the present Section, it is feared, may prove dry and tedious to the reader; but the basis upon which all the conclusions rest is formed by this accumulation of facts relative to topography, morbility, and mortality, in connection with the laws of climate developed in Part First.

As the total of deaths at Fort Brady, for the period of ten years, according to the Adjutant General's return, is eleven, and the aggregate mean strength 984, the annual ratio of mortality is $1\frac{1}{10}$ per cent. Of the deaths, six are reported in the medical returns, *viz.*, one typhus fever, one phthisis pulmonalis, one cholera morbus, occurring in a patient exhausted by chronic diarrhœa and secondary syphilis, and three from causes not designated, exhibiting a mortality of $\frac{6}{10}$ per cent. This discrepancy arises from the circumstance that medical officers generally report the deaths on the sick-list only, omitting those that occur suddenly, from accidental causes or on detachments.

This post may justly be regarded as one of the most salubrious stations in the United States. Morbid action generally assumes an inflammatory character; and, with the exception of the typhus, which prevailed in the winter of 1837–8, there has been no disease of a malignant tendency. During the ten years, there are fifteen cases of typhus fever reported, of which eight occurred at the period to which reference has just been made. Diseases of malarial origin are little prevalent, the annual ratio of cases of intermittent fever being only four *per cent.*, and that of remittent fever even less than three *per mille* of the strength. In the last two quarters of 1835, pneumonia was prevalent, but, notwithstanding severe, no case terminated fatally. The agency of climate, as regards locality and the relative influence of the seasons in the production of special diseases, will not be noticed in the details of each post, as these endemic influences will be fully illustrated in the "General Deductions." As regards disease in general, there is little diversity presented in the different seasons. On the average of ten years, the ratio of cases reported per one hundred of mean strength, is as follows:—In the first quarter of the year, 30; in the second, 36; in the third, 35; and in the fourth, 33. Hence every man, on an average, was under treatment once in every nine months.

FORT MACKINAC.—LATITUDE 45° 51′ N., LONGITUDE 85° 5′ W.

General Description.—Based upon limestone, with a very superficial covering of soil, the island of Mackinac rises, in its greatest elevation, two hundred and twenty feet above the water of the lake. As the site of the present fort is elevated one hundred and fifty feet, it is seven hundred and twenty-eight feet above the level of the ocean. The island is about nine miles in circumference, and rises on its eastern and southern shore in abrupt rocky cliffs to the height of one hundred and fifty feet. Although a large portion of the immediate shores of the lake in this vicinity is composed of marsh, yet there is much that presents an opposite character. From the site of old Mackinac, at the very extremity of the peninsula, the immediate shores, extending one hundred and fifty miles along lake Michigan, are generally elevated, sometimes rising abruptly from three hundred to four hundred feet. As this post is unoccupied at the present time, (1839) it is impracticable to furnish the medical topography of the immediate locality of the fort.

Than this post there is not a more healthy one in the United States. According to the Adjutant General's returns, there occurred but five deaths from all causes, in a mean aggregate strength of eight hundred and sixty five, within the ten years, being about $\frac{6}{10}$ per cent. per annum. In the Medical returns, there is not reported a single death, which can in any way be ascribed to the agency of an endemic cause. In 1832, one soldier of the command died of Asiatic cholera, and of four men laboring under this epidemic, left at this post on their march to Chicago, three died. In 1833, there was one death from a casualty; and in 1836, an officer died from neuralgia.

The general character of morbid action presents so little peculiarity that scarcely any comments from the medical officers have been elicited. Fevers of malarial origin present a low ratio, that of intermitting being eight, and that of remitting fever, one annually per one hundred of the mean strength. The fact that intermittent fever is more than twice as prevalent in the second as in the third quarter, must arise from the circumstance that the majority of cases are of foreign origin.

The relative salubrity of the seasons, as calculated from the number of cases reported, is as follows:—Ratio per 100 of mean strength treated in the first quarter 42, in the second 47, in the third 52, and in the fourth 42. Hence every man, on an average, was under treatment once in every six and a half months.

FORT GRATIOT.—LATITUDE 43° N., LONGITUDE 82° 10′ W.

Fort Gratiot, situated on the river St. Clair, half a mile from the outlet of Lake Huron, is elevated five hundred and ninety-eight feet above the level of the ocean, being twenty feet above the surface of the lake.

Black river, distant about one mile in a south and west direction, is the only stream, with the exception of the St. Clair, in the vicinity. "It is bordered," says Assistant Surgeon Motte, "particularly on the west, by frequent broad marshes, which have been subjected to an accumulation of alluvion for a sufficient period to allow a deposition of *peat* from vegetable decomposition. These marshes exhale, during the summer and autumnal months, a pestilential atmosphere, generative of fever and ague, which is but too prevalent among the inhabitants in the vicinity."

"The surrounding country is gently undulating. The soil is mostly a sandy loam, and the proportion of marsh is small. Clay is reached at the depth of twelve or fifteen feet. Most of the surrounding country is covered with forest; among the vegetable productions are oak, elm, maple, ash, hickory, black walnut, pine, &c.

"The lake and river shore in the immediate vicinity of the fort," says Assistant Surgeon Motte, "is a low gravelly ridge, extending nearly a quarter of a mile from the margin of the lake, when the ground suddenly rises to the height of twenty-five feet above the surface of the lake, and retains this elevation, with little variation, to near the shores of Black river. This elevated ground gradually approximates the St. Clair towards the fort, and a few rods below it becomes a perpendicular bluff in immediate contact with the water."

Between the fort and the ridge just described, there is a stagnant pond, which it has been found impracticable to drain, and which, it is supposed, is the copious source of miasmata. The hospital and barracks are represented as defective, being very damp and ill adapted for ventilation.

Although the aggregate mortality in ten years, according to the Adjutant General's returns, is thirty-five, being nearly four per cent. per annum, yet, when the twenty-one deaths which arose from epidemic cholera in the third quarter of 1832 are deducted, the ratio is found much below the mean mortality of the army, being $1\frac{6}{10}$ per cent. Of the fourteen deaths, excluding those caused by cholera, ten are reported in the medical returns, viz., two hydrothorax, one apoplexy, one typhus fever, one chronic bronchitis, one ebriety, one casualty, one sudden, and two from no assigned causes. It is thus apparent that, although morbific agents of a miasmatic character are yearly developed, their effects are never manifested in malignant and fatal endemics.

In regard to the general character of morbid action, the principal fact requiring comment is the extraordinary prevalence of intermittent fever compared with the other posts of this class. Whilst the annual ratio of this type of fever, at this post, based on a calculation of the mean strength and total number of cases for ten years, is seventy-two per one hundred men, the ratio at the remaining six posts, varies from as low as four to no higher than twenty-four. As the general meteorological phenomena of this class of posts exhibit similar features, these unequal results must necessarily be ascribed to the agency of endemic causes connected with medical topography. Whilst the ratio of intermittent fever at this post is higher than the average of our southern stations, that of remittent fever is only three per one hundred of the strength. In regard to these two forms of fever, the relative influence of the seasons is strikingly manifested. As respects disease in general, the diversity presented in the different seasons is as follows :—Ratio per 100 treated in the first quarter, 65—in the second, 87—in the third, 95—and in the fourth, 72. Hence every man, on an average, was under treatment once in a little less than every four months—a high ratio ascribable to topographical causes.

In 1832, when Asiatic Cholera first made its appearance on the north-east coast of America, and spread with fatal rapidity along the great water-courses on our own northern frontier, the epidemic raged violently at this post, our troops having become infected while on board steamboats on their passage up the lakes towards the country of the Sac and Fox Indians, who were then in open hostility. This subject will, however, form a distinct chapter in the concluding section.

FORT DEARBORN.—LATITUDE 41° 51′ N., LONGITUDE 87° 15′ W.

This post, which is now abandoned, is situated on the south-west shore of Lake Michigan, in the State of Illinois, twelve miles from the Wiskonsan line. It is distant from the lake two hundred and fifty yards, and is elevated fourteen feet above its surface. The river Chicago, which runs upon three sides of the fort, divides, half a mile above it, into two branches, the one north and the other south, in directions nearly parallel with the lake shore. As the bank of the lake is several feet higher than the ground in the rear, the latter is sometimes covered with water. Indeed, the whole country is so low that, in its early settlement, boats frequently passed, during the spring floods, over the praries from Chicago to the Illinois river. At this post, the prairie opens upon the lake four miles wide, extending west beyond the reach of the eye. Above and below this point, the shore of the lake is densely covered with large forest trees, such as the different varieties of oak, ash, and hickory. The soil is generally a rich loam, in some places clay, and in others sand, predominating. Limestone is found in large quantities.

Notwithstanding the prevalence of malarial diseases, this post gives a low mortality. According to the Adjutant General's returns, the deaths from all causes amount to eight, being $1\frac{3}{10}$ per cent. per annum. Of these deaths, five are reported in the medical returns, viz., one phthisis pulmonalis, two bilious remittent fever, and two spasmodic cholera. Excluding the last two cases, which occurred in 1834, the annual ratio of mortality is no higher than $\frac{5}{10}$ per cent.

As regards the relative influence of the seasons, the agency of heat and moisture is strikingly evidenced in the causation of fevers of the intermittent and remittent type. The annual ratio of intermittents is twenty-three, and that of remittents is four, per one hundred of the strength. In reference to disease in general, its diversities as respects the seasons are as follows:—In the first quarter, the ratio treated per 100, is 34,—in the second, 33,—in the third, 61,—and in the fourth, 30. Hence the average period in which every man came under treatment, is only seven and a half months.

At this post, which was temporarily re-occupied in 1832, during the campaign against Black Hawk, epidemic cholera displayed its most fatal effects among our troops, as will be shown in the sequel.

FORT NIAGARA.—Latitude 43° 15′ N., Longitude 70° W.

Situated on a point of land projecting westerly at the entrance of Niagara river into Lake Ontario, Fort Niagara is bounded on the north and north-west by the lake, and on the west and south-west by Niagara river. The river at this point is about half a mile wide. It is 14 miles from the Falls of Niagara, and 32 miles from Lake Erie. The surface of the country in the immediate vicinity is remarkably level, but there are no marshes within six or eight miles. The vegetable productions of the climate flourish here luxuriantly.

This station presents the usual degree of healthfulness exhibited by the statistics of the posts on our northern chain of lakes. The deaths from all causes, according to the Adjutant General's returns, amount to ten, being $1\frac{8}{10}$ per cent. per annum. Of these deaths, eight are reported in the medical returns, viz: five phthisis pulmonalis, one peripneumonia, one dropsy, and one delirium tremens, the ratio of mortality being $1\frac{4}{10}$ per cent.

The diseases of this post have at no time presented any unusual characters. In regard to fevers of the intermittent and remittent type, a singular feature, at first view, obtains. In the second quarter, the ratio of intermittents is twice as high as in the third, whilst the reverse occurs in respect to remittents. It would thus seem that the cause of these febrile lesions becomes so augmented in intensity during the third quarter, as to develope itself mostly in the remittent modification. In the third quarter of 1838, a detachment of troops from Florida furnished nearly all the cases of diarrhœa and intermittent fever. The annual ratio of intermittents is twenty-four, and that of remittents is eleven per cent. of the strength.

The influence of the seasons, as regards disease in general, is expressed in the following ratios: In the first quarter, the total of cases reported per 100 men, was 54; in the second, 70; in the third, 71; and in the fourth, 60. Hence every man, on an average, was reported sick once in nearly every five months.

The garrison of this post also suffered from epidemic cholera in 1832, when on its march towards the theatre of Indian hostilities, the disease having made its appearance in the command when encamped at Detroit.

MADISON BARRACKS.—LATITUDE 43° 50′., LONGITUDE 77° 55′.

This station is at Sackett's Harbor, New York. Situated on the southern side of the bay formed by the entrance of Black river into Lake Ontario, it is distant from the latter eight miles. The color of the water in the river, as its name indicates, is quite dark—a feature not unusual in this region. About three-fourths of a mile north-east of the post, a small creek empties into Black river. There are no marshes in the vicinity. The barracks, as they are elevated about thirty feet above the level of the lake, are 262 feet above tide-water.

"The grounds around the garrison," says Assistant Surgeon, T. Henderson, who has furnished a detailed description of the medical topography of this post, "are so level that they cannot be perfectly drained. The soil is dark, with much clay, and rests on a stratum of limestone, which is from one to three feet below the surface. The nature of the soil and this superficial calcareous stratum keep the immediate vicinity of the post, even after ordinary rains, boggy and favoring terraqueous exhalation. The physical aspect of the surrounding country is waving and undulating. The soil is generally rich. The forest trees are maple, beech, birch, walnut, ash, elm, and hemlock. Esculent vegetables are produced in great abundance and variety. The staple agricultural product is wheat. No minerals are found in the immediate vicinity of Madison Barracks. About fifty miles north-east, lead mines of great value are wrought, and iron ore is obtained in the south-east part of the county (Jefferson) in which the station is located."

The barracks and hospital, built of limestone, were erected in 1822. A new hospital, constructed of the same material, is now (1839) being built upon a more approved plan.

As the deaths from all causes, according to the Adjutant General's returns, amount to eleven, and the aggregate mean strength is 751, the annual ratio of mortality is $1\frac{5}{10}$ per cent. Of the deaths, nine are reported in the medical returns, viz., one congestive fever, one intermittent fever, two pneumonia, one phrenitis, one ebriety, one chronic visceral obstructions, one atrophia, and one nervous irritation supervening on amputation of the right arm Hence the ratio of mortality, excluding the last case, is $1\frac{4}{10}$ per cent.

Although this station does not exhibit a higher mortality than the mean ratio of posts on the lakes, yet it is found that disease prevails to a considerably greater extent; but the most remarkable fact is, that this excess arises mostly from diseases of the digestive organs, more especially diarrhœa and dysentery, whilst fevers of a malarial origin bear no corresponding ratio. Of cases of intermitting fever, the annual ratio is twenty, and of remitting fever it is three, per 100 of the strength. Although the average of intermittent fever is higher than that of Forts Brady, Howard, or Mackinac, it is lower than the ratio of Dearborn or Niagara, and little more than one-fourth as high as that of Fort Gratiot. The relative influence of the seasons upon disease in general, is as follows: Ratio of cases under treatment, per 100, of the strength, in the first quarter, 107; in the second, 122; in the third, 98; and in the fourth, 84. Consequently, every man, on an average, was reported sick once in every three months—the highest ratio yet presented. There is here an apparent exception to a general law in the circumstance that the first and second quarters exhibit the highest ratio of disease; but this result is reversed, if the third and fourth quarters of 1838, when the command was large and little disease prevailed, whilst the post was unoccupied in the first two quarters of that year, are excluded from the calculation.

"The annals of Sackett's Harbor," says Assistant Surgeon Henderson, "like those of the lake shores on the frontier generally, show that formidable diseases have prevailed at all seasons of the year. During the war of 1812, the epidemic called pneumonia typhoides originated on the lines, and appeared at this place. Those who recollect that extraordinary disease, know that it existed in the winter and spring, ceasing in summer. In July, 1813, from a tenth to a fifth of the crews of Commodore Chauncey's squadron were on sick report at the harbor. In August, more than one-sixth of the seamen were left on shore; and Cooper, in his Naval History, states that at one time in this season (1813) the Madison had nearly one-half of her complement on sick list. The same author says, "in the winter of 1814, the sickness at the harbor was of the gravest character. One-half of the crew of the Madison was sick, and one-fifth died. In the summer of that year, the operations of the squadron were delayed by the illness of the mechanics at the Navy Yard."

Since the peace of 1815 up to 1839, it would seem that no epidemic of a malignant tendency has prevailed at Sackett's Harbor.

"In May and June, 1839," says Dr. Henderson, "diarrhœa became very rife at Madison Barracks, with here and there a case of fatal remittent fever. In July and the subsequent months up to this date, October 25th, the diarrhœa has been almost universal. Cases of fever became more numerous in July and August, several proving fatal.

"Let it be here observed, that the summer of 1838 was intemperately hot and dry; the summer of 1839 was cool and seasonable as to rain. General health prevailed east and south, except at Charleston, South Carolina, in 1838. In 1839, with a season throughout ostensibly favorable to health, so far as moderate heat and moisture are concerned, epidemic dysentery prevailed in New England; the most maligant endemics existed in New Orleans, Mobile, Pensacola, St. Augustine, Charleston, Augusta, Ga., in Illinois, and in the towns and cities on the lower Mississippi. Is it then remarkable, that Madison Barracks should have been more sickly than usual, especially when it appears that, in several localities not far from the post, similar and severe visitations of fever appeared? Sackett's Harbor village has had more fever than has been known for twenty years. In the neighboring farming country, places usually healthy have suffered from fatal malarial sickness.

"And yet, as if the caprice of malarial influence were ever to baffle search into its causes successfully, at Rochester and Buffalo, I am told, the troops were healthy, and at Plattsburg most remarkably so. Nearer to Madison Barracks, at Ogdensburgh on one side, and at Oswego on the other, the towns were perfectly free from disease.

I was informed by a very respectable physician at Oswego, that between May and the 22d August he had not seen one case of fever. At the same time, the eighth regiment, in all its departments, officers, soldiers, and families, was affected with diarhœa; and as the autumn approached, remittent fever appeared very generally. In September [strength 592] there were forty-four cases of fever, exclusive of what appeared among the families. In October [strength 397] up to the 22d, there were thirty-eight cases on the hospital register; making an aggregate, of what I have seen since the 23d of August, of about ninety cases, exclusive of *jaundice* and *intermittent* cases, that are forms of malarial disease; and especially exclusive of *diarrhœa*, the cases of which are extremely numerous and obstinate. This last disease would readily yield to hospital treatment and diet, but recurred too readily on going to quarters and to ration diet, or it would lapse into remittent fever."

In regard to the remedial management of the modification of fever alluded to above, he remarks, that "my conclusion is, that it is a tractable form of disease, requiring prompt vigilance to ascertain its earliest impression, and the immediate subjection of the soldier to the sanative influence of hospital treatment; and that, looking at the number of cases of diarrhœa, fever, jaundice, and intermittent, the mortality was not great."

In treating of the supposed causes of disease, it is shown that in 1838, when general health prevailed, all local circumstances, compared with 1839, when morbid action was very rife, were apparently disadvantageous. Again—"It is known that within a few years the lakes have risen between three and five feet, and are now falling. Popular opinion, which should always be attended to on such questions, though very often incorrect, has ascribed the sickness to this fall of water. I see nothing in the laying bare annually of a few inches of lake shore, nor in the draining of tributary streams, that could cause the sickness at Madison Barracks; for in the vicinity no grounds have been covered or laid bare by the rise or fall of the water, so as to afford malaria. This rise and fall of the vast interior seas is a phenomenon which cannot be philosophically considered as a cause of endemics."

In reply to the question, Is Madison Barracks a healthy station? the answer of Dr. Henderson is in the affirmative, based on the following reasons:

"Although in 1813 and 1814 there was much sickness at Sackett's Harbor, yet it was incident to the state of war, to the crowd of soldiers and sailors assembled hastily at the post, to the inadequacy of good food and shelter, and to the exposures and privations endured by the seamen and soldiers.

"Since the war the station has generally been healthy, and the village adjoining uniformly so.

"If Madison Barracks has been more sickly during the present season, so has the surrounding country in various places, heretofore perfectly healthy.

"The inference that a station is unhealthy cannot legitimately be drawn from the experience of a season. The cause of the sickness at Madison Barracks in 1839 is, like the cause of summer and autumnal diseases, inscrutable. Disease seems to move in a cycle of years, and at some period of that cycle almost all sites are sickly."

The result of statistical data, however, proves that this post, although the mortality is not higher, is more insalubrious than any other station on the lakes; and that this excess of disease arises chiefly from the class of lesions pertaining to the digestive organs. The well known talents and industry of Dr. Henderson entitle his opinions upon medical subjects to much respect; but the result shows that there are questions connected with medical science which no ordinary observation, however aided by the efforts of genius, can decide. It is only by accumulating a multitude of facts, extending over diversified regions, and embracing thousands of individuals,—the application of numerical analysis to the investigation of morbid actions,—that the comparative prevalence and influence of disease can be determined.

FORT HOWARD.—LATITUDE 44° 40′, LONGITUDE 87°.

This post is situated on the north-west bank of Fox river, one mile from the point at which it empties into Green Bay. This bay, which is an arm of Lake Michigan, indents the land for ninety miles. It commences forty miles wide, and gradually lessens to four miles at its head, where it receives the waters of Fox river. "It is skirted about its head," says Acting Assistant-Surgeon Ward, "with marshes a mile in width, covered with a luxuriant growth of grass and wild rice, which embrace the mouth of the river, and continue within a half a mile of the fort: The water is from six inches to six feet deep on these marshes, which, by the operation of a diurnal flux and reflux of the waters of the bay, are alternately flooded and drained twice every twenty-four hours. Twenty rods back of the fort another marsh begins, and spreading to the right and left, extends a a mile or more in each direction. It differs from the marshes just described in this, that it is partly covered with timber, thickets of alder, evergreens, and grass." Proceeding north and west two miles, the country presents a densely wooded region, as far as explorations have been made. On the opposite side of the river, as far as Lakes Michigan and Winnebago, the country is also in its primitive state, covered with dense vegetation of forest and underwood. The soil mostly consists of a vegetable mould, intermixed with clay and sand; and is generally of a character to reward the labors of the husbandman.

The annual quantity of rain, on an average of four years, is 38.83 inches. The climate of this post, as has been shown in Part First, is so little modified by the waters of Green Bay, that its position in the third class would be more appropriate; but as all the results are calculated according to the present arrangement, the advantages to be realized by the change would be no compensation for the labor required.

The deaths from all causes, according to the post returns, are twenty-five, being $1\frac{5}{10}$ per cent. per annum. Of these, fifteen are reported in the medical returns, *viz.*, four diarrhœa, one gun-shot wound, one influenza, one chronic pneumonia, one phthisis pulmonalis induced by excessive ebriety, and seven of causes unreported. Including all these cases, the ratio of mortality is less than one per cent.; but, as the causes of death are not regularly reported, it is impracticable to give the exact ratio of mortality from disease. In 1829, the subjects of two deaths were recruits, who were "far gone" when they joined, and in 1832, one resulted from a gun-shot wound, whilst the causes of seven are not stated. It thus appears that this station is a very salubrious one.

There is little in the history of disease at this post requiring comment. The annual ratio of intermittents is six, and that of remittents is three, per 100 of mean strength. When it is considered that this fort, which occupies a sandy eminence about ten feet above the level of the bay, is almost surrounded by marshes, the low average of malarious fevers seems at first view inexplicable. It may be safely assumed that this exemption is owing to the circumstance that these low lands are always covered with water; and, upon the same principle, it follows that when drained and brought under cultivation, this station will become unhealthy.

The relative influence of the seasons as regards disease in general, is as follows:—Ratio of sick, per 100, in the first quarter, 40,—

in the second, 42,—in the third, 70,—and in the fourth, 40. Consequently every man, on an average, was reported sick about once in every six months.

There are upon these ocean-lakes other posts which have recently, owing to the disturbances on that frontier, grown into importance, such as those at Detroit, Buffalo, and Plattsburg. The data, although insufficient to authorize the usual tabular arrangement, yet suffice to show that these stations are no less salubrious than those already described.

A general view of the results obtained from the statistics of the class of posts described, possessing the common characters peculiar to positions on our northern lakes, will show that this region is extraordinarily salubrious. The annual ratio of mortality according to the medical reports is $\frac{9}{10}$ per cent., and, according to the Adjutant General's returns, $1\frac{3}{10}$ per cent. Although there is little difference in the ratio of mortality at the various posts, yet the extent of sickness, as determined by the number of cases reported, presents considerable diversity. Fort Brady exhibits the lowest, and Madison Barracks the highest average. As the ratio per 1,000 of mean strength under treatment is 2,185, it follows, pursuing the mode of calculation adopted, that each man, on an average, has been on the sick list once in every five and a half months. As cholera produced its greatest havoc among troops on the march, the results do not appear in the returns from the posts.

In the official publication, in addition to the tabular details of diseases under the head of each post, the general results of each class were also exhibited in a tabular form, thus illustrating the relative influence of the seasons in the production of special diseases in each system of climate. If 1,000 men, for example, were stationed at the several posts of the class just described, the average would show, that in the first quarter 13 would be attacked with intermittent fever, in the second quarter 73, in the third 77, in the fourth 36, and in the whole year 193; and so in regard to each particular post. But as the results of each class are given in the "General Deductions," it is not deemed advisable to encumber the work with these statistical details. As the results of this class are based on the statistics of ten years, and embrace 6,377 individuals occupying seven different localities, the numerical ratios may be regarded as fair expressions of the general laws of this system of climate in relation to diseases.

2d Class.—POSTS ON THE COAST OF NEW ENGLAND.

The posts embraced in this class.—Medical topography and statistical details relative to Forts Sullivan, Preble, Constitution, Independence, Wolcott, Trumbull, and Columbus.—General results.

The class of posts to be now brought under view, *viz.*, Forts Sullivan, Preble, Constitution, Independence, Wolcott, Trumbull, and Columbus, extends along the coast of New England, from Eastport to the harbor of New York. Although arranged in a distinct class, they bear a striking similitude, as regards meteorological phenomena, to those already described. It is, therefore, deemed unnecessary to enter into any detail, more especially as the subject is fully illustrated in Part First. As a fertile district partially cultivated is more insalubrious than a wilderness or a country in the highest state of agricultural improvement, it may be worthy of remark, that in the region comprising this class of posts, unlike the preceding one, much comparatively, notwithstanding the general sterility of the soil, has, in this respect, been effected by the labors of man.

FORT SULLIVAN.—Latitude 44° 44′, Longitude 67° 4′ W.

Fort Sullivan is the most northern post on the Atlantic coast, being near the line of the British possessions. It is situated on Moose Island, which is close to the main land, a small isle intervening. The town of Eastport is on the same island, which is about four miles long and two wide, having a rocky and sterile soil. The fort is elevated about seventy feet above the level of the ocean.

The deaths from all causes, according to the Adjutant General's returns, are seventeen, being nearly four per cent. per annum. Of these, all are reported in the medical returns, *viz.*, three epilepsy, one apoplexy, two phthisis pulmonalis, one typhus, one remittent fever, one cynanche maligna, one scorbutus, one concussion of the brain, and six from causes not designated. The rate of mortality, (four per cent.,) without some explanation, will lead to unauthorized inferences; for, excluding the year 1829, in which are reported eleven deaths, the ratio is only $1\frac{6}{10}$ per cent. In this year, there were three fatal cases of epilepsy and one of apoplexy, all induced by the excessive use of ardent spirits, one of concussion of the brain from a fall upon the ice, also caused by inebriety, one from scurvy, and five from causes not stated, the post being attended by a civil practitioner.

This post is, indeed, a very salubrious one. No disease of a malignant tendency has, at any time during the above ten years, prevailed. Intermittent fever may be said to be unknown; for, although seven cases are reported, yet, as none occurred in the third quarters, it is probable that these cases were originally contracted in other localities. The average of diarrhœa and dysentery is also exceedingly low.

The relative agency of the seasons in the causation of disease in general is as follows:—First quarter 45 cases, second 45, third 57, and fourth 55, *per centum*. Hence the average period in which each man was reported sick, is once in every six months.

FORT PREBLE.—LATITUDE 43° 38′ N., LONGITUDE 70° 18′ W.

This post is situated on Cape Elizabeth, on the side of Portland harbor opposite the town of the same name. The harbor is about one mile wide at this point, at which it opens directly into the ocean. The fort is elevated about twenty feet above the level of the sea, the grounds in the rear becoming higher, and consisting mostly of masses of bare rock. The soil is dry, hard, and gravelly.

The total of deaths, according to the Adjutant General's returns, is eleven, being $2\frac{7}{10}$ per cent. per annum. Of these, seven are reported in the medical returns, *viz.*, two phthisis pulmonalis, one typhus fever, three from causes not designated, and one drowned, giving, without including the last, a mortality of $1\frac{6}{10}$ per cent.

This station is equally healthful with the preceding one. As no more than four cases of intermittent fever are reported, and as these occurred in the same quarter, it may be assumed that this disease is unknown in this locality. It is found, however, that remittent fever exhibits comparatively a high ratio; but this, in consequence of the rarity of the disease, may reasonably be ascribed to a nosological error. The relative agency of the seasons in the causation of disease in general, is as follows:—First quarter 34 cases per 100 of strength, second 41, third 43, and fourth 36. Hence the mean period in which each man was reported sick, is nearly eight months.

FORT CONSTITUTION.—LATITUDE 43° 4′ N., LONGITUDE 70° 49′ W:

Situated on a peninsula which forms the most eastern point of the State of New Hampshire, in the county of Rockingham, between two and three miles from Portsmouth, Fort Constitution is washed on the south by the Atlantic, and on the north by the Piscataqua river. The country adjacent is uneven and rocky. Small marshes, some fresh and some salt, as well as peat beds, are found on Great Island, about half a mile distant. The soil is not very productive. The mean annual quantity of rain, on an average of four years, is 28.85 inches.

The deaths, according to the post returns, amount to seven, being $1\frac{8}{10}$ per cent. per annum. Of these, six are reported in the medical returns, viz., one pneumonia, one phthisis pulmonalis, one enteritis, one convulsions, one apoplexy, and one asphyxia from submersion, giving, without including the last, a mortality of $1\frac{3}{10}$ per cent.

It is remarked by Assistant Surgeon James H. Sargent, who has been stationed at this post for many years, that " it is so healthy that the hospital is seldom occupied." A case of fever is, indeed, a rare phenomenon. But one case of intermittent fever is reported, and this came from Fortress Monroe. He observes that in thirty-three years' practice, he has known, at this post or its vicinity, but one case of intermittent fever which was not of foreign origin. There is no case of remittent fever reported within the ten years; and of inflammatory fever there are but two, and of typhus six cases.

As regards the relative agency of the seasons in the production of diseases generally, the result is, in the first quarter 23 cases, in the second 19, in the third 15, and in the fourth 25 per 100 men. Consequently every man, on an average, was reported sick but once in every seventeen months and a half. The fact that there is less morbility in summer than in winter at some of these New England posts, is ascribable to the absence of malaria, as will be shown in the sequel.

FORT INDEPENDENCE.—Latitude 42° 22′ N., Longitude 71° 2′ W.

This post, situated on Castle Island in the harbor of Boston, occupies an eminence of forty feet above the sea. The island, which has a hard and gravelly soil, is in dimensions 1000 by 900 feet, having a sandy tongue running off 700 feet. It is distant three miles south-east from the State house. The nearest land on the west is the extreme point of West Boston, known by the name of Dorchester point, which is three-fourths of a mile distant. On the south, the nearest point is Thompson's Island, distant one mile and a half; and one mile north is Governor's Island, which overlooks Fort Independence sixty feet, and, in military language, commands it.

"In point of situation," it was remarked by Assistant-Surgeon Mann, in 1827, "no post can be more salubrious than this, inasmuch as the tide ebbs and flows from ten to fourteen feet, and there are no stagnant waters in the vicinity to generate infectious miasmata productive of autumnal fever. Since I have been stationed here, there have been two seasons of epidemic pneumonia; the first in the spring of 1821, and the last, which was accompanied with many severe cases, in the spring of 1826. These epidemics were not confined to this post, but extended over the New England States, and, if I am not mistaken, as far south as Virginia."

The deaths, according to the Adjutant General's returns, number thirteen, being $2\frac{2}{10}$ per cent. per annum. Of these, nine are reported in the medical returns, viz., one pneumonia, two phthisis pulmonalis, one marasmus, three from causes not designated, and two casualties, (one from suicide and the other from drowning,) giving, excluding the last two, an annual mortality of $1\frac{3}{10}$ per cent.

The only fact in the history of disease at this post requiring comment is the remarkable prevalence of pleuritis and pneumonia compared with catarrh. The ratio of the first two is eight times higher than the last; whereas it will be seen that the general law, as deduced from seven posts on the lakes, shows that the ratio of catarrh is six times higher than the average of pleuritis and pneumonia; whilst a similar comparison of the class of posts now under consideration, excluding this station, shows that the ratio of the former is five times higher than that of the latter. As but one death from pneumonia, however, is reported, it is apparent that the lesions registered under this nosological term must have been of a slight grade of intensity.

The relative agency of the seasons in the causation of disease in general gives in the first quarter 62, in the second 71, in the third 85, and in the fourth 69 cases *per centum*. Hence every man, on an average, was reported sick once in every four months.

FORT WOLCOTT.—LATITUDE 41° 30′, LONGITUDE 70° 18′.

This fort is situated on Goat Island, which is one hundred and fifty yards wide and half a mile long, within the harbor of Newport. It is two miles from the sea-shore, and half a mile from the town of Newport on the island of Rhode Island. The surface of Goat Island consists of a rich mould, elevated about twenty feet above the ocean. The drainage is good. On the south-east, distant about a mile, is a salt marsh half a mile square; and on the north-east, somewhat nearer than the former, is a lagoon, into which the tide flows constantly. In regard to barrack accommodations, the men occupy rooms twenty feet square, with thick and arched walls, the second story, constructed of wood, being occupied as officers quarters.

The total of deaths, according to the post returns, is five, being $1\frac{3}{10}$ per cent. per annum. Of these, all are reported in the medical returns, viz., two phthisis pulmonalis, one mania a potu, and two asphyxia from submersion. In 1832, when the fatal case of delirium tremens was reported, it is remarked by Assistant-Surgeon William Turner, that it is the first death that occurred in five years in an average of more than one hundred persons, including engineer officers and their families, as well as the families of enlisted men; and this death he regards virtually a case of suicide. In 1834, in reporting a death from drowning, Dr. Turner speaks thus:—"The only three deaths amongst the troops in seven years, have occurred one from delirium tremens and the other two from accidental drowning whilst in a state of intoxication." In reporting a fatal case of phthisis pulmonalis in the second quarter of 1835, it is again remarked that this case and one of mania a potu are the only two deaths from disease in the period of eight years, amongst the troops, including the officers of the corps of engineers and their families.

It is observed by Assistant-Surgeon Turner that no epidemic ever prevails at this station. So complete an exemption is there from all febrile affections, with the exception of simple inflammatory fevers, that he never met, in the course of thirty years' practice, with a single case of intermittent fever which could not be traced to foreign origin. Of remittent fever, there is but one case reported. There are many cases of "febricula from intemperance" registered, all of which are placed under the head of ebriety. Indeed, what little disease prevails among the troops at this post is ascribed by Dr. Turner mostly to the abuse of spirituous liquors.

As respects diseases generally, the relative influence of the seasons is expressed by the following ratios *per centum*:—First quarter 35 cases, second 37, third 43, and fourth 37. Consequently the average period in which every man was reported sick is eight months.

FORT TRUMBULL.—Latitude 41° 22′ N., Longitude 72° 5′.

This fort is situated on the right bank of the River Thames, one mile below New London, and two and a half miles from the shore of

Long Island Sound. It is elevated fifty feet above the level of the ocean; the position is rocky, and the drainage good. The river opposite the fort is about half a mile wide; and within the same distance from the fort, are two small salt marshes. The soil of the surrounding country is rather sterile, presenting an undulating aspect, rising in prominent ridges of eighty or one hundred feet, with rock frequently breaking forth abruptly upon its surface.

The total of deaths, according to the Adjutant General's returns, is thirteen, being a little above two per cent. per annum. Of these, seven are reported in the medical returns, viz., four phthisis pulmonalis, one dropsy, one atrophia induced by intemperance, and one compression of the brain from a rupture of a blood vessel, making about one per cent. of mortality.

This post still maintains the character of salubrity found on the coast of New England. Fevers of malarial origin are scarcely known. In the second quarter of 1832, fifteen cases of "spotted fever" are reported, none of which proved fatal. In the neighboring town of New London, there occurred between three and four hundred cases, which terminated fatally in the ratio of about four per cent. It was treated with powerful stimulants both internally and externally. The epidemic seems to have been widely diffused.

The relative agency of the seasons as regards the etiology of disease in general, gives in the first quarter 38 cases, in the second 34, in the third 35, and in the fourth 35 per 100 of the strength. Hence every man, on an average, was reported sick once in nearly every eight and a half months. The low ratio of the summer season is doubtless attributable to the absence of morbific agents of a malarial nâture.

FORT COLUMBUS.—LATITUDE 40° 42,′ LONGITUDE 74° 2′.

This post is on Governor's Island, in the harbor of New York. This island, situated near the confluence of the Hudson and that arm of Long Island Sound called the East River, is distant from the main, at the nearest point, about half a mile, and from the ocean at Sandy Hook about twenty miles. It is about a mile in circumference, with a soil composed of sand, intermixed with fine gravel and loam, based upon ferruginous clay. The portion brought under cultivation yields in abundance the usual esculent vegetables of the climate. There are no swamps or marshes in the vicinity, and in consequence of the regular artificial slope in every direction from the fort to the water, the drainage is perfect. Exclusive of ten large cisterns, capable of containing many thousand gallons, it is abundantly supplied with excellent water from five wells.

This post constitutes the last of the class now under examination, embracing those situated on our northern Atlantic coast. "The prevailing winds," says Assistant-Surgeon J. P. Russell, who has furnished these facts in relation to the medical topography of this post, "are, during the summer, south to south-west, and during the winter, north-west to north-east; the mean temperature for the year is about 53° of Fahrenheit, and the annual quantity of rain is about forty-six inches. This island is almost constantly fanned by refreshing and invigorating breezes from the ocean.

A new hospital on the south side of the island has been lately finished. Well constructed and commodiously arranged, it combines all the advantages of modern improvements. The wards are furnished with iron bedsteads—an improvement now being generally introduced in our hospitals and barracks.

The total of deaths in the harbor of New York, including Forts Columbus and Hamilton, according to the Adjutant General's returns, is thirty-five, and as the mean strength for the same period is 1,444, the annual mortality is $2\frac{4}{10}$ per cent. Of these, twenty-six are reported in the medical returns, (fifteen at Fort Columbus and eleven at Fort Hamilton,) viz., nine epidemic cholera, five phthisis pulmonalis, one variola, one paralysis, one sudden, one suicide, two casualties, and six from causes not designated. Excluding the cases of cholera, casualties, and of suicide, the ratio of mortality is about one per cent. As the post returns include New York harbor in the aggregate, it has been found almost impracticable to determine the precise strength of each post.

That the position is salubrious is, however, plainly manifest. "Remittent and intermittent fevers," says Dr. Russell, "are of rare occurrence, and never fairly attributable to this station. I have never known a case of either which may be said to have originated here."

The relative agency of the seasons in the production of disease in general gives in the first quarter 42, in the second 64, in the third 78, and in the fourth 57 cases. Hence every man, on an average, was reported sick once in every five months.

There are two other posts in the harbor of New York, which have from time to time been occupied; but the reports are not sufficiently numerous to authorize the usual tabular arrangement. *Fort*

Wood is situated on Bedloe's Island, which contains an area of about seven acres. It is upwards of two miles from the city of New York, and a mile and a half from the shores of New Jersey and of Long Island. The fort occupies the most elevated part of the island, which is about thirty feet above high water-mark. It is old and in a state of dilapidation. The hospital accommodations are tolerably good; but the building is so located, that it is liable to have its lower floors inundated by extraordinary high tides. The mean annual quantity of rain, on an average of four years, is 47.90 inches. This island of late years has been a depot for the majority of the recruits of the whole army. The post has always been remarkably salubrious, fevers of malarial origin, except cases which arose from causes operating in other localities, being unknown. Whilst intermittent and remittent fevers have prevailed to a great extent within a few miles, on Long and Staten Islands, as in the year 1828, this station has always maintained its healthfulness.

The other post is *Fort Hamilton*, situated on the Narrows, at Long Island, about seven miles from the city of New York. Contrary to the results given by the other posts of this class, the ratio of malarial diseases is found to be high. It is a remarkable fact that the laborers employed in 1828 in the erection of this post,—a locality which had been previously exempt from the effects of malaria,—suffered greatly from intermittent and remittent fevers. The elevated coast of Long Island, in the vicinity of the Narrows, where a case of intermitting fever was unknown in the memory of the oldest inhabitant, became so rife with intermittent and remittent fever as to drive the inhabitants from their possessions. The former disease is still very prevalent at Fort Hamilton. In the third quarter of 1834, in a strength of 200, one hundred cases are reported; and in the third quarter of 1835, in a strength of 150, one hundred and forty-seven cases are reported.

From a table in the official Report exhibiting the relative degree of sickness and the mortality of each post of this class, it appears that the annual ratio of mortality, according to the medical reports, is $1\frac{5}{10}$ per cent., and, according to the Adjutant General's returns, two per cent., based on an aggregate mean strength of 4,279. As in the preceding class, the deaths from epidemic cholera (four at Fort Columbus) have been excluded, and in the medical returns, such deaths also as arose from suicide and drowning. As the ratio per 1,000 of mean strength under treatment is 1,915, it follows that each man, on an average, was reported sick once in every six months. Although the extent of morbility, as indicated by the number admitted on the sick list, is a little less than in the region of the lakes, yet the mortality is about fifty per cent. higher. In looking over the details of each post, the most striking fact is, the low ratio of those that die from what may be regarded as natural causes. Perhaps four-fifths of the deaths are reported under the names of epilepsy, apoplexy, mania a potu, phthisis pulmonalis, atrophia, etc., with the remark to each case that it arose from the abuse of sprituous liquors. It may with truth be said, that nine-tenths of the mortality at the salubrious posts along the coast of New England, has its origin in inebriating potations.

Although all comments in regard to the general results of each class of posts, as regards the influence of the climate generally or the relative agency of the seasons in the etiology of such diseases as have a manifest dependence on endemic influences, will be reserved for the next section, yet it may be well here to note a fact peculiar to this class. Compared with the region of the Lakes, it is found that the annual ratio of cases of intermittent fever per 1,000 of strength, is as 36 to 193. This contrast, however striking, is still less than the reality: for, inasmuch as most of the cases at the Atlantic posts occurred among troops brought from malarial regions, the average is far too high. At Fort Columbus, for example, at which post about two-thirds of the cases are reported, the disease has never been known to originate. It may be safely averred that along the coast of New England, intermittent fever is unknown.

3d Class.—POSTS REMOTE FROM THE OCEAN AND INLAND SEAS.

General meteorological remarks.—Posts embraced in this class.—Medico-topographical and statistical details in regard to Hancock Barracks, West Point, Forts Snelling, Winnebago, Crawford, Armstrong, and Leavenworth.—General results.

This class embraces those stations of the Northern Division which are remote from the Atlantic ocean as well as inland seas. Compared with the two preceding, it is characterized by great extremes of temperature, by seasons strongly contrasted, and a corresponding dryness of the atmosphere. The seasons follow each other in constant and rapid succession. As summer succeeds winter so rapidly that there is scarcely any spring, the sudden excess of heat by the increase of vernal temperature, renders the progress of vegetation almost perceptible. The prevailing weather is fair, notwithstanding the annual quantity of rain is greater at some of these posts than at those of the opposite localities; for in the latter, the rain, though falling more frequently, descends in slighter showers. The climate of this class of posts, excepting the most southern ones, is distinguished by the extreme severity of winter. From November to May, cold weather prevails, the ground being generally covered with snow to the depth of three or four feet. The general range of the thermometer is from the freezing point to 30° below zero. The summers are equally remarkable for extremes of temperature. During June, July, and August, the heat is often as oppressive as in Florida, the mercury sometimes rising to 100° of Fahrenheit in the shade. The climatic features of this class have been so fully described already, that any further details are deemed supererogatory.

This class embraces the following posts: Hancock Barracks, West Point, Forts Snelling, Winnebago, Crawford, Armstrong, and Leavenworth.

HANCOCK BARRACKS.—LATITUDE 46° 5′ N., LONGITUDE 67° 40′ W.

Hancock Barracks, according to a topographical description furnished by Assistant-Surgeon Sprague, is situated in the town of Houlton, Maine. It is distant from the ocean one hundred and fifty-six miles, and from the bay of Fundy one hundred and eighty miles. The surrounding country presents an undulating aspect. The position seems to the eye to be circumscribed by a range of hills, intersected at two points by the passage of the Meduxnikrag, a small rapid stream which runs through the town half a mile from the fort. In the direction of this river lies a great body of low lands, covered with a dense forest, and chequered with many farms in every stage of improvement. The soil is rather productive. As the fort occupies an elevated position, the drainage is complete.

The season of summer is short, and as frosts frequently occur before its close, the destruction of vegetation is not unusual. In the winter, snow falls to a great depth and lies upon the ground during the whole season. The seasons pass rapidly into each other. On the opening of spring, vegetation is developed with remarkable suddenness. Summer succeeds with a rapid pace; and as the thermometer in winter sinks 30° below zero, so now it may rise to 96° in the shade. The extremes at this post are much greater than in the peninsula of Nova Scotia, owing to the circumstance that the latter has not only an insular climate, but is intersected by lakes and bays. The annual quantity of rain, on an average of three years, is 36.92 inches.

The total of deaths, according to the Adjutant General's returns, is seventeen, the annual ratio of mortality being one per cent. Of these, ten are reported in the medical returns, viz., four phthisis pulmonalis, one pneumonia, one hæmoptysis, one hepatic abscess, two from causes not designated, and one frozen, making, excluding the last, a mortality of about $\frac{5}{10}$ per cent. Two of the cases of phthisis were confirmed drunkards, and the frozen man lay all night in a snow bank intoxicated.

This station presents a very salubrious locality. As there is no marsh in the vicinity, and the current of streams is rapid, there are no diseases of malarial origin. The average of diarrhœa and dysentery is higher, however, than might have been *a priori* supposed. The vice of intemperance is the most prolific source of disease and death.

The relative agency of the seasons, in the production of disease in general, gives, per 100 of the strength, in the first quarter, 48; in the second, 47; in the third, 52; and in the fourth, 44 cases. Consequently the mean period in which every man was reported sick, is six months.

WEST POINT.—Latitude 41° 23′ 33″, Longitude 73° 51′ 15″.

Situated on the west bank of the Hudson, about midway in that part of the river called the Highlands, it is fifty miles from the ocean, and one hundred and seventy from Lake Champlain. The public buildings are on a plain about a mile square, elevated one hundred and fifty-seven feet above the river, having in its rear a range of hills varying in height from 600 to 1,400 feet. On each side of the plain there are ravines which serve to carry off the torrents of water which descend from the adjacent hills after heavy rains or spring freshets—a circumstance aided by the gravelly nature of the soil and the continuous slope presented on every side. The nearest marshy ground is on the opposite side of the river, about a mile distant. The annual quantity of rain, on an average of four years, is 48.70 inches. The hospital and barrack accommodations are of the best kind.

The total of deaths, according to the post returns, is thirteen, viz., three officers, two professors, one cadet, one ordnance storekeeper, and three soldiers, the annual ratio of mortality being a fraction upwards of $\frac{3}{10}$ per cent. Exclusive of these, six cadets died in different parts of the United States, perhaps all of them on sick leave. Of the former, nine are reported in the medical returns, viz., three phthisis pulmonalis, one sudden rupture of an abscess in the lungs, (a teacher of drawing who was treating his own case by means of animal magnetism,) one scarlatina, two continued fever, one typhus, and one wound of the brain.

Although it will be seen that the average of cases treated is higher than at any other station, yet an examination of the abstract, which accompanies the description of each post in the official publication, in connexion with the ratio of mortality, warrants the opinion that this post holds a place among the first in point of salubrity. It is remarked by Surgeon W. V. Wheaton, who has been stationed here twelve years, that the locality is singularly exempt from all local causes of disease, and that among 800 persons for weeks together, there is often no one seriously sick. To estimate properly the high ratio of disease, compared with the low mortality, it must be borne in mind that this command, with the exception of a detachment of enlisted men never exceeding fifty, is composed of cadets, and that the simple circumstance of being registered on the hospital books affords respite from all mental and bodily labor. Of the 16,804 cases reported, the majority consists of such complaints as headache, toothache, cough, pain in the chest, and sore throat. Of headache alone there are 3,788 cases registered; and as this affection, in default of a better nosological arrangement, has been placed under the head of brain and nervous system, it appears that there are but five other cases in the same class. Of the 482 cases of synochal fever, about 200 are reported under the name of ephemeral, and nearly all the rest as inflammatory. Several diseases have, at certain periods, assumed an endemic character. In the first quarter of 1835, there are forty-six cases of cynanche tonsillaris reported; and in the first quarter of 1837, fifty-nine cases of cynanche parotidea. In the second quarter of 1832, the sick report exhibits thirty cases of measles confined to the cadets and soldiers.

As regards the influence of age on mortality, it has been ascertained, that at the period of life between the age of ten and fifteen the ratio is lowest, and next in the order of increase comes the interval between fifteen and twenty. Cadets belong to the latter class, of which the annual ratio of mortality, per 1,000 is, in England $7\frac{9}{10}$, in Belgium $6\frac{6}{10}$, and in Sweden 7. Now as four cadets died at the academy, one death being the result of a wound, and six when on leave, the total arising from disease, admitting that all the latter may be fairly ascribed to causes operating at the post, may be set down as nine; and assuming the aggregate mean strength of cadets to be 3,234, that is, deducting fifty annually for officers and soldiers, the ratio is only $2\frac{8}{10}$ per 1,000. As contrasted with civil life, the result is, therefore, highly favorable to the regulations of this institution.

The relative agency of the seasons in the causation of disease in general, gives in the first quarter, 106; in the second, 114; in the third, 124; and in the fourth, 106. Consequently every one was, on an average, reported sick once in less than every three months —the highest ratio yet presented.

FORT SNELLING.—Latitude 44° 53′ N., Longitude 93° 1′ W.

Fort Snelling, situated in the angle formed by the confluence of the St. Peter's and Mississippi, is elevated ninety-four feet above these waters, and about 820 feet above the level of the ocean. The St. Peter's, at its mouth, is one hundred and fifty yards wide and sixteen feet deep; and the Mississippi, at this point, is about 400 yards wide, but is much less deep than the former. The banks of the latter, up to the falls of St. Anthony, a distance of eight miles, are about 200 feet high, the upper strata of which consist of limestone, and the lower of sandstone. Beyond the falls the banks are less high, and the immediate valley of the river becomes more extended. The St. Peter's, which has its source about 500 miles from this point, courses through a valley, varying in breadth from one to three miles, which is marshy, owing to the inundation of the river. The surface of the surrounding country presents an undulating prairie, studded here and there with "islands" of timber. Large lakes, plentifully supplied with fish, are occasionally found. The soil, although sandy, is productive. These facts have been furnished by Assistant-Surgeon John Emerson. The mean annual quantity of rain, on an average of three years, is 30.32 inches.

The total of deaths, according to the post returns, is twenty-four, the annual ration of mortality being $1\frac{6}{10}$ per cent. Of these, thirteen are reported in the medical returns, viz., one phthisis, two remittent fever, one meningitis, two gun-shot wounds, two casualties, one drowned, one suicide, and three from causes not designated. Excluding those reported from accidental causes, the average of mortality is less than $\frac{8}{10}$ per cent.

The diseases of this post require no special comment. As morbid action generally assumes a purely phlogistic character, the therapeutic means are correspondently simple. The relative agency of the seasons in the production of disease in general, gives in the first quarter 52, in the second 69, in the third 65, and in the fourth 51. Hence the mean period in which each man was reported on the sick-list, is five months.

FORT WINNEBAGO.—LATITUDE 43° 31′ N., LONGITUDE 89° 28′ W.

This fort is situated on the right bank of Fox river, directly opposite the portage between this river and the Wiskonsan, and is elevated about seventy feet above the level of the latter. It is eighty-one miles west of Lake Michigan, and one hundred and twelve south-west of Green Bay. Both the Fox and Wiskonsan are bordered by extensive marshes, which are occasionally inundated, so that boats pass from one river to the other.

"The formation of these marshes," says Surgeon Foot, "is a subject of much speculation. In cutting through the thick vegetable matter on the surface, from two to four feet thick, you come to a stratum of soft mud, generally a foot or two in thickness. In a few places, however, this stratum of mud and water is from eight to ten feet deep. These are known by the name of "shaking marshes," and are dangerous to cross with horses. They appear, however, to be filling up from the same causes that have made the others more solid."

Beneath the mud and water is a stratum of fine silicious sand, which is believed by Dr. Foot to be of animalcular origin. He supposes these marshes to have been originally shallow lakes or lagoons, full of aquatic plants, which were then, as now, covered with myriads of animaculæ, whose shell is pure silex. As these die annually, each one deposites its particle of silex, until, in the process of time, the lagoon becomes filled up, having below a stratum of sand, and above an imperfectly organized soil, formed by the annually decaying vegetation.

"The soil of the upland about this post," says Dr. F., "is a light loam, mixed with silex, lime, and clay. It is what is called a *warm soil*, and vegetation comes forward earlier than at any place in the same latitude I have ever been stationed at. The mineral productions are very few: secondary limestone and sandstone of recent formation are the only rocks that I have ever seen."

The annual quantity of rain, on an average of three years, is 31.88 inches.

The total of deaths, according to the post returns, is twenty; the annual ratio of mortality being $1\frac{3}{10}$ per cent. Of these, fourteen are reported in the medical returns, viz., three phthisis pulmonalis, one pleuritis, two chronic hepatitis, one gastro-enteritis, one splenitis, one syphilis, one ebriety, one idiotcy, and three from causes not stated, giving a mortality of $\frac{9}{10}$ per cent. Two of these cases occurred in recruits, who were sick when they arrived; and of the remaining fatal cases, the majority is, as usual, ascribed to the abuse of alcoholic liquors.

From a general view of the facts presented, it is manifest that this station is highly salubrious. When it is considered that marshes abound in the immediate vicinity of this post, it is surprising that diseases of malarial origin are not more rife. "I have never thought," says Surgeon Foot, "that the marshes about this post produced disease, till last fall, [1838.] Last year the Wiskonsan overflowed its banks in the latter part of July, covering all the extensive marshes bordering the Wiskonsan and Fox rivers with water for two or three weeks. All plants, except aquatic, were killed. This was succeeded by excessively hot and dry weather, during the month of August and part of September, when we had a number of cases of intermittent and remittent fever, which, I think, were caused by the decomposition of the vegetable matter on the marshes." The results obtained from the statistics of ten years do not, however, warrant the conclusion that these marshes are generally the sources of miasmata in the summer season. It is only when those meteorological causes, which are essential to the production of malaria, are peculiarly favorable, that intermittent or remittent fever prevails.

The relative agency of the seasons in the etiology of disease in general gives in the first quarter 36, in the second 34, in the third 38, and in the fourth 31 cases. Every man was consequently reported sick once in every eight months and a half.

FORT CRAWFORD.—Latitude 43° 5′, Longitude 90° 55′ W.

Fort Crawford, situated on the Mississippi, two miles above the mouth of the Wiskonsan, is on Prairie du Chien. This prairie, lying in the angle formed by these two rivers, is about ten miles long and two wide, terminating on the east by a range of abrupt hills about 300 feet in height. These bluffs present almost a naked surface, studded with boldly projecting rocks. The fort, which is about 300 yards from the Mississippi, is elevated seventy feet above its level. Directly in front of the fort is a marsh, which extends five miles up the river, and about as far down as the mouth of the Wiskonsan. This marsh or slough, which exists only during the low water of the summer and autumnal months, not unfrequently so abounds with putrid vegetable matter as to be extremely offensive. The soil, which is generally fertile, producing wheat, corn, rye, oats, and potatoes, abundantly, consists of a dark loam combined with lime and silex. Lead, iron, and copper, are found at many points; and among the productions of the forest, different varieties of *quercus*, (oak,) *acer*, (maple,) *betula*, (birch,) *salix*, (willow,) *juglans*, (walnut,) and *carya*, (hickory,) stand most prominent. The annual quantity of rain, on an average of three years, is 29.54 inches.

The total of deaths, according to the post returns, is ninety-four, the annual ratio of mortality being $2\frac{7}{10}$ per cent. Of these, thirty-five are reported in the medical returns, making, excluding six deaths from epidemic cholera, four from gun-shot wounds, and one from exposure to low temperature, $1\frac{3}{10}$ per cent. The causes of death, as stated in the medical returns, are as follows: six phthisis pulmonalis, six epidemic cholera, one common cholera, four remittent fever, three dysentery, four gun-shot wounds, two ebriety, two chronic visceral derangement, one sudden, one disease of the heart, one gangrene of the lower extremities from exposure to cold, one casualty, and three from causes not specified. The gun-shot wounds were received in battle in the expedition against Black Hawk. In the third quarter of 1832, there are reported twenty-one cases of gun-shot wounds, received in the action of the second of August, on the Mississippi, forty-five miles above this post.

The average of disease at this post is higher than the mean of the stations already examined. When it is considered, however, that those causes regarded as most conducive to the evolution of miasmata exist here abundantly, it seems surprising that fevers of malarial origin are not more rife. Equally remarkable is the fact of the variation in the ratio of these fevers from year to year. Thus, in the third quarter of 1830 there were 154 cases, whilst the same quarter of 1836, with a greater strength, affords but one case. The following table will show the relation between these fevers and endemic causes at this post:

Years.	Mean temperature July.	Mean temperature Aug.	Mean temperature July and Aug.	Highest Degree.	Quantity of rain in inches in July and August.	Ratio of cases of intermittent and remittent fever, per 100 of strength.
1829	74.33	73.76	74.09	94	No register.	3
1830	81.47	77.07	79.27	94		72
1831	76.56	71.93	74.24	98		33
1832	74.41	70.09	72.25	94		1
1833	78.73	76.58	77.65	98		8
1834	80.49	77.55	79.02	98		14
1835	73.80	69.62	71.71	94		3
1836	73.00	66.66	69.83	90	5.50	.4
1837	73.83	70.87	72.35	95	5.48	17
1838	78.61	73.90	76.26	97	8.24	19

Although the essential causes of intermittent and remittent fever may forever remain involved in obscurity, yet the general fact that the average of these fevers is highest in the third quarter of the year, in every district of the United States, warrants the conclusion that heat and moisture are requisite to develope them. In regard to the operation of these causes, however, there exists this striking difference, that heat acts in proportion to the rise of the mercury, whilst excess of moisture is no less inimical to the evolution of miasmata than its deficiency. This law in reference to atmospheric temperature obtains in the table just given. It is seen that the highest mean temperature of July and August, at Fort Crawford, is in 1830, when the ratio of intermittent and remittent fever in the third quarter is seventy-two per 100 of mean strength, and that the lowest mean temperature is in 1836, when the average of these fevers is only $\frac{4}{10}$. The years of 1832 and 1835 are the next lowest both in regard to the mean temperature and the ratio of these fevers. As there are doubtless many modifying causes, the precise influence of elevated temperature cannot be determined in each season.

With the exception of cholera asphyxia, no epidemic has prevailed at this post. In August 1833, among twenty three decided cases, six proved fatal.

The relative agency of the seasons in the production of disease in general, gives in the first quarter, fifty-nine ; in the second, seventy-two ; in the third, one hundred and three ; and in the fourth, sixty-eight cases per 100 men. Hence every man, on an average, was reported sick once in nearly every four months.

FORT ARMSTRONG.—Latitude 41° 28′, Longitude 90° 33′.

This fort is situated on Rock Island, which lies in the Mississippi, four miles above the mouth of Rock river. It is two miles long, and about four hundred yards wide, being a rich alluvial bottom based on a substratum of limestone.

The total of deaths, according to the Adjutant General's returns, is twenty, the annual ratio of mortality being $3\frac{4}{10}$ per cent. Of these but eight are reported in the medical returns, viz: one mania a potu, one accidental, one frozen, and five from causes not stated. The medical reports from this post are defective in details; and, consequently, no means are afforded of determining the causes of the high mortality given in the post returns. The ratio of intermittent and remittent fever is low, whilst of typhus there is not a single case. In the post returns, seven deaths are reported in September, 1832, which, it is more than probable, arose from epidemic cholera. In the first quarter of 1834 it is noticed that, on the night of the 13th January a man deserted, and when brought back on the 17th, the right foot was mortified as high as the tarsus, and the os calcis of each extremity was very much injured. On the 18th of March two deserted; and on the following day, both were brought back, one dead and the other torpid.

The relative agency of the seasons in the production of disease in general, gives, in the first quarter, forty-nine; in the second, seventy-four; in the third, eighty-eight; and in the fourth fifty-two cases. Hence the average period in which each man was reported sick, is four months and a half.

FORT LEAVENWORTH.—LATITUDE 39° 20′ N., LONGITUDE 95° 5′ W.

This post is situated on the right bank of the Missouri river, about 500 miles above its confluence with the Mississippi. As the Missouri here is not more than three hundred yards wide, being one of its narrowest points, the water is deep and the current rapid. This mighty river is at times navigable for steamboats 1,750 miles above the fort, and always, unless obstructed by ice, to its mouth.

The fort stands on a plain elevated about one hundred and fifty feet above the surface of the river. This plain is the highest point of an undulating prairie, which extends as far south as the eye can reach. The opposite shore is an extensive alluvial bottom, covered with a dense forest of cotton-wood, (*populus canadensis.*) The margin of the river, north of the fort, presents a similar character; but as the prevailing winds are from the south, the full effects of the exhalations from this miasmatic surface are not experienced.

The soil, which is quite productive, consists of a sandy loam, covered with a rich vegetable deposite, the whole based on a stratum of clay and limestone.

"The forest," says Surgeon Macomb, "abounds in trees valuable for fuel or timber. With the exception of the pine, almost all kinds are to be found. The most common are the *juglans nigra, carya olivæformis, carya alba, acer saccharinum, acer negundo, platanus occidentalis, cerasus virginiana, morus rubra, quercus alba,* etc."

The annual mean of rain and snow, on an average of three years, is 32.68 inches.

The total of deaths, according to the post returns, is forty-seven, the annual ratio of mortality being $2\frac{4}{10}$ per cent. Of these, twenty-eight are reported in the medical returns, viz., three typhus fever, two remittent fever, four phthisis pulmonalis, two pneumonia, three cholera epidemica, three atrophia, one chronic diarrhœa, one dysentery, one phrenitis, one apoplexy, one epilepsy, one drowned, one gun-shot wound, one suicide, one assassination, and two accidental, making, excluding the last six, an annual mortality of $1\frac{2}{10}$ per cent. In the post returns nineteen deaths are reported in 1834, of which no report is made by the medical officer. These fatal cases occurred among the Dragoons, who had just returned from an expedition among the Pawnees. In the command of the post proper, there was no death during the year. The result of this year and the subsequent ones cannot be regarded as a fair test of the healthfulness of the locality of Fort Leavenworth, as the Dragoons generally made summer campaigns into the country of the Osages, Pottawatamies, &c. In 1833, there occurred nine cases of epidemic cholera among the Mounted Rangers at this post, three of which proved fatal. This disease, although much diminished in fatality compared with the wide-spread epidemic of the previous year, prevailed very generally along our western frontier. In the first quarter of 1837, "the measles," says Surgeon Macomb, "prevailed among the troops; after which an epidemic catarrh made its appearance, similar to the influenza, and sometimes accompanied with symptoms of the peripneumonia notha of Sydenham." The unusual prevalence of diarrhœa (251 cases) in the third quarter of this year, is ascribed to the moisture and extreme heat of the summer months acting upon unacclimated constitutions, most of the troops being recruits from the east and the north. The post was regarded by the medical officer as "decidedly salubrious."

In a topographical description of this post, it is remarked by Surgeon Macomb, that "the Missouri river is at its highest rise in the month of June, in consequence, as it is supposed, of the melting of the snow in the Rocky Mountains. It continues thus full and overflowing the low grounds until the last of July. On the subsidence of the waters, many low spots in the bottoms are left filled with stagnant water, which the sun rapidly decomposes. Hence we may say that about the 1st of August the season of sickness commences. The diseases are, early in the season, chiefly intermittent fever and dysentery. Subsequently, they assume the remittent type; these are complicated with local congestions, and ultimately become typhoid."

Although this post, considering its relative position, may be justly regarded, at the present day, as decidedly salubrious, yet the history of its early establishment in 1827 and 1828, shows that the command suffered much from the diseases incident to troops establishing themselves in an uncultivated region.

The relative agency of the seasons in the causation of disease in general gives in the first quarter 82, in the second 83, in the third 109, and in the fourth, 86 cases. The mean period in which every man was reported sick is three months and a half.

The general results of this class of posts show that the annual ratio of mortality, according to the medical reports, is $\frac{8}{10}$ per cent., and according to the post returns, $1\frac{4}{10}$ per cent., based on an aggregate mean strength of 12,790. As in the preceding classes, the deaths from epidemic cholera (six at Fort Crawford and three at Fort Leavenworth) have been excluded, and in the medical returns, such deaths also as arose from other than natural causes, as drowning, suicide, &c. As the ratio per 1,000 of mean strength annually under treatment is 3,103, it appears that each man, on an average, was reported sick once in nearly every four months.

In regard to the ratio of mortality, it is seen that there is little difference between the first and third class of posts. On the Atlantic coast, it is about fifty per cent. higher than the mean of the other two classes—a result to be ascribed mainly to the circumstance that the troops have more easy access to spirituous liquors. Moreover, in the third class, more than one-fourth of the aggregate mean strength consists of the cadets at the Military Academy, among whom the usual effects of alcoholic potations among soldiers are not exhibited.

As regards the relative degree of salubrity, as shown by the ratio of cases reported in each class, it appears that the third is about fifty per cent higher than the mean of the other two; but in estimating the value of this result, it is necessary to bear in mind the high average of

West Point and Fort Leavenworth, as detailed under each post respectively.

The following table shows the number of deaths in each month, according to the post returns, in the three classes described :

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	27	26	26	32	28	55	41	39	25	37	40

The ratio of November and December may be regarded as the highest, for in the total of July are included thirty deaths from epidemic cholera, in August six, and in September six, from the same cause.

In the "General Deductions," when the investigation of each class of posts shall have been completed, the various relations of our different systems of climate in reference to mortality, morbility, and the comparative prevalence of certain diseases, will be fully elucidated. For the present, let the following suffice :

In the Northern Division of the United States just described, especially situations remote from the ocean and great lakes, characterized by extreme atmospheric dryness, the human frame experiences an increased activity of all the functions. As the function of respiration is performed most completely, and animal heat is rapidly generated to supply the expenditure on the surface of the body, increased tone is evinced in the nervous and circulating systems, and the constitution acquires the phlogistic diathesis, giving to diseases generally the sthenic character. Among the native inhabitants, muscular frames, plethoric habits of body, and the sanguine temperament, predominate ; and vascular depletions are generally required and well borne in the treatment of their maladies. These phenomena have apparently a close connection with the accumulation of positive electricity in the human frame ; inasmuch as the animal economy is very differently constituted in a warm and moist atmosphere, where the relative electrical states of both are correspondently modified.

II.—THE MIDDLE DIVISION OF THE UNITED STATES.

Its sub-divisions.—General Meteorological Character.—Topography of New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Kentucky, Tennessee, Missouri, Arkansas, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Alabama, and Mississippi.

This Division comprises two general systems of climate, which bear the same meteorological relation to each other as the modified climate of the great Lakes and the coast of New England does to that of the third class of the same Division. Whilst in the Northern Division a steady temperature predominates, this one, notwithstanding the extremes of temperature are much more modified, is characterized by variableness. On reference to Part First, these laws will be found fully illustrated in regard to the mean annual range of the thermometer, and the difference between the mean temperature of summer and winter, of winter and spring, and of the warmest and coldest months.

Of the two classes of posts pertaining to this Division, the *first* embraces the stations on the sea-coast and inlets of the ocean between the Delaware and Savannah rivers, viz., Forts Delaware, McHenry, Severn, Washington, Monroe, Bellona Arsenal, Moultrie, Johnston, and Oglethorp Barracks; and the *second* comprises the interior posts, viz., Jefferson Barracks, Forts Gibson, Smith, Coffee, Towson, and Jesup.

Conformably to the plan adopted in the preceding Division, the general physical characters of this region having reference to endemic influences, will now be brought under notice. It may be here remarked that in regard to a classification of soils, the nomenclature commonly received, has been adopted; such as the term, *sandy*, or arenaceous, *clayey* or argillaceous, *loam*, which is a medium soil composed of clay and sand, and lastly *vegetable mould*, which contains a large quantity of decomposed vegetable matter.

New Jersey. The northern portion is traversed by several mountain ranges, which are prolongations of the New York chain. The southern section of the State consists of a low plain, forming the north-western part of the great *Atlantic Plain*, which will be found to play an important part in the production of endemial causes. It is composed of a series of horizontal deposites of sand, clay, and some limestone, deeply furrowed by the channels of its water courses, and containing some basins having the character of swamps. The greater part of the Plain is covered with extensive pine-forests, not, however, without many patches of good land.

Pennsylvania. Stretching quite across the great Apalachian system, it is naturally divided into three strongly marked regions, viz., the Atlantic slope, the Central mountainous region, and the Ohio and Erie table-land. This State, like every other portion of the Union, abounds in noble rivers, and fine rivulets and brooks. East of the mountains, the country is generally under cultivation. Wheat is the great agricultural staple, whilst the other cereal grains, particularly Indian corn and buckwheat, with flax and hemp, are also extensively cultivated. Of mineral productions, coal, iron, and salt, are the most important in an industrial point of view.

Ohio. This State consists of a lofty table-land, elevated in the centre about 1000 feet, and on the northern and southern borders from 600 to 800 feet above the level of the sea; but the surface presents no considerable elevation above this general level. The greater part was originally clothed in forests of gigantic trees, upon which only partial inroads have yet been made; but three-fourths of the surface are eminently productive, and nine-tenths susceptible of cultivation, whilst even the summits of the hills have a fertile soil. The river-alluvions, called bottom-lands, are extensive and exuberantly fertile. Prairies and natural meadows are numerous in the centre and north-west of the State. The agricultural productions are those common to the Eastern and Middle States. As in other western States, Indian corn is a staple, more than 100 bushels being produced from an acre in the rich alluvial soils of the bottom-lands. Wheat, rye, oats, buckwheat, barley, potatoes, and all garden vegetables, thrive luxuriantly.

Indiana. With the exception of a narrow belt on the southern border, the whole surface is level or slightly undulating. As regards the nature of the soil, in popular acceptation, there are four principal varieties, which characterize all the north-western States, viz., 1. The alluvions of the river-valleys, called bottoms; 2. The forests, consisting of a dense growth of gigantic trees and a thick undergrowth of shrubs and vines; 3. The prairies or unwooded lands, richly covered with grasses and a gay profusion of flowering plants; and 4. The "barrens" or "oak-openings." The prairies, either level or undulating, are more extensive than in Ohio and Michigan, but less so than in Illinois. Grand Prairie on the Wabash is 300 miles long, and 100 broad. When broken up by the plough, they soon become covered with trees, being converted into oak-openings.

These barrens partake of the character of the forest and prairie, being covered with scattered oaks, interspersed with pine, hickory, and other forest-trees, springing from a rich vegetable mould. The soil is every where, even to the summits of the hills, productive, and in general exuberantly fertile. On all the streams are belts of rich alluvial soil of exhaustless fertility. The productive industry is almost exclusively agricultural, such as wheat, Indian corn, hemp, and tobacco.

Illinois. About two-thirds of the State, the middle and the northern part, consist of prairies, there being no elevations of more than 200 feet above the general level. The heavily wooded tracts are mostly confined to the borders of streams. Indian corn and wheat are the staple products, whilst the culture of oats, rye, buckwheat, hemp, flax, cotton, and tobacco, also proves successful.

Kentucky. This State is traversed in its eastern portion by numerous low mountain ridges. Proceeding westward, these bold features gradually disappear, being finally merged into an almost complete level on the Cumberland, Tennessee, and Mississippi. In its primitive state, nearly the whole surface was densely wooded with a forest of majestic trees and a thick undergrowth of gigantic reeds, called cane-brakes; but in the southern part is an extensive tract thinly wooded, with high grass growing amid the scattered and stunted oaks. In point of fertility of soil, much of this State is unsurpassed. Indian corn, wheat, hemp, and tobacco, are the great staples, cotton being but little cultivated.

Tennessee. The eastern part is mountainous, some ridges rising 3000 feet above their bases, which are elevated about 2000 feet above the sea. In Middle Tennessee, the surface is moderately hilly; and the west beyond the River Tennessee, presents a level or slightly undulating plain. Of this State, a large proportion is fertile and much is eminently productive. Cotton and Indian corn are the staples, but hemp, wheat, and tobacco, are considerably cultivated. Although cotton thrives well in the southern and western portions, yet the climate is not so well adapted to its cultivation as that of the States south of the 35th parallel.

Missouri. North of the River Missouri, the surface is generally moderately undulating; and, with the exception of the margins of streams, nine-tenths of it is destitute of trees. The alluvial patches along the course of streams are of remarkable fertility, and the soil of the upland is correspondently rich. South of the Missouri and west of the Osage, the country is of the same character; but the region south-east of the latter river is very rugged, being traversed by numerous ridges of the Ozark Mountains. Cotton is raised in the southern part of the State, but tobacco, hemp, wheat, Indian corn, and other cereals, are cultivated with more success.

Arkansas. The eastern border of the State to the distance of from 30 to 50 miles from the Mississippi, consists of low grounds, interspersed with numerous lakes and swamps, and annually overflowed, with little exception, by the inundations of the Mississippi, Arkansas, and other streams. The surface of this swamp presents in ordinary times a succession of lakes, bayous, cypress-lands, and marshy ground. The ponds, whose depth does not ordinarily exceed three or four feet, are mostly filled with very large cypress trees growing in the water The marshy ground is covered with trees of immense size, principally gum and sycamore in the lower places, and in the higher and more dry, white oak and hickory, and occasionally dense cane-brakes rising to the height of thirty feet. The valleys are often inundated to the depth of from fifteen to twenty-five feet.

Delaware. With the exception of the northern part, which, pertaining to the primary formation, is somewhat hilly and rugged, this State lies wholly on the Atlantic Plain, which extends from the Hudson to the Mississippi. As the States belted by this Plain possess many features in common, they have been reserved for the last in description. In this State there are numerous swamps on the sandy ridge or rather table-land, which, elevated about seventy feet tide-water, divides the rivers flowing into the Delaware and above Chesapeake. Along the Delaware and Atlantic, the shore is flat and in some places marshy. The soil, which is generally light and sandy, is occasionally rendered productive by the river-deposits. The agricultural staples are wheat and Indian corn. These river-deposits, consisting of a black mud, composed chiefly of vegetable fibre, sometimes attains a depth of fifty feet. As the low lands are very flat with an argillaceous substratum impervious to water, the ponds which originate from rains and springs, as they become dammed up by fallen trees, leaves, and brushwood, naturally expand into broad basins, termed marshes. These are covered with a black vegetable mould from one to six feet in depth, in which the proportion of organic matter is so great that the soil, if accidentally ignited during a dry season, will continue to burn until extinguished by rain. These phenomena, observed in this State, are no doubt common to the entire Atlantic Plain, or rather augment with the decrease of latitude.

Maryland. The eastern portion on both sides of the Chesapeake, belongs to the great Atlantic Plain. At the falls in the Susquehannah above Port Deposit and in the Potomac above Georgetown, we meet the first well-defined ridge, which, separating the low lands from the Atlantic slope, may be regarded as a step to a higher plain. Indian corn, wheat, and tobacco, are the agricultural staples. In the southern counties, the culture of rice, cotton, and the palma Christi or castor-oil bean, succeeds.

Virginia. As this State extends quite across the great Apalachian chains, four natural divisions are presented, viz., 1. The Tidewater region below the falls of the rivers; 2. The Middle region, between the falls and the Blue Ridge; 3. The Great Valley, between the Blue Ridge and the Alleghany Mountains; and 4. The Trans-Alleghany region, west of that chain. The western limit of the first would be marked by a line drawn from Georgetown through Fredericksburg, Richmond, and Petersburg—a low plain, exhibiting no considerable elevations, but deep ravines scooped out by the action of running waters, through which flow broad and sluggish streams. The primary ridge over which the rivers descend into the low country, is about 150 feet high; and here the surface becomes hilly, and proceeding westward gradually mountainous. The agricultural staples are, Indian corn, wheat, rye, oats, and tobacco; but as there is considerable diversity of climate on the same parallel, the phenomena of vegetation, as shown in Part First, are correspondently modified.

North Carolina. In this State, the Atlantic Plain, extending sixty or seventy miles from the sea, forms, as it were, a chaos of land and water, consisting of vast swamps traversed by sluggish streams, expanding ever and anon into broad basins. These swamps, which form so striking a feature of this plain, are estimated to occupy 3,000,000 acres; but a great proportion is susceptible of being reclaimed by embankments, and fitted for the culture of maize, rice, cotton, and tobacco. The middle region, corresponding to that described in Virginia, gradually merges into the mountainous country farther west. Here the table-land has an elevation of 1,000 or 1,200 feet above the sea, upon which rise many crests, one of which, the Black Mountain, has an elevation of 6,426 feet—the highest known summit on this side of the Rocky Mountains. Here too, as in Virginia, are found great diversity of climate and corresponding difference in the vegetable kingdom. Whilst the low-lands yield cotton, rice, and indigo, the western high country produces wheat, hemp, tobacco, and Indian corn.

South Carolina is also divided into three strongly marked regions—the Low, the Middle, and the Upper Country. The first two lie on the great Atlantic Plain.* The *Low* country, which extends about eighty miles from the sea, rising imperceptibly to the height of nearly two hundred feet, is covered with an almost unbroken forest of pines, known under the name of "pine-barrens." These barrens are occasionally intersected by fertile veins of land upon a clayey or marly foundation, bearing oak of different varieties, hickory, walnut, maple, &c. But this plain is also dotted with numerous swamps and savannahs. The *Middle* country, which is from thirty to forty miles wide, consists chiefly of sand-hills, interspersed with swamps and valleys producing shrubs and trees indicative of a more generous soil. Beyond the limit of the Atlantic Plain at the lower falls of the rivers, at Hamburg, Columbia, and Camden, the surface is diversified with hill and dale, irrigated by clear, rapid, and pleasant streams, and clothed in forests of oak, ash, beech, walnut, chesnut, hickory, &c., until, in the extreme west, the mountain-crests rise up from an elevated table-land to the altitude of nearly 5,000 feet. The staples are cotton and rice. The Upper country yields the finest wheat, Indian corn, tobacco, &c., whilst the cultivation of rice is confined to the low-lands.

Georgia. Like the Carolinas, this State is divided into three well-defined belts, extending across the state from east to west. The Atlantic Plain, the northern boundary of which passes near Augusta, Milledgeville, Macon, and Columbus, exhibits the usual features; whilst a zone of sand-hills forms a higher terrace, reaching to the base of the mountains and constituting the Atlantic Slope. Extending thence to the sources of the rivers is the hilly region, which, blessed with a mild climate and productive soil, contrasts strongly with the hot, sultry, and malarial region below. Cotton and rice are the great agricultural staples. Some tobacco is cultivated in the middle and northern, and some sugar in the southern parts.

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* The term *Atlantic Slope* ought to be applied to the region, which, commencing with the abrupt rocky limit of the Atlantic Plain properly so called, extends gently upwards to the base of the mountains.

Alabama. In this State, the Atlantic Plain, which continues in a north-west direction, the northern limit passing near Wetumpka and Tuscaloosa, is little elevated above the Gulf of Mexico, being furrowed with deep ravines in which the sluggish streams wind their devious course. Much of the soil is sandy and unproductive; but the margins of rivers are amazingly fertile, covered in some places, in a state of nature, with a dense and impenetrable growth of gigantic canes, which often attain a height of more than thirty feet, and in others clad in forests of oak, hickory, dog-wood, magnolia, etc. North of this great Plain, the surface, as in Georgia, becomes hilly and finally mountainous. Cotton absorbs nearly all the attention of the agriculturist. Some sugar is cultivated in the southern, and some tobacco in the northern part. Indian corn is the principal grain-crop; but the culture of indigo, formerly much attended to, is now abandoned.

Mississippi. The geographical description of Alabama is applicable to this State, only the mountainous region, owing to the north-west direction of the continuation of the Atlantic plain, is less extensive. Much of the State presents an undulating surface, arising more from depressions below than elevations above the general level. The western border skirting the Mississippi, consists mostly of swamps, marshes, and lagoons; and between Memphis and Vicksburg, the broad and extensive low grounds, are subject to frequent inundations, to the distance of ten, twenty, and even thirty miles from the Mississippi. This extensive tract, called the Mississippi or Yazoo Swamp, assumes, during the prevalence of high floods, the character of a marine forest more than that of a wood-land bottom. The soil of the State presents three well-defined varieties: First, the bluffs adjacent to the Mississippi overflow; second, the alluvial margins of the rivers; and third, the pine-forest lands. The first, the bluff-zone of Mississippi, which commences as low down as Iberville, Louisiana, and stretches into Tennessee, varying in breadth from ten to forty miles, affords a tract not exceeded in intrinsic value in any other portion of the United States. Tobacco and indigo were the earlier staples, but cotton is now the main object of agriculture. The sugar-cane is cultivated to some extent; and for home consumption, some wheat and Indian corn.

1st Class.—POSTS ON THE ATLANTIC COAST.

Medico-topographical and statistical details in reference to Forts Delaware, McHenry, Severn, Washington, Monroe, Bellona Arsenal, Moultrie, Johnston, and Oglethorpe Barracks.—General results.

FORT DELAWARE.—Latitude, 39° 35′, Longitude, 75° 29′.

Fort Delaware is situated on a mud island, formed by the deposition of alluvion in the Delaware. The soil is of such a spongy nature that a heavy body will gradually sink for several days. It is four miles from Newcastle, and about forty miles below Philadelphia.

As the total of deaths, according to the post returns, is eleven, and the aggregate mean strength is 350, the annual ratio of mortality is a fraction above three per cent. All of the deaths are reported in the medical returns, viz., two remittent fever, one intermittent fever and anasarca combined, two phthisis pulmonalis, one pneumonia typhoides, two delirium tremens, one cynanche maligna, one aneurism of the aorta, and one ulcer in ano. Although the ratio of mortality is high, yet the causes of death are, in most instances, not ascribable to climate or local position.* The high average of intermittent fever, in the summer of 1829 and 1830, is attributed to the marsh mud thrown up from a ditch encircling the island. The annual ratio of intermittent fever is sixty-two per cent., and that of remittent fever is sixteen per cent. In 1831, many cases of the most obstinate constipation of the bowels were reported both at this post and at Fort Severn, followed in some instances by paralysis of the hand and fore-arm. It was ascribed to the white lead used by the men in cleaning their belts and gloves. As it was necessary to moisten the material, and apply it by means of a sponge, the hands were daily exposed to its action. As the belts were also rubbed with pumice-stone, particles of the lead may have been inhaled. It became necessary to abandon its use, substituting pipe-clay. The history of this post prior to 1829 also shows a high ratio of morbility as well as a severe grade of morbid action. In the third quarter of 1825, nearly every man suffered from diarrhœa and intermittent and remittent fever. The soldiery, during all this summer, were employed in en-

* Although the term, climate, according to the definition before given, includes the effects of "local position," yet custom may be said to warrant this loose phraseology.

larging the *fosse* surrounding the fort; and as the bottom consisted of soft alluvial matter, the prevalence of these affections was ascribed, in a great measure, to this agency. The deleterious effects arising from the introduction of lead into the system, were, at this period, also evidenced among this garrison, to which more particular reference will be made in the "General Deductions."

The relative agency of the seasons in the production of disease in general is expressed in the following ratios:—First quarter 39 cases, second 43, third 96, and fourth 51 per 100 men. Hence every man, on an average, was reported sick once in every five and a half months.

FORT McHENRY.—LATITUDE 39° 17′, LONGITUDE 76° 36′ W.

Situated on a peninsula, bounded on the one side by the Patapsco river, and on the other by the harbor of Baltimore, Fort McHenry is about three miles distant from the centre of the city, in a southerly direction. It occupies the whole of the extremity of the peninsula, covering an area of fifty-five or sixty acres; the fort is elevated about thirty-six feet above the level of the river, when at high water mark; and as this elevation has a gradual slope in every direction, the drainage is naturally good.

The surrounding country is rather low and level, with occasional undulations; but there are no mountains or very high lands in the vicinity. The soil is mostly argillaceous and silicious. During the summer, the prevailing winds vary from south to east, whilst those of the winter are mostly north-west. When blowing from the south, the current of air traverses some low land called Romney Marsh, on the opposite side of the Patapsco; but the distance of this marsh from the fort is upwards of a mile. The annual quantity of rain, on an average of four years, is 40.80 inches.

As the total of deaths, according to the post returns, is twelve, and the aggregate mean strength is 624, the annual ratio of mortality is nearly two per cent. Of the deaths, ten are reported in the medical returns, viz., one bilious colic, one phthisis pulmonalis, two ebriety, one mania a potu, one chronic diarrhœa resulting from an attack of epidemic cholera at Fortress Monroe, one wound, one sudden, and two from causes not designated, being $1\frac{7}{10}$ per cent.

Although much disease has always prevailed at this post in the summer season, yet among the causes of death just given there is scarcely one that can be ascribed to locality. The following remarks, collated from the quarterly sick-reports, will serve to elucidate this point. In 1829 the command, as usual, went into summer encampment; but as Fort McHenry was being repaired, it was necessary that all the artificers and some of the soldiers should be employed at the fort; and consequently, of fifty-five cases of intermittent and remittent fever reported, all, with the exception of one case of the former type, were contracted at the fort. In the third quarter of 1830, there are fifty-six cases reported, ascribed by Assistant-Surgeon French to the delay in proceeding to a summer encampment. It is his opinion that the post ought to be abandoned on the 15th June. In the summer of 1831, a camp was again formed. It is remarked that no death among the men had occurred in two years. In 1832, in transmitting the sick-report of the second quarter, it is remarked,—"The cases of intermittent and remittent fever begin to assume a highly bilious character, and I have no doubt that in ten days one-half of the command will be on the sick-list, unless the men be ordered to the high ground above the city, where they ought to be every year by the 30th June." On the 23d July, the command left the fort for Camp Huntington; and in this quarter (the 3d) there are only six cases of fever reported. The high average of cases in the third quarter of 1834, is attributed to the circumstance that the garrison did not form the customary encampment. Bilious intermittents and remittents were the prevailing diseases, but no case terminated fatally. The annual average of intermittent fever is very high, being 91 per cent., whilst that of remittent fever is only 6 per cent.

On referring to the history of this post prior to 1829, it is found that, in 1825, the command, in consequence of the insalubrity of the position during the summer months, retired to a camp two miles from Baltimore, and that this step had been rendered necessary for several preceding years. In 1819 and several succeeding years, much is said of a "violent bilious colic," attended "with frequent attacks of inflammation of the brain, terminating in delirium, apoplexy, and death." It was at first regarded as a new modification of morbid action—one of those inscrutable results, which, by a fortuitous concurrence of circumstances, are developed from time to time; but in 1822, by the observation of certain facts, it was supposed to have received a rational explanation. In a garrison of 108 men, fifty-six were recruits, all of whom were employed on police duty, whilst the old soldiers performed the necessary guard duties. The diet of both was the same. Both were exposed to the high temperature of the day; but the latter were subjected to the additional influence of the damp atmosphere of the night, laden with marsh effluvia. The extent of sickness in these two classes of men, was perhaps equal; but the cases of "bilious colic" occurred only among the old soldiers, whilst the detachment of recruits suffered much from intermittent fever. It would seem, then, that the poison, in a certain quantum, produced intermittent fever; and when conjoined with the effects of exposure to night air, the result was "bilious colic." Between the skin and the liver there exists an intimate and powerful sympathy. In proportion as high atmospheric temperature excites these organs into inordinate functional action, are they rendered susceptible to the impressions of cold and dampness. Assuming, therefore, that both the recruits and old soldiers were equally exposed to the causes of intermittent fever, we are led to the inference that the conjoined influence of exposure to the night air produced a sudden torpor or inactivity of these two important emunctories, causing that group of violent abnormal manifestations, designated "bilious colic." This view of the subject accords with the appearance of similar affections at other points, and accounts for its unusual prevalence two years previously, when the men were employed in boats. Improper diet and irregular habits were the causes then assigned.

The relative agency of the seasons in the etiology of disease in general is expressed in the following ratios:—First quarter 65 cases, second 74, third 99, and fourth 72 per 100 of the strength. Hence the mean period in which each man was reported sick, is four months.

It would seem, however, that this station within the last few years has become more salubrious. Unoccupied by troops, the fortification has been undergoing repairs under the supervision of the Engineer Department. The grounds have been graded, a sea-wall built, and an excellent hospital erected. It is the opinion of Dr. Roberts, a civil practitioner, who was employed at this post for several years, that the necessity of removing to a summer camp will in future be obviated.

FORT SEVERN.—LATITUDE 38° 58′, LONGITUDE 76° 27′.

This post is situated on Severn river, on a point of land which makes out from the city of Annapolis. It is very little elevated above the level of Chesapeake bay. The river is here about eight hundred yards wide. There are no marshes in the immediate vicinity.

As the total of deaths, according to the Adjutant General's returns, is sixteen, and the aggregate mean strength is 423, the annual ratio of mortality is $3\frac{5}{10}$ per cent. Of the deaths, thirteen are reported in the medical returns, viz., five bilious congestive fever, one phthisis pulmonalis, one abscess of the lungs, one mania a potu, one worn-out, three from causes not stated, and one suicide, being, excluding the last, about three per cent.

At this post, diseases have generally manifested a violent grade of action. The fevers of the third quarter have generally appended to them the title of *malignant*. In the summer of 1830, Annapolis and the adjacent country suffered severely from "congestive bilious fever." In the third quarter of 1832, 1833, and 1834 also, all diseases assumed an aggravated character, and especially bilious remittents, which manifested a strong tendency to congestion. In the second quarter of 1830 are reported eleven cases of enteritis, which were regarded by Assistant-Surgeon Smith as genuine colica pictonum, arising from the careless use of ceruse on the belts and gloves. The annual average of intermittent fever is 50 per cent., and that of remittent fever is 24 per cent. It thus appears that, whilst the former is little more than half as rife as at Fort McHenry, the latter is four times as prevalent. In 1819, and several subsequent years, this garrison, like that of Fort McHenry, was severely harassed by a peculiar modification of disease, termed *bilious colic*.

As regards the etiology of disease in general, the relative agency of the seasons is expressed in the following averages:—First quarter 63 cases, second 74, third 104, and fourth 68. Hence every man, on an average, was on the sick list once in every four months.

FORT WASHINGTON.—Latitude 38° 41′, Longitude 76° 58′.

This fort is on the banks of the Potomac, about sixteen miles below Washington city. The parade of the main work is 115 feet above high-water mark, being on a ridge extending towards the river. It is surrounded by hills rather higher than this one, the intervening space on the south-east being a deep ravine, 400 feet wide, under cultivation, with a brook running through it. On the north is also a ravine about 300 feet wide.

As the total of deaths conformably to the post returns is fourteen, and the aggregate mean strength is 394, the annual ratio of mortality is $3\frac{5}{10}$ per cent. Of the deaths, nine are reported in the medical returns, viz., four phthisis pulmonalis, (two of these, perhaps all, drunkards,) three sudden from ebriety, one frozen when in a state of intoxication, and one suicide. Excluding the last two, although all might perhaps be set aside on similar grounds, the ratio of mortality is 2 per cent. per annum. The vice of intemperance is, indeed, fraught with evils, both moral and physical, of incalculable magnitude. One man, for example, in a state bordering on delirium tremens, cut off his left hand with a hatchet to avoid being compelled to work.

The prevalence of intermittent fever at this post, in the summer season, has generally rendered it necessary to form an encampment at this period. The fort was usually evacuated about the middle of July, and re-occupied about the 30th September. In 1831, four men, who were left behind in charge of the public property, as well as the families that remained until late in August, had frequent attacks of intermittent fever. The cases of intermittent fever reported in the first quarter of this year, occurred chiefly among recruits who had been employed the previous autumn on the Chesapeake and Ohio Canal. The annual average of intermittent fever is 57 per cent., and that of remittent fever is 10 ; but the ratio of malarial disease at this post, as well as at Fort McHenry, is much below the reality, owing to the circumstance that the troops formed summer encampments. In 1826, remittent fever prevailed at Fort Washington and the surrounding country to a great extent.

The comparative agency of the seasons in the production of disease in general is expressed in the following ratios :—First quarter 54 cases, second 75, third 93, and fourth 67. Hence the average period in which every man was reported sick, is four months.

FORT MONROE.—LATITUDE 37° 2′ N., LONGITUDE 76° 12′ W.

This fortification occupies a low sandy point or peninsula, the termination of the western shore of Chesapeake bay, bounded on the east and south-east by the waters of that bay, on the south and south-west by Hampton Roads, and on the north and north-west by Mill creek, which is an inlet of the roads. The general aspect of the country is low, and uniformly flat. The salt-water marshes, bordering Mill creek, are the only ones in the immediate vicinity, and these are inundated by every influx of the tide. The principal production of the forest is the pine, (*pinus palustris*.) The annual quantity of rain, on a mean of three years, is 52.55 inches.

As the total of deaths, according to the Adjutant General's returns, is 120, and the aggregate mean strength is 2,827, the annual ratio of mortality is $4\frac{2}{10}$ per cent. Of deaths, 102 are reported in the medical returns, viz., seventeen phthisis pulmonalis, four pneumonia, three pneumonia typhoides, four influenza, one engorgement of the lungs, thirteen remittent fever, thirteen chronic diarrhœa, two dysentery, fourteen epidemic cholera, six mania a potu, seven sudden from ebriety, three dropsy, one worn out, two aneurism, two gangrenous ulcer, seven casualties, and three drowned. Excluding the deaths from drowning and epidemic cholera, as in the preceding calculations, the average annual mortality is $3\frac{2}{10}$ per cent.

The most striking fact in the history of this post is the remarkable prevalence of diseases of the respiratory organs, twenty-nine deaths having arisen from this class; but this subject will be fully illustrated in the investigation of this class of diseases in the "General Deductions."

The annual ratio of intermittent fever is not high for this latitude, being 19 per centum annually; but this result evidently finds an explanation in its topography. The average of remittent fever is 22 per cent., thirteen deaths being reported from this cause. Of the deaths reported in 1837 and 1838, nine were invalids from Florida, all save one having died of chronic diarrhœa. The high ratio of cases in the third quarter of 1837 is owing to the circumstance that the command consisted of unattached recruits and invalids from Florida. In the third quarter of 1832, twelve deaths from cholera Asiatica are reported, there having been thirty-four unequivocal cases, and many more in the premonitory stage. In the third quarter of 1834, there are reported forty-eight cases of the same disease, of which two proved fatal.

It is shown then, that, with the exception of remittent fever, nearly all fatal cases arose from thoracic lesions. Excluding the deaths from epidemic cholera, and those from chronic diarrhœa among the invalids from Florida, it is found that nearly all other cases were casualties, or the direct effects of drunkenness.

The comparative agency of the seasons in the causation of disease in general, is expressed in these averages:—First quarter 64 cases, second 76, third 92, and fourth 85 per 100 men. Every man was consequently, on an average, reported sick once in nearly every four months.

BELLONA ARSENAL.—Latitude 37° 30′ N.

This post is situated on the right bank of James river, twelve miles from Richmond. It occupies a position elevated upwards of 100 feet above the level of the river, with grounds sloping rapidly.

It is about 200 yards from the river, a cultivated field intervening; and on each side is a ravine running nearly at right angles with the river, the eastern one having a small stream distant about 300 feet from the arsenal.

As the total of deaths, according to the post returns is eight, and the aggregate mean strength is 249, the annual ratio of mortality is $3\frac{2}{10}$ per cent. Of the deaths, six are reported in the medical returns, viz., one remittent fever, one cholera morbus, and four from causes not designated, being at the rate of $2\frac{4}{10}$ per cent.

At this post the average of fevers of malarial origin is high, the annual ratio of intermittents being 44, and that of remittents 46 per cent. In the third quarter of 1829, this station and its vicinity suffered much from bilious remittent fever. But one death, however, occurred among the soldiers. "The diseases, principally bilious remittent," says Assistant-Surgeon Monroe, "have been of the most malignant type, requiring the most energetic treatment. If ever the patient has a third chill, the case is extremely doubtful, and if a fourth, it is hopeless. I have had cases terminating in death in twelve or twenty-four hours after the first apparent symptoms of attack. These cases were ushered in with coma, and a bright saffron suffusion of the skin, and even of the nails. Such cases were of course hopeless from the beginning." It does not appear that any disease of similar malignity has since prevailed. On referring to the earlier history of this post, however, it is found that in the third quarter of 1825 intermittent and remittent fever prevailed, "as usual," to a very great extent. The locality was regarded as so very insalubrious, that a summer encampment was recommended. On the first establishment of this arsenal it seems to have been quite healthy, being then well wooded and sheltered, more especially on the side next the river.

The relative agency of the seasons in the production of disease in general, is expressed in the following averages:—First quarter 43 cases, second 55, third 83, and fourth 59. Consequently the mean period in which every man was reported sick, is five months.

FORT MOULTRIE.—LATITUDE 32° 42′ N., LONGITUDE 79° 56′ W.

This post is situated on a sand island at the mouth of Charleston harbor, four miles from the city. Although there is much salt-water marsh in the rear of the island, no deleterious effects arise. The town of Moultrieville, exposed to the same agencies, is a resort in the summer season.

As the post returns include Charleston harbor, that is, Forts Moultrie, Pinckney, and Johnson, in the aggregate, it has been found very difficult, as in the case of Fort Columbus, to give the precise strength of Fort Moultrie. The total of deaths in the harbor of Charleston is thirty, and as the mean strength for the same period is 1,148, the annual ratio of mortality is $2\frac{6}{10}$ per cent. Of these twenty are accounted for in the sick reports from Fort Moultrie, viz., seven phthisis pulmonalis, three chronic diarrhœa, two yellow fever, one apoplexia, one delirium tremens, two ebriety, one variola, one atrophia, one worn-out, and one casualty. As the mean strength for Fort Moultrie, for the same period, was 665, the rate of mortality is 3 per cent. As the principal hospital accommodations were at this post, it would seem, that many of those most seriously ill were brought from the neighboring fortifications.

The annual ratio of intermittent fever is remarkably low, being but 9 per cent., whilst that of remittent fever is 7 per cent. As yellow fever is often endemic at Charleston, it has appeared several times at this post, but in no instance with much fatality. In the third quarter of 1834, there are five cases of febris icterodes reported, two of which proved fatal. Of these cases, two originated at Charleston and the other three at Castle Pinckney. In 1824 it is found that, whilst this disease prevailed with great malignity in the city, not more than twelve cases, none of which proved fatal, appeared on the island in a strength of seventy.

The comparative agency of the seasons in the causation of disease in general is expressed in the following ratios:—First quarter, 54 cases, second 70, third 85, and fourth 48. Hence every man, on an average, was registered on the hospital books once in every five months.

FORT JOHNSTON.—Latitude 34° N., Longitude 78° 5′ W.

This post is situated in the town of Smithville, North Carolina, immediately on the Atlantic coast, three miles from the mouth of Cape Fear river. There are some marshy low lands within the distance of half a mile.

As the total of deaths, according to the Adjutant General's returns, is fifteen, and the aggregate mean strength is 400, the annual ratio of mortality is $3\frac{7}{10}$ per cent. Of the deaths, eleven are reported in the medical returns, viz., one remittent fever, one continued fever, one chronic diarrhœa, one phthisis pulmonalis, one apoplexy, and six from causes not designated, being $3\frac{1}{10}$ per cent.

The reports from this station are not given sufficiently in detail, to be enabled to state with much precision the peculiar character of morbid action. The annual average of intermittent fever is pretty high, being 46 per cent., whilst that of remittent fever is 10 per cent.

The relative agency of the seasons in the etiology of disease in general is expressed in the following ratios:—First quarter 46 cases, second 50, third 59, and fourth 43. Hence the mean period in which every man was reported sick is six months.

OGLETHORPE BARRACKS.—LATITUDE 32° 4′ 56″, LONGITUDE 81° 7′ 9″.

This post, in its present position, is in the suburbs of Savannah, which is distant about twelve miles in a direct line from the ocean. Situated upon a sandy plain, elevated about forty feet above low-water mark, this city stands upon the southern side of the river of the same name. This ridge extends upwards of a mile along the river, terminating abruptly. At the depth of twenty or thirty feet, fine water is obtained. The city is bounded on the east and west by alluvial soil, called, in the language of the country, *tide-swamp*, being by the ordinary spring tides subject to inundation. It is consequently well adapted to the cultivation of rice. The city, divided by numerous and wide streets, intersecting each other at right angles, is open and spacious; and being planted with the Pride of India, (*melia azedarach*,) the long continued heats of summer, moderated by the sea-breeze, prove less oppressive than in some more northern towns.

It is necessary to remark that the station to which these statistics have reference, had a different locality from the present barracks. Situated about a mile south of the city, their vicinity abounded in rice-fields and marshes, some of which contained an intermixture of fresh and salt water. So prevalent and fatal did diseases prove in the summer season that the abandonment of the post was generally demanded; and hence these statistics fall short of a fair expression of the actual ratio of sickness.

As the total of deaths, according to the Adjutant General's returns, is eighteen, and the aggregate mean strength is 325, the annual ratio of mortality is $5\frac{5}{10}$ per cent. Of the deaths, fourteen are reported in the medical returns, viz., five remittent fever, two phthisis pulmonalis, one bilious pleurisy, one cholera morbus, one epilepsy from ebriety, one convulsions from drinking cold water, and three from causes not designated, being at the rate of $1\frac{2}{10}$ per cent.

The annual ratio of intermittents is sixty-seven per cent., and that of remittents is twenty-two; but these averages, inasmuch as the post was evacuated in the sickly season of 1829, 1830, and 1831, is below the actual result. In the third quarter of 1835, intermittent and remittent fever prevailed to a very great exent. The strength of the garrison, including women and children, was seventy-three, of whom sixty-nine were attacked by some form of fever. This post was always very unhealthy, as the records of the preceding decennial period show. Thus in 1828, in the third quarter, there occurred twenty-three deaths in a command of ninety-five men; and in the fourth, eighteen deaths in a strength of eighty-five. The total of deaths for the year was fifty-two, besides nineteen women and children. Remittent fever and dysentery were the most fatal diseases. The station at Tybee Island, at the mouth of the Savannah, had been equally insalubrious. In the third quarter of 1823, the whole command, including women and children, were attacked with "autumnal fever." The number of men present was forty-one, of whom nine died, and eight or ten were rendered nearly unfit for service.

The relative agency of the seasons in the etiology of disease in general is expressed in the following ratios :—First quarter 47 cases, second 59, third 83, and fourth 73. Hence the average period in which every man was reported on the sick list, was nearly five months.

The investigation of each station along the coast of the Atlantic and its inlets, between the Delaware and Savannah rivers, having been completed, the results obtained, as a class, are as follows :— The annual ratio of mortality, according to the medical reports, is three per cent., and according to the post returns, $3\frac{1}{10}$ per cent., based on an aggregate mean strength of 6,740. As in the preceding classes, the deaths from epidemic cholera (fourteen at Fort Monroe) have been excluded, and also in the medical returns, the deaths reported as drowned, frozen, and suicide. As the ratio per 1,000 of mean strength annually under treatment is 3,890, it follows that each man, on an average, was reported sick once in a little upwards of every four months. Judging from the ratio under treatment annually, as affording an index of the comparative extent of sickness, it appears that the highest average is presented at Fortress Monroe, and the lowest at Fort Johnston. As many invalids, however, were brought to Fortress Monroe from Florida, it is found, excluding these, that the ratio is lower than that of Fort Severn or McHenry.

This average, in connection with the ratio of mortality, affords an unerring criterion for estimating the comparative salubrity of a station. By itself, it is liable to lead to error, inasmuch as ten cases of remittent fever may give more deaths than five hundred of intermittent fever. Thus, although the ratio of mortality at Oglethorpe Barracks is the highest in this class, yet the number of cases treated presents only a medium average. This fact is more apparent in the statistics of the British army, embracing climates of the most diverse character. For example, in the West Indies, the Jamaica command with sixty-three constantly sick is far more unhealthy than the Windward and Leeward with eighty-seven constant ineffectives. In the former, four-fifths of the mortality is caused by fevers, which rapidly terminate in death or recovery. Thus, during the ravages of epidemic fever, the mortality may be very great without the average number in the hospital being materially augmented. In the Windward and Leeward command the mortality is six times as high as in the United Kingdom, although the extent of sickness, as shown by the number of admissions into hospital, is but twice as great.

The total of deaths in each month, according to the post returns, is given in the annexed table:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total of deaths in each month.	19	19	20	11	16	22	19	32	17	23	25	21	244

The fourteen deaths from epidemic cholera, reported in this class, occurred three in July, eight in August, and three in September.

Without giving any precise results, we may so far anticipate the general conclusions, as to state that diseases of malarial origin increase *pari passu* as southern latitudes are approximated. This is strikingly apparent in fevers of the intermittent and remittent types, and in diarrhœa and dysentery. In reference to the class of pulmonary diseases, the laws developed are of so general a character that any illustrations or comparisons, at this stage of the investigation, could serve no useful purpose.

2d Class.—THE INTERIOR POSTS.

Medico-topographical and statistical details relative to Jefferson Barracks, Forts Gibson, Smith and Coffee, Towson, and Jesup.—General results.

JEFFERSON BARRACKS.—Latitude 38° 28,′ Longitude 90° 8′.

Jefferson Barracks are situated on the right bank of the Mississippi, ten miles below the city of St. Louis. They occupy at the distance of 150 yards from the river, a sloping ridge elevated about 100 feet above high-water mark. The surface of the surrounding country presents an undulating character; and, as it frequently rises into abrupt hills with deep ravines, the drainage is perfect. The soil is a rich loam based upon clay with a sub-stratum of limestone. The country around, with the exception of the public grounds, remains covered with a heavy growth of timber. As to mineral productions, indications of lead are common, and stone-coal is found in abundance. In Illinois, on the opposite side of the river, which is here about one mile wide, is the "great American bottom," which is said to be sixty miles long, and on an average seven miles wide. On the river, it is skirted with forests varying in breadth from a half to one mile, whilst the remaining space to the high ground consists principally of prairie, covered with a luxuriant growth of grass. This prairie is chequered with numerous lakes; and as the evaporation of the water, during the latter part of summer, exposes the surface of the subjacent soil, a fruitful source of disease is engendered. These bottom-lands are but partially cultivated.

At the St. Louis Arsenal, the annual amount of rain, on an average of two years, is 24.12 inches.

As the total of deaths, according to the post returns, is 159, and the aggregate mean strength is 3,313, the annual ratio of mortality is $4\frac{8}{10}$ per cent. Of the deaths, 137 are reported in the medical returns, viz., eight remittent fever, one intermittent fever, eighteen phthisis pulmonalis, eight pneumonia, one pleuritis, one hæmoptysis, two gastro-enteritis, three dysentery, six chronic diarrhœa, twenty-four cholera epidemica, one stricture of the intestines, one rheumatism, one dropsy, one scorbutus, ten mania a potu, nineteen ebriety, one apoplexy, one atrophia, one worn-out by obscure chronic affections, one ulcer, one caries of the malar bones, one sudden, one gun-shot wound, two casualties, two suicide, and eighteen from causes not designated. Excluding the cases of epidemic cholera and suicide, the annual ratio of mortality is $3\frac{5}{10}$ per cent.

every one in the command was affected with diarrhœa, which often terminated in cholera. In 1835, in the second quarter, are reported seven cases and four deaths, and in the third quarter, one case and one death. This was the last appearance of this mysterious epidemic.

The comparative agency of the seasons in the etiology of disease in general is expressed in the following ratios of cases per 100 of the strength :—First quarter 71, second 82, third 104, fourth 88. Hence every man, on an average, was registered on the sick list once in every three and a half months.

FORT GIBSON.—Latitude 35° 47′, Longitude 95° 10′.

This post is situated on the east bank of the Neosho or Grand river, in Arkansas, and is distant about 425 miles north of the Gulf of Mexico, measuring from a point near the mouth of the Sabine river. The site of the fort is about one hundred yards from the banks of the Neosho, and three miles from its mouth. About a mile and a half to the southwest, towards the Arkansas river, is a lake surrounded by marshes ; and, as its level varies little from that of the fort, the drainage of the latter is consequently very defective. As the fort was originally located in a cane-brake, the soil partakes in a very high degree of what is designated, in the language of the country, "river bottom land." It is skirted on three sides by elevated prairie, about four miles in extent, environed by a chain of hills. The opposite side of the river presents a cane-brake, extending a mile above and below the fort, interspersed with lakes and marshes towards the southwest. The soil is of a character admitting of the most prolific cultivation. Indian corn is the staple commodity ; and of mineral productions, the principal are coal and salt.

As regards thermometrical observations, it is found that the mercury rises higher at this post than at any other in the United States. The mean annual quantity of rain, based on three years' observations, is 30.64 inches—one of the lowest averages among twenty eight posts at which observations upon the rain-gauge have been made. The prevailing winds, which are southerly from the Gulf of Mexico, traverse the marshes and lakes above described.

It thus appears that all the circumstances most conducive to the evolution of malaria obtain. The soil is composed of a rich alluvion; solar heat is of the most intense character ; and the quantity of rain, although adequate to the maintenance of a certain degree of moisture, is not sufficient to overflow the low lands during the summer season.

As the total of deaths, according to the post returns, is 277, and the aggregate mean strength is 4,269, the annual ratio of mortality is $6\frac{5}{10}$ per cent. Of the deaths, 210 are reported in the medical returns, viz., forty-four remittent fever, five intermittent, four continued, two mucous, and two typhus fever, twenty-six phthisis pulmonalis, eleven pneumonia, one pleurisy, one hæmoptysis, one serous effusion into the lungs, one cynanche trachealis, two rubeola, one tonsilitis, seven dysentery, two diarrhœa, one gastro enteritis, eighteen epidemic cholera, three apoplexy, one phrenitis, one arachnitis acutus, one convulsions, one neuralgia pedis, two delirium tremens, six ebriety, two anarsarca, five erysipelas, five obscure chronic visceral lesions, one poisoned by opium, two wounds, one sudden, one homicide, two suicide, three submersion, two casualties, and forty-five from causes not stated. Excluding, as before, the deaths from epidemic cholera, homicide, suicide, and submersion, the annual ratio of mortality is $4\frac{5}{10}$ per cent.

Fevers of malarial origin are more rife here than at any other station. The annual average of intermittent fever is 120 per cent., and that of remittent fever is 25 per cent. In the first and second quarters, the averages are comparatively low. Although the ratio of these fevers is about thrice as high as at Jefferson barracks, yet it is found that the annual ratio of diarrhœa and dysentery at these two posts bears an inverse proportion, being as 55 to 80.

In the third quarter of 1833, there were reported 150 cases of epidemic cholera, sixteen of which terminated fatally. Besides these, there were twenty cases in the families about camp. The total of cases in this quarter was much augmented by the hardships endured by two detachments sent out in May,—one in pursuit of some Pawnees, and the other to cut roads for the Choctaws. In the last quarter of this year, Surgeon Z. Pitcher observes, that "dysenteric cases in several instances have assumed the character of tertians, that is, the patient would have his well day as in an intermittent of that type." This disposition in many diseases to exhibit a paroxysmal and strictly periodical character has been recently noticed by Surgeon W. L. Wharton. "As a result of the general prevalence of malaria," he says, "it may be stated that most of the diseases occurring at this station partake of the intermittent character, embracing pleurisies, cholera morbus, dysentery, diarrhœa, rheumatism, hæmorrhage, etc." The strict periodicity of these affections, and their subjection to the same remedies which are found to arrest the course of intermitting fever, imply a close alliance, if not a common origin.

The year 1834, the last quarter of which was marked by extraordinary fatality, comes now under consideration. According to the Adjutant General's returns, the annual mean strength was 485, and the total of deaths 103, the ratio of mortality being $21\frac{2}{10}$ per cent. In the first two quarters of this year, only five deaths are reported, the great mortality having occurred late in the season, after the return of the troops from the prairies. The following extracts are from the report of Surgeon De Camp :—

"The mortality, although great, has not been more so than we had reason to anticipate from the malignant character of the disease early in the season. The deaths have been confined entirely to those who were taken sick previously to the 30th of September. They were all originally fever cases, terminating either in dropsy or dysentery. Some have died of excessive ptyalism from mercury, taken before or soon after their return to this post. Post mortem examinations of dysenteric cases have shown great engorgement of the mesentery, inflammation of the mucous membrane of the bowels, and an enlarged and engorged state of the liver and spleen. In the treatment of these cases, much perplexity and many contradictory indications were presented. Tonics and stimulants seemed often to be imperiously demanded, but the irritability of the bowels, with red tongue, rendered them inadmissible. The ptyalism, which had continued in some cases for many weeks, would, after disappearing for a time, burst forth spontaneously, and hurry the victim to the grave with a dreadful destruction of the soft parts about the mouth and the cheeks. Opiates, absorbents, diaphoretics, and demulcents, with tonics when admissible, have been the remedies relied upon, sometimes with good effect, but too often, I regret to add, with no advantage whatever. Intermittents are still frequent, but they generally yield readily to the use of quinine.

"I am aware that there is great prejudice against this post on account of its supposed unhealthiness; but I am far from believing that the troops who were in the prairies last summer would not have been as sick had they gone to any other post. On the contrary, I am of opinion that the seeds of disease were sown before their arrival at this post, and that it only required an exciting cause to bring them into action—a cause found in the repletion and other indulgences which a regular military post affords to soldiers. As an evidence of this I would state, that the troops left at Fort Gibson during the summer were not more sickly than usual at that season; and I believe that it will be found, on examination, that the mortality was less than in other years."

It is thus seen that much of the disease ascribed to this post may be fairly attributed to causes operating in other localities. The Dragoons, for example, were frequently on detached service. Thus, as in the third quarter of 1835, about three-fourths of this squadron were on this kind of duty, up to the 6th September, on Grand Prairie, on Canadian river, about 150 miles from Fort Gibson, it is found that the cases of intermittent and remittent fever were furnished mostly by this detachment.

In the report of the fourth quarter of 1835, Assistant-Surgeon L. C. McPhail speaks thus—"The diseases that prevail here are bilious congestive, remittent, and intermittent fevers, during the summer and fall; pneumonia, especially pneumonia biliosa, pleurisy, and catarrh during the winter; tertian agues during the spring; and mucous fevers and bowel disorders all the year round. In the treatment of the affections which prevail here, calomel will not answer the expectation of its advocates. Its moderate use is sometimes beneficial; but when given in a dose of more than ten grains, or repeated, it often does more harm than good. In the treatment of catarrhal affections, particularly those implicating the pulmonary structures, I find *antimonials* more efficient than blood-letting, though sometimes we conjoin them. Blood-letting is not often required here in my practice, as the diseases are mostly congestive, and seldom inflammatory."

The mortality from phthisis pulmonalis at this post makes one eighth of the total of those deaths the causes of which are reported; and at Jefferson Barracks, the proportion is nearly the same. Comparing the first quarter with the third, it is found that diseases of the respiratory organs are more than six times as high in the former; and making the same comparison in respect to intermitting fever, it is found that the third is three times as high as the first. It is shown, then, that at this post the diseases of the respiratory organs are twice as much under the influence of the seasons as intermittent fever.

Viewing all the facts bearing on the question of the comparative salubrity of this station, it would seem that its unhealthfulness has been somewhat exaggerated. At the same time, it may be safely assumed that it is the most insalubrious post now permanently occupied. Circumstances pertaining to its medical topography are sufficient to explain the statistical results obtained. Situated about three miles from the junction of three streams, the Neosho and the Verdigris with the Arkansas, it consequently occupies a spot originally formed of the alluvion of these streams. In the immediate vicinity are extensive cane-brakes and miry lagoons, whilst the prevailing winds in the summer are from this point of the compass, wafting their exhalations over the fort. Heat, another agent regarded as essential in the production of malaria, is found more intense here than at any other post in the United States. The mercury, perhaps, every year rises above 100° Fahrenheit; it not unfrequently rises to 106° and 110°; and on the 15th August, 1834,—the season of the high mortality,—the thermometer indicated 116° in the shade.

The mortality of this post, according to the Adjutant General's returns, shows no extraordinary fatality, with the exception of the year 1834. As the high average of this year is limited to the fourth quarter, and as the troops returned from the prairies sick, the inference that the causes of the disease were of a general character, and not confined to the locality of Fort Gibson, is at least warranted; and this opinion is confirmed by the fact that the mortality in 1834, at Jefferson Barracks and Forts Towson and Jesup, is above the mean average. From 1829 to 1839, the ratio of deaths per 1000 of mean strength, with the exception of 1834, varies from 13 to 68. This mortality, it will be seen, is much below that of the troops at Baton Rouge, from 1819 to 1824, the annual ratio being 208 per 1000.

The comparative agency of the seasons at Fort Gibson in the production of diseases in general, is expressed in the following ratios per 100 men:—First quarter 79 cases, second quarter 89, third 144, and fourth 93. Hence every man, on an average, was reported sick once in every three months. The influence of malarial causes is equally apparent in the relative monthly mortality; for among 277 deaths, three occurred in April and fifty-nine in September.

FORTS SMITH AND COFFEE.

Fort Smith.—Latitude 35° 22′, Longitude 94° 10′.

As these two posts, which have been successively occupied, are not more than ten or twelve miles apart, the statistics have been united under one head. Both posts are upon the Arkansas river. Fort Smith, now a permanent station, is situated at the mouth of the river Poteau, directly on the western boundary of the State of Arkansas. These statistics, therefore, which cannot be regarded as affording precise results in reference to a special locality, are valuable only as indicating the character and general ratio of disease in this region.

Fort Smith is bounded immediately on the west by the Arkansas river and the Cherokee Nation; on the south by the Poteau river and the limits of the Choctaw Nation; and on the east and north, by the State of Arkansas. Lakes and marshes abound in every direction, some being subject to be inundated by the Arkansas and Poteau rivers. In the immediate vicinity, the country presents a broken and an undulating aspect, approaching in some parts to a mountainous character.

The annual quantity of rain at Fort Smith, on an average of three years, is 35.64 inches.

As the total of deaths, according to the post returns, is twenty, and the aggregate mean strength is 291, the annual ratio of mortality is $6\frac{9}{10}$ per cent. Of the deaths, eleven only are reported in the medical returns, viz., four remittent fever, two pneumonia, one diarrhœa, two ebriety, and two from causes not specified, being $4\frac{7}{10}$ per cent.

The difference in the ratio of mortality between the medical and post returns is owing chiefly to accidental deaths. Thus, in the first quarter of 1834, it is remarked by the medical officer, that, "during the same period, one soldier was drowned, another died suddenly in quarters from the excessive use of ardent spirits, and a third died in an hour after having received a severe beating from a whiskey retailer; none of which cases was entered on the register."

The annual average of intermittent fever is 107 per cent., and that of remittent fever is 14 per cent. The ratio of the former is nearly as high as that of Fort Gibson, whilst that of the latter is scarcely more than half as high. The total of deaths from remittent fever is four. The annual average of diarrhœa and dysentery is 41 per cent. The relative agency of the seasons in the production of disease in general is expressed in the following ratios per 100 of the strength:— First quarter 77, second 50, third 159, and fourth 86 cases. Hence the average period in which each man was reported sick is three months.

FORT TOWSON.—LATITUDE 33° 51′ N., LONGITUDE 95° 1′ W.

This fort, which is situated upon the spot formerly occupied by Cantonment Towson, is about six miles north-west of Red river, and the same distance south and east from the Kiamichi. Immediately in the rear of the buildings is an abrupt ravine about eighty feet deep, varying in breadth from a few yards to half a mile, and bounded on the opposite side by rolling hills, densely covered with oak and pine. Through it, at the foot of the hill, runs a creek, which has its source among the pine hills to the north-west of the fort, and which empties into Red river, a short distance below the Kiamichi. This bottom, covered with hickory, scrub-oak, etc., presents a marshy surface, which is the obvious source of malarial exhalations. In front of the fort, the ground descends gradually for a mile. At this point, the prairies commence and spread out in an undulating manner, occasionally interrupted by woods, to a great distance. In the immediate vicinity of the fort, the soil, which is composed of light sand and clay, is not very productive. Upon the prairies, the soil, although superficial, is much richer, based upon a thick stratum of limestone.

On an average of three years, the mean annual quantity of rain is 46.73 inches.

As the total of deaths, according to the post returns, is forty-seven, and the aggregate mean strength is 1,560, the annual ratio of mortality is three per cent. Of the deaths, twenty-eight are reported in the medical returns, viz., two typhus, two remittent, and two congestive intermittent fever, four phthisis pulmonalis, one pneumonia, one abscess of the lungs, three gastro-enteritis, one peritonitis, two dysentery, one intussusceptio, one gangrene, one drowned, one frozen when intoxicated, and six from causes not specified. Excluding the two cases of asphyxia from submersion and low temperature, the annual ratio of mortality is nearly two per cent.

This station, keeping in view the region in which it is located, has generally maintained a remarkable degree of salubrity. It is only when wide-spread epidemics prevail, as in the summer of 1839, that this post exhibits a high ratio of sickness. Intermittent fever, however, is very rife. The annual average of this type of fever is 114 per cent., and that of remittent is 20 per cent. In 1835, in a mean strength of 178, there are reported 342 cases of intermitting fever. In the first quarter of this year, the sick report embraces 172 cases, of which 125 are intermitting fever. It is remarked that it yields readily to the ordinary course of treatment, but that it is liable to recur from the slightest causes. During the ten years, but six deaths are reported from fever. As regards the high ratio of intermittents, it would seem that a sufficient explanation is afforded in the topographical description of this station.

The relative agency of the seasons in the production of disease in general is expressed in the following ratios per 100 men:—First quarter 56 cases, second 52, third 100, and fourth 65. Hence each man, on an average, was on the sick report once in every four months and a third.

FORT JESUP.—LATITUDE 31° 30′ N., LONGITUDE 93° 47′ W.

This post is situated on the ridge dividing the waters of the Red and Sabine rivers, being distant from each about twenty-five miles. On the northern side of the ridge the streams empty into Red river, mostly through Spanish lake, the nearest point of which is about twelve miles from the fort. On the opposite side, the waters are conveyed directly into the Sabine. The post is about 100 miles due north from the Gulf of Mexico. It was established in 1822.

The aspect of the country on either side of the ridge is rolling and broken. Along the margins of streams some good lands are found, being a black clayey soil of a tenacious nature. The high lands are covered chiefly with pine, thinly intermixed with oak and hickory; whilst the streams are skirted with beach, mulberry, sassafras, and occasionally cypress.

The summer usually commences about the 1st of May, and continues until the last of September; during which period a high temperature, from ten o'clock until sun-set, generally prevails, the range of the thermometer being from 76° to 96° of Fahr. The nights, however, are often cool and pleasant, owing to the refreshing breezes which come in the direction of the Gulf of Mexico. What is called the rainy season begins generally in the month of February, and continues until the first or middle of May. The annual quantity of rain, on an average of four years, is 47.43 inches.

As the total of deaths, according to the post returns, is seventy, and the aggregate mean strength is 2,306, the annual ratio of mortality is 3 per cent. Of the deaths, all are reported in the medical returns, viz., one remittent fever, two typhus fever, twelve phthisis pulmonalis, eight pneumonia, three hydrothorax, one ascites, nine gastro-enteritis, two dysentery, six chronic diarrhœa, one hepatitis, three epidemic cholera, seven mania a potu, six ebriety, two apoplexy from ebriety, one casualty, two sudden, and four from causes not specified.

It is a remarkable fact that among seventy deaths three only are reported from fevers. The annual average of fevers of malarial origin is low for this region, intermittents being 24, and remittents 7 per cent. The third quarter of 1835 is the only season in which a high ratio of intermitting fever is presented, being at the rate of 41 per cent. for the quarter. "Intermittents," says Surgeon P. H. Craig, "have prevailed to a greater extent than I have ever known before, and many of the cases were characterized by great obstinacy. Few of the families escaped the disease; but I report the cases only that occurred among the officers and soldiers. The sudden atmospheric vicissitudes in the months of June, July, and August, may be assigned as the probable cause of its unusual prevalence." It is a singular fact, that, notwithstanding the peculiar rifeness of intermitting fever, not a single case of the remitting form is reported.

In regard to the treatment of diseases, it is remarked by Surgeon Craig, that morbid action is generally of a character requiring antiphlogistic means in the early stages, such as bleeding, both general and local, and the exhibition of mild purgatives.

The relative agency of the seasons in the causation of disease in general is expressed in the following ratios per 100 of the strength:—First quarter 66 cases, second 92, third 87, and fourth 57. In regard to the average period in which each man was reported sick, the time is four months.

The general results of this class of posts, based on the statistics of ten years and comprising an aggregate mean strength of 11,739, show that the annual ratio of mortality, according to the medical reports, is $3\frac{6}{10}$ per cent., and according to the Adjutant-General's returns, $4\frac{6}{10}$ per cent. As in the preceding classes, the deaths from epidemic cholera, (twenty-four at Jefferson Barracks, eighteen at Fort Gibson, and three at Fort Jesup) have been excluded in both these calculations; and in the medical returns, those deaths also reported as drowned, frozen, and suicide. As the ratio per 1,000 of mean strength annually under treatment is 3,504, it follows that every man, on an average, was reported sick once in nearly every three and a half months. Judging from the ratio under treatment annually as affording an index of the comparative salubrity of the several posts composing this class, it is found that Fort Gibson exhibits the highest, and Fort Towson the lowest, extreme. The ratio under treatment annually in this class is the highest yet presented.

The total of deaths in each month, according to the post returns, is exhibited in the annexed table:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total of deaths in each month.	41	34	35	19	28	46	56	66	88	72	57	31	573

In this table are included forty-five deaths from epidemic cholera. Of these, three occurred in January, eight in May, three in June, nine in July, ten in August, and twelve in September.

III.—THE SOUTHERN DIVISION OF THE UNITED STATES.

Its sub-divisions.—Topography of Florida and Louisiana.

This Division comprises two classes of posts:—1. The stations on the Lower Mississippi; and 2. The posts in the peninsula of East Florida. The former class comprises Augusta Arsenal, Georgia, Fort Mitchell, Alabama, and six posts on the Lower Mississippi, Louisiana, viz., Forts Pike, Wood, St. Philip, and Jackson, and the posts at New Orleans and Baton Rouge, the first two being included in default of a better arrangement; and the second class embraces four permanent and thirty-one temporary posts.

The climatic laws of this region, which is characterized by the predominance of high temperature, have been fully illustrated in Part First. As this is more especially true in regard to the Peninsula of East Florida, in which all the posts of the Second Class are situated, nothing further, as regards atmospheric laws, is now deemed necessary.

Although this Division, in the description of the physical characters of the preceding one, was encroached upon, yet its geographical peculiarities in reference to endemic influences require still farther elucidation.

Florida. Belonging entirely to the Atlantic Plain, no part of the surface rises more than two hundred feet above the level of the ocean. South of Latitude 28°, it consists chiefly of a vast morass, called the *Everglades*. North of this point to the Georgia line, the surface is mostly a dead level, with scarcely an undulation. The ridge dividing the waters east and west, is not more than about one hundred and fifty feet high, and disappears at Lake Tohopkalika. This northern portion is an extensive pine-forest, interspersed with ponds, swamps, low savannahs, and hummocks,* which last are rich bottoms overgrown with trees and a redundant underwood. The barrens are covered with forests of pine with little undergrowth. The soil consists mostly of sand; but the hummocks, which are numerous, have a fertile soil composed of clay and sand. The savannahs, which are covered with a tall grass, are inundated during the wet season. The river-swamps are wooded with a variety of heavy trees, whilst the pine-barren swamps are mostly overgrown with cypress and cypress-knees. The nature of the rock formation—a kind of stratified rotten limestone—explains the phenomenon of the frequent bursting forth of full-grown rivers from the surface. The Natural Bridge on the Santa Fe, for example, is a shelf of calcareous rock, beneath which the river disappears, and, after flowing for the distance of three miles, again emerges from its dark labyrinth; and to the same cause are owing the numerous cavities in the ground called *sinks*. Although Middle and Western Florida partakes of the same features, yet the soil is more productive. In consequence of the extremely modified climate of the Peninsula, the indigenous vegetation is exceedingly various, comprising even many of a tropical character as described in Part First. Here also, in common with our southern borders, the fig, date, orange, lemon, citron, pomegranate, banana, olive, tamarind, papaw, guava, as well as cotton, rice, sugar-cane, indigo, tobacco, maize, etc., find a genial climate.

Louisiana belongs nearly altogether to the Low-lands, the surface presenting numerous depressions with some hilly ranges in the north-western part. Below latitude 31°, the greater portion of the surface, with the exception of the tract lying between the Pearl and the Mississippi and north of the lakes, is not elevated ten feet above the level of the Gulf of Mexico, and is mostly inundated by the annual floods of the Mississippi or the spring-tides of the Gulf. The Delta of the Mississippi—a name to which its configuration gives it no pretensions—is an alluvial plain covering an area of 12,000 square miles, having an extreme length of 230 miles and an extreme breadth of 140 miles. North of latitude 31°, and nearly separated from the Delta by the approach of the Uplands, is another alluvial plain, with a breadth of about thirty miles and a length within Louisiana of 120 miles. The sea-marsh extends westward to the Sabine, varying in

* The orthography of this word, according to Webster, is *hommoc*. He supposes it to be an Indian word. In Florida, it is now generally pronounced *hammock*.

breadth from fifteen to forty miles,being nearly on a level with the waters of the Gulf. In the prairies or unwooded plains, which lie between the Teche and the Sabine, the water-courses are skirted with trees, and here and there appear clumps of trees, called, from their isolated appearance in these grassy expanses, *islands*. The agricultural staples are cotton and sugar. Rice, maize, tobacco, and indigo, also thrive well. The climate, according to Darby, is favorable to the peach and fig-tree, but the apple does not succeed well, and the cherry is wholly unproductive.

As the region of the Lower Mississippi is of comparatively recent formation, it may not be unimportant to determine some of the laws which obtain here relative to the deposition of alluvion. A discoloration of the water of the ocean from the deposites of the Mississippi, when thirty miles distant from its debouchure, is perceptible. As the coast is approached, it is found that the bed of the ocean rises one fathom in every mile—the result of the alluvial deposites from the river. As the bed of the ocean in deep water is not disturbed by the force of the billows, this law is found to hold generally. In shallow soundings, however, the soft deposite is thrown, by the force of wind and wave, into ridges and ravines. The delta of the Mississippi, according to the account of a pilot who has lived there nineteen years, has advanced by its deposites, during that period, two and a half miles into the Gulf of Mexico. As the outlets of the Mississippi comprise a line of about one hundred miles along the coast, the alluvial lands between these mouths give an addition of 250 square miles, in nineteen years, to our continent. The bar at the mouth of the river keeps pace with this encroachment upon the ocean. Nineteen years ago, it was two and a half miles further inland, with twelve feet of water. In its present position it has fourteen feet, whilst the place of the former bar has thirty feet of water. By the operation of the same law, we find at New Orleans, at which point the shallow bar of the river, some centuries ago, may have existed, water thirty fathoms in depth. Following out this theory of the deposition of alluvion, it would be interesting to determine the change produced in 5000 years.

When these deposites of alluvial matter once rise to the surface of the water, vegetation rapidly succeeds. Under the genial influence of the sun, all the seeds germinate; those of an aquatic nature live and flourish, whilst the rest quickly perish. As the deposites of mud are now more effectually intercepted, the soil becomes more dry and firm; plants of various kinds begin to spring up, and by and by large trees appear; whilst here and there are still found marsh and swamp, intersected by lagoons and bayous. Thus has the Mississippi constantly pushed forward her delta, gradually encroaching upon the domains of Neptune.

Thirty or forty yards from the Mississippi is what is called the *second bank*, which is higher than the lands behind—a feature common to all rivers. This admits of a ready explanation. Whenever the river overflows its banks, the water, no longer confined to its channel, is diminished in velocity; and as the transportation of alluvion depends upon this rapidity, it is at once deposited—a result favored by the stems and leaves of vegetables, which perform the part of so many strainers.

As this alluvial soil presents the most luxuriant vegetation, it is here that the pioneer of civilization first strikes his axe into the mighty oak of the forest; and it is here that the Destroying Angel makes his most desolating visitations under the form of febrile endemics.

The low lands contiguous to plantations which border the Mississippi, extending back generally from one to two miles, are annually inundated. It is only when the levee, or embankment, gives way, that the plantations are overflowed. The waters generally overflow their banks in May, and subside in the latter part of August. During the intervening period, these lands afford excellent pasturage for cattle and wild animals. It is by means of creeks and bayous that the water of the Mississippi, in times of freshets, mostly escapes; and as the floods subside, part of it returns to the river by the same channels or drains. Much the greater part, however, is left to disappear by absorption and evaporation. At the Balize, the difference between the highest and lowest stage of water is about three feet; at New Orleans, about twelve feet; at Baton Rouge, twenty-five feet; and thence, to the mouth of the Ohio, it gradually increases to forty-five feet.

1st Class.—POSTS ON THE LOWER MISSISSIPPI.

Medico-topographical and statistical details in reference to Augusta Arsenal, Forts Mitchell, Pike, Wood, St. Philip, and Jackson, and the posts at New Orleans and Baton Rouge.—General Results.

AUGUSTA ARSENAL.—Latitude 33° 28′ N., Longitude 81° 53′ W.

Augusta Arsenal, distant three miles from the city of Augusta and about 130 from the ocean, occupies a high and dry position among the *sand-hills*, which form the slope between the mountain region and the Atlantic plain. The nearest point of the Savannah river is two miles, whilst the surrounding country presents no marshes or lakes. The locality of this station has an elevation of about 200 feet above that of Augusta; and as the soil is hard, dry, and sandy, and the physical aspect of the neighboring country exhibits a succession of hills and sloping valleys, the most favorable natural circumstances obtain to facilitate drainage. The soil is rather unproductive. Culinary vegetables are very inferior in size and quality. Some varieties of fruit, however, such as the apple, plum, peach, and watermelon, are very abundant, attain a large growth, and are finely flavored. The forest trees consist chiefly of different species of the genera, *quercus*, *pinus*, *carya*, *juglans*, and *diospyras*.

As the total of deaths, according to the Adjutant General's returns, is eighteen, and the aggregate mean strength is 488, the annual ratio of mortality is $3\frac{7}{10}$ per cent. Of the deaths, seventeen are reported in the medical returns, viz., three remittent fever, four phthisis pulmonalis, one scarlatina anginosa, one gastro-enteritis, one cholera morbus, one chronic diarrhœa, one chronic gastritis, attended with ulceration of the mucous tissue, one chronic visceral lesions, two mania a potu, one ebriety, and one wound. The ratio of mortality, according to the medical returns, is $3\frac{5}{10}$ per cent.

The average of fevers of malarial origin is low, the ratio of intermittents being 15, and that of remittents 16 per cent. Among seventy-nine cases of remitting fever, four terminated fatally. The fevers of this locality, which are generally of a mild and manageable nature, are ascribed mostly to exposure to solar heat, the abuse of alcoholic liquors, and perhaps the excessive use of unripe and indigestible fruit.

During the summer of 1839, most of the cities of the Southern States suffered severely from yellow fever. Although the city of Augusta experienced its worst ravages, the garrison of this post, with the exception of one case, was exempt from the fatal epidemic. This man passed a night in the city, in a state of intoxication. In regard to the origin of this endemico-epidemic, termed yellow or "strangers' fever," much contrariety of opinion, as has been found to obtain at all periods, existed. From the report of a committee consisting of physicians of Augusta, by whom the question of its origin and cause was carefully investigated, it appears that the disease was of domestic origin, and exhibited nothing of a contagious nature. The "*fons et origo mali*," it was believed, were traced to a point called "trash-wharf,"—a slide, or inclined plane, which was erected in 1834, for the purpose of throwing the filth of the city, including dead animals, into the river. This mass of animal and vegetable matter having accumulated to upwards of 200,000 cubic feet, it was resolved by the authorities of the city to have it removed; and, accordingly, during the months of May and June, its interior was exposed to the action of the sun. Having penetrated the exterior crust, the heat evolved was so great that the workmen, although wearing thick shoes, were compelled to desist from their work, "for two hours at a time, so as to suffer it to cool." This may have been an exciting cause; but our present knowledge does not warrant us in saying that the same miasm which produces remittent fever is, in its more virulent state, the cause of yellow fever, or even that the latter is of paludal origin.

The advantage of position, as regards salubrity, is strikingly illustrated in this locality. On reference to the history of this garrison prior to 1829, it will be found that, during the period when the Arsenal was situated on the Savannah, disease prevailed to so great an extent that it was necessary to abandon the post in the summer season, and encamp on the "sand-hills." The advantages of this measure were, indeed, but partial; for as it was necessary to keep a guard at the Arsenal, the men were in turn exposed to this miasmatic atmosphere. Thus, in the third quarter of 1825, all the garrison, with the exception of two men, suffered from the "country fever;" and, consequently, the only benefits of a summer encampment were that fewer cases proved fatal, and relapses were less frequent.

The comparative influence of the seasons in the causation of disease in general is expressed in the following ratios:—First quarter 55 cases, second 43, third 46, and fourth 28 per 100 of the strength. Hence the average period in which every man was reported sick, was six and a half months. The fact that the first quarters present a higher average of sick than the third, is ascribable to the circumstance that the post had a very large command in the first quarter of 1833. The law, that an increase in the mean strength is followed by more than a corresponding ratio of disease, is one that obtains universally.

FORT MITCHELL.—Latitude 32° 19′, Longitude 85° 10′.

This post is situated near the Chattahoochee, about ten miles below Columbus. Occupying an elevated ridge on the west side of the river about one mile from its banks, the position is both salubrious and agreeable to the eye. Between the ridge and the river the lands are low, but generally speaking the locality is exempt from marshes.

As the total of deaths, according to the post returns, is 25, and the aggregate mean strength is 761, the annual ratio of mortality is $3\frac{3}{10}$ per cent. Of the deaths, nineteen are reported in the medical returns, viz., three remittent fever, three phthisis pulmonalis, one chronic hepatitis, one chronic diarrhœa, two mania a potu, two accidental, and seven from causes not designated, being nearly three per cent.

The average of intermitting and remitting fever is very low, the former being thirteen, and the latter eight per cent. There is nothing in the history of this post requiring special comment. Considering that it is a southern post, both this and the preceding one may be regarded as remarkably salubrious; but it is necessary to bear in mind, in estimating the influence of endemial causes, that neither is on the Atlantic Plain. The ratio of mortality is low, with the exception of 1836, the period of the Creek difficulties. In this year it is nine per cent., owing doubtless to the exposures incident to such a state.

The relative agency of the seasons in the etiology of disease in general is expressed in the following ratios:—First quarter 75, second 93, the third 68, and the fourth 55 cases. Every man, on an average, was consequently reported sick once in every four months and a third.

BATON ROUGE.—LATITUDE 30° 36′ N., LONGITUDE 91° 23′ W.

This post is situated on the east bank of the Mississippi river, in Baton Rouge, Louisiana. This town occupies the first bluff or highland found in ascending the river—the point at which the *levee* or artificial embankment terminates. The bluff on which the barracks are situated is twenty-two feet above high-water, and sixty feet above low-water mark. There are no marshes in the vicinity, a cypress swamp, distant fifteen miles north, being the nearest. The public grounds are bounded on the north by a bayou, which empties into the Mississippi about 200 yards above the barracks. "This bayou," says Surgeon B. F. Harney, "is filled to a greater or less extent from the river, from the 1st of February to the 1st of August, of each year. It might be supposed that, as the water retires from the bayou, deposites of a nature productive of disease would take place. But experience has proved the reverse; for, as soon as the annual fall of the Mississippi commences, the 'rainy season' begins; and thus the bayou is thoroughly washed, and the deposites that might prove a source of disease are carried to the river. It also lies in a direction whence we have no winds during the sickly season."

The public grounds are undulating and well drained. The country on the same side of the river, extending north and east, is of the same character; but that lying south, together with the lands west of the Mississippi, consists of a rich alluvial deposite, low and level.

The barracks, constructed of brick, with slate roofs, were completed in 1824. The hospital, built of the same materials, was finished in 1839. These buildings are well constructed, and admirably adapted for the purposes intended. The public grounds are now well shaded by trees, such as the mulberry, pride of China, etc. These trees, planted in 1824, contribute, it is believed, very materially towards maintaining the healthfulness of the station.

As the total of deaths, according to the post returns, is seventy-nine, and the aggregate mean strength is 1,090, the annual ratio of mortality is $7\frac{2}{10}$ per cent. Of the deaths, seventy-three are reported in the medical returns, viz., twelve congestive typhus, ten yellow fever, one remittent fever, one intermittent fever, one pneumonia, one pleuritis, one phthisis pulmonalis, five dysentery, three gastro-enteritis, eight epidemic cholera, one erysipelas, one delirium tremens, seven ebriety, one epilepsy, one chronic visceral lesions, and nineteen from causes not specified. Excluding the cases of cholera, the average mortality, according to the medical returns, is $6\frac{2}{10}$ per cent.

The average of intermittent fever is 51, and that of remittent fever is 30 per cent. Although the ratio is not so high, for example, as that of Fort Gibson, yet the mortality from fevers of malarial origin, owing to the circumstance that remittents often assume the most malignant character, is considerably higher.

From 1819 to 1825, this post presents a melancholy history. Every quarterly report exhibits a high mortality. In the third quarter of 1821, for example, the total of deaths was thirty-five, in a mean strength of 287, being one-third of the aggregate of the whole army. Surgeon Harney reports that "the most of the diseases, and particularly those of a severe type, are almost solely the consequence of severe labor and exposure. * * * The men employed in getting timber in the swamps of the Mississippi, some ten or fifteen miles above this place, have been very subject to diseases which have proved of the most severe and fatal character." The 1st regiment of Infantry had in truth become "hewers of wood and drawers of water," much better qualified to shoulder a hod than a musket. All *esprit du corps* being lost, the officer, instead of drilling his men in warlike exercises, expended his military spirit in superintending fatigue parties, operating in dismal swamps. Baton Rogue, or more properly speaking, the swamps of the Mississippi, proved literally the grave of the regiment. Again, in the second quarter of 1823, whilst the aggregate mortality of the army was only fifty-three, this post furnished twenty-nine fatal cases. In the corresponding quarter of the prior year, the total of deaths was forty-one, of which twenty-eight were reported at Baton Rouge. The garrison now consisted of about 400 men, of whom three-fourths were recruits. The continued prevalence of disease is ascribed by the Surgeon, as in former reports, to the operation of the following causes :—1. Intemperance ; 2. Severe fatigue duty ; and 3. The consequent exposure, especially among the recruits who were unacclimated. These causes, in conjunction with the change of diet, and other habits to which a recruit is necessarily subjected, are regarded by Surgeon Harney as adequate to the explanation of the extent and fatality of diseases.

The mortality of the 1st regiment of Infantry at this post, from 1819 to 1825, is, doubtless, higher than that of any other regiment since the organization of our Government. To ascertain the exact ratio it was necessary, as the condensed records kept in the Adjutant General's Office at that period could not furnish all the essential data, to collect the information from musty regimental returns. Although some of these files are now imperfect, yet the author had the good fortune to find, with one exception, all the monthly returns of the 1st regiment of Infantry at Baton Rouge complete. From these reports, it appears that the ratio of mortality, on an average of the six years is nearly 21 per cent,—a result unparalleled in our military annals. In 1822, the most fatal year, the mean was nearly 26 per cent.; and during June of this year, it was as high as 76 per cent. As there were, among every 1,000 men, 4596 cases under treatment in the course of the year, it follows that every man, on an average, must have been on the sick-list once in every two months and nineteen days.

It is deemed unnecessary to extend these remarks. The question, why the post was not abandoned or a new system of internal economy adopted, is doubtless suggested to every mind. It were useless, at this late day, to inquire into the motives that influenced our public councils. Suffice it to say, that the late Surgeon General, in a report to the Secretary of War, as early as November, 1821, uses the following language: "The duties required of the soldiery at this post, since the commencement of the public works, have not only been laborious and severe in the extreme, but *inhuman and unjust.* The number of cases treated, the deaths, and desertions, will, I think, conclusively prove how impolitic have been the measures pursued. It also appears that, whilst the mortality amongst the troops has been so great, the citizens in the vicinity are quite healthy."

In a recent report on the medical topography of this post, Surgeon Harney remarks,—"The diseases are mostly bilious intermittents and remittents, tending to a typhoid character. The yellow fever was first known here in 1817, re-appearing in the years 1819, 1822, and 1827. There were many cases in 1829, mostly confined, however, to the European Spaniards driven from Mexico. These cases were owing to their mode of living, their filth, and their crowded condition; and being unacclimated, they were especially obnoxious to disease.

"The soldiery suffered in 1821, 1822, and 1823, without assignable cause, from a disease called the *cold plague*, during which years the village was free from disease. It has not been known here since 1823. This disease prevailed in the month of May and part of June in each year. The symptoms were very similar to those of cholera, and were treated with mercurial cathartics in very large doses, sinapisms, the warm bath, etc.

"The causes of general sickness in 1821, 1822, and 1823, were exposure while at work on the barracks then building, intemperance, and labor in the Cypress swamp, about fifteen miles from this point, in procuring timber."

The relative influence of the seasons in the production of diseases generally is expressed in the following ratios per 100 men:—First quarter 78, second 92, third 97, and fourth 74 cases. Hence the average period in which each man was reported sick, is three and a half months.

NEW ORLEANS.—Latitude 29° 57′ N., Longitude 90° 14′ W.

The barracks, erected in 1834 and 1835, are situated on the left bank of the Mississippi, three miles below the city proper. They form a parallelogram of about 300 feet on the river, extending back 900 feet. Built of granite and brick, the quarters are commodious, dry, and well ventilated. The grounds within the parallelogram have been raised thirty inches by means of earth, the external surface consisting of a stratum of shells; intersected by ditches, these grounds are easily maintained in a dry state. The quarters are sheltered from the north and north-east winds by a forest of cypress and other trees, which, commencing about 500 yards from the river, extends back towards Lake Ponchartrain.

As the troops have until recently been always quartered in New Orleans, this city is the station to be now described. Situated on the left bank of the Mississippi in a large bend of the river, it is distant one hundred and five miles by the channel from its mouth, and eighty miles in a direct line, south-east; it is fifty miles from the Gulf of Mexico, south; forty miles from Chandeleur bay, south-east; fifteen miles from Lake Borgne, east: and six miles from Lake Ponchartrain, north. The city is built upon a sloping surface, which descends gently from the river to the lakes. It is not elevated more than eleven feet above the level of the ocean; and when the Mississippi becomes full, the streets are three or four feet below its surface, protected from inundation by the dyke or levee,—an embankment made from a few miles above the Balize to the high lands about Baton Rouge on the east, and to Point Coupee, seven miles above Natchez, on the west side of the river. The draining company, established for the purpose of reclaiming the marshy lands between the city and Lake Ponchartrain, have been successful in rendering a large portion of the ground fit for cultivation. There are no hills in the vicinity of the city, the surrounding country being low and flat, and the soil alluvial. The vast marsh, in the midst of which the city stands, must necessarily render a residence, during the hot season, dangerous to strangers; but the insalubrity of the city has been much diminished by drainage, the paving of the streets, and increased precaution in regard to health-police generally. As the well-water of the city contains muriates of lime, magnesia, and soda, and bicarbonate of lime and iron, rain and river water are used for culinary and all other purposes. The water of the Mississippi, though exclusively turbid when taken from the river, becomes, when filtered or allowed to deposit its sediment, clear and palatable.

The annual amount of rain, on a mean of six years, is 51.85 inches. The following monthly results, based on three years' observations, are given by Surgeon Hawkins—

January,	4.66	May,	2.95	September,	5.60
February,	2.25	June,	6.10	October,	1.37
March,	2.59	July,	6.38	November,	3.18
April,	6.21	August,	5.72	December,	2.87

As the total of deaths, according to the post returns, is fifty-nine, and the aggregate mean strength is 486, the annual ratio of mortality is 12 per cent. Of the deaths, thirty-three are reported in the medical returns; and as the mean strength, during the same period, was 312, the ratio of mortality is $10\frac{6}{10}$ per cent. The causes of the deaths are as follows:—three yellow fever, one phthisis pulmonalis, two chronic diarrhœa, nineteen epidemic cholera, five epilepsy, one suicide, and two from causes not specified. Excluding the cases of cholera and suicide, the average is only $4\frac{2}{10}$ per cent. The statistics of morbility given by this post cannot be regarded as affording any very precise results. To avoid the sickly season, the troops were removed, every summer, to the Bay of St. Louis; and the data furnished by the year 1838 are entirely excluded, inasmuch as most of the sick consisted of invalids from Florida. The ratio of mortality is high, but the majority of deaths is the result of accidental causes. In the fourth quarter of 1831, for example, twenty-six cases of epilepsy are reported. This disease and colic (twenty-seven cases) were extraordinarily severe. Of the former, "not more than five or six," says Surgeon Lawson, "had ever before labored under the disease. Two of the subjects expired in the first fit; three sank, after enduring, for eighteen or twenty hours, an almost uninterrupted succession of paroxysms; and several were left in a state of paralysis, which continued for some weeks." Upon investigating every probable source of these dreadful disorders, it was traced to the agency of the wine sold by the sutler, which proved to contain a great quantity of acet. plumbi.

With the exception of the summer months, called emphatically the *sickly season*, very little disease prevails at New Orleans. It is at this period that that fatal endemic, yellow fever, is almost certain to make its visitation. Among the troops there are only three deaths reported from this cause, owing to the circumstance that they were generally removed in May to the bay of St. Louis; and hence, too, it is found impracticable to illustrate the relative influence of the seasons in the production of diseases generally.

In a report by Surgeon H. S. Hawkins, in 1839, the following remarks occur:—"The south-west and south-east winds prevail during the five months from April to August, and north-east winds in September. It is to be remarked that east, north-east, and south-east winds come from the Gulf of Mexico, over an immense tract of low swamps, and that the prevalence of north and east winds in July, August, and September, is always attended with the epidemic yellow fever. In fact, these three months are the only ones that can be considered as proper seasons of disease, that is, the cause of epidemic yellow fever is produced during these months. Its ravages may and do extend into October; but when there has been no epidemic during August and September, strangers are not so liable to disease in October. It has also been remarked that, during an epidemic, for example in September, if the wind prevails steadily for a few days from the south-west or west, the disease seems to be checked, fewer cases occur, and those who are sick recover more readily. If, after this state of things, the wind shifts around again to the north-east, the disease resumes its virulence, cases occur more frequently, and those who are convalescent are suddenly thrown back and frequently succumb."

From a report chiefly devoted to the subject of yellow fever, made by Surgeon Lawson, (now Surgeon-General,) in 1832, the following extract is made :—"By far the most fatal disease of Louisiana, however, whether in our city or the low lands of the country, is the congestive form of fever, or, as it is called here, the *cold plague*. It is an insidious enemy, attacking most commonly the weak and enfeebled, and those laboring under mental depression. In many instances, the subject of the disease, before he himself or those around him are aware of it, becomes cold in the extremities, and on the superficies of the body generally, with the exception perhaps of the region of the chest; the blood retires to the interior of the system, and the patient is at once prostrated. The vital organs being overwhelmed, the system cannot of itself react, and not unfrequently all the means of art are of no avail in removing the load of oppression. There are other instances, however, in which the disease, though always insidious in its invasion and never without danger, is less severe in its attack."

In 1839, yellow fever, in its most malignant form, prevailed at New Orleans, Mobile, Pensacola, St. Augustine, Charleston, and Augusta. Passing over one year, the epidemic re-appeared in its most virulent character in the summer of 1841. The Board of Health report 1,325 victims to the "acclimating process," out of the probable number of 15,000 supposed to have been subject to the disease at the commencement of the epidemic. As a general remark, it may be stated that persons who have once had the yellow fever at New Orleans, possess an exemption.

FORT PIKE OR PETITE COQUILLE.—LATITUDE 30° 10′, LONGITUDE 89° 38′

The island of Petites Coquilles, as its name imports, seems to have been originally formed of a congeries of small shells, with an admixture of earthy deposite, based on a substratum of argillaceous earth, rendered black or blue by the oxide of iron. The post is situated on the northern margin of this alluvial island, which divides Lake Borgne from Lake Ponchartrain, the waters of which communicate by means of the passes Rigolets and Chef-Menteur, exhibiting an area whose diameter from north to south is about seven miles, and from east to west twelve miles. It is distant about thirty-five miles north-east from New Orleans. The island is intersected with tortuous bayous resembling artificial canals. As their beds are never exposed to solar action, being under the influence of the tides, they are at no time a source of miasmata. The natural elevation of the surface of the island above the lake no where exceeds two feet. The soil is fertile, being well adapted for the cultivation of vegetables. In the summer, the prevailing wind is from the Gulf of Mexico. This tropical east wind prevails with such constancy, that the trees on the shores of the lakes and the gulf have acquired an inclination from the sea, supposed to be the effects of its continued action at the period when their growth is most rapid.

As the total of deaths, according to the Adjutant General's returns, is eleven, and the aggregate mean strength is 426, the annual ratio of mortality is $2\frac{6}{10}$ per cent.; but, excluding the year 1838, in which the command consisted of men from Florida, the average is reduced to two per cent. Of the deaths, seven are reported in the medical returns, viz., two remittent fever, one phthisis pulmonalis, one sudden, one unknown, one gun-shot wound, and one drowned. Excluding the last two cases, the ratio is $1\frac{3}{10}$ per cent.

The average of fevers of malarial origin is very low, that of intermittent fever being nineteen, and that of remittent fever seven per cent., whilst there are but two deaths from the latter disease reported. The healthfulness of this post compared with that of Fort Wood, to be next described, is remarkable. The distance between them is not more than seven miles, and they are apparently exposed to the influence of similar external agents. They are both surrounded by marshy low lands; but Fort Pike is encompassed by salt water, whilst Fort Wood communicates with the immense swamps that skirt the Mississippi. Moreover, the garrison of the latter has direct communication with New Orleans, which renders very easy the introduction of ardent spirits, whilst the troops of Fort Pike, on the contrary, are isolated, preventing all clandestine intercourse.

The remarkable salubrity of this post has, at all times, been a matter of comment. In a well-written report on the medical topography of this post, made by Post Surgeon E. H. Bell, in 1821, it is shown that, since the establishment of the old post of Petite Coquille in 1811, the station has been extraordinarily healthy. Again, in 1835, a communication is made by the commanding officer, giving an abstract of the diseases and deaths for the period of ten years, (from 1825 to 1834 inclusive.) It is shown that only eleven deaths have occurred; and that although yellow fever was prevalent in New Orleans and the surrounding country each year, yet no case appeared at this post, and that whilst cholera was perhaps as fatal in New Orleans and Louisiana generally as in any other part of the world, the disease at this point was wholly unknown.

The relative influence of the seasons in the production of diseases generally is expressed in the following ratios:—First quarter 33, second 39, third 53, and fourth 30 cases. Hence each man, on an average, was reported sick once in about eight months.

FORT WOOD.—LATITUDE 30° 5′ 15″, LONGITUDE 89° 51′ 15″.

This post is situated on the west side of the pass Chef-Menteur, the southern boundary of the island of Petite Coquille. It is surrounded by marshy low lands, and is under the influence of the immense swamps that skirt the Mississippi.

As the total of deaths, according to the Adjutant General's returns, is twenty-five, and the aggregate mean strength is 335, the annual ratio of mortality is $7\frac{5}{10}$ per cent. Of the deaths, twenty-one are reported in the medical returns, viz., eight yellow fever, two remittent fever, one typhus, one pleuritis, two dysentery, one enteritis, two malignant cholera, one mania a potu, one asphyxia from cold, and two from causes not designated. Excluding the deaths from cholera and asphyxia, the ratio, according to the medical returns, is $5\frac{1}{10}$ per cent.

Ten of the deaths are reported in 1829. In the second quarter, the garrison, owing to the unhealthiness of this post in the summer season, encamped at Shieldsborough, on the bay of St. Louis, Mississippi. At this point, yellow fever made its appearance among the troops in the third quarter, forty-six cases and eight deaths being reported. "The disease," says Assistant Surgeon Lining, "commenced on the 5th August, and by the end of the month all the officers and men present, with the exception of four privates, were attacked. Several died of black vomit. The orderly sergeant of the company threw up black vomit for four successive days, but finally recovered.

As the command occasionally abandoned the post, it is impracticable to arrive at precise statistical results. It may be justly classed among our most insalubrious stations. The annual average of fevers of malarial origin is high, that of intermittent fever being seventy-six, and that of remittent fever twenty-seven per cent.

The relative influence of the seasons in the causation of disease in general is expressed in the following ratios:—First quarter, 92 cases, second 81, third 123, and fourth 76. Hence the average period in which each man was reported sick, is three months and a quarter.

FORT JACKSON.—LATITUDE 29° 29′, LONGITUDE 89° 71′.

This post is situated on the west bank of the Mississippi, in Plaquemine bend, about seventy miles below New Orleans.

As the total of deaths, according to the post returns, is fourteen, and the aggregate mean strength 224, the annual ratio of mortality is $6\frac{3}{10}$ per cent. Of the deaths, nine are reported in the medical returns, viz., two congestive typhus, one pneumonia, two bilious colic, and one chronic diarrhœa, one cholera, one dropsy, and one mania a potu, exhibiting a mortality of $5\frac{5}{10}$ per cent.

The annual mortality, although high, is below the actual average, inasmuch as these statistics embrace only four years, in two of which the troops were removed to a salubrious position during the sickly season. "This post," says Assistant Surgeon Burton Randall, "is three months inundated, and six months exposed to violent diseases. The water rises about the first of June, and leaves a large deposit of alluvion, which inevitably gives rise to violent fevers." The annual ratio of fevers of malarial origin is high, although, for the reasons above stated, below the actual average, that of intermitting fever being 114, and that of remitting fever fifteen per cent. No death, however, is reported from these diseases. The posts on the Lower Mississippi, as regards disease, present a remarkable contrast in the seasons, one-half the year being extraordinarily healthy, and the other moiety correspondently insalubrious.

The comparative influence of the seasons in the production of diseases in general is expressed in the following ratios:—First quarter 66 cases, second 57, third 139, and fourth 73. Consequently every man, on an average, was reported sick once in nearly every four months.

FORT ST. PHILIP

Is situated on the Mississippi, at the mouth of Plaquemine river, directly opposite the post just described. As the post was abandoned on the 7th May, 1831, the records are too meagre to enter into regular statistical details. This station was always very insalubrious in the summer season.

The details pertaining to each post having been completed, the general results of the class will now engage attention. The annual ratio of mortality, according to the medical reports, is $4\frac{4}{10}$ per cent. and according to the post returns, $5\frac{3}{10}$ per cent., based on an aggregate mean strength of 3,810. As in the preceding classes, the deaths from epidemic cholera, (eight at Baton Rouge, nineteen at New Orleans, and two at Fort Wood,) have been excluded in both calculations; and in the medical returns, those deaths also reported under the heads of drowned, frozen, and suicide. The ratio per 1,000 of mean strength annually under treatment being 2,860, it follows that every man, on an average, was on the sick-list once in a little upwards of every four months. Assuming this ratio as an index of the comparative salubrity of the several posts constituting this class, it is found that Fort Wood exhibits the highest, and Fort Pike the lowest extreme. Although the ratio annually sick is lower in this class than in the preceding one, yet the mortality, owing to the circumstance that fevers are of a more malignant nature, is higher.

The annexed table exhibits, according to the Adjutant General's returns, the total of deaths in each month.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total of deaths in each month.	8	6	12	21	29	21	22	24	27	30	20	11	231

In this table, twenty-nine deaths from epidemic cholera are included. So far as the quarters of the year are concerned, the number of deaths from this cause, that occurred in each, is as follows:—In the first, one; in the second, eleven; in the third, five; and in the fourth, twelve.

As most of the stations of this class are on the Lower Mississippi, and are consequently much under the modifying influence of large bodies of water, pulmonary diseases as a class, as will be shown more fully, exhibit a ratio correspondently low. In this region, diseases of malarial origin are of the most fatal tendency. Compared with the second class of the Middle Division, the ratio of cases of intermittent fever is little more than half as high, but that of remittent fever is higher. As regards diarrhœa and dysentery, the average of cases is lower, owing, in a great measure, to the circumstance that the troops were generally removed to healthy summer encampments; and to the same cause may doubtless be ascribed the result exhibited in the third quarter, which gives a lower ratio than either the first or second.

2d Class.—POSTS IN EAST FLORIDA.

Medico-topographical and statistical details in reference to Forts Marion, King, Brooke, and Key West.—General remarks in regard to the temporary posts established during the pending Seminole difficulties.—General results.

FORT MARION.—Latitude 29° 50′ N., Longitude 81° 27′ W.

Fort Marion is in the city of St. Augustine, which is situated on the bay of the same name. It is distant about two miles from the ocean, and about half a mile from Anastasia Island, which divides the bay from the ocean. The St. Sabastian, a small stream, runs within half a mile of the town; and North river, which rises about thirty-five miles north of the city, empties into the ocean immediately opposite the fort. There are a few marshes in the vicinity, but they are inundated twice every twenty-four hours by the tides; and there are also some low *hummock* lands from two to six miles distant, from which, when the wind prevails from the south-west, clouds of mosquitoes issue in the month of June, subject to be driven back as the wind changes. The site of the city is slightly elevated, being about twelve feet above the level of the ponds and marshes in the vicinity. The adjacent country is level and generally sandy, some parts being sufficiently rich in calcareous and vegetable matter to produce most of the vegetables cultivated at the north. Oranges flourish here most luxuriantly; but, in the early part of 1835, all the groves in the northern half of the peninsula were wholly destroyed by frost—an occurrence previously unknown.

St. Augustine has long been celebrated as a winter residence for pulmonary invalids; but the city itself has claims upon the traveller's attention, not the least being the fact that it is the oldest town in the United States. The fort is also one of the oldest in the United

States. It was finished, as appears by its now nearly illegible inscription, in 1756, in the reign of Ferdinand the Sixth. The walls consist of a concretion of sea shells obtained from quarries on Anastasia island; and as the material, under a bombardment, crumbles away without suffering fractures, the fort duly manned would be almost impregnable. The barracks and hospital are situated directly on the bay, about a mile south of the fort. The position of these buildings is eligible in every respect.

The statistics of this post include no returns later than 1835, as it became, after that period, a general hospital for the troops in the field. As the total of deaths, according to the Adjutant General's returns, is nine, and the aggregate mean strength is 350, the annual ratio of mortality for seven years is $2\frac{7}{10}$ per cent. Of the deaths, eight are reported in the medical returns, viz., one remittent fever, two convulsions from intemperance, and five from causes not specified.

This post has been at all times justly esteemed for its salubrity. Compared with the average mortality of southern posts in general, this station is found to exhibit a much lower ratio. The annual average of fevers of malarial origin is very low, that of intermitting fever being 20, and that of remitting fever 11 per cent. It is seldom that diseases of a malignant character appear at St. Augustine. Towards the close of the year, 1839, yellow fever, which ravaged the principal cities of our southern States, made its appearance at this station. This is only the second time that this epidemic has prevailed in this city within the period of twenty years; whilst at Charleston, we are told by Professor Dickson, that in twenty-four years' practice, but three have passed without his knowing the occurrence of yellow fever. Prior to its occurrence in 1821, it is said that there is but one instance known of the prevalence of this disease at St. Augustine. When in the possession of the British with a garrison of 4000 men, the general mortality was exceedingly low. When yellow fever prevailed at St. Augustine immediately after the cession of the province by Spain, as much filth had been allowed to accumulate during a succession of years, both at this place and at Pensacola, the circumstances incident to its removal by the American authorities were regarded as the exciting cause of the disease by the medical officers of the army. The experience of a century and a half teaches us that the causes of yellow fever are perennially present in our southern cities. Indissolubly connected with climate, it maintains the same relation towards the animal economy, as the malaria of our immense low country. As regards the essential cause of yellow fever, we still remain in the dark. It is manifest, however, that to develope the cause, and to keep up its action, requires a high range of atmospheric temperature; and as this condition seldom obtains on the coast of Florida, it would seem to afford in part an explanation of its infrequent occurrence in this region. As the extremes of temperature are much modified by geographical position, and as the combined influence of the various causes acting in the most intense degree, appears necessary for its development, a link in the chain seems to be wanting. At Key West, as in the islands generally of the West Indies, yellow fever has, however, prevailed with much malignity.

The relative influence of the seasons in the production of disease in general is expressed in the following ratios per 100 of the strength: —First quarter 47 cases, second 55, third 61, and fourth 55. Hence the mean period in which every man was reported sick, is five and a half months.

FORT KING.—Latitude 29° 12′ N, Longitude 82° 12′ W.

The following extracts in regard to the medical topography of Fort King, are taken from a report transmitted to the Surgeon General's office, in 1837, by the author of this work, then in the Medical Staff of the Army.

"As regards geographical position, this station is about ninety-five miles north-east of the head of Tampa Bay, 130 south-west of St. Augustine, perhaps forty miles due east from the Gulf of Mexico, and sixty due west from the Atlantic ocean. The fort, which has been recently rebuilt, is situated on rising ground, partially encompassed by a hummock, which describes almost a semi-circle, at an average distance of 500 yards from the pickets. The surface of the surrounding country is slightly undulating. The soil of the so-called *pine barren* consists of loose sand and a light admixture of vegetable mould, with an argillaceous substratum. Its principal vegetable productions are, the pitch pine, (*pinus vigida,*) black jack, (*quercus nigra,*) scrub oak, (*quercus catesbaei,*) palmetto, (*chamœrops,*) and coarse herbaceous plants. The *hummocks* are rich marshy bottoms, composed of vegetable deposition, overgrown with redundant vegetation. Here flourish the live oak, with other species of the same genus, the cypress, magnolia, cabbage-tree, and several varieties of hickory, (*carya,*) all united by a cordage of vines and brambles, extending from trunk to trunk and from limb to limb, constituting an immense net-work of vegetation.

"My observations on vegetation have been limited. The dewberry or creeping blackberry, *rubus trivialis*, I discovered ripe in the Wahoo swamp, near Dade's battle-ground, in the middle of April. On our arrival at this post, on the 28th April, the dandelion, *leontodon taraxicum*, had already bloomed, and the *magnolia grandiflora* was just expanding its blossoms. The *chenopodium anthelminticum*, found here in the greatest abundance, is now (August 1st) just putting forth its organs of fructification. The Spanish moss, (*tillandsia usneoides*,) which is produced very exuberantly, I discovered in every stage of existence in the month of June. My attention was first attracted by the manifest state of its organs, the stamens and pistils being half an inch long. The seed of this parasite has an egret more than six lines in length, consisting of a bundle of simple hairs without branches.

"The mineral productions of this region seem to be all of secondary formation. These stratified rocks contain organic remains, both animal and vegetable. They consist chiefly of carbonate of lime, and in some the most delicate structure of shells is preserved.

"No large bodies of water exist in the vicinity of this post. Three miles from this point is Silver spring, the source of a beautiful stream of the same name. From this fountain, remarkable for its transparency, Silver creek emerges at once a bold stream, sixty yards wide and twenty feet deep, running into the Ocklewaha about twelve miles from this post. A remarkable peculiarity is often found in regard to the course of waters; considerable streams sometimes disappear, and, after running several miles subterraneously, again emerge. Near Dade's battle-ground is a small lake, into which a rapid creek empties, but no outlet is visible. These waters are generally well stored with the finny tribe, whilst the forest abounds in every kind of game pertaining to the country.

"Although large bodies of water do not exist in the vicinity, yet the actual quantity is very great, owing to the extensive marshy low lands, swamps, and stagnant pools; and as the soil is not completely covered with water, the circumstances most conducive to the evolution of those morbific agents resulting from solar influence, obtain. The humidity of the vicinal *hummocks* gives rise to constant exhalations, which fall in heavy mists at night; and no doubt to this cause is to be ascribed, in some measure, the prevalence of intermitting fever.

"This post, which had been for some years the Seminole agency, has always maintained the character of being a healthy station. A striking advantage over most other localities in Florida is, the existence of a never-failing spring of excellent water."

Since the date of this report, a singular phenomenon occurred at the post of Micanopy The waters of Lake Tuskawilla, perhaps a mile in length, suddenly disappeared subterraneously, leaving its inhabitants upon dry land. Orange lake is running off in a similar manner, about ten thousand acres having been completely drained.

This post was evacuated July 3d, 1829, and re-occupied July, 1832; abandoned in May, 1836, and re-established in April, 1837. As in the preceding station, no returns are included in this report, since the commencement of the present Indian disturbances. As the total of deaths, according to the post returns, is fourteen, and the aggregate mean strength is 420, the annual ratio of mortality is $3\frac{3}{10}$ per cent. Of the deaths, seven are reported in the medical returns, viz., two remittent fever, one phthisis pulmonalis, one phrenitis, and three from causes not designated, being at the rate of $1\frac{7}{10}$ per cent. In the post returns, ten deaths are reported in 1835, whilst but three are given in the sick reports, excluding the death of Lieutenant Smith, who, with General Wiley Thompson, the Indian agent, was massacred by a party of Seminoles. Assuming eight deaths as the total from all causes, with the exception of casualties, the annual ratio of mortality is nearly two per cent.

The annual average of fevers of malarial origin is high, that of intermitting fever being one hundred and twenty-three, and that of remitting fever twenty per cent.; but the ratio is very much reduced, if the year 1835 is excluded, the former being thirty-eight, and the latter nineteen per cent. This post, however, has always been regarded as decidedly salubrious, with the exception of the liability to fever and ague. Violent fevers of the remittent form, and intermittents running into the same type, occurred in the latter part of the summer of 1837, owing doubtless to the circumstance that the smaller trees and undergrowth of a neighboring *hummock* had been cut down as a precaution against Indian ambuscade. It is a well known fact that military stations, near jungles, often continue healthy until the soil is brought under cultivation, or the trees and shrubbery cut down, exposing the boggy surface to the agency of solar action.

The following remarks are from the author's own report already quoted :—

"Fevers generally assume the intermittent form. They are mostly of the tertian type, sometimes the quotidian, and very rarely the quartan or quintan. After the employment of mercurial cathartics, emetics, and blood-letting, according to the indications presented, the disease speedily and invariably yields to the use of sulphas quinine. It is seldom, however, that venesection is required. When not contra-indicated by diarrhœa, I always use the solution of quinine saturated with the sulphas magnesiæ. According to my experience, it not only adds much efficacy to the remedy, but its employment is admissible when slight febrile symptoms still contra-indicate the usual preparations of quinine. The happy effects of this prescription have been displayed also in cases that have assumed a chronic character, attended by visceral indurations and enlargements. In several neglected cases among the friendly Creeks, the continued use of this preparation alone speedily arrested the paroxyms, removed the icterode hue of the skin, and reduced the liver and spleen to their normal condition.

"Several cases of *scorbutus* have been presented. The disease manifests itself with most of the symptoms by which it is generally described. Muscular power is completely prostrated, the gums are swollen, spongy, and livid, the legs are anasarcous and covered with blotches of extravasated blood, and the nates sometimes, but very rarely, become the seat of bloody abscesses. These lesions gradually yield to the plentiful use of lemon acid and vegetables with vinegar. The only therapeutic means employed in conjunction is, the sulphas quinine dissolved in elixir vitriol. When stationed at a neighboring fort, several cases of this disease occurred. Deprived of vegetables, they grow worse from day to day, until the free use of wild pepper-grass, (*lepidium virginicum*,) found in a neighboring swamp, was prescribed. At this post we have the good fortune to find in great abundance *purslane*, renowned among the older physicians as an anti-scorbutic."

The comparative agency of the seasons in the causation of disease in general is expressed in the following ratios:—First quarter, 50 cases, second 59, third 78, and fourth 91. Hence every man, on an average, was reported sick once in every four months and a quarter.

FORT BROOKE.—LATITUDE 27° 57′ N, LONGITUDE 82° 35′ W.

This post is situated at the head of Hillsborough Bay, now generally known by the name of Tampa, about thirty miles from the Gulf of Mexico. The Hillsborough river empties into the bay at this point. The general aspect of the surrounding country is low and level. This post has always been regarded as a delightful station.

Here tropical fruits, such as the lime, the orange, and the fig, find a genial climate. Vegetation, as already remarked, may be regarded as continuous throughout the year, wild flowers blooming, and culinary vegetables growing, in the month of January; and, at the same season, the water of the bay is generally of a temperature to admit of bathing.

As a general hospital was established at this post as soon as the Seminole war began, no reports subsequent to the year 1835 are embraced in these statistics. As the total of deaths, according to the Adjutant General's returns, is fifteen, and the aggregate mean strength is 651, the annual ratio of mortality is $2\frac{3}{10}$ per cent. Of the deaths, twelve are reported in the medical returns, viz., three remittent fever, one continued fever, one intermittent fever, (in the cold stage of a quartan,) one cynanche trachealis, one meningitis, one acute hepatitis, one chronic diarrhœa, one atrophia, one drowned, and one from no specified cause. Excluding the case of asphyxia, the ratio, according to the medical returns, is $1\frac{8}{10}$ per cent.

Like the two preceding posts, this one has always been regarded as highly salubrious. The ratio of mortality is equally low. As regards fevers of malarious origin, the annual average of intermitting fever is seventy-three, and that of remitting fever is nine per cent. The high ratio of intermittent fever, both at this post and the preceding one, is owing in some measure to the exposure incident to detached service.

The relative influence of the seasons in the production of disease in general is expressed in the following ratios :—First quarter 73 cases, second 96, third 97, and fourth 78. Consequently the mean period in which every man was reported sick, is four months and a half.

KEY WEST.—Latitude 24° 33′ N., Longitude 81° 52′ W.

Key West or Thompson's Island, lies about sixty miles southwest of Cape Sable. It is about ten miles long, and from one to three in breadth. Composed of a formation of coral, lime-stone, and sea-shells, it is low and level as regards its general surface, the south-eastern shore presenting the most elevated point. This ridge, consisting chiefly of sand and shells thrown up by the sea, rises about five feet above high water-mark. In the interior of the island are found many marshes and lagoons, some of which are lower than the surface of the surrounding ocean. These marshy low lands, covered in some parts with fresh, and in others with salt water, doubtless constitute a prolific source of miasmata. Another important feature in the medical topography of this island is the occasional appearance upon the beach of an immense quantity of marine substances, both animal and vegetable. The mass thus accumulated, during the prevalence of a south or south-westerly wind, lies in some places to the depth of several feet, and extends several miles along the shore. Although these decomposing materials emit in a few hours effluvia of the most offensive character, yet their agency in the production of disease is a question admitting of disputation.

The mean annual quantity of rain, on an average of five years, is 31.39 inches.

This island is the most southern settlement of the United States. It contains about fourteen hundred inhabitants, and is a place of some commerce, chiefly in the way of wrecked goods. As it commands, from its position, the commerce of the Gulf of Mexico, and as it possesses a good harbor, it early attracted the attention of our government as a suitable place for a naval and military depot; and it has consequently been, from time to time, the station of our West India squadron.

As the total of deaths, according to the Adjutant General's returns, is twenty-four, and the aggregate mean strength is 268, the annual ratio of mortality is nearly nine per cent. Of the deaths, twenty are reported in the medical returns, viz., five inflammatory fever, two phthisis pulmonalis, two hydrothorax, one chronic hepatitis, one casualty, one ebriety, and eight from causes not designated, being at the rate of $9\frac{5}{10}$ per cent.

The mortality of this station is extraordinarily high. In April, 1833, the garrison, in consequence of sickness, evacuated the post temporarily, and occupied Fort Clinch. The quarterly sick-reports are not sufficiently full in details to be enabled to determine the precise character of the prevailing diseases. Of the twenty deaths, the causes of eight are not specified; and the five fatal febrile cases, in the third quarter of 1835, are ascribed to the "fever of the climate," whilst the sixteen cases which occurred are registered under the head of inflammatory fever. Fevers of malarial origin present a very low ratio, the average of intermitting fever being twenty per cent., and that of remitting fever less than two per cent. The cases of phthisis pulmonalis occurred in old drunkards; and to the agency of inebriation, combined with the influence of the summer season upon northern constitutions, the mortality is doubtless chiefly attributable.

Yellow fever prevailed among the naval forces stationed at this island in 1824. The epidemic is well described by Dr. Benjamin Ticknor, of the United States Navy. Independent of the operation of local causes, reference is made to excessive fatigue, unwholesome food, and the intemperate use of ardent spirits. The sailors drank not only to gratify the appetite, but to guard against an attack of fever. In accordance with a regulation of the naval service, every man received a daily allowance of half a pint of rum or whiskey; but this quantity served only to whet the appetite, and to excite the well-known ingenuity of the soldier and the sailor in its obtainment. The effects of this excessive potation were rendered more pernicious in consequence of atmospheric vicissitudes; for the men, when in a state of high excitement, with the perspiration streaming from every pore, would throw themselves upon the floor or ground, and, falling asleep, lie thus exposed to the damp night air.

The relative agency of the seasons in the causation of disease in general is expressed in the following ratios:—First quarter 117 cases, second 94, third 157, and fourth 120. Hence every man, on an average, was reported sick once in every two months and a half—a ratio exceedingly high.

TEMPORARY POSTS.

2d Class.—SOUTHERN DIVISION.

We come now, in conclusion, to the consideration of the posts temporarily established in various parts of the present theatre of military operations. The results, based upon the statistics of thirty-one stations, are confined to a single year, inasmuch as an exact separation previously between the regulars and volunteers is impracticable.

The topographical descriptions already given, afford a good idea of the general features of this region, which consists of a succession of marshes, savannahs, and sandy pine forests. The soil of this coast is frequently of a deep alluvial character, and of comparatively recent formation. As the rivers annually bring down immense quantities of deposite, the land gains so rapidly upon the ocean that its waters have, as for instance at the mouth of the Mississippi, receded three or four miles within a century. Owing to this peculiarity in its formation, the country is a vast flat, with an occasional elevation produced by a sand-reef, covered with rank and tall grass, or with dense forests. Little elevated above the level of the sea, the southern portion of the peninsula presents, with the exception of a belt along the coast, an endless succession of swamps and marshes, called "*everglades.*" The dry "sand barren," covered with a forest of pines, forms much the greater part of the northern portion. A rich soil for cultivation is found along the coast, on the banks of rivers, or in those dense jungles, called *hummocks*, which seem to have been once lakes. The *pine barrens* are composed principally of silecious sand, more or less mixed with calcareous and vegetable matter. The swamps on the borders of rivers seem to be formed by inundation. Immediately after leaving the channel, the grosser part of the alluvial matter is deposited, forming a ridge; and this embankment, as the water subsides, prevents its complete return. The whole country being a dead level, the superabundant moisture remains until evaporated by the sun's rays; and the winds, traversing the grounds thus saturated, it is supposed, possess considerable agency in the causation of fevers.

The year comprising the statistics of the temporary posts, extends from October 1838 to October 1839. The mean strength was 3092, the number of cases reported 6510, and of deaths 83. From the usual abstract of diseases making up the details of each post in the official Report, it is found that under the class of fevers, there are comprised 1,356 cases of intermittent fever, 300 of remittent, and 11 of synochal; under the class of diseases of the respiratory organs, 330 catarrh, three acute bronchitis, thirty-four pneumonia, sixty-two pleuritis, twenty-three phthisis pulmonalis, four hæmoptysis, and six asthma; under the head of digestive organs, 1,594 diarrhœa and dysentery, 113 colic and cholera, and twenty-two hepatitis; under the class of brain and nervous system, forty-nine nyctalopia, six apoplexy, twelve epilepsy, and fifteen mania a potu; and under that of venereal affections, fifty-one gonorrhœa, and forty-three syphilis. Of dropsical affections there were reported fourteen, of scorbutic sixty, and of rheumatic 340 cases.

The 83 deaths are reported from the following causes, viz., twenty remittent fever, two intermittent fever, one pleuritis, six phthisis pulmonalis, fifteen dysentery, sixteen chronic diarrhœa, five gastroenteritis, two apoplexy, one epilepsy, one phrenitis, two mania a potu, three scorbutus, two dropsy, five gun-shot wounds, and two casualties. The ratio of mortality is consequently $2\frac{7}{10}$ per cent.; but inasmuch as seven deaths arose from wounds and injuries, and one from yellow fever contracted at Savannah, the total of deaths is reduced to 75, and the average mortality to $2\frac{4}{10}$ per cent.

It thus appears that the mortality, during a period of Indian hostilities, when the troops occupied a number of posts which dot the whole surface of the Peninsula, is, like the ratio prior to the war, remarkably low. It is seen, too, that a large proportion of the deaths arose from that class of diseases of a chronic character, to which soldiers of intemperate habits are peculiarly liable,—twenty-nine fatal cases of phthisis pulmonalis, chronic diarrhœa, mania a potu, and dropsical and scorbutic affections being reported. As regards fevers of malarial origin, the annual average of intermittents is forty-four, and that of remittents is ten, per cent. In the latter, the ratio of fatal cases is one in fifteen. On comparing the second and third quarters, a singular relation between intermittent fever and the class of diseases of the digestive organs is perceived. In the former, the ratio of intermittent fever is nine, and that of the diseases of the digestive organs is twenty-three per cent.; and in the third quarter, the ratio of the former is nineteen, whilst that of the latter is only seventeen per cent. As the average of the former is more than doubled in the third quarter, whilst that of the latter is decreased, it would seem, assuming an identity of cause, that the same morbific agents operating in a less intense degree produce, as in the second quarter, diseases of the digestive organs, and when more concentrated in their action, as in the third quarter, intermittent fever.

It appears that intermittent and remittent fevers are both more frequent and fatal in the portion of Florida bordering on Georgia. This result is attributable to the circumstance that in the latter district the soil is in a state of cultivation; and to the opposite condition of the Peninsula, it being generally in a state of nature, is to be ascribed, in a great degree, its comparatively low mortality. Positions along the coast, and in many parts of the interior of the Peninsula, are often found very salubrious. Along the eastern coast, there are several posts at which a case of fever has not been reported in one, and even two quarters. Other localities again, many being selected less with reference to salubrity than military advantages, have proved very unhealthy. Fort Roger Jones, for example, established on the Oscilla river in Middle Florida, in March, 1839, by one company of Infantry, (forty-two men,) became so sickly that it was necessary to abandon it on the 13th June. The sickness commenced towards the end of May, and continued progressively to increase, not only numerically, but in severity, showing with what concentrated virulence of action the effects of that mysterious agent, termed malaria, are sometimes manifested.

Under the class of diseases of the brain and nervous system are reported forty-nine cases of *nyctalopia*, *hemeralopia*, or *paropsis noctifuga*—diseases of very unusual occurrence in other parts of the United States; but these affections will be noticed more fully in the following section.

The relative influence of the seasons in the etiology of disease in general, is expressed in the following ratios per 100 of the strength: First quarter 33 cases, second 49, third 75, and fourth 49. Hence the average period in which every man was reported sick, is five months and a half.

Along the frontiers of Florida, as in our southern States generally, may be always witnessed deplorable examples of the effects of endemic influences. Many localities consequently proved very unhealthy to our troops. Whilst some fell under the direct influence of disease, others brought away its germ. Not a few persons, who had maintained uninterrupted health in Florida, took sick upon returning north. It is, indeed, a remarkable fact in the medical history of fleets and armies, that, during the active progress of warlike operations, troops are little subject to the influence of disease. It seems as though the excitement of the passions has the power of steeling the system against the agency of morbific causes. On the contrary, as soon as the excitement is withdrawn, by a cessation of operations and a return to the monotony of a garrison, the constitution manifests the consequences of recent fatigue and exposure.

A general opinion obtains that, to preserve health in localities subject to malaria, full living and a liberal allowance of wine are requisite. This opinion, so far as Florida is concerned, is founded in error. Irregularities in diet and drink, more especially when the person has been unduly exposed to the direct influence of the sun, are found to be among the most frequent exciting causes of fever. It is a truth that holds good in every clime that, in proportion to the healthy state of the digestive organs, is the constitution enabled to resist the causes of disease, or to pass through it safely when under its influence. A plain and moderate diet is, as a general rule, most conducive to the preservation of health; but in a malarious district, to fortify the system against the influence of its noxious exhalations, a tonic and nutritious diet is obviously demanded. A stimulating regimen might prove a prophylactic in the damp and chilly atmosphere of Holland, but it is wholly inadmissible in the exciting climate of Florida. "I aver," says Mosely on Tropical Diseases, "from my own knowledge and custom, as well as from the custom and observation of others, that those who drink *nothing but water*, are but little affected by the climate, and can undergo the greatest fatigue without inconvenience."

It is a law of the animal system, that a gradual and protracted exposure to morbific agents insensibly diminishes its natural susceptibility to their influence. Hence, the acclimated natives of insalubrious regions possess a comparative immunity from the diseases of the climate; or rather, the system merely loses its susceptibility of being excited into those violent febrile commotions to which strangers, arriving from northern latitudes, are so peculiarly obnoxious in many localities in our Southern States. In the former class, the agency of this poison may be compared to a slow and concealed combustion; whilst in the latter, its operation is manifested in a raging and rapidly consuming flame. As the regular troops in Florida were almost wholly from northern regions, those that escaped the first summer, instead of gaining an immunity from disease by exposure to the climate, acquired an increased susceptibility of the system to it, in a less violent form. The power of resisting morbific agents, inherent in the animal organization, is so much diminished every succeeding summer, that the ratio constantly sick in each regiment, more especially as regards intermittent fever, bears a close relation to its period of service in the Territory.

Those who advocate the doctrine of acclimatization, will be surprised to find how much the theory is opposed by numerical results. The statistical data, furnished in the West India commands, leads to the following conclusions: "1. That troops are likely to gain but little immunity from either disease or mortality by a prolonged residence in the West Indies. 2. That soldiers are not, in general, liable to any greater mortality during their first year of service there, than at any subsequent period. 3. That though, in years of ordinary mortality, corps long resident in the Island suffer as much, or even more, than those recently arrived, yet, during the ravages of epidemics, there appears a partial exemption in favor of the former." This *partial exemption*, however, may be reasonably ascribed to the fact that, as fear and despondency augment the susceptibility to fever, the minds of those newly arrived would be acted upon more powerfully than of those who had survived similar epidemics. The following table exhibits, in ratios per thousand of the mean strength, based upon extensive data, the influence of length of residence in the Windward and Leeward command :—

Years.	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	General Average.
Ratio of deaths per 1,000 of mean str'gth	77	87	89	63	61	79	83	73	120	109	140	85

From the table giving these results it appears that, whilst the mortality, during the first year, is in nine instances above the average, it is in twelve below it ; that the mortality has increased, as often as diminished, with length of residence ; and that, upon an average, the ratio of the last years is higher than the first. The prevailing opinion in regard to acclimatization is, therefore, disproved by numerical results. " Noxious agents or causes of mortality," says a late writer,* " exist in all countries, and these causes of mortality will have greater or less influence upon the human body, in proportion to its conservative powers. The rate of mortality among a body of troops is therefore, in some degree, a test of the existence, and a measure of the power, of these destructive agents. It has long been supposed that the conservative powers of the constitution acquired strength by length of residence in unhealthy climates, but this inference or conjecture derives no confirmation from statistical investigations." In Jamaica, for example,—a station in which the strength is usually kept up by young recruits varying from nineteen to twenty-one years of age,—the annual ratio of mortality among soldiers between the ages of eighteen and twenty-five, is 70 per 1000, between twenty-five and thirty-three, 107, between thirty-three and forty, 131, and between forty and fifty, 128 per 1000. This is the case, adds the same writer, " not only in regard to Jamaica, but also in respect to the Windward and Leeward Island station, and uniformly in all the other stations, both in the temperate and torrid zones."

The ratio of mortality among the troops in Florida, $6\frac{1}{10}$ per cent., varies little from the general average of troops serving in our southern States in time of peace—a fact established by the results of statistical

* *On the enlisting, discharging, and pensioning of soldiers.* By Henry Marshall, F. R. S. E., Deputy Inspector-General of Army Hospitals.

inquiries. This ratio is, indeed, lower than that of the 4th Infantry, on an average of ten years. This regiment, which bore the "tug of war" amid ungenial climes, presents the highest ratio, $7\frac{6}{10}$ per cent.; whilst the 5th Infantry, which had a kind of *home* station on the northern lakes, exhibits the lowest mortality, $1\frac{8}{10}$ per cent. As an evidence that no extraordinary mortality has been experienced in Florida, it is found that the average of the three years ending with 1839, taking all the regiments in the army, is $4\frac{5}{10}$ per cent., whilst that of the ten years terminating with the same year, is $4\frac{4}{10}$ per cent.; and that, although more than one-third of the actual strength of the army served in Florida in 1838, yet the mortality of the whole army is only $4\frac{2}{10}$ per cent.,—a ratio lower than the mean of ten years. It may be supposed that the mortality among the invalids sent out of Florida will increase the ratio; but, on investigation, it is found that it does not materially affect the result. According to the regimental returns, it appears that there has been a progressive decrease each year in the mortality arising from all causes—"ordinary, killed in action, died of wounds, and accidental." In 1836 it was $11\frac{4}{10}$, in 1837, $6\frac{9}{10}$, in 1838, $4\frac{7}{10}$, and in 1839, $4\frac{7}{10}$ per cent., the average for the four years being $6\frac{1}{10}$ per cent. In the summer of 1836, the troops remaining in the Territory being chiefly concentrated on the frontier settlements, suffered much from disease. On the Suwanee river, the 4th Infantry experienced a high mortality.

The ratio of mortality among commissioned officers, ($8\frac{9}{10}$ per cent.,) is higher than that of the troops in general. The ratio of sickness, however, it will be seen, is much lower. Of the twenty-six deaths, seven were caused by wounds received in battle, two by the explosion of a steam-boiler, and seventeen by disease. Computing those only that died from disease, the ratio is $5\frac{7}{10}$ per cent.

In the official Report is given a table exhibiting the number sick among the troops serving in Florida, on the last day of each month, compiled from the monthly regimental returns, the most striking result of which is, the contrast between the ratio constantly sick among officers and that of the troops in general. The ratio of the officer being $3\frac{1}{10}$, per cent., and that of the troops generally $18\frac{4}{10}$, the number constantly sick is six times greater among the latter. As 184 men out of every 1,000 serving in Florida are constantly sick, this number multiplied by 365 shows the annual average of days of sickness to 1,000 troops to be 67.160, or to each about sixty-seven days in the course of the year; and pursuing a similar calculation in regard to the officer, we find that he is subject to no more than eleven and one-third days of sickness in each year. But this striking disproportion is more apparent than real; for, among soldiers, every case of disease, however slight, is registered on the hospital books—a circumstance favored by him as it relieves him from duty. Moreover, as the sick left behind or sent to a general hospital, are not immediately on recovery ordered to their proper companies, the average may be from this cause a little too high. This supposition is rendered probable by the sudden decrease, from 250 to 192, in the ratios of September and October,—the period when each company gathers up its men in preparation for the opening campaign; but in referring to this result it is necessary to ascribe appropriate influence to other causes, such as change of season, as well as the accession of fresh troops from the north, by which the force is generally augmented one-half. The officer, on the contrary, seldom comes on the sick-list for slight ailments; moreover, his military pride induces him to make an effort to be reported on duty at the period of making the monthly returns. The high ratio constantly sick is to be ascribed less to the agency of climate than to the arduous and unceasing duties required of the soldier.

A contrast equally striking is observed on comparing these results with those furnished by the tables of the Scotch and English Benefit Societies and by the returns of the Portsmouth and Woolwich dock laborers. This marked disproportion between the ratios annually under treatment among soldiers and among the class of civil population, arises from the circumstance, that among these laborers it is cases only of so serious a nature as to create a disability for manual labor that are recorded; for, whilst among soldiers an admission upon the sick-list secures an exemption from labor, without a reduction of pay, among the working classes it is attended by loss of wages. Among troops, nearly two-thirds of all the diseases are of that class which seldom incapacitates a man for the labors of civil life. In a comparison of the relative extent of sickness among the civil and military population, these facts must be kept in view.

In the Prussian army, the number constantly sick, on an average of ten years, amounts to 44 per 1,000. Among troops serving in the United Kingdom, it is about 40 per 1,000. In the Mediterranean stations, the average of Gibraltar, Malta, and the Ionian Islands, is 44. The average of the stations in British America is about 45. In the West Indies, in the Jamaica command, 63, and in the Windward and Leeward command, 87 are constantly ineffective from sickness. With the exception of Florida, which exhibits a ratio of 184 per 1,000, the average of none of our stations has ever been ascertained.

The numerical results obtained in regard to East Florida, confirm the opinions derived from ordinary observation in regard to the comparative unhealthfulness of the seasons. The ratio per 1,000 constantly sick in each quarter of the year is as follows:—First quarter, 151; second, 175; third, 241; and fourth, 169.

The general results of this class of posts show that the annual ratio of mortality, according to the medical reports is $2\frac{6}{10}$ per cent., and according to the post returns, $3\frac{2}{10}$ per cent., based on an aggregate mean strength of 4,781. This is the only class in which no death from epidemic cholera is reported; and in the total mortality given in the medical returns, but eight deaths are excluded, viz., one drowned and seven from wounds. In the mortality of the temporary stations, as exhibited in the post returns, every death incidental to a state of war is given; and although the total of deaths is forty-nine greater than the number reported as arising from diseases, yet the average mortality is much lower than either of the two preceding classes. The ratio per 1,000 of mean strength annually under treatment being 2,461, it follows that every man, on an average, was under treatment once in nearly every five months. Assuming this ratio as an exponent of the comparative salubrity of the several posts constituting this class, Key West is found in the highest extreme, and the temporary posts in the lowest.

The total of deaths in each month, according to the Adjutant General's returns, is exhibited in the annexed table—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep	Oct.	Nov.	Dec.	Total
Total of deaths in each month.	9	17	7	10	11	16	20	22	28	14	13	19	186

In relation to the climate of East Florida, as regards its comparative salubrity, erroneous impressions pervade the public mind. With the exception of the Northern Division, the mortality is lower in East Florida than in any other class of posts—a result ascribable, in a great degree, as already remarked, to the circumstance that it is nearly wholly in a state of nature. Forts Marion, King, and Brooke, which have been kept up for many years, have always been esteemed healthy posts. The annual mortality at these three posts is 28 per 1000, and including Key West, the average is 40.

Fevers of the intermittent and remittent type are the prevailing diseases. Excepting the south-western region, the ratio of intermittents is higher in this class than in any other; but if the comparison is limited, for example, to Fort McHenry, (Baltimore,) Fort Severn, (Annapolis,) and Fort Washington, (opposite Mount Vernon,) it is found favorable to the former, notwithstanding the garrisons of these northern posts generally formed summer encampments. As regards remittents in East Florida, the annual ratio of cases, which is 102 per 1000 of the strength, is lower than the three preceding classes described, whose respective averages are 181, 180, and 196. In the first class of the Middle as well as of the Southern Division, febrile action often assumes the high grade of intensity designated *yellow fever*. Whilst the causes of this fatal endemico-epidemic seem to be annually present at Charleston and New Orleans, it has not been known to have made its appearance more than three times at St. Augustine.

As this class of posts is comprised in a region characterized by a mild, insular climate, the numerical results, as will be fully elucidated in the "General Deductions," possess a peculiarly intimate and interesting relation with the class of pulmonary diseases.

SECTION II.

GENERAL DEDUCTIONS.

Having completed the details of each Division in reference to atmospheric laws, topography, and the statistics of morbility and mortality, it remains to classify these numerous and diversified facts, with a view to general conclusions.

A.—DISEASES OF THE PULMONARY ORGANS.

Object in view.—Difficulty of the subject.—Laws relative to the etiology of catarrhal diseases.—Advantage of East Florida as a winter residence to the northern invalid laboring under chronic bronchitis.—Laws developed in regard to the etiology of pleuritis and pneumonia.—Laws in reference to the etiology of phthisis pulmonalis.—Laws determined in respect to pulmonary diseases as a class.—Phthisis prevails less in hot and very cold than in temperate countries.—The supposed connection between phthisis and a changeable climate, doubtful.—The influence of moisture in the production of catarrh, pleuritis, pneumonia, and phthisis, too exclusively considered.—The exciting causes of acute pulmonary diseases subordinate to the predisposition induced by the high temperature of summer contrasted with the low temperature of winter.—Explanation of the advantages derived by the pulmonary invalid from a winter residence in a warm climate.—The climatic character of East Florida considered.—Its applicability in incipient cases of pulmonary consumption, asthma, chronic disorders of the digestive organs, chronic rheumatism, etc.—Directions for the northern invalid as regards a winter residence.—An analysis of the British army statistics relative to pulmonary diseases, with the view to confirm the laws established in the United States.

To elucidate the laws which obtain relative to the etiology of this class of diseases in the several systems of climate pertaining to the United States, and to demonstrate the advantages of peninsular Florida as a winter residence for pulmonic and other invalids, is the object now in view; and to accomplish this end, it is requisite to generalize the necessary data scattered throughout the preceding pages, and thus, by a proper induction, to establish general laws. If the application of the laws of climate to the science of medicine is susceptible of elucidation, it is in the class of diseases now under investigation; and if any region of the earth affords a fair field for this illustration, it is that of our own country. Stretching over a vast extent of territory, the United States present a corresponding variety of climate, exhibiting, under multiform aspects, the animal and vegetable kingdoms. Occupying, as we do, the eastern coast of a continent of the northern hemisphere, the human frame is exposed to the contrasted seasons of the most excessive clime. The extreme north has a climate in which cold predominates, vexed by winds that have passed over interminable snows; the south acknowledges the genial influence of the sun; whilst the middle vibrates alternately to both extremes. The climate of the United States is, in truth, remarkably inconstant and variable, "passing rapidly," says Malte-Brun, "from the frosts of Norway to the scorching heats of Africa, and from the humidity of Holland to the drought of Castile." So sudden are the vicissitudes of weather in the middle States, that it may be truly said, we often "lie down in July and rise in December."

In endeavoring to determine, by ordinary observation, the influence of meteorological causes in relation to disease, the difficulties of the inquiry are very great, owing both to the complexity of the agents concerned and that of the organs and functions upon which they act. Independent of incidental miasmata, whether gaseous admixtures, animal or vegetable products, or other agents still less within our knowledge, this inquiry naturally divides itself into four heads—viz., *The Temperature of the Air—Its Hygrometrical Condition—Its Weight—and Its Electrical State and Changes.* The agency of winds may be referred, in a great measure, to some one of these conditions. Although little has been done to determine the influence of light, yet seeing what has been effected by science in expounding the physical conditions through which this great agent operates, and its effects, for example, on the growth and economy of plants, many of its relations to the body, there is reason to believe, will be hereafter ascertained. The present inquiry embraces in its scope the temperature of the air, and, in some measure, its hygrometrical state. Although we feel these various agents to be in perpetual operation, yet it is singular how little real knowledge has been gained in relation to their connection with disease. The difficulty of the research is mainly enhanced by the circumstance that none of these conditions act singly upon the living body; and to meet the perplexity of these questions, meteorology, which is itself only taking a place among the exact sciences, has not yet accomplished much. To determine these laws, the personal observations of a single individual cannot be of much avail. It is only by extending these observations through a series of years and over vast masses of individuals, upon the principle of the numerical mode of analysis, that correct conclusions can be attained. It will be shown that by the application of the doctrine of averages, important relations have been disclosed discoverable in no other way. The progress of physical science, it is thus seen, is ever lending fresh aids to that of pathology; and judging from the character of the results now developed, a favorable augury of the future, (as the range of meteorological science, aided by new instruments, is being enlarged,) is justly warranted.

Catarrhal Diseases.

Having already demonstrated that the regions of the United States on the same parallels of latitude, present systems of climate very diverse in character, viz., 1. The regions bordering on the ocean; 2. Those under the influence of inland seas; and 3. Those remote from such controlling powers,—it will be seen that these laws of climate maintain an intimate relation with the etiology of pulmonic diseases. It seems to be a well-established law, that the prevalence of *catarrh* and *influenza* in each *system* of climate, increases and decreases in proportion as the seasons are contrasted, thus maintaining an unvarying relation with the extreme range of the thermometer as connected with the seasons.

The following table* presents in a condensed form, so far as regards the *catarrhal* forms of pulmonic lesions, the results of the quarterly sick reports of forty-five permanent posts, arranged in classes, comprising a period of ten years:—

* This table contains, besides the results of the permanent stations, those of the thirty-one temporary posts in Florida. It is based on an aggregate mean strength of 47,220, and it exhibits the condensation of about 1500 quarterly reports of sick, the ratios being calculated from the mean strength of each post computed from the monthly returns in the Adjutant General's office.

RATIO OF CATARRHAL DISEASES.

Divisions	Systems of Climate.	Latitude.	Diff. between the mean temp. of winter and summer.	Ratio treated per 1000 strength.				
				First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual result.
North'n.	1st Class. Posts on coast of N. Eng.	43°18′	38°.61	63	49	36	85	233
	2d Class. Posts on N. chain of Lakes.	46°27′	43°.00	90	62	50	96	300
	3d Class. Posts remote from the ocean and inland seas. . .	44°53′	55°.84	175	120	86	169	552
Mid.	1st Class. From Del. Bay to Savannah.	37°2′	32°.99	102	45	23	97	271
	2d Class. South-western Stations. .	35°47′	36°.83	122	61	33	78	290
Sou.	1st Class. Posts on the Lower Mississip.	30°10′	24°.39	82	34	26	60	218
	2d Class. Posts in the Penin. of Florida	24°33′	11°34*	45	24	40	33	143
	Average,			98	56	42	88	287

This table, which exhibits the annual and quarterly ratios of each system of climate, and serves to elucidate their relations and sequences, affords a beautiful illustration of the etiology of catarrhal affections as connected with the meteorological laws established. Take, for example, the Northern Division consisting of the first three classes:—On the New England coast, as the ocean modifies the atmospheric temperature, the annual ratio treated per 1,000 of mean strength, is as low as 233; on the Great Lakes, where a similar modifying influence is in operation, it is 300; whilst the third class, characterized by the extreme range of the thermometer, has a ratio as high as 552. But let us follow more narrowly the isotheral and isocheimal lines, (representing the mean temperature of summer and winter,) which describe four curves within the same space, presenting alternately a *mild* and an *excessive* climate. As these lines, on the coast of the Atlantic, present comparatively little deviation from the terrestrial parallel, the ratio of catarrhal diseases is low; advancing into the interior, the line of equal summer rises and that of winter sinks, and the ratio increases proportionally; proceeding into the region of the lakes, the lines again converge beneath the controlling power of the waters, and the ratio of catarrh and influenza is modified

* This result is obtained from the observations made at Key West. At Fort Brooke, Tampa Bay, it is 16°.49.

accordingly; again advancing into the interior beyond these ocean-lakes, the average rises in proportion as the isotheral and isocheimal curves tend to opposite directions. In the other divisions, the same law obtains. On the Atlantic coast, between the Delaware and Savannah rivers, the annual ratio is 271,* whilst the average of the interior posts of the Middle Division, notwithstanding this class lies somewhat farther south than the former, is 290. As most of the posts of the first class of the Southern Division are on the Lower Mississippi, and are much under the influence of large bodies of water, the annual ratio is as low as 218; whilst the second class, which comprises the mild, insular climate of East Florida, has an average of only 143.

It would seem then, at first view, that sudden atmospheric vicissitudes combined with moisture, do not excite a strong susceptibility to catarrhal diseases, else the sea-coast and the lakes should give a higher ratio than the dry and cold atmosphere of the opposite localities; but here it is necessary to bear in mind that the former condition is an *exciting*, and the latter a *predisposing* cause. The results, on every hand, afford satisfactory proof that the ratios of these lesions are highest, when the seasons are well marked, producing a decided impression upon the animal economy, and that they are less dependent upon daily variations of temperature than upon its extreme range as connected with the seasons.

In regard to the climate of the United States, the rule holds good, that wherever the seasons are violently contrasted the ratio of catarrh and influenza is highest, decreasing in proportion as the difference between the mean temperature of summer and winter grows less. Thus the ratio on the northern chain of lakes is little more than half as high as in the adjoining localities removed from the agency of large bodies of water; and accordingly, we find that the difference between the mean temperature of summer and winter, on the same parallels, is at least 16° less on the Lakes. Conformably to the same law, it is found that as the ratio of the third class of the Northern Division is nearly four times higher than that of the second class of the Southern, so the disparity of summer and winter at Fort Snelling is 56°.60, and at Key West only 11°.34. Although we possess no extensive measurements of the relative quantity of rain which falls in these

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* In this class, Fort Monroe, and in the first class of the Northern Division, Fort Independence, have been excluded, for reasons to be given in the sequel.

two positions, nor any comparative hygrometric observations ; yet we know that the atmosphere of the lakes is much more moist, as the number of rainy and cloudy days is nearly twice as great as in the opposite locality.

Here then are several laws established in meteorology as applied to the etiology of disease. But let us test, by a further application of the principles, the universality of these physical laws. As the *Middle* Division is subject to the extremes of the northern and southern latitudes, so it is found to be prolific in pulmonic lesions in general. The result of eight military stations, (the first class of the Middle Division,) situated on the sea-coast and inlets between the Delaware and Savannah, gives an average of catarrhal diseases higher than that of the northern coast, where cold prevails, as well as that of more southern latitudes, in which a high temperature predominates.

The annual ratio of the middle coast being higher than either extreme, let us see whether it bears the usual relation with the interior region of the same latitude. This refers to the south-western posts, of which Jefferson Barracks, latitude 38° 28′ is the most northern, and Fort Jesup, latitude 31° 30′, is the most southern point. True to the general law developed, we find that the ratio (290 to 271) is in accordance with the augmented difference between the mean temperature of summer and winter.

It will be necessary here to remark that the statistics of Fort Monroe, on the coast of Virginia, which seems to be under the influence of no ordinary laws, have been excluded in the calculation of the class to which it belongs. The ratios of catarrh and influenza per 1,000 of strength, compared with the eight other posts of this class, stand as follows :—

	1st Quarter.	*2d Quarter.*	*3d Quarter.*	*4th Quarter.*
Fort Monroe,	225	146	94	339
Remaining Posts,	102	45	23	97

It is thus seen that the averages at Fort Monroe are from two to fourfold higher than the mean ratios of the other posts of the same system of climate. Although the results are extraordinary, yet the influence of the seasons is strikingly manifest. The statistics of this post embrace a period of nine years ; and whilst the nine fourth quarters, with an aggregate mean strength of 2,625, give a total of 774 cases of diseases of the respiratory organs, 426 cases are reported in one of these quarters, with a mean strength of 609. Of these cases, 372 are registered as "epidemic influenza," which continued to prevail until the following April. In the first quarter of this year, (1832,) 259 cases of pulmonary disease are reported, 219 being "epidemic catarrh," in a command of 570 men; and in the second quarter, in a mean strength of 352, 154 pulmonic affections are reported, (126 being of the epidemic form,) most of which occurred early in the quarter. As these facts, however, are insufficient to explain the general result, much may have been owing to the agency of local causes; for example, the dampness of the men's quarters, which were in the casemates between the ditch of the Fort and the water of the Bay. In regard to pleuritis and pneumonia, the contrasts are equally great; and it may be added that a large proportion of the deaths have arisen from this class of diseases. During the nine years, 102 deaths are reported in the medical returns, among which are seventeen phthisis pulmonalis, four pneumonia, three pneumonia typhoides, four influenza, and one engorgement of the lungs. The average mortality from pulmonary diseases is about twice as high as at the remaining posts of this class.

The *Southern Division*, consisting of two classes, remains to be examined. The annual ratios of both these systems of climate are lower than that of any other. The first class of this Division is little removed from the second of the *Middle* Division in point of latitude; but, owing to the modifying agency of the Gulf of Mexico and the large lakes in the region of the Lower Mississippi, it holds an intermediate relation in respect to the south-western stations and the climate peculiar to the peninsula of Florida. These annual ratios are as follows—290, 218, and 142. As the climate of East Florida is the most mild and equable, possessing all the advantages of the most favored insular regions, so it presents the lowest average of catarrh and influenza.

The numerical results thus far obtained have been not in the least anticipated. If to enter upon an investigation free of preconceived opinions may be considered a merit, the claims, in the present instance, are still greater, inasmuch as the views of the author were diametrically adverse to the conclusions warranted by the data; for he believed, with the rest of mankind, that the high dew-point and sudden vicissitudes of temperature characterizing positions on lakes and the ocean, exercise a greater agency than the dry and less variable climate of the interior, in the production of catarrhal diseases. The fact that the extremes of the seasons act as a predisposing cause, had never before been noticed. Content to observe facts and to trace their relations and sequences, the author has essayed to be a faithful interpreter of nature; and as it is a leading principle of the inductive philosophy, to *ascertain the universality of a fact*, these researches will now be continued in a new direction.

Having obtained thus far unvarying results in regard to the annual average, an investigation of the quarterly ratios as illustrative of the influence of the seasons, will next engage attention. Having determined elsewhere the relative agency of the seasons in the causation of intermittent fever throughout the United States, it is demonstrated that catarrhal affections acknowledge this influence in a still more eminent degree. A single glance at the table of the "*Ratio of Catarrhal Diseases*," (p. 231,) will afford a satisfactory explanation. It will be seen that the ratios of the first and fourth quarters, in obedience to a general law, are always the highest, and that the third invariably presents the lowest average. The second class of the Southern Division, which exhibits an apparent exception to this rule, the third quarter having a higher ratio than the second or fourth, it will be found, illustrates the ancient axiom—*exceptio probat regulam*. As the Peninsula of Florida affords no marked distinctions of seasons, it follows that amongst the causes which determine the prevalence of catarrhal lesions, those that are secondary in the other systems of climate, become in this the primary ones. Finally, the average of each quarter, which gives a fair expression of the relative influence of the seasons in the etiology of catarrh and influenza throughout the United States, as shown in the same table, affords satisfactory demonstration of the general laws developed. These ratios stand as follows:—

1st Quarter.	*2d Quarter.*	*3d Quarter.*	*4th Quarter.*
98	56	42	88

These facts having been determined, the advantage of a winter residence in a more southern latitude to a person laboring under *chronic bronchitis*, becomes at once apparent. If he can avoid the transition of the seasons—that meteorological condition of the atmosphere, which stands first among the causes which induce catarrhal lesions, he will do much towards controlling his malady. Let us suppose him on the coast of New England, in the third quarter, the ratio being as low as 36, when the sudden transition of the season brings it up to 85. The consequences will inevitably be an aggravation of that disorder to which he is predisposed; for the respiratory organs, even when healthy are peculiarly susceptible, at this season, to abnormal action. Let us, on the contrary, suppose him gradually moving south with the change of the season, and the fourth quarter will find him in a climate whose ratio is even lower than that of the preceding quarter in the region which he had left. On the coast of New England, the ratio of the third quarter is 36, and that of the fourth is 85, whereas the average of the latter quarter in peninsular Florida is only 33. These are not isolated facts, but uniform results obtained from ten years' observations. As the same law obtains in every system of climate, it is easy to apply the remedy.

The assemblage of morbid phenomena, usually designated by the term *consumption* or *phthisis pulmonalis*, it is well known, may arise from various pathological conditions of the respiratory organs. In a practical point of view, it is important to discriminate these several affections. Varying much in the degree of sanability, it is generally conceded that that form of consumption which depends upon chronic bronchial inflammation, is by far the most under the control of remedial management. Recoveries are not uncommon in those cases in which the mucous tissue remains free from ulceration, or the subjacent pulmonic structure has not become consolidated.

As regards the advantages of change of climate, it will be observed that reference is made only to *chronic bronchitis* as a natural consequence, notwithstanding the inference, that similar effects, reasoning from analogy, would follow in other forms of consumption, might be warranted. As it is, however, the catarrhal or pituitous consumption of authors that probably constitues the majority of the reputed cases of phthisis pulmonalis in northern latitudes, and as this is the only form that can be really considered remediable, the importance of determining the comparative influence of climate in relation to catarrhal lesions, becomes more strikingly manifest.

As the doctrines maintained are conclusively established, a further discussion were useless. But this subject, at the present day, is invested with more than ordinary interest, by reason of the conclusions deduced from the " Statistical Reports on the Sickness, Mortality, and Invaliding" among the British troops stationed in every quarter of the globe. In regard to *phthisis pulmonalis*, the reporter shows by numerical results, that it is more prevalent in southern than northern latitudes, and that it is "*by no means likely that any beneficial influence can be exerted by climate itself*" in pulmonary affections. The conclusion that pulmonic lesions, as regards the annual ratio, are more prevalent in certain *systems* of climate in southern than northern latitudes, is confirmed by the statistics of the United States army; but as we proceed in the investigation of this question, in relation to the relative influence of the *seasons*, the general opinions in regard to change of climate in pulmonary affections, maintained since the days of Hippocrates, will be triumphantly established. The British army statistics, whilst they have, in some measure, as will be shown, set the world right in regard to a *theoretical* error, have unfortunately led it, at the same time, into a *practical* one.

It is not, however, pulmonary diseases alone that augment and diminish with the varying seasons—a fact established by the results of statistical data. The prevalence of a specific disease, or a class of diseases, constitutes a morbid *diathesis*, which modifies the character of all other lesions. In our northern and middle States, pulmonary diseases constitute the prevailing *diathesis* in the first and last quarters of the year; whilst, in the second and third quarters, the ratio is not more than one-third as high as the average given by the diseases of the digestive organs. An invalid laboring under chronic bronchitis is, therefore, on the accession of the fourth quarter, doubly subject to renewed attacks; whereas by going south in the latter part of the *third* quarter, he leaves a region in which diseases of the digestive organs are the reigning lesions, and enters another of the same character in the *fourth* quarter; and as his system has not been acted upon by the long continued heats of a southern summer, he is less susceptible than the residents, to the influence of those causes which induce pulmonary affections. The pulmonic of the south, to enjoy the full benefit of his own climate, must, therefore, spend his summers in more northern latitudes; for he will thus have, as is beautifully illustrated in the curves of the seasons as shown in Plate II, nearly all the year round, the same mean temperature. In Florida, malarial diseases constitute the morbid diathesis in every season; and if the old idea, that the air of a marshy country is beneficial in consumption, be but partially true, then, indeed, must this climate be an infallible remedy. It will be shown, however, that among northern troops, stationed at the south through all seasons, consumption of a tubercular nature frequently supervenes upon febrile diseases, more especially in constitutions broken down by intemperance, standing in the relation of those other sequelæ—dropsy, jaundice, and the various chronic lesions of the viscera.

The investigation of catarrhal diseases in reference to the agency of climate, and especially the seasons, is thus concluded; and the results, it is conceived, demonstrate conclusively the advantage of a winter residence in the peninsula of Florida in cases of *chronic bronchitis*.

Pleuritis and Pneumonia.

The laws which obtain in regard to *pleuritis and pneumonia* will now be investigated. As these lesions, it is very probable, are dependent upon the same meteorological causes, the results will be investigated conjointly. The following table presents the quarterly and annual ratios of pleuritis and pneumonia in each system of climate :—

RATIO OF PLEURITIS AND PNEUMONIA.

Divisions.	Systems of Climate.	Ratio treated per 1000 of mean strength. First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter	Annual Results.
North'm.	1st Class. Posts on the coast of New England,	12	11	8	10	41
	2d Class. Posts on Northern chain of Lakes,	11	15	13	11	49
	3d Class. Posts remote from the ocean and in-land seas, - - - -	14	11	7	12	45
Mid.	1st Class. Coast from Delaware Bay to Savannah,	21	11	8	16	57
	2d Class. South-western Stations,	46	18	10	20	92
Sou.	1st Class. Posts on the Lower Mississippi,	20	9	4	11	47
	2d Class. Posts in the Peninsula of East Florida,	14	9	8	6	39
	Average,	20	12	8	12	53

It hence appears that the laws in regard to pleuritis and pneumonia, as expressed by the numerical results, differ, in some points, from those peculiar to catarrhal diseases. In the three classes of the Northern Division, the modifying agency of the ocean and lakes, is not evidenced in the results. In the other systems of climate, the laws are the same as in catarrhal affections ; thus, the difference between the two classes of the Middle Division is very striking, whilst those of the Southern exhibit a remarkable decrease in the annual ratio. An examination of the quarterly averages as illustrative of the influence of the seasons, compared with catarrh and influenza, will also show some variation. In the Northern Division, notwithstanding the third quarter is the lowest, the agency of the seasons is not very manifest. In every other class, the difference is very striking ; and in taking the mean of each quarter, which affords a fair expression of the relative agency of the seasons in the causation of pneumonia and pleuritis throughout the United States, it is found that the law is the same as in catarrhal diseases, the first, second, and fourth quarters presenting the highest, and the third, the lowest average.

In these calculations, Forts Monroe and Independence have, as before, been excluded. At Fort Independence, the total of pleuritis and pneumonia is eight times as high as that of catarrh, whilst the ratio of the former is nearly twenty times as high as that of the remaining posts of this class. As but one death is reported among 261 cases of pleuritis and pneumonia, it is reasonable to presume that a great majority belonged to the class of catarrhal affections.

From the table just given, it appears that the average of pleuritis and pneumonia is much lower in the cold and variable climate of our northern and eastern States than in the middle and south-western regions of the United States. At the south-western posts the annual ratio is 92, whilst on the coast of New England it is only 41. In catarrhal affections, the same law obtains so far as the New England coast is concerned; but the second, and especially the third class of the Northern Division exhibit contrary results. It has been seen that catarrhal lesions in every system of climate obey the law in respect to extremes of temperature as connected with the seasons. In pleuritis and pneumonia, this law receives some modification; for example, the third class of the Northern Division, comprising the posts remote from the ocean and inland seas, has a ratio only half as high as that of the south-western stations. At Fort Snelling, Iowa, in the former class, the difference between the mean temperature of winter and summer, is 56°.60; whilst at Fort Gibson, Arkansas, in the latter, it is only 36°.83. In the former, the summers, although the mercury rises very high, are short; but in the latter the summer heats are both great and long continued. It would seem to be a law that in proportion as the high temperature of summer makes an impression upon the system, do the lungs become susceptible to the morbific agency of the opposite seasons. In the Northern Division, for example, as cold predominates, and no decided impression is made upon the animal economy by the short summer, the annual ratio of pleuritis and pneumonia is not only low, but there is little difference in the ratios of the seasons; on the other hand, at the south western posts, remarkable for high and long continued summer heats, the annual ratio is about twice as high as in the northern States, whilst the difference in the seasons is very considerable, the ratio of the third quarter being less than one-ninth of the annual average. This contrast is rendered still more striking by the fact, that whilst the ratio of the first quarter is nearly four times higher at the south-western than at the northern posts, there is no difference in the averages of summer. At Fort Gibson—a point at which the mercury rises higher than at any other post in the United States—the averages stand thus :—First quarter 71, second quarter 19, third quarter 9, and fourth quarter 15, the annual ratio being 112. On comparing the south-western stations with the corresponding posts on the Atlantic, the general law in reference to the modifying agency of the ocean is strikingly evidenced. In the first class of the Southern Division, as the seasons grow less contrasted, the annual ratio decreases materially; and lastly, in the remaining class (East Florida), in which, for example, at Fort Brooke and at Key West, the difference between the mean temperature of winter and summer is respectively only 16°.49 and 11°.34, the lowest average is presented. It is thus seen that in regard to pleuritis and pneumonia, it seems necessary to consider not only the degree of contrast in the seasons, but the duration of high temperature. Leaving out of view the three classes composing the Northern Division of the United States, the law is precisely the same as in catarrhal lesions.

Phthisis Pulmonalis.

The subject of *Phthisis Pulmonalis* will next engage attention. The quarterly and annual averages, in each system of climate, are shown in the annexed table :—

RATIO OF PHTHISIS PULMONALIS.

Divisions.	Systems of Climate.	Ratio treated per 1000 of mean strength.				
		First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class. Posts on the coast of New England,	2	3	2	3	9*
	2d Class. Posts on Northern chain of Lakes.	3	2	2	2	9
	3d Class. Posts remote from the ocean and inland seas, - - - -	2	1	1	1	5
Mid.	1st Class. Coast from Delaware Bay to Savannah,	4	5	2	3	13
	2d Class. South-western stations, - -	3	3	4	2	11
Sou.	1st Class. Posts on the Lower Mississippi,	3	3	2	2	9
	2d Class. Posts in the Peninsula of East Florida,	2	2	2	2	9
	Average,	3	3	2	2	9

* As fractions are not given, and as the mean strength of each quarter varies, the annual results do not always correspond with the total of the quarterly ratios.

It would not appear that any general laws can be deduced from these numerical results. In the Northern Division, the average of the third class, contrary to the general results of the class of diseases of the respiratory organs, is much the lowest; but this difference is more apparent than real, from the circumstance that nearly all the fatal cases of consumption in this Division are ascribed to the abuse of ardent spirits. In the third class, for example, were the results of West Point, a command consisting mainly of officers and cadets, excluded from the calculation, the annual ratio of cases per 1,000 rises nearly to seven; and the difference still existing is doubtless owing to the greater facility of obtaining, at the posts along the sea-board, inebriating potations. It is more than probable that the ratio of chronic bronchitis, follows the laws which obtain in respect to catarrhal lesions; but in regard to phthisis pulmonalis in general, these laws cannot be recognized. It is an important fact that whilst the averages of catarrh and influenza, pleuritis, and pneumonia, in the first class of the Middle Division, are reduced nearly fifty per cent. by excluding Fort Monroe, the ratio of phthisis pulmonalis is increased. It confirms the opinion that this disease, although much under the influence of climate, is still more, especially among troops, under the control of other agents. As all causes by which the energies of the human frame are sapped, conduce to the development of the tubercular form of consumption, so northern constitutions exposed to the chronic diseases and debilitating heats of a southern latitude, acquire a peculiar susceptibility. In systems broken down by habits of intemperance, it is very apt to supervene upon certain chronic affections, as the sequelæ of remitting and intermitting fever, diarrhœa, &c. Facts of this kind having relation to the annual results, without reference to the influence of the seasons, it will be seen, led the Reporter of the British statistics into the erroneous conclusion that no change of climate is beneficial in any form of consumption.

The *annual* results in regard to the class of pulmonary diseases, as well as the mortality from each, now come under investigation. As the cause of every death is not specified in the quarterly sick-reports, a correct result in respect to the mortality can only be approximated. The total of deaths given in the following table are those only which occurred among men on the sick-list—a ratio considerably lower than that of the post returns which include the deaths from all causes :—

Northern Region of the United States.	Ratio of cases per 1000 of mean strength.						Deaths.						
	Mean Strength.	Catarrh and Influenza.	Pneumonia.	Pleuritis.	Phthisis Pulmonalis.	Total.	Catarrh and Influenza.	Pneumonia.	Pleuritis.	Phthisis Pulmonalis.	Hæmoptysis.	Total per Medical Returns.	Causes not specified.
Atlantic Posts, . .	3130	233	22	26	9	290		1		15		140	16
Posts on the Lakes, . .	5973	300	19	30	9	358	1	4		9		65	12
Posts remote from the ocean and the Lakes, . .	12604	552	17	28	5	602		3	1	22	1	119	16
Total,	21707	439	18	28	7	490	1	8	1	46	1	324	44
Southern Region.													
Coast from Del. to Savannah,*	3199	271	25	32	13	341		1	1	19		196	18
South-western Stations, . .	11140	290	39	52	11	392		31	2	61	2	458	75
Posts on the Lower Mississippi,	3381	218	22	28	9	277		2	2	10		178	30
East Florida, . . .	4607	143	15	24	9	191			1	9		131	17
Total,	22327	246	29	40	10	236		34	6	99	2	963	140

It is thus seen that, with the exception of catarrh and influenza, the annual ratio of pulmonary diseases is lower in the northern than in the southern regions of the United States. It is in the middle districts of the United States, however, that pneumonia, pleuritis, and phthisis pulmonalis, are most prevalent, the peninsula of Florida having a lower average than any other region. It is found too, that the same law obtains in regard to the mortality arising from this class of diseases, the deaths per 1,000 of mean strength being as under :—

	Phthisis Pulmonalis.	*Pneumonia, Pleuritis, and Catarrh.*
Northern Region.	2.1	0.5
Southern "	4.4	1.8

For the purpose of comparison, these results are deemed suffi-

* Fort Monroe, as before, so far as pulmonary diseases are concerned, is excluded from this class. There are reported 102 deaths, of which four arose from influenza, eight from pneumonia, and seventeen from phthisis pulmonalis.

ciently accurate; but it is necessary to mention, as appears by the table, that among the deaths in the Northern Region, the causes of about one-eighth, and in the Southern, the causes of one-seventh are not reported. It is known, however, that the majority of the deaths of which the causes are not specified, belongs to the class of casualties.

The high mortality of the southern regions is caused by the Middle Division of the United States, the average on our southern coast being comparatively low. Taking the statistics of the posts in East Florida, and those on the Lower Mississippi, the ratio of phthisis pulmonalis is found to be only $1\frac{7}{10}$ and that of the remaining lesions of this class to be no more than $\frac{7}{10}$ per 1,000 of mean strength. It is also ascertained that these diseases are of a more fatal tendency in the Southern than in the Northern Regions. In the latter, the ratio of mortality from phthisis pulmonalis is thirty-two, and in the former, forty-two per hundred cases; and as regards pleuritis and pneumonia, the difference is much greater, the average mortality in the the Northern being nine, and in the Southern, twenty-six per 1,000 cases. It is necessary to add, however, that this high mortality is limited to the south-western posts, thirty-three deaths, (out of forty—the total of the four southern classes,) being reported in this class.

These statistics then show that as regards pneumonia, pleuritis, and phthisis pulmonalis, the ratio of cases and deaths is greater in our middle regions, including the south-western stations, than at either extreme. In endeavoring to account for this result, much may, perhaps, be due to the circumstance that the subjects are generally from the Northern States, or from Europe. It may be safely asserted, as has been already remarked, that the majority of cases of consumption at our southern posts supervene upon febrile diseases, more especially in constitutions broken down by intemperance, bearing the same relation to fevers as those other sequelæ—dropsy, jaundice, and the various chronic lesions of the viscera. On the Lower Mississippi—a class of posts which presents the highest mortality—the average of phthisis pulmonalis is low, owing very probably to the circumstance that fevers are of the most fatal tendency, terminating either in speedy death or rapid recovery. At the south-western stations, and those along our middle coast, the malarial poison acts more slowly, thus developing, by a gradual deterioration of the constitution, a tubercular form of consumption, general opinion to the contrary notwithstanding. It follows then that a continuous residence in the South, so far from being beneficial in this disease, will often hasten its fatal issue. This fact does not, however, in the least militate against the doctrine which maintains that advantage will be derived from change of climate in the way of a winter residence; and so far as regards the propriety of the measure in *chronic bronchitis*, no reasonable doubt can be entertained.

These general conclusions are confirmed by statistical facts in a recent edition of M. Laennec's work, edited by M. Andral. It is found that phthisis, as in the middle regions of the United States, is much more frequent in the temperate regions of Europe, comprised between the 55th and the 45th degree of latitude, than it is further to the north. Whilst in London it is calculated that 236 of every 1000 deaths is caused by pulmonary phthisis, in Sweden the ratio is only 63. At St. Petersburg and Stockholm it is much less destructive than throughout Germany, and more especially at Berlin, Munich, Vienna, and Paris; and by Sir William Crichton, it is stated, that "consumption is infinitely more frequent in Great Britain and Ireland, in comparison of their population, than in the northern parts of Russia." In the southern parts of Europe, from the 45th to the 35th parallel, it is still found to be a very common disease. That a cold temperature is not essentially *per se* favorable to the development of phthisis pulmonalis, as well as pleuritis and pneumonia, seems, therefore, an established point.

So potent is the influence of early opinion, that the ideas of phthisis and a changeable climate, seem almost inseparable. In countries, however, in which the disease occurs most frequently, "those who are *least* exposed to its influence are precisely those *most* exposed to the vicissitudes of the climate."* Now as it has been satisfactorily ascertained that the maximum of liability to phthisis in England is found among those who suffer the least exposure to climatic variations, it follows that the influence of the latter must be regarded as secondary to the action of other causes, as, for example, occupation, food, and habits. Although it cannot be doubted that a changeable climate exercises an evil influence on constitutions predisposed to phthisis; yet, as we find that the most variable climates are best adapted for the development of the various mental and bodily powers, it is apparent that the agency of this cause in the production of phthisis has been much exaggerated, or much too exclusively considered. Confirmatory of these remarks is the obser-

* Cowan's Additions to Louis on Phthisis.

vation of Dr. Rush, that among our Indians and the frontier inhabitants, phthisis is very uncommon.

Notwithstanding *moisture*, of all the physical qualities of the air, has been regarded as the most injurious to human life, it is also stated in the Appendix to Louis on Phthisis, that as regards its agency in the production of this disease, all evidence "tends strongly to expose the fallacy of theoretical opinion." But what is yet more surprising, is, that the same fact has just been demonstrated, throughout every region of the United States, in regard to pleuritis, pneumonia, and catarrhal affections; for these diseases are invariably less prevalent in the moist and changeable climate peculiar to the sea-coast and large lakes than in the dry atmosphere of the opposite locality. This opinion is likewise confirmed by the British Army Statistics, on comparing the results given by the cold and extremely foggy regions of Nova Scotia with the dry inland climates of the same parallel, or even of more southern latitudes.

Although the human system possesses the power of accommodating itself to these atmospheric changes, yet they who are liable to internal affections on slight irregularities, generally experience bad effects. The error of ordinary observation has arisen from the circumstance that the exciting causes are more obvious than the predisposing ones; and hence it is by statistical investigations only that it could be shown that pulmonary diseases are less dependent on the former than the latter. As vicissitudes in temperature are more appreciable by our senses, it is to such that our attention is most attracted; and it could not have been *a priori* inferred that the effects thus produced are subordinate to the predisposition arising from the law, that in proportion as the high temperature of summer makes an impression upon the system, do the lungs become susceptible to the morbific agency of the opposite seasons. Our organs are most disagreeably impressed by a rapid alternation from heat to cold, because a large quantity of vapor retained in the air in an insensible form, becomes apparent, if the temperature suddenly sinks very low. When the air is damp, the sensations of heat and cold are most appreciable, owing to the presence of water between its particles increasing its conducting power; and as the power of absorption in the air augments in proportion to its dryness and degree of temperature, it follows that when the atmosphere has a high dew-point the perspirable matter accumulates on the surface in a sensible state, and that in the opposite condition it evaporates as soon as secreted. These vicissitudes in the thermometric, hygrometric, and barometric states of the air, can seldom occur singly. For example, when the air is warm and consequently more rarefied, the barometer sinks, whilst its capacity for holding aqueous vapor in the invisible state is greater than when the temperature is lower. Moreover, the dissipation of moisture is much accelerated by the agency of sweeping winds, the effect being sometimes augmented five, and even ten times.

To the predisposition induced by the high temperature of summer contrasted with the low temperature of winter, no observer has heretofore directed any attention. The subjoined quotations express the general sentiment of the profession. In the Cyclopædia of Practical Medicine, we read as follows:—"The usual cause of bronchitis is cold, particularly when conjoined with moisture, applied locally or generally, as for instance, by wearing damp clothing, or exposure to a cold, moist, variable atmosphere, especially after the body has been heated by exercise, crowded rooms, etc." The writer also refers to epidemic states of the atmosphere, irritating gases and vapors, and some of the acute eruptive diseases, as causes of acute catarrhal affections. Again, in respect to the causes of acute pleurisy, so far as the atmosphere is concerned, reference is made to "cold applied to the surface when the cutaneous capillaries are in a state of excited action, etc." Upon this subject, it is remarked in Tweedie's Library of Practical Medicine, that "we are not aware that any circumstances predispose to pleurisy further than those which render the body liable to other inflammations, such as a relaxed or debilitated state of the system after fevers or other severe disorders, the puerperal state, etc."

Among the various systems of climate presented in the extensive region of the United States, that of the Peninsula of Florida is wholly peculiar. Possessing an insular temperature not less equable and salubrious in winter than that afforded by the south of Europe, it will be seen that invalids requiring a mild winter residence, have gone to foreign lands in search of what might have been found at home. Florida, therefore, merits the attention of physicians in our northern States; for here the pulmonary invalid may exchange for the inclement season of the north, or the deteriorated atmosphere of a room to which he may be confined, the mild and equable temperature, the soft and balmy breezes, of an ever-green land. Instead of that feeling of loneliness and abandonment which often casts a gloom over the sensitive mind of him, who goes to foreign lands in search of health, he finds himself still among his fellow citizens, with whom he is bound by the common ties of language, laws, and customs; and should he require a physician, the difficulty of communicating with a foreigner, perhaps by means of an interpreter—a circumstance peculiarly vexatious to an invalid—is not here presented.

From the earliest period, change of climate has been regarded as a remedial agent of great efficacy. The opinion is, indeed, confirmed by daily experience. Diseases that have long resisted medical treatment, are frequently suspended or entirely cured by a removal from a crowded city to an open country, or are found to yield, under the influence of such a change, to remedies that previously produced no impression.

Although the influence of different climates in the causation as well as the alleviation and cure of diseases, is a fact universally conceded; yet the attempts hitherto made to explain the *modus agendi* of this power are not wholly satisfactory. This, however, will not be a matter of surprise, when it is recollected that the problem of physical climate remains, in a great measure, unsolved. How much more complicated, then, must the subject become, when involved with the elements of organic life, and all the complexity of their combinations resulting from health and disease.

As regards the benefit which invalids experience by a removal from a cold to a warm climate, a satisfactory explanation seems, however, to be afforded in the obvious agency of a warm and dry atmosphere in promoting an equable distribution of the circulating fluids, and more especially in relieving that congestion of the internal vessels which generally obtains in chronic disorders, by augmenting the activity of the capillary circulation on the surface. Its influence is, indeed, manifested on perhaps every function of the animal economy. Another very evident explanation of the effects observed may be reasonably ascribed to the influence of a bland atmosphere on the extensive surface of the respiratory organs. To this we may add the impression made on the nervous system generally, and on the mind through the medium of the external senses, and conversely the reciprocal influence of the mind on the corporeal functions. But there are many incidental circumstances, not directly ascribable to climate, which contribute to the same end; such as change of scene and of occupation, the influence of the journey or voyage, as well as the hope inspired.* Most important of all, however, as regards the advantages of a winter residence in more southern latitudes, is the

* As these are the views of Sir James Clark, the author would here express his indebtedness, notwithstanding the frequent reference made to his name throughout

avoidance of the extremes of the seasons, and consequently the predisposing causes of pulmonary diseases.

In treating of the climate of Florida, the primary object held in view is, to direct attention to its fitness as a *winter* residence for northern invalids. An examination of abstracts A, B, C, appended to Part First, showing—1. The mean temperature of each month, each season, and the whole year; 2. The difference between the mean temperature of each month and season; and 3. The annual and monthly ranges of temperature,—will, it is believed, not only furnish further confirmation of the doctrines already conclusively established, but lead to results of great value to the practical physician.

These climatic peculiarities have been already so fully detailed that further elucidation is deemed unnecessary. Whilst in our northern States, in places remote from large bodies of water, no month of the year is exempt from frost, along the southern coast of this Peninsula, on the contrary, it is never known. Between the climate of this region and that of the sea-board of Cuba, little difference is presented. It has been seen that a comparison with the most favored localities on the continent of Europe, and the various islands of the Mediterranean and the Atlantic held in highest estimation for mildness and equability of temperature, is no way disparaging to the climate of East Florida. A special reference to these various situations, resorted to as a winter residence by pulmonary invalids from harsher climes, which are fully described by several writers, is not here required. Suffice it to say that for this purpose the island of Madeira is esteemed by Sir James Clark as best adapted; for as a variety of climates may be here commanded, the invalid may remain the whole year without suffering from oppressive heat. Compared with Italy, which is alternately exposed to the icy winds which sweep from the snow-clad Alps, and to the sirocco, with its depressing high dew-point, from the desert sands of Lybia, peninsular Florida possesses decided advantages.

It has been seen that the meteorological agents which determine the ratio of pulmonic lesions, causing the first and fourth quarters to present the highest averages, and the third the lowest, is the marked distinction of season characterized by extremes of temperature. Hence the apparent exception to this rule in the system of climate pertaining to East Florida, where the third quarter has a higher ratio than the second or fourth, (see Table p. 231,) instead of

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this article, for much valuable information derived from his writings on the sanative influence of climate contradicting a general law, corroborates it. As Florida is an evergreen land, the influence of the seasons does not impress the pulmonary organs sufficiently to derange their functions by their transition. Hence the ratio of the pulmonic lesions is low; for as there is very little *predisposition* to them induced, and as the *exciting* causes become the primary ones, these diseases may be as rife in the summer as in the spring or autumn.

Although we possess no precise data to determine the actual or comparative atmospheric humidity of this system of climate, yet it was shown from several circumstances, in Part First, that the air is much more humid than in our northern regions. As general relaxation and lassitude are consequent on this prevailing humidity, it may exercise some agency in the production of the comparatively high ratio of pulmonic and rheumatic affections in the summer season. One of the best safeguards against its effects is, to wear flannel next the skin—a custom generally adopted in the army. It is, indeed, a hygienic measure no less valuable in warm than in cold climates, affording comparative immunity against thermometrical and hygrometrical vicissitudes.

In winter, however, the atmosphere is comparatively dry and serene, owing to the circumstance that the rains generally fall at a particular season. Thus although the annual quantity of rain is 31.40 inches, yet the proportion during the six months intervening between November and May, is only 8.84 inches. Moreover as the same quantity of rain descends in a much shorter space of time in tropical than in temperate climates, the former has a much greater proportion of fair days and clear skies. Whilst on the northern lakes, the annual ratio of fair days is only 117, on the coast of Florida it is 250, and at Fort King, in the interior, 309.

The influence of temperature on the living body, more especially as regards winds, is often indicated more accurately by our sensations than the thermometer.* Consequently the advantages of climate as regards its fitness for the pulmonic, not unfrequently depend on the mere circumstance of exposure to, or shelter from cold winds. The frequency and severity of the winds at St. Augustine constitute a considerable drawback on the benefits of the climate.

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* In Parry's voyages to the Arctic regions, we are told that when the mercury stood at 51° below zero of Fahr., in a calm, no greater inconvenience was experienced than when it was at zero during a breeze.

The chilly north-east blast, surcharged with fogs and saline vapors, sweeping around every angle of its ancient and dilapidated walls, often forbids the valetudinarian venturing from his domicil. To obviate these disadvantages, a large house was erected at Picolata on the St. John's; but during the pending Indian disturbances, it has been converted into a barrack and an hospital.

As regards the impression made by winds upon the human body among pulmonary invalids, the effects depend doubtless more particularly upon the qualities of the air as to heat and dryness with little reference to its electrical states or its condition as respects noxious terrestrial emanations. If the wind be cold and damp, like the north-east winds of St. Augustine, the system of the pulmonic is especially liable to all the irregular action of the capillaries generally imputed to the operation of these causes. Although it has been demonstrated in these statistics that pulmonary diseases are more rife in the dry atmosphere of inland regions than in the moist and variable climate of the lakes and sea-coast—a fact confirmed by observations in England; yet we are not the less bound to estimate the influence of moisture and variability as exciting causes. "Experience has amply proved," says Dr. Morton,* "that a mixture of sea and land air, such as exists on all our maratime situations, is unfavorable to delicate lungs; and especially where there is phthisis, or even a predisposition to it." Now, by what law is this opinion to be reconciled with the demonstrated fact that catarrhal diseases are scarcely half as prevalent on the moist and variable coast of New England, as well as the lakes, as in the dry and less changeable regions of the same latitude. As regards a permanent residence, the former is certainly less injurious; but the predisposing causes may be diminished in intensity by spending the summer in the modified climate of large bodies of water, whilst the exciting ones may perhaps be equally avoided by selecting the opposite locality in winter.† Upon this point, it is remarked by Sir James Clark that "the profession are not quite agreed. * * From all that I have been enabled to learn and observe, consumption is, I think, *cæteris paribus*, more frequent on the sea-coast than in the interior." This *may*

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* *Illustrations of Pulmonary Consumption.*

† It is no doubt upon this principle that the advantages of "Mammoth Cave," in Kentucky, to the pulmonary invalid, are to be explained. It is in lat. 37°, and the temperature is, in all seasons, at 60° Fahr., which is of course the mean annual temperature at the surface of the earth.

be true as regards *tubercular* consumption; but it certainly is not in any form of pulmonary disease, which has its origin in mere inflammatory action. On the other hand, it is remarked by Laennec that near the sea but few consumptive cases occur. This, again, may be true in the modified climate of Europe; but a winter residence on our sea-board, exposed to the prevailing north-east wind, can be any thing but advantageous to the consumptive. When we come, however, to investigate such a climate as that of East Florida—one which presents no marked distinction of the seasons—the exciting causes supersede the predisposing ones; and in the same relation, as regards the seasons, does the invalid of the north place himself by spending the winter in the south. Hence there is reason for the commonly received opinion that in Georgia and Florida, the dry air of the interior in conjunction with the aroma of pine forests, is peculiarly congenial to delicate lungs.* Indeed the ancients, as we are told by Hippocrates, sent their consumptives to the pine forests of Egypt. And here it may be added that though the older writers mention severe inflammatory affections of the chest as common in this country, Clot Bey, in his recent work, asserts that Egypt enjoys an immunity from those diseases, as also from consumption; and he therefore proposes it as a residence for patients suspected of phthisis.

To persons laboring under an irritable state of the bronchial membrane, high winds are particularly injurious. If the consumptive invalid have much sensibility to harsh and keen winds, and if the immediate vicinity of the sea be known to disagree, Fort King ought to be recommended before St. Augustine or even Fort Brooke; but as sea-air is often adapted to a relaxed habit and a languid and oppressed circulation, a favorable position on the coast should, in such cases, be selected as a winter residence.

The natural advantages of position, without reference to extrinsic circumstances are now under consideration. St Augustine is on the eastern coast; Fort Brooke is at the head of Tampa Bay, about thirty miles from the Gulf of Mexico; Fort King is intermediate to these two points; and Key West belongs to the Archipelago south of Cape Sable. The pending hostilities with the Aborigines, and

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* The author has more than once heard Gen. Jesup, who is a confirmed consumptive, when marching through the swamps and pine forests of East Florida, make the remark—" we are not far from the sea—I feel it upon my lungs."

the difficulty of obtaining accommodations indispensable to the comfort of the invalid, render a winter retreat almost impracticable any where but at St. Augustine or Key West. The oldest town in the United States, and built mostly of a concrete shelly stone in the Spanish style, St. Augustine presents an antiquated appearance, enlivened by beautiful orange-groves bending at due season beneath their golden fruit. The old Spanish fort and the *tout ensemble* of the city, give it more the resemblance of a place of defence than of elegance; but it is these circumstances which associate it with history, and render it peculiarly interesting to the American traveller. Moreover, the inhabitants extend kindness and hospitality towards strangers. Key West, about sixty miles south-west of Cape Sable, is a small island already described, which has grown into importance from the two circumstances that it is a place of some commerce chiefly in the way of wrecked goods, and from time to time the station of our West India squadron. Fort Brooke, which is truly a delightful spot in which tropical fruits flourish luxuriantly, whilst the moss-covered* live-oak and the Pride of China, add beauty and variety to the scenery, has likewise been fully described; and so of Fort King, which belongs to the pine-forest region of the interior.

But there are other localities which combine advantages equally important to the pulmonary invalid. On the eastern coast of Florida, at New Smyrna for example, the warmth and softness of the air wafted from the isles of the West Indies across the gulf-stream, in the winter months, are truly grateful to the senses, lulling them into repose, and making one forget that it is a winter landscape. Even the virtuoso would not be without materials for contemplation; for here may be seen the ruins of Dr. Turnbull's colony of Greeks, Italians, and Minorcans—his unfinished castle, whose dilapidated and mouldering walls are covered with ivy, amid the luxuriance of the palm,† orange, mangrove, and magnolia. Cape Sable and the coast

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* This parasite, (*Tilandsia usneoides,*) known by the vulgar name of Spanish moss, casts a sombre aspect over the scenery of Florida. Resembling the weeping willow clothed in the garniture of hoary age, it has been styled, not inappropriately, the shades of death.

† The cabbage palm, (*Chamærops palmetto,*) is a beautiful tree, presenting sometimes a straight column of eighty feet without a limb. The trunk is generally enclosed by the foot-stalks of the old branches, resembling a coarse net-work. The embryo head is esculent, bearing the taste of unripe chesnuts. The leaf is used in the manufacture of hats, mats, and baskets, as well as in the construction of the Indian's wigwam.

extending northward towards Key Biscayno, as well as the adjacent islands, would also afford an excellent winter retreat. Adapted to the cultivation of tropicoid fruits, and abounding in game, fish, and turtle, this region, from the prevalence of the sea-breeze or trade-winds, presents a climate delightful even in the summer season. Key Biscayno, which is situated on the south-eastern coast of Florida, affords an excellent harbor of safety and protection from the storms which frequently rage along the coast. This island is thus described by a medical officer of the army, when stationed there six months :—

"In the midst of summer, the constant prevalence of the sea-breezes renders it at all times of the day delightful in the shade. During the winter, frost is never known; nor is it ever so cold as to require the use of fire. The eastern beach commands a beautiful view of the open sea, and offers, especially during low tide, an admirable place for exercise on horseback for the distance of four or five miles, and for morning and evening walks. The waters around abound in green turtle, and a variety of excellent fish, forming a wholesome and nutritious diet, particularly well suited to cases of pulmonary disease. There is also an abundance of crawfish and crabs. The main-land is only a short distance off, abounding with deer and a variety of other kinds of game, affording a fine field for the sport and exercise of hunting; and the vicinity of the West India islands will, at all times, present the opportunity of procuring the best of the tropical fruits.

"The proprietor of the island will, in a short time, erect buildings, and will establish every means in his power for the convenience and comfort of those who may be disposed to visit the place for the recovery of their health. There has not been a single case of fever among the troops since I have been stationed here, and I have no hesitation in stating my opinion that it will be perfectly healthy at all seasons of the year."

When not exposed to the influence of malaria, the climate of Florida, as along the eastern coast, is, even in the season of summer, quite salubrious. The sea-breezes, aided by the deposition of moisture from the atmosphere, generally render the nights pleasant, even in the hottest months, and in the centre of the Peninsula. The author can state from personal knowledge, that after the middle of August the nights become so cool that a blanket is desirable. The climate of the tropics is characterized, as has been already remarked, much more by the duration of heat than its intensity ; and it is to the action of this unceasing high temperature that much of the injurious influence of tropical climes on northern constitutions, is to be ascribed.

But woe to the invalid that braves the torments of a summer residence under the disadvantages of a camp life ! Insects are the pest of a tropical clime. As to fleas, flies, and ticks, the interior of Florida may well rival Egypt in the days of Pharaoh. The chigoe (*pulex penetrans*) insinuates itself beneath the skin, where it soon establishes a populous colony. Flies seem, indeed, to form a component part of your food, your drink, and the atmosphere you inhale. Lizards, snakes, and scorpions, get into your bed, whilst the industrious ant and weevil not only eat your rations, but devour your books—the food of the mind. All nature seems alive; and every hour you observe some uncouth living thing, whose family name has scarce been registered by the entomologist. In addition to these annoyances, the ear will be greeted with a nightly serenade performed by wolves and alligators—a woful concert of whining yells and dismal bellowings, constituting the realization of a *howling* wilderness.

Since a more rational view of the nature and causes of pulmonary diseases has prevailed, the beneficial effects of change of climate in certain forms, have been fully established. Formerly, when consumptive patients were indiscriminately condemned to undergo expatriation, the unfortunate invalid often sank before he reached his destination, or he was doomed soon to add another name to the long and melancholy list of his countrymen, who seem to have sought a foreign land, far from friends and home, only to find a premature grave. When it is considered, however, that all remedial agents have proved so inefficacious in phthisis pulmonalis as to place it emphatically among the *opprobria medicorum*, it is no ways surprising that its victims should seek beneath the influence of a more genial clime, the relief, however uncertain, denied them in their own.

The south-western coast of a country, especially when lying like England on the western coast of a continent, is generally mild and humid, and consequently soothing but rather relaxing. In diseases accompanied with an inflammatory condition of the general system, or dependent on an excited state of particular organs, this variety of climate has been found more especially beneficial. Decided advantage may reasonably be anticipated in chronic inflammatory affections of the trachea and bronchia, attended with a dry cough and little expectoration ; but when such cases occur in individuals of a languid and relaxed state of constitution, accompanied by copious expectoration from the mucous surfaces, the disease is as likely to be aggravated as relieved. These remarks are equally applicable to all other diseases attended with great relaxation of the general system. It is, therefore, obvious that, in recommending a change of residence to invalids, attention to these distinctions, both in regard to varieties of climate and peculiarities of disease, is absolutely necessary.

The climate of Florida has been found beneficial in incipient cases of pulmonary consumption, and those threatened with the disease from hereditary or acquired predisposition. It is in chronic bronchial affections more particularly that it speedily manifests its salutary tendency. To distinguish the *bronchial* from the *tubercular* form of the disease, often demands considerable powers of discrimination; and upon this distinction frequently hangs the propriety of a removal to a southern clime. The application of the physical means of exploration, now so ardently cultivated, has fortunately given a greater degree of certainty to our diagnosis. The same remarks apply to the more mild and simple grades of chronic laryngitis.

But even patients affected with *tuberculous* lesions, when mostly limited and merely nascent, often experience remarkable benefit from this change. In these cases, our object must be not only to remove these lesions, but also that low degree of vascular irritation, or that unhealthy condition of the nutrient matter of the blood, which causes the deposition of tuberculous indurations.* Hence, in the management of consumptive patients, constitutional treatment should always hold a prominent place; but it is in cases in which local lesions have been the chief cause of the mischief, that we have the best chance of success. In the constitutional treatment, our remedial agents must be calculated to give at once tone to the system, and promote the free action and balance of all the functions; such as, the most nutritious food that the digestive organs can readily assimilate without inducing excitement of the vascular system, pure air and a climate well adapted for regular exercise, and proper clothing to maintain the activity of the superficial circulation. But it is not intended to enter into a detail of the treatment, which must be constantly

* That in the production of tubercles, a peculiarity in the vital constitution of the blood is essentially concerned, is apparent from the fact, that in the discolorised coagula found in the heart and large vessels of scrofulous subjects after death, tubercles may sometimes be distinctly perceived.

adapted to individual cases. The remedial measures applicable to the local lesions and particular symptoms, may be so combined as to act, at the same time, favorably on the functions at large. It must be constantly borne in mind that this disease is a secondary one, originating in a morbid state of the general system.

In this form of consumption, pure country air may be considered indispensable. A dry sea-coast, under these circumstances, is truly an antidote to the poisonous effects of a town residence, more especially if conjoined with gentle exercise, both by walking and riding on horseback. If the locality, however, is much exposed to the east and north, and is not dry, the evil may be changed from cachexia to inflammation.

Although our diagnostic means, as remarked above, have been much improved of late years, yet the diagnosis of the early stage of tubercular phthisis, depending as it does, on a proper consideration of the general symptoms, as well as a careful examination and interpretation of the physical signs, is often a matter of extreme difficulty. In the advanced stages of phthisis—the softened tuberculous and ulcerated states—as no benefit can scarcely accrue from change of climate, it is only admissible when strongly desired by the patient. On the other hand, notwithstanding the disease be but little advanced, it is unallowable, if the patient is strongly averse to the measure; for the possible advantage which might accrue would be more than counterbalanced by the moral effects resulting from this involuntary expatriation.

But there are other forms of disease in which such a climate as East Florida is not unfrequently of decided advantage. To this class belongs *Asthma.* As this term is too commonly applied to every disease in which difficulty of respiration is a prominent symptom, let us not prescribe for a mere name; but when consulted on the propriety of a change of climate, let the pathological condition of the patient be duly estimated. In simple spasmodic asthma, unconnected with organic disease, or in that form which is complicated with chronic bronchitis, or is symptomatic of primary irritation in other viscera, such as the stomach, intestines, or uterus, the patient is generally much benefitted. In asthma connected with affections of the heart, a mild climate often affords temporary relief. In this variety of complication, a sea-voyage is frequently of striking service.

In chronic disorders of the *Digestive* organs, when no inflammaon exists or structural changes have supervened in viscera important to life, but the indication is merely to remove disease of a functional character, a winter residence promises great benefit; but exercise in the open air, aided by a proper regimen, are indispensable adjuvants. These morbid states of the digestive organs are treated of by Sir James Clark under three heads, viz., inflammatory, atonic, and irritable dyspepsia. For these different forms, he recommends different climates; for the first, the south-west of France, or Rome and Pisa in Italy; for the second, Nice and Naples; and for the third, a climate of a medium character. But to enlarge upon these distinctions were contrary to the design of this work. It is the opinion of the same writer, that "in dyspepsia and disorders of the digestive organs generally, and in the nervous affections and distressing mental feelings which so often accompany these, in asthma, in bronchial diseases, in scrofula, and in rheumatism, the beneficial effects of climate are far more strongly evinced than they are in consumption."

In many of those affections, called *Nervous*, unconnected with inflammation, exercise and travelling, in this climate, are frequently powerful and efficient remedies.

Chronic Rheumatism, though apparently much less under the influence of meteorological causes than pulmonic affections, will often be benefitted by a winter residence in Florida. As these cases frequently resist the best directed efforts of medicine, it is the only remedy which the northern physician can recommend with a reasonable prospect of success. In northern Europe, a warm climate and the internal and external use of thermal mineral waters, are regarded as the most valuable resources known in the treatment of inveterate chronic rheumatism. Rome and Nice are considered the most eligible situations in Europe, whilst the climate of the West Indies is supposed to exercise a still more beneficial influence. When the disease is complicated with much derangement of the digestive organs, it is customary to visit such places as combine the additional advantages of a course of bathing, as the mineral waters of the Pyrenees, those of Aix in Savoy, and the various baths of Italy. In our own country, the Hot Springs of Virginia, which are used only externally, in the form of bathing and the spout-bath or douche, are much resorted to; and in many cases, if the patient visits them in summer, they succeed very well, more especially in preparing the system to realize the advantages to be derived from a winter's residence in Florida.

When there exists a general delicacy of the constitution in childhood, often the sequel of rubeola or scarlatina, manifesting itself by symptoms indicative of a scrofulous disposition, a winter residence in a warm climate frequently produces the most salutary effects. At the period of puberty in females, a similar condition of the system often arises, preventing the development of those new functions peculiar to this stage of life. This general derangement, if not soon corrected, often results in that constitutional disorder beyond the resources of our art, which is denominated by Sir James Clark, "*Tuberculous Cachexia*"—the precursor of pulmonary consumption. If the winter can be passed in a warm climate, and the patient have the advantage of exercise on horseback, warm sea-bathing, and a well-regulated diet, the youthful invalid may often be rescued from an untimely grave.

Another form of disease remains to be alluded to, in which change of climate promises its healing powers, viz., premature decay of the constitution, characterized by general evidence of deteriorated health, whilst some tissue or organ important to life commonly manifests symptoms of abnormal action. This remarkable change often occurs without any obvious cause, and is not inappropriately termed in common parlance, "a breaking up of the constitution."

All the advantages, however, to be expected from change of air, depend upon the just adaptation of the remedy to the individual case. In bronchial disease, for example, attended with little expectoration and that degree of irritation which induces cough from the slightest exciting causes, a mild and humid air often gives relief, whilst a dry and keen air cannot be tolerated. On the other hand, the same state of atmosphere which proves so irritating in this case, acts beneficially in subjects of a more languid habit, with less sensibility of the mucous membrane and a more copious expectoration. This remark is equally applicable to the other affections just brought under notice. As regards the sea-coast or the interior of a country, not only is the relative preference a subject for consideration, but likewise the situation itself as modified by particular local causes. But there are also peculiarities of constitution, as already brought under notice, which, notwithstanding the case seems to require a marine atmosphere, render the sea-side, at all times, an unfit residence in every variety of locality; whilst others, under circumstances the most disadvantageous, realize the most beneficial results.

Let not the invalid, however, trust too much to a change of climate. Unfortunately for the character of the remedy, it has been recommended indiscriminately and without proper consideration. It has been too often resorted to as a last resource or forlorn hope; or in cases suceptible of alleviation or permanent cure, it has been wholly misapplied. One person is hurried from his native land with the certainty of having his sufferings increased and his life shortened, instead of being allowed to die in peace in his own family; whilst another, who might derive much advantage from the change, is sent abroad wholly uninstructed in regard to the selection of a proper residence, or ignorant of the various circumstances by which alone the most suitable climate can be rendered beneficial. It is one of our most powerful remedial agents, and one, too, which, in many cases, will admit no substitute. But much permanent advantage will result neither from travelling nor change of climate, nor their combined influence, unless the invalid adheres strictly to such regimen as his case may require. This remedy—change of climate—must be considered in the light of all other therapeutic means, and to ensure its proper action, it is requisite that the necessary conditions be observed. The patient should, in a measure, regard the change of climate as merely placing him in a situation more favorable for the operation of the remedies demanded by his disease.

The author may here advert to his own case. When he reached Tampa Bay in October, 1836, his constitution was enfeebled by what he regarded as chronic bronchitis complicated with a disordered state of the digestive organs. He had also suffered two years before from an attack of hæmoptysis. Having spent the winter in active service in the field, exposed to the hardships of a campaign, as for instance sleeping for successive nights in wet blankets on a marshy ground, the following spring found him restored to vigorous health, having gained twenty pounds in weight; but remaining in the interior of the Peninsula during the ensuing summer, he lost this excess of weight, notwithstanding his health remained good. Having spent the succeeding winter in the same region, he continued to improve; and early in the summer, he came as far north as the Cherokee nation in Tennessee, and late in the fall to Washington city. The advantages realized in this case were, however, purchased at the expense of a predisposition to severe acute rheumatism, which has every winter since recurred.

At the present time, St. Augustine and Key West are the only places which afford the conveniences required by the wants of an invalid; but assuming that proper accommodations can be equally obtained at all points, Key Biscayno on the south-eastern coast, or Tampa Bay on the Gulf of Mexico, claims a decided preference, especially over St. Augustine. As a general rule, it would be judicious for the northern physician to direct his pulmonary patient to embark about the middle of October for Tampa Bay. Braving the perils of the wide ocean, he will realize the healthful excitement incident to the fears and hopes of a sea-voyage. The salubrious air of the sea has, indeed, always been esteemed as peculiarly congenial to the lungs. Even the Romans, among whom consumption seems to have been of frequent occurrence, were wont to seek relief in a voyage to Alexandria. Having spent the winter months at Tampa, let the invalid proceed early in March to St. Augustine, by way of Dade's battle-ground and the old Seminole agency. In addition to the corporeal exercise, he will find food for mental digestion at every step of his journey. Having thus reaped the benefit of a sea-voyage and all the advantages to be derived from a change of climate, the valetudinarian may return to his anxious friends so much renovated in health and spirits as to be capable of enjoying again the blessings of social life.

As long, however, as predatory Seminole bands retain possession of this Peninsula, few itinerant invalids will imitate the example of the celebrated Spanish adventurer, Ponce de Leon, who, in the wild spirit of the 16th century, braved the perils of unknown seas and the dangers of Florida's wilds, in search of the far-famed fountain of rejuvenescence. When the period, however, of the red man's departure shall have passed, the climate of this "land of flowers" will, it may be safely predicted, acquire a celebrity, as a winter residence, not inferior to that of Italy, Maderia, or Southern France.

As the subject of pulmonary diseases is invested with more than ordinary interest, especially as the researches of late years tend to subvert long-established opinions, it is proposed now to bring under review the British army statistics in reference to this class of diseases. The opinion that it is worse than useless to visit southern regions in pulmonary diseases, has been very generally embraced on the strength of these statistics. The following extract from the Medico-Chirurgical Review, may be given as an example:—These reports "*have given the death-blow to the expatriation of invalids affected with pulmonary alterations.* They serve also to show us the salubrity of our calumniated climate, and to lower our aspirations for that 'sweet south,' whose sunny skies and luxuriant plains too commonly smile but to betray. Statistics dispel those illusions of poesy, and even prove that consumption, the reproach of our fickle seasons, lurks as fatally in the balmy Italian zephyr, or the sultry tropical breeze." This examination, however, will be instituted less with the view to analyze these statistics critically than to adduce facts in confirmation of the laws established in regard to the systems of climate pertaining to the United States. Having reviewed these statistics in detail in the American Journal of the Medical Sciences,* so far as the West Indies, the United Kingdom, the Mediterranean, and British America, are concerned, the results in reference to pulmonary diseases, calculated for each of these military commands, will be now employed without presenting them in a tabular form. Before proceeding, however, to test the legitimacy of the inferences deduced, as well as the correctness of the numerical results themselves, it will be necessary, as a preliminary step, to free the question from several difficulties.

The Reporter, Major Tulloch,† has assumed England as the *standard of comparison*, by which to test the relative salubrity of other countries in regard to pulmonary diseases. He has consequently adopted a classification of climates based on mere latitude, without reference to the phenomena of temperature arising from physical geography. In the present instance, the impropriety of arranging climates by the test of latitude is the more apparent from the circumstance that pulmonary diseases, as a class, are peculiarly dependent on climatic characteristics. If, then, it can be shown that the causes which induce a low ratio of pulmonary affections are little influenced by latitude, will not this standard prove a false one? Now, it has been demonstrated by the statistics of the United States Army that, in the climates in which the extremes of temperature are moderated, in which there is little difference between the mean temperature of winter and summer, pulmonary diseases as a class exhibit a low ratio. It has been seen that so great is the influence of local causes upon temperature that at Edinburgh, Scotland, the difference between the mean temperature of winter and summer is only 17°.90, whilst on the same parallel at Moscow, Russia, it is 56°.32; and in North America, on a parallel 12° farther south, we find this difference between the two seasons to be, at Fort Sullivan on the Atlantic coast, 39°.15, at Fort Snelling in the interior remote from

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* No. 2, New Series.

† It would appear that the credit of drawing up these able reports is due to the combined labors of Mr. Marshall, Deputy Inspector-General of Hospitals, Major Tulloch, and Staff Assistant Surgeon Balfour.

any large body of water, 56°.60, and at Fort Vancouver, about 1° farther north, on the western coast of America, seventy miles from the Pacific, only 23°.67. Moscow, in latitude 56°, according to Humboldt, has the same mean summer temperature as Loire in France, in latitude 46°; and in Scotland, in latitude 57°, the winters are more mild than at Milan, in latitude 45°28′. As the range of the thermometer is not greater in England* than in Italy, and as the difference between the mean temperature of summer and winter is actually less, a classification of climates based on mere latitude in reference to pulmonary diseases, becomes an actual absurdity; but, as in the British Commands investigated, the Reporter had to deal entirely with regions characterized by a mild insular climate, or those in which a low temperature predominates, he had not the means of arriving at truth, presented in the systems of climate pertaining to the United States. We are further told in connection with this subject, that a comparison of the ratio annually attacked out of a given number in different countries, presents the most accurate method of determining the relative agency of climate in the causation of particular diseases, more especially if these investigations extend over a long series of years, and include large masses of individuals of the same profession, the same age, the same habits, and the same diet. Now, if the comparisons, unlike the various British commands, were instituted among the natives of each region, the truth of the remark would be more evident.

Keeping these facts in view, we will be at no loss to reconcile many of the apparent incongruities in regard to the laws of pulmonary diseases inferred by the Reporter of the British statistics. The conclusion that pulmonary diseases as regards the *annual* ratio. are more prevalent in certain *systems* of climate in southern than northern latitudes, is confirmed by the statistics of the United States Army; but when we come to consider the relative influence of the *seasons*, the fallacy of the opinion that it is "*by no means likely that any beneficial influence can be exerted by climate itself*" in pulmonic lesions, becomes at once apparent. That catarrhal diseases,

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* At Salcombe on the south-west coast of England, the orange and lemon tree thrive and ripen their fruit. Although there is less difference here between the mean temperature of summer and winter than perhaps in any part of Italy, yet the climate is not well adapted to this species of fruit; for the winter temperature is so low that these plants require a covering of straw-mat, whilst the summer temperature is not sufficiently high to develope the fruit in its fullest perfection.

for example, are much controlled by different climates and the seasons of the same climate, is proved by the following statistical results :—Taking the average of the United States, the ratio of winter is more than twice as high as that of summer, and the ratio of the class of posts in our northern regions remote from large bodies of water is nearly four times as high as in the peninsula of East Florida. In the former class is Fort Snelling, whose difference between the mean temperature of summer and winter is 56°.60, and in the latter is Key West with a difference of only 11°.34. As even on the same parallels we find very marked contrasts, so on the great lakes and the coast of New England, where the extremes of temperature are modified, the ratio of catarrhal affections is comparatively low; whilst in the excessive climate, in the same latitude, in positions remote from the ocean or lakes, it is more than twice as high. The application of these facts in the way of change of climate, and more especially in reference to chronic bronchitis, has been sufficiently illustrated. Even admitting with the Reporter of the British statistics that the ratio of pulmonary diseases is as high in southern as in northern latitudes, it does not militate against the doctrine that benefit will be derived from change of climate in the way of a *winter* residence; for the great object of the pulmonic invalid in our northern climes, which is to avoid the abrupt transition of the seasons from summer to winter, is easily attained by seeking, on the approach of cold weather, the region of East Florida. (*See curves of the seasons, Plate II.*) To trace out these relations farther in connection with pleuritis, pneumonia, and phthisis pulmonalis, would be a mere repetition of what is said in the preceding pages.

Another objection to the assumption of England as a standard of comparison, is, that the ratios of that command which gives the *lowest* results are taken as the comparative tests, by which all the deductions in reference to pulmonary diseases become still further vitiated. Although the ratio of mortality from this class of diseases in England, varies from $7\frac{7}{10}$ to $14\frac{1}{10}$, yet the former—that of the Dragoon Guards and Dragoons—is in all cases assumed as the standard. The high ratio of the Foot Guards in London, it is true, is set aside as an "exception," because it appears "*attributable to other causes than the climate of the metropolis;*" but, on the other hand, we find that the comparison is made with the *highest* ratio among the white troops in the West Indies, notwithstanding he thinks it "*not attributable to climate only, but also to some peculiarity from which officers are ex-*

empt"! As the mortality among the enlisted men from this class of diseases is four or five times greater than among the officers, the result cannot be wholly ascribed to general causes; and, as the same morbid agents may be in operation in the Windward and Leeward Command in the West Indies, as among the Foot Guard in London, it is unfair to suppress the one and hold forth the other. Reasoning from general principles, it is apparent that the ratio of pulmonary diseases ought not to be very much higher in England than in the West Indies; and this relation obtains in reality. Taking the aggregate strength and aggregate mortality from diseases of the lungs of all the white troops in the West Indies, and the same of all the commands in England, the result is in favor of the former. In the United Kingdom, the annual mortality per 1000 of strength is $10\frac{1}{10}$, whilst in the West Indies the ratio is but $9\frac{3}{10}$. Contrary to the deductions of the Reporter, this general average also shows that the mortality from hæmoptysis and phthisis pulmonalis, as well as from pleuritis and pneumonia, is lower in the latter. The average of pulmonary cases under treatment is found, likewise, much lower in the West Indies, the annual ratio per 1000 being as 103 to 149, notwithstanding the latter is the ratio of the Dragoon Guards and Dragoons, which give the lowest mortality, it being impracticable to determine from the tables the ratio of cases treated in the other commands.

It is thus seen that by assuming the *highest* average in one command and the *lowest* in another, unwarranted conclusions have been deduced. Were even the mortality from pulmonary diseases in the West Indies higher than in England, it would not be surprising; for here are men from a northern clime exposed, through all seasons, to the influence of a high temperature; and as this mortality arises chiefly from phthisis pulmonalis, which the Reporter maintains to be of tubercular origin, the disease is doubtless often induced by the deterioration which the constitution undergoes, especially in cases of intemperate habits, from repeated attacks of febrile and chronic intestinal affections,—an opinion warranted by the statistics of the United States army. The tendency of continued fever to develope phthisis pulmonalis in the predisposed, has been long since observed. A prolific source of pulmonary consumption among the British troops in the hot climate of the West Indies, may be referred to these causes. An English soldier sent to these islands, enlisted for life, with no hope of escape but in the grave—laboring under the influ ence of the depressing passions, as is manifest from the extremely high ratio of suicides—reckless in his habits, both moral and physical—and exposed to the unceasing agency of those morbific causes by which the vital energies are gradually exhausted,—is peculiarly liable, especially when strongly predisposed, to the development of this disease. This view is corroborated by the fact that officers in the West Indies—a class of men animated by the opposite feelings—enjoy a comparative exemption from this malady, which is a circumstance the more remarkable when it is considered how carefully re cruits, more especially as regards the chest, are examined, whilst officers undergo no personal examination. Among the troops the mortality from diseases of the lungs is four or five times greater than among the officers—a difference which has been attributed by some to intemperance and exposure to night air; but to this it is replied, on the one hand, that in the East Indies, where the soldier undergoes similar exposure, the mortality is only one-fourth as great; and, on the other hand, that the non-commissioned officers, who are much less addicted to the vice of intemperance than the private soldier, suffer even a greater mortality. Hence it is inferred that the comparative exemption of the officer can be attributed neither to his non-exposure nor superior temperance.

The prevailing idea in regard to the advantages of acclimatization, it has been seen, is disproved by statistical investigations, not only in the West Indies, but all other climates in which British troops are stationed. As no length of residence is of any avail in diminishing the liability to the malignant diseases of the West Indies, it follows that the causes assumed as exercising a powerful agency in the production of phthisis pulmonalis, are uniformly progressive in their fatal tendency. Laboring for years under the most insidious forms of disease, the system becomes less fitted to resist morbific agents than that of him who brings to this climate the full health and vigor of an unimpaired northern constitution. The conclusion of the Reporter that the great susceptibility of troops to consumption in the West Indies, "is not attributable to climate only, but also to some peculiarity in their condition from which officers are exempt," finds, it is believed, an adequate explanation in the operation of the causes here detailed.

Although this subject has been adverted to several times already, yet as the idea that a marshy country is beneficial in consumption, has been long entertained, it may not be out of place here to show on how slender a foundation it rests. The author has been long impressed with its fallacy from the circumstance of having often wit-

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nessed in our southern States the supervention of rapid pulmonary consumption in constitutions deteriorated by malarial diseases, and having subsequently, when engaged in arranging the statistics of the United States Army, frequently met among the reports of deaths from consumption, the remark that it followed an attack of remittent or intermittent fever, chronic diarrhœa, and other forms of malarial disease. In regard to this old opinion, Sir James Clark, in the last edition of his work on 'Climate,' says that "an attack of ague is much more likely to favor the occurrence of consumption than to prevent it."

Whenever any cause depresses the vital energy and lowers the power of assimilation beyond a certain point, the tubercular diathesis will be produced. Moreover, the connection of pulmonary phthisis with congestion and derangement of the abdominal viscera, has been long since noticed; and as abdominal phethora is the predominant character of the prevailing diseases of tropical latitudes, we have a ready explanation of the high ratio of tubercular consumption in the West Indies. Hence, malaria has a tendency to develope this disease; for it tends to destroy the balance of the functions and diminish the tone of the system, thus robbing the blood of that rich fibrinous and vital condition, by which proper nutrition and the organic functions are sustained. Malaria holds a prominent place among the causes productive of the cachectic condition of the system which precedes the formation of tubercle; such as, unhealthy air, whether from closeness, humidity, or impurities,—long continued exposure to extremes of temperatures as connected with the seasons, or to cold alone as from insufficient clothing, in constitutions which have not vascular irritability enough to induce inflammation,—imperfect nutrition, whether from improper or deficient food, the abuse of spirituous liquors, or from lesions of the digestive or assimilative organs,—venereal excesses,—repeated courses of mercury,—profuse and very debilitating discharges, or their sudden suppression when habitual,—the depressing passions, as disappointed love, distress from reverses of fortune, etc.,—irregularities of the uterine function, especially when of a chlorotic character,—adynamic fevers, as well as the exanthematous forms when followed by the atonic state. In all these conditions of the system, resembling that induced by malaria, the impoverished blood, defective in that vital albumen with which the tissues, in the ceaseless change of the human organization, are constantly renovated, deposits in its stead a degraded matter, imperfectly or not at all organizable, called *tubercle;* and this deposition naturally takes place in those organs whose textures are in closest relation with the blood.

But to return. That the West Indies offer no advantages as a winter residence to the pulmonary invalid, may, at first view, be inferred; but this is more apparent than real, inasmuch as it has been shown that these diseases, as a class, are more under the influence of the seasons than intermittent fever, and that consequently one great object of the pulmonic invalid in seeking a southern clime as a winter residence, is to avoid the abrupt transition of summer into winter. That tubercular consumption might be hastened to its fatal issue by a continuous residence in these islands is quite probable, but this objection has no reference to a mere *winter* residence. Notwithstanding the Reporter directs attention to "the baneful influence of the climate of the West Indies in accelerating the progress of consumption," it is found that the annual ratio of mortality from hæmoptysis and phthisis pulmonalis is only $6\frac{8}{10}$ per 1000, exclusive of those sent home as invalids, whilst that of the United Kingdom, is $8\frac{2}{10}$. Now could we institute a comparison between the civil population of England and the native white inhabitants of the West Indies, the comparative results might be deemed correct.

By Sir James Clark it is "laid down as a general rule that the climate of the West Indies is an improper one for patients with tuberculous disease of the lungs." As the winter temperature of some of these islands is higher than the summer temperature in the south of Europe, this may be a correct opinion; but it certainly has no application to the larger islands, as for example Cuba, more especially if they contain elevated tracts. By those who have had the best means of arriving at a correct knowledge, as Drs. Arnold, Musgrave, Fergusson, and Melville, this climate generally has been highly esteemed for its influence on persons predisposed to consumption. As regards the climate of Cuba, the author can speak, from personal knowledge, of its highly beneficial effects.

Next in order come the Mediterranean commands. In *Gibraltar*, notwithstanding the unfavorable views taken by the Reporter, the annual ratio of mortality from all pulmonary diseases is only $5\frac{3}{10}$ per 1000, which is little more than half the average presented in the United Kingdom. From hæmoptysis and phthisis pulmonalis, the mortality in the former is $3\frac{6}{10}$, and in the latter $8\frac{2}{10}$; but as many of the consumptive patients were invalided, the Reporter thinks the ratio for Gibraltar too low. In regard to the correctness of the opinion that inflammation of the lungs is "much more" frequent at Gibraltar than in England, it is impracticable to judge, as the Reporter in his tabular abstracts of the troops at home, with the exception of the Dragoon Guards and Dragoons, does not give the number treated; but one fact is evident, viz., that the mortality from this cause is one-third less than in England. The average of all pulmonary cases treated at Gibraltar is also lower, even taking that of the Dragoon Guards and Dragoons, the *lowest* ratio, as the standard of comparison.

The island of *Malta*, notwithstanding the Reporter thinks it "by no means favorable to persons predisposed to" pulmonary diseases, presents an annual ratio of mortality by this class of 6 per 1000, whilst that of England is $10\frac{1}{10}$. From hæmoptysis and phthisis pulmonalis, the mortality is $3\frac{7}{10}$, which is not one-half as high as in England; but in these comparisons, some allowances must be made for the invaliding of consumptive patients. From pleuritis and pneumonia, the mortality is also higher in England, notwithstanding the Reporter asserts "*that in the mild climate of Malta they are twice as fatal.*"

The Reporter next inquires into the extent of pulmonary diseases among the civil population of Malta—an investigation which leads him to the following conclusion:—"Nor is the fatal influence of diseases of the lungs confined to the troops alone; it extends in a *corresponding degree* to the inhabitants." As this result is wholly unwarranted, it again becomes necessary to expose the fallacy of his deductions. The average population is 100,270, and the tabular abstract extends over a period of thirteen years. From diseases of the lungs, the aggregate of deaths is 6664, among which are reported 1363 of phthisis pulmonalis, and 2786 of consumption. The annual ratio of deaths from this class of diseases among all ages, is, therefore, about $5\frac{1}{5}$ per 1000 of the population. This ratio then, according to the Reporter's own calculation, is only half as high as in England; but it will be observed that deaths are reported by the Maltese medical practitioners under the different heads of consumption and phthisis pulmonalis. "The former," the Reporter says, "is understood principally to refer to that class of consumptive cases more generally designated as *marasmus*, which term has been adopted in the returns since 1831. * * * They are understood to have occurred *principally among children and old persons*, and many of them may not have been directly attributable to diseases of the lungs, though, as we possess no means of distinguishing the *excep-*

tions, it has become necessary to include them under that class." The *exceptions*, in this case, evidently constitute the rule. In his anxiety to establish his favorite views, the Reporter is not content to include under the class of diseases of the lungs the cases of marasmus reported as consumption prior to 1831, but he also takes those *reported as marasmus* subsequently to that period. Excluding, therefore, the 2786 fatal cases of marasmus or consumption, which "*occurred principally among children and old persons*," the ratio of mortality from hæmoptysis and phthisis pulmonalis is reduced to $1\frac{1}{10}$, (about one-eighth of the average in England,) and that from all diseases of the lungs, to 3 per 1000. The fatality of pleuritis and pneumonia is not half as great as among the troops. It is thus seen that the mortality from all diseases of the lungs among the civil population, contrary to the deduction of the Reporter, that it is in a "corresponding degree," is not half as high as among the troops, and not one-third as great as the average of the several commands in the United Kingdom. But as truth, it is said, never lies in extremes, so it may be well to take the ratio of hæmoptysis and phthisis pulmonalis, including *one-half* of the cases of marasmus. By this computation, the ratio is $2\frac{2}{10}$, which is much lower than among the military, and only one-fourth of the average in England. These results find corroboration in the fact that among the "Malta Fencibles,"—a corps composed entirely of natives, the annual ratio of mortality from all causes is only 9 per 1000, being less than half as high as that of the foreign troops.

The Ionian Islands.—This group, remarkable for tempestuous weather and sudden and frequent alternations of temperature, gives a lower ratio than Maltà or Gibraltar. The mortality from all diseases of the lungs is $4\frac{6}{0}$ per 1000, and including the invalids sent to Malta, $4\frac{8}{10}$—a mean not half as high as that of the United Kingdom. The ratio of cases treated is also much higher in England, aye, even in the Dragoon Guards and Dragoons, being as 149 to 90.

This view of the results of the several Mediterranean commands leads to conclusions diametrically adverse to those deduced by the Reporter. It exposes satisfactorily the fallacy of "the interesting fact that, except the Ionian Islands, the liability of troops to consumption in the Mediterranean stations is even greater than in the United Kingdom," or that, if due allowance be made, "the proportion of deaths also, among those attacked by consumption, will be found fully as high." On the contrary, it is found that excluding those invalided, of which the mortality is unknown, the ratio of deaths from hæmoptysis and phthisis pulmonalis, in the Mediterranean stations per 1000, is $3\frac{1}{10}$,and the mortality from all the diseases of the lungs, $5\frac{2}{10}$, whilst in England the former is $8\frac{2}{10}$, and the latter $10\frac{1}{10}$. But as the ratio invalided is not more than 4 per 1000 annually, it follows that if all died, still the average is lower in the Mediterranean. Hence these results afford *no* "striking contradiction to the popular idea," more especially when we call to mind the fact that these ratios are exceedingly low among the Maltese natives. "That inflammatory affections of the lungs are nearly twice as prevalent in the Mediterranean" as in England, and that in the "mild climate of Malta they are also twice as fatal," are deductions that have been completely disproved; and in respect to the civil population of Malta, the position has been more than reversed. Instead, therefore, of its "being by no means likely that any beneficial influence can be exerted by the climate itself" in pulmonary diseases, it is satisfactorily shown that it is even advantageous as a continuous residence. To the pulmonic invalid from the excessive climates of the interior regions of Europe, who seeks this region merely as a winter residence, the beneficial results must consequently be incalculable. Admitting even the correctness of the Reporter's results, they would not militate against the laws established in relation to the relative influence of the seasons.

The last command investigated is British America. In the Bermudas, lying about 600 miles east of South Carolina, the annual ratio of mortality from diseases of the lungs is $7\frac{8}{10}$ per 1000. This average, though higher than in the Mediterranean stations, is lower than in England. Notwithstanding the uniformity of temperature which obtains in this group of islands, the summers are exceedingly hot, even more so than in the West Indies; and as regards winds, the damp and oppressive south-west, and the dry, sharp, and cold north-west, are so injurious to delicate invalids as to justify the epithet applied by Shakespeare—" the still-vexed Bermoothes "

In Nova Scotia and New Brunswick, as well as Upper and Lower Canada, the ratio of admissions and deaths from diseases of the lungs is considerable lower than in the United Kingdom. As this is a region in which a low temperature predominates, the result is no ways surprising; for notwithstanding in Canada, " the variation sometimes exceeds 50° in the course of a few hours," the law that pulmonary diseases are less prevalent in those regions in which a high or a low temperature prevails than in the intervening region characterized by the extremes of both, has been abundantly established in the systems of climate pertaining to the United States. In these British Possessions and in Florida, as little predisposition to pulmonary diseases is induced by the contrasted temperature of summer and winter, the usual exciting causes are the chief agents; and as this law finds confirmation in the fact that pulmonary diseases are more prevalent in the middle regions of Europe than at either extreme, we perceive in the harmony of these results the order which reigns throughout nature.

The more recent statistical reports "On the sickness, mortality, and invaliding among the troops in Western Africa, St. Helena, the Cape of Good Hope, and the Mauritius, afford no evidence corroborative of the Reporter's favorite views in regard to pulmonary diseases. As all these commands belong to the class of mild or uniform climates, the results are much in favor of southern latitudes; for whilst in England, the annual mortality from all diseases of the lungs per 1000 is $10\frac{1}{10}$, among the troops on the western coast of Africa it is $4\frac{3}{10}$, in St. Helena $3\frac{2}{10}$, and at the Cape of Good Hope $3\frac{3}{10}$. At the Mauritius, the average is nearly twice as high as at the Cape of Good Hope; but as the ratio of pulmonary cases treated in the two commands is nearly the same, the great source of mortality in the former arising from consumption, we have another evidence of the fact that the ratio of phthisis pulmonalis including its several forms and of the other diseases of the lungs, has no apparent relation. We are also told that "among 71,850 native troops serving in the Madras Presidency, the deaths by every description of disease of the lungs did not, on the average of five years, exceed *one per thousand* of the strength annually. This ratio, which is only one-tenth as high as in Great Britain, may be considered, unlike that of the island of Malta, a fair standard of mortality from pulmonary diseases among native troops.

It is thus seen that the conclusion of the Reporter, that the class of pulmonary diseases is more prevalent and fatal in southern than northern latitudes, is the result of hasty generalization, or rather that it has arisen from a classification of climates on mere latitude without reference to the phenomena of temperature induced by local causes. Although the Reporter has, in some measure, set the world right in regard to a *theoretical* error, he has unfortunately, at the same time, led it into a *practical* one. His first error was assuming the climate of England as the standard of comparison,—the second, comparing the *lowest* average in one command with the *highest* in another,—and the third, basing his deductions on the *annual* results without reference to the relative influence of the *seasons*. It thus appears that figures are not facts; and hence the necessity of ascertaining the correctness of the data represented by numerals. Arithmetical reasoning is of all kinds the most fallacious, for not unfrequently the error in the premises can be detected only by the absurdity of the results. The more attention has been devoted to this subject in consideration of its importance to the pulmonary invalid, and from the conviction that the evil influence of false doctrines bears a direct ratio to the character of the authority whence it emanates.

B.—RHEUMATISM.

Laws developed in regard to Rheumatic diseases.—Comparison with the results of the British Army Statistics.—The exciting causes, viz., exposure to a cold, moist, and variable atmosphere, subordinate to the predisposition induced by the extremes of summer and winter.

As Rheumatism has been referred to in the preceding article as pertaining to that class of diseases for which a winter residence in southern latitudes is often recommended, a few inquiries in regard to its etiology will be now instituted. This subject, like the preceding one, is of such a nature that the experience of the civil practitioner is on too limited a scale, and too immethodical in its character, to warrant general conclusions, and although generally unsafe to disagree with mankind on matters of daily observation, yet it would not be surprising were the commonly received opinions upon a question of such magnitude, to prove, when submitted to the test of numbers, to be founded in error. It is a disease which, on account of its great prevalence in our climate, its painful and protracted course, and the baneful evils which follow in its train, has strong claims upon the attention of physicians. The following table exhibits the annual and quarterly ratios of rheumatic cases, treated per 1000 of strength, on an average of ten years, in each system of climate :—

RATIO OF RHEUMATIC DISEASES.

Divisions.	Systems of Climate.	Ratio treated per 1000 of mean strength. First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class. Coast of New England,	24	28	29	30	110
	2d Class. Posts on Northern chain of Lakes,	41	37	36	38	151
	3d Class. Posts remote from the ocean and inland seas, - - - - -	45	48	37	34	166
Mid.	1st Class. Coast from Delaware Bay to Savannah,	37	36	27	24	126
	2d Class. South-western Stations,	36	31	20	27	112
Sou.	1st Class. Posts on the Lower Mississippi,	28	16	22	23	90
	2d Class. Posts in the Peninsula of East Florida,	38	23	30	26	119
	Average,	36	31	29	29	125

It thus appears that these affections, which are generally ascribed to sudden variations of temperature conjoined with excess of moisture, are less under the influence of atmospheric agency, as exciting causes, than is commonly supposed. It is evident, however, that they are, in some measure, controlled by the same laws which govern pulmonary diseases. Were cold, moisture, and sudden alternations of temperature, the chief causes, the highest ratio should be given on the New England coast and the northern chain of lakes; on the contrary, it is found that, like pulmonic lesions, the disease is most rife in the dry and cold atmosphere of the interior, (the third class of the Northern Division,) characterised by the extreme range of the thermometer and by seasons strongly contrasted. In the Middle Division, the first class, it is true, is higher than the second; but if the results of Fort Monroe, as in the calculations in regard to pulmonary diseases, are excluded, the annual average of the former is reduced to ninety-three. In the Northern Division, the annual ratio of cases, per centum of the strength, is fifteen, whilst the mean of the Middle and Southern Divisions is eleven. Among 6257 cases registered, only one death is reported.

Were these affections very much under the influence of meteorological causes, we should find, as in pulmonic lesions, a great contrast in the ratios of the seasons. Taking the mean of the four seasons, as shown in the table just given, the first and second quarters give the highest averages; but, contrary to the law which governs pulmonary diseases, the ratios of the third and the fourth are the same. Viewing the whole subject, however, it is found that a similarity obtains in the general laws which, on the one hand, govern rheumatic, and, on the other hand, pulmonary, but more especially catarrhal diseases.

These views are confirmed by the results given in the following abstract from the recent reports upon the medical statistics of the British troops :—

	Jamaica.	Nova Scotia and New Brunswick.	Bermudas.	Malta.	Ionian Islands.	Gibraltar.	Canada.	Mauritius.	Windward and Leeward Command, West Indies.	United Kingdom.	Cape of Good Hope.
Admissions from Rheumatic affections annually per 1000 of mean strength.	29	30	33	34	34½	38	40	46	49	50	57

The reporter here directs attention to the fact, that rheumatic diseases are more prevalent in the Mediterranean than in Canada and Nova Scotia, and that " though some of the provinces of the Cape of 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." Between the ratio of Canada and that of Nova Scotia and New Brunswick, the former being one-third higher than the latter, the same law obtains as in the United States ; for whilst in Canada the cold becomes so intense that the mercury congealed in the thermometer, serves no longer to indicate the extreme reduction of the temperature, in Nova Scotia, on the contrary, the mercury is seldom lower than 6° or 8° below zero in winter, or above 88° in summer. Notwithstanding the atmosphere, in consequence of the same causes which modify its temperature, viz., its insular character and intersection by lakes and bays, is exceedingly moist, and fogs are along the coast common throughout the year,—a circumstance regarded as most favorable for the production of rheumatism,—yet it is seen that the ratio is lower than in the dry and intensely cold climate of Canada. This, of course, is to be explained on the ground of the predisposition induced by the extremes of the opposite seasons. If the average of Nova Scotia were given distinct from that of New Brunswick, a more striking contrast, it is very probable, would be revealed. At all events, the opinion that rheumatic affections, like those of the lungs, obey, in some measure, the inflections of the isotheral and isocheimal curves, is warranted.

The term Rheumatism, however, is generally so loosely applied, that a host of ailments, with no character in common save that of pain, are classed under it. Hence it is reasonable to suppose, that were this investigation confined to cases of the acute form, the result would be modified. Of the fact that the application of cold, more especially when combined with moisture, to the body when unusually heated, is the chief exciting cause of acute rheumatism, there can be little doubt; but when we reflect that for every instance of rheumatism so induced, numbers continually endure a much greater exposure to the alleged causes with impunity, it follows that still more depends on the predisposition. Now this predisposition is said to be given by many circumstances, as age, temperament, climate, and even hereditary liability. As regards the influence of climate, it would appear that acute rheumatic affections, like those of the lungs, are less dependent on mere variations of temperature than upon its extreme range as connected with the seasons, the former being an exciting and the latter a predisposing cause.

It will be observed that the annual ratio of rheumatic affections is two and three-fold greater among our troops than among the British, and that the same relation obtains in regard to pulmonary diseases. This may arise in some measure from the mode of reporting. In our service, all cases of disease, more especially of late years, are registered, those in hospital as well as those in quarters, whilst the British statistics, it would seem, contain only cases of admission into hospital. Much, however, is to be ascribed to the nature of the region we inhabit, which lies in the middle latitudes of the eastern side of a continent prolonged towards the poles. It is, therefore, emphatically an *excessive* climate, exhibiting the greatest range of temperature and the most marked distinction of seasons, whilst all the regions of the British commands are either mild insular climates, or those in which a low temperature predominates.

C.—DISEASES OF MALARIAL ORIGIN.*

Difficulties inherent in the nature of the subject.—Laws developed relative to intermittent fever.—The apparently incongruous results in regard to intermittent fever in the Northern Division, explained by reference to geological structure and the nature of soil.—General pathological character of intermittent fever in our several systems of climate.—Laws developed in regard to remittent fever.—Pathological nature of congestive, remittent, and yellow fever, as modified by our systems of climate.—Laws developed relative to synochal and typhus fevers.—The character of continued fevers, comprising synocha, synochus, and typhus, as observed in Europe and America, contrasted.—Statistical results in reference to the whole class of fevers.—Laws developed in respect to the etiology of diarrhœa and dysentery, colic and sporadic cholera, malignant cholera, dropsies, and hepatic affections.—Relative monthly mortality throughout the United States.—The opinion that catarrhal fever is dependent on malarial causes, disproved.—The essential nature of malaria investigated at length.

In the investigation of those diseases which are generally ascribed to, or supposed to have some relation with, causes of malarial origin, the same arrangement of the subject, as regards the influence of climate, will be adopted as in the inquiry relative to the preceding diseases. Although in this attempt to establish a relation between climate and malarial diseases, the author may not prove so successful as in the researches in reference to pulmonic affections; yet he will at least determine the relative prevalence of these diseases in the different regions of the United States, and develope at the same time some of the laws, as regards particular systems of climate and the seasons of each, by which the diseases attributed to malarial origin are governed. As the etiology of pulmonic diseases is more especially connected with mere temperature and humidity, we are enabled to arrive at some positive knowledge; but as regards malaria—that mysterious agent which has hitherto remained inscrutable in its nature—all our knowledge is derived from its effects on the human frame. We know that terrestrial emanations dissolved in atmospheric moisture modify the constitution of climate, and that consequently the *nature of soil*, which consists of a stratum of comminuted mineral

* It may be well to state here that the term, *malaria*, derived from the Italian, *mal'aria*, literally *bad air*, is used to designate, as is now generally done, a certain effluvium or emanation from marshy or humid ground, containing both vegetable and animal remains. *Miasma*, which is a Greek word, signifying originally contagion or pollution, with the adjunct, *marshy*, is not unfrequently employed to express the same idea.

substances and organic remains upon which man is dependent for existence, constitutes one of the most important points involved in the inquiry. Although malaria has hitherto defied the power of the chemical etiologist, yet as caloric is the controlling element in the constitution of climate, modifying its other properties, so it will be seen that the meteorology of heat is intimately connected with the laws of malarial diseases in the relation of cause and effect.

Having said thus much in relation to the inherent difficulties which attend researches in reference to malarial diseases, it may be well to add that the doctrine of averages, (the application of which to the investigation of morbid actions, gives to medical inquiries the same character which pertains to statistical researches on other subjects,) bids fair to unravel some of the mysteries connected with this subject. Instead of being bewildered by contradictory conclusions based on the few cases which fall under the observation of particular practitioners, we are enabled, by thus accumulating a vast aggregation of facts extending over thousands of individuals, to deduce the laws by which the operations of nature are controlled.

The statistical data brought to bear upon the present subject, extending, like the rest, over a period of ten years, comprise the whole of the United States and Territories, and are based on an aggregate mean strength of 47,219.

INTERMITTENT FEVER.

The following table presents in a condensed form the—

RATIO OF INTERMITTENT FEVER.

Divisions.	Systems of Climate	Ratio treated per 1000 of mean strength.				
		First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class. Posts on the coast of New England,	2	15	11	9	36
	2d Class. Posts on Northern chain of Lakes.	13	73	77	36	193
	3d Class. Posts remote from the ocean and inland seas, - - - -	21	34	57	40	151
Mid.	1st Class. Coast from Delaware Bay to Savannah,	41	71	158	101	370
	2d Class. South-western stations, - -	101	129	305	197	747
Sou.	1st Class. Posts on the Lower Mississippi,	62	77	170	90	385
	2d Class. Posts in the Peninsula of East Florida,	52	105	244	138	520
	Average,	45	75	156	93	368

The low ratio of intermittent fever on the coast of New England compared with interior regions on the same parallels, is at first view very surprising; but even the average of the former given is entirely too high, inasmuch as by far the majority of cases arose among soldiers who had been exposed in malarial regions. Of the seven posts constituting this class, two-thirds of the cases were reported at Fort Columbus; and at this post, no case has ever been known to originate. Dr. James H. Sargeant avers that in thirty-three years, during which period he was stationed at Fort Constitution, New Hampshire, only one case, which he regarded as really of domestic origin, fell under his observation. The coast of New England may, indeed, be considered as exempt from this disease—a remark that applies equally to the interior of the New England States; for it is stated by Dr. Smith* that "on the Connecticut river, from Northampton in Massachusetts to its source, a distance of more than 200 miles north and south, and on all its tributary streams on both sides, for a hundred miles in width, there has been no instance of any person having contracted the intermitting fever, from the first settlement of the country to the present time."

The same contrast as regards the prevalence of intermittent fever, is shown, in the statistics of the British Army, to exist between Canada, on the one hand, and Nova Scotia and New Brunswick, on the other. Whilst several thousand cases are annually reported in the former Command, the disease is so rare in the latter that scarcely one indigenous case has ever been known to occur. Even in Lower Canada, intermittents are almost unknown, the proportion, compared with Upper Canada, being as thirteen to eighty-nine, and these cases have in most instances been traced to soldiers, who had labored under the disease or had acquired a predisposition to it in the Upper Provinces. The fact seems, at first view, inexplicable, that this disease should prevail extensively along the shores of the lakes and the margins of streams in Upper Canada, whilst situations abounding in similar supposed sources of malaria in Nova Scotia, should be exempt. As the soil of Halifax is arid and rocky, this exemption would have been inferred *a priori*; but it is surprising that it should extend equally to the troops and inhabitants at Windsor, Annapolis, Fort Cumberland, and Frederickton, notwithstanding their position at the embouchure of rivers, and exposure to the influence of that com-

* Dr. Smith on the Etiology of Epidemics, New York, 1827.

bination of mud and marsh, regarded as its prolific source in Upper Canada. This seems the more remarkable when it is considered that the climate of Upper Canada and that of Nova Scotia are very similar. The climate of the former is modified by the agency of the lakes, and as the latter is a peninsula so much intersected by lakes and bays that nearly one-third of its surface is under water, the temperature, it has been seen, is still more uniform. But as the laws of nature never clash, it is only necessary, in order to harmonize these apparently incongruous results, to determine their relations.

The posts of the second class, (those on the lakes,) like the British military stations, in the same region, exhibit comparatively a high ratio of intermitting fever. The mean aggregate strength of this class of posts is 5975, and the total of cases of intermitting fever reported is 1150; and of these, 560 cases are reported at Fort Gratiot in a strength of 782. At this post situated at the outlet of Lake Huron, the disease is exceedingly rife both among the troops and the inhabitants. As the annual ratio of cases treated per 1000 is 715, this post presents an average nearly as high as the south-western stations, and higher than that of East Florida. Unlike the class of posts on the coast of New England, at which the majority of cases are of foreign origin, the class on the lakes strongly manifests the influence of the seasons in the causation of the disease. For example, if 1000 troops were stationed at these seven posts, thirteen would be attacked with intermitting fever during the first quarter of the year, seventy-three in the second, seventy-seven in the third, and thirty-six in the fourth.

The average of the third class of the Northern Division is 151. Of the seven posts constituting this class, the occurrence of the disease is very unusual at Hancock Barracks, West Point, and Forts Snelling, Winnebago, and Armstrong, whilst at Forts Crawford and Leavenworth, it is very prevalent. If the statistics of Fort Leavenworth on the Missouri, which is nearly as far south as the 39th°, were excluded from the calculation, the annual average of the class would be reduced from 151 to 70 per 1000. The average of the Northern Division, comprising the three classes just examined, is 143.

As the remarkable contrast in the relative prevalence of agues in New England, New Brunswick, and Nova Scotia on the one hand, and, on the other, in the region of the great lakes on either the American or British side, finds no explanation in any difference of climate as regards temperature and moisture, it follows that the solution must be sought in the modification of climate arising from geological formation and the nature of soil. Now as the region of New England as far as the St. Lawrence, with little exception, has a primitive formation with a sandy and sterile soil, whilst that of the lakes consists of a secondary formation having not unfrequently an alluvial superstratum composed of a rich vegetable mould from three to six feet deep, it is not difficult to deduce the correct inference. In the former, the geological structure is destitute of organic remains, and the little contained in the sandy soil does not find enough of moisture to induce the necessary chemical action; whilst in the latter, not only is the geological formation of secondary origin, but the deep, rich soil is sufficiently humid, when a high temperature acts upon the organic remains with which it abounds, for the development of the morbid poison, called malaria.

The *Middle Division*, which comes next under consideration, shows that in proportion as southern latitudes are approached, diseases of malarial origin, under like circumstances, increase *pari passu*. The intermittents in the three classes composing the Northern Division, average of is not more than two-fifths as high as that of the class now under examination, embracing Forts Delaware, McHenry, Severn, Washington, Monroe, Johnston, Moultrie, Bellona Arsenal, and Oglethorpe Barracks. With the exception of Fort Moultrie, in Charleston Harbor, and perhaps Fort Monroe, in Virginia, (both having a sandy and sterile locality,) none of these posts possess an exemption from intermittent fever. At Fort McHenry, (Baltimore,) Fort Severn, (Annapolis,) and Fort Washington, (opposite Mount Vernon,) the disease has always been so rife, notwithstanding these garrisons generally formed summer encampments, that the average is higher than in Florida. The influence of the seasons in this class is very decidedly evidenced, the ratio of the first quarter being 41, the second 71, the third 158, and the fourth 101.

The second class of this Division, consisting of the south-western posts, viz., Jefferson Barracks, Forts Gibson, Smith and Coffee, Towson, and Jesup, presents an average twice as high as the last class, and higher than any other in the United States. With the exception of Fort Jesup, intermittents are very rife at all these stations. At Fort Gibson, for example, the average number of cases exceeds the mean strength nearly one-fourth. This post is situated about three miles from the junction of three rivers—a spot originally formed by the rich alluvion of these streams; and as the solar heat is intense, and the quantity of rain, though adequate to the maintenance of a certain degree of moisture, not sufficient to overflow the surface, the circumstances most favorable to the evolution of malaria, obtain. The high ratio of this class of posts, compared with the class on the Atlantic in similar latitudes, is doubtless to be ascribed to the combined influence of more recent cultivation, a soil richer in organic remains, and the great and long-continued summer heats. In this class, the relative influence of the seasons in the production of intermittents is very apparent, the four quarters presenting the following ratios—101, 129, 305, and 197 cases per 1000 of the mean strength.

The *Southern Division* remains to be considered. The first class, comprising Baton Rouge, New Orleans, and Forts Pike, Wood, and Jackson, all on the Lower Mississippi, and Augusta Arsenal, Georgia, and Fort Mitchell, Alabama, gives an annual average of three hundred and eighty-five per 1000, being scarcely more than one-half as high as that of the south-western stations; and the second class, embracing the posts in East Florida, both permanent and temporary, presents a ratio of five hundred and twenty, which, with the exception of the south-western posts, is higher than that of any other class. In the explanation of these varied results, the operation of several causes is to be considered. It is more than probable, as the summer temperature never rises so high in the two classes of the Southern Division, as well as the first of the Middle, as it does at the class of south-western posts, that the causes productive of intermittent fever are not generated so abundantly at the former. But at the same time it is to be considered that at the posts on the Lower Mississippi the troops were frequently removed to healthy summer encampments, and that those of the region of East Florida, which is nearly altogether in a state of nature, were occasionally relieved; whilst at the south-western stations lying in a district in the first stage of cultivation, the troops serve out the whole period of their enlistment. As the ratio of the third quarter is three and four-fold greater than that of the first, it may reasonably be inferred, all other causes being equal, that the higher the temperature of this season, the greater will be the proportion of cases of intermitting fever; and this deduction is corroborated by the fact that as we proceed south, the ratio of intermittents augments with the increased summer temperature. On reference to the table, it will be seen that the striking distinction in the average of cases in the different seasons, is equally apparent in the two classes of the Southern Division. As regards the relative prevalence of this disease in our northern and southern regions, it is found that in the former, comprising the first three classes, the annual ratio per 1000 is one hundred and forty-three, whilst in the latter, embracing the Middle and Southern Divisions, the average is five hundred and sixty-eight.

The average ratios of intermittent fever per 1000, among all the troops stationed throughout the United States, are as follows:—

1st quarter.	*2d quarter.*	*3d quarter.*	*4th quarter.*	*Annual result.*
45	75	156	93	368

The ratio of mortality from this cause is very low. It is only in our southern latitudes, where violent congestions of internal organs are apt to occur, that death may be said to arise directly from intermittent fever. In the Northern Division, the total of cases reported is 3,187 and one death; and in the Middle and Southern Divisions, 14,094 cases and thirteen deaths. The ratio of deaths from this disease, on an average of all the posts, is only eight in every ten thousand cases. According to the British statistics, the annual ratio of cases, per 1000 of the strength, in the West Indies, is two hundred and forty-three, and the ratio of mortality, six per 1000 cases; in the Mediterranean Commands, the ratio of cases is fifty-eight, and that of deaths five; among the troops on the home station, the disease is almost unknown; and among those stationed in Canada, New Brunswick, and Nova Scotia, the ratio of cases is forty-seven per 1000 of the strength, and the mortality eight per 10,000 of the cases. In Nova Scotia and New Brunswick, however, there is almost an entire exemption from the disease.

In regard to the relative prevalence of the different *varieties* of intermitting fever, it is impracticable to furnish any statistical results, inasmuch as all the cases of fever of this type among our troops were reported under the *specific* term. This desideratum, however, is supplied by the present mode of reporting in the Army, which specifies each variety, as quotidian, tertain, quartan, etc. Again, each type is liable to certain modifications, having their origin in idiosyncracy or on what has been termed atmospheric temperament; but to describe the symptoms by which these modifications are characterized does not comport with the plan of this work. Suffice it to say that *simple uncomplicated* ague almost exclusively prevails in our northern latitudes. The *inflammatory* variety occurs throughout the United States, but more especially in warm climates, during the cold season and in persons of a previously healthy constitution. Owing to its common occurrence in sound constitutions, it yields readily to active treatment; but when neglected or improperly managed, in hot climates, it passes rapidly into the remittent type. Intermittents partaking more or less of an *adynamic* character, occur rarely in our northern States; but they are often met with in our southern latitudes among the debilitated and intemperate, especially northern persons who have long resided in this region. They are rarely observed uncomplicated with visceral congestions, constituting the *malignant* form of some writers. These complications may be with the abdominal, the pulmonary, or the cerebral organs. As *Masked* or *Anomalous* Intermittents occur most frequently in localities in which the disease is very rife, or seasons in which it is very prevalent, so they are met with more frequently, under like circumstances, in proportion as southern latitudes are reached. They assume diversified forms, numerous diseases, especially those of the nervous system, putting on an intermittent type. In regard to the consequences and terminations of intermittent fever, it may be said that it seldom continues long, even in the simple form of our Northern States, without materially impairing the vital energy of the viscera of the large cavities, particularly those of the abdomen. Hence arise the complications just referred to, the supervention of the remittent or continued type, or a fatal issue in consequence of an insurmountable congestion in the cold stage; and as sequelæ, we observe chronic diarrhœa and dysentery, dropsical effusions, inflammation and structural changes of internal organs. The influence of the seasons and of climate generally upon this disease has been already amply illustrated. Whilst in our southern regions, death frequently takes place during the paroxysm, in consequence of the vital powers being overwhelmed; in our northern, it sometimes occurs when the disease is prolonged and obstinate, the vital powers being worn out by the effects of some local lesion.

That intermittent fever has a tendency to a septenary revolution, is a fact that was frequently verified in Florida under the author's observation; and this too in a manner so unequivocal, that it attracted the attention of the common soldier. At these septenary periods, either after the seventh, fourteenth, or twenty-first paroxysm, the disease has a disposition to terminate spontaneously. It is at these periods that febrifuge remedies act with the greatest success; and as regards relapses, it is then too that a vast majority occurs,—a circumstance of such frequent occurrence in Florida that soldiers would voluntarily come to the hospital to obtain medicine to prevent its return.

The most striking example of endemial influence as regards malarial diseases in the United States, is not exhibited in these statistics, viz., the Atlantic Plain or tide-water region compared with the adjacent highlands. Whilst the latter presents a surface which allows no stagnant waters and a soil comparatively free from organic remains, the former has a geological formation of tertiary and cretaceous secondary deposits, with an argillaceous and rich alluvial soil dotted with marshes and coursed by sluggish streams. From the Delaware to the Mississippi, malarial diseases are dominant in the hot and sultry atmosphere of the low-lands; but in the mountain regions of the same parallels, the climate is mild and salubrious. But this subject will be further illustrated in Section III.

Having completed the details relative to Intermittent Fever, the subject of Remittent Fever will be next investigated.

REMITTENT FEVER.

The following table exhibits the

RATIO OF REMITTENT FEVER.

Divisions.		Systems of Climate.	Ratio of cases treated per 1000 of mean strength. First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class.	Posts on the coast of New England,	3	9	8	6	26
	2d "	Posts on northern chain of Lakes,	3	6	21	4	33
	3d "	Posts remote from the ocean and inland seas,	2	3	13	6	24
Mid.	1st Class.	Coast from Delaware Bay to Savannah,	3	20	110	48	181
	2d "	South-western Stations,	12	19	104	38	180
Sou.	1st Class.	Posts on the Lower Mississippi,	17	47	86	56	196
	2d "	Posts in the Peninsula of East Florida,	9	20	55	33	102
		Average,	7	15	58	22	101

In the three classes of the Northern Division, there is little difference in the annual ratios—a result which, as the coast of New England is exempt from intermittent fever, may be regarded, at first view, as militating against the doctrine of their common origin. As remittent fever is much under the influence of the seasons, the ratio of the third quarter being more than eight times as high as that of the first in the general average of the United States, and as this inequality of the seasons is not evidenced on the coast of New England, the ratio of the second quarter being higher than that of the third, it is more than probable that many of the cases reported as remittent were of the common continued type. In every other class, this preponderance of the third quarter over the first is very striking, being in the first class of the Middle Division as one hundred and ten to three. Although there is no exact relation discoverable between these two forms of fever, yet the statistics of our troops prove, as a general rule, that where one is rife the other is so too. In the British statistics, the same connection is established ; for in the West Indies and the Ionian Islands, both prevail extensively, whilst in England, Gibraltar, Malta, the Bermudas, Nova Scotia, and New Brunswick, the ratio of both is low. In Canada, as might be expected in a cold country, the average of intermittents is much higher than that of remittents. In the Middle Division, compared with the Northern, the ratio of remittents increases very rapidly, being more than six-fold greater. In the first class of the Southern Division, the ratio is still higher ; and here too the mortality is highest in consequence of the high grade of intensity assumed by febrile action ; but in the second class, comprising the posts in East Florida, the ratio is lower than that of any one of the three preceding classes. In the first class of the Middle and of the Southern Divisions, as for example at Charleston and New Orleans, the form of fever designated *febris icterodes* or *yellow fever*, appears annually ; whilst in the second class of the Middle Division, it is almost unknown, and in the second class of the Southern appears very rarely. As to the proper distinction between the bilious remittent fever of warm climates and the genuine *febris icterodes*, an arbitrary classification has been pursued by our medical officers as well as the British, the majority of them reporting all these cases under the common nosological term of "remittent fever." In the present state of our knowledge, we are not, however, warranted in admitting that the same miasm which causes common remittent fever can, in its more virulent form, induce yellow fever, or indeed that the latter is of paludal origin. To prove that the causes productive of intermittent fever are generated most abundantly under a high temperature, it was shown that the annual average increases with the decrease of latitude, and that the third quarter invariably presents the highest ratio; and in regard to remittent fever, a comparison of the tables will show that these facts are yet much more striking. In the three classes constituting the Northern Division, the annual ratio of cases of remitting fever per 1000 of the strength is twenty-six, and in the four classes constituting the Middle and Southern Divisions, it is 168, whilst the ratio of all the classes is 101. In like manner, the ratio of mortality in the Northern Division is $\frac{5}{10}$, and in the southern regions, six, per 1000 of the strength; but the proportion of deaths to the number of cases, owing to the greater prevalence of the disease in our southern latitudes, does not exhibit so great a contrast in the two Divisions, being one in forty-nine in the former and one in twenty-nine in the latter. In the West Indies, the annual ratio of cases of remittent fever, including yellow fever, is, among the British troops, 413 per 1000 of the strength, and the mortality from the same cause is fifty-four; but it is in the Jamaica command that this disease prevails with its utmost virulence, the ratio of cases being 745 and of deaths 102 per 1000 men—an average furnished by the statistics of twenty years, comprising an aggregate mean strength of 51,567; and during the same period, the average of cases among the black troops was only eighty-five, and of deaths less than eight per 1000. Among the troops in the United Kingdom, the disease is almost unknown. In the Mediterranean stations, including the fatal epidemics of yellow fever at Gibraltar, the ratio of cases per 1000 is fifty-three, and of mortality six. And lastly in British America, comprising the commands of Canada, Nova Scotia, and New Brunswick, the ratio of cases is less than three per 1000, and of deaths, less than two per 10,000.

Some of the cases included in this class were reported under the term *congestive* fever, which has been generally substituted for *bilious remittent*, of late years, by the physicians of the south-west; but whether this is owing to an improved pathology or a change in the character of the disease is uncertain. Perhaps both causes have operated in producing this change of nomenclature. We know at least that in a country partially cultivated, as will be shown more fully, deleterious agents are generated causing endemics of a character more malignant than when the surface was in a state of nature. As congestion, however, may be associated with intermittent, remittent, or typhus fever, giving each a marked character, it does not serve to designate a fever, so much as it does a modification which may occur in any variety of fever and at any period of it. Identical with the malignant or pernicious remittents or the intermittent ataxic fever of continental Europe, it is yearly met with in its southern regions; and as such, it was long ago accurately described by Torti and Riverius, and in our own day by Rubini and Bailly. The accounts of these writers, more especially those of Italy, as well as Cleghorn, Lind, Pringle, Johnson, etc., in other regions of the world, would be readily taken as highly descriptive of congestive fever on the Mississippi. Congestion of a morbid kind is common in nearly all fevers, and is not limited to any organ. Thus in winter epidemics, the thoracic organs are the chief sufferers; and in summer and autumnal ones, the brain and abdominal viscera experience the greatest lesions. Of the former, the epidemic called *pneumonia typhoides*, which prevailed, in 1812, among our troops on the Canada frontier, is an example; and of the latter, an instance is afforded in the *cold plague*, referred to in the descriptions of Baton Rouge and New Orleans.

As regards remittent fever, if we define it to be a disease attended by distinct paroxysms of fever alternating with remissions, its affinity to intermittent fever is apparent; and if, on the other hand, it be defined as a variety of continued fever, characterized by very evident and distinct exacerbations, it seems to have a like affinity to the latter. That it is, however, intimately allied with intermittent fever, is clearly established by these statistics,—an opinion confirmed by their analogous origin, their associations, their organic lesions, and their tendency to assume each other's character. In our northern regions, remittent fever usually assumes the simple and inflammatory character; whilst in the districts of southern latitudes in which the miasm is generated, every form of the disease prevails, and in places near its origin or in low ill-ventilated localities, the malignant form more especially is experienced. But individual constitution also exerts a great influence both in regard to primary susceptibility and the subsequent character of the disease. Generally speaking, in those of a plethoric habit, the inflammatory variety prevails, and among the weak and languid, those debilitated by previous disease or intemperance, the malignant form is most apt to supervene. The adynamic or malignant form, more especially if complicated with congestion and inflammation of the viscera of the large cavities, is one of the severest and most fatal of endemic fevers, being observed in places in which the endemic causes are intense and concentrated relatively to the state of predisposition, and being ushered in by a prolonged sense of cold, and a universal collapse of the vital powers and of vascular action. In warm miasmatous climates, the inflammatory variety frequently attacks sanguine plethoric individuals from northern latitudes, attended, in the most severe and unfavorable cases, with yellowness of the skin or vomiting of matters resembling coffee-grounds, or both. This, as well as the modifications referred to above, are considered by many as differing essentially from epidemic yellow fever.

In regard to *Yellow Fever*, there has always existed great contrariety of opinion both in reference to its nature and origin, arising mainly from the fact that its phenomena are much modified by climate, and especially by temperature, season, and locality. By some, it is associated with typhus fever; and by others, it is regarded as a variety of remittent fever. It is now, however, with few exceptions, viewed as a specific disease, some referring it to lesions of the solids, and others to disorganization of the fluids. Without reference to individual liability to this disease, as influenced by age, sex, constitution, and occupation, it may be said that the development of its causes requires a climate in which the mean summer temperature is not less than 75°, and perhaps 80°; and hence the localities liable to its occurrence include almost every point, mostly limited to the vicinity of the ocean, between the latitudes of 40° N. and 25° S. of the equator. That yellow fever is never found above the height of 2500 feet, was long since observed by Humboldt. At Stony Hill, in Jamaica, elevated 1300 feet above the level of the sea with a mean annual temperature of 70°, it is only of occasional occurrence and rarely epidemic. At the height of 4200 feet, the vegetation of the tropics gives place to that of temperate regions; and here the inhabitants enjoy a complete exemption from the scourge of yellow fever and the violent bilious remittents, which cut off thousands annually along the coast. In these elevated regions, we are told that the inhabitants, far from presenting the pallid and sickly aspect of those that dwell along the coast, exhibit that ruddy glow of health which tinges the countenance in northern climes. The opinions in regard to the causes of yellow fever may be arranged under three heads:—1. That it is a disease induced solely and essentially by contagion; 2. That it is essentially of endemic origin; 3. That being of endemic origin originally, it becomes contagious.

The doctrine that not only intermittent and remittent, but yellow fever, assume, according to circumstances, more or less the type of one another, has been extensively entertained. In the British and American army statistics, nearly every case of *Febris icterodes* characterized by black vomit, is reported under the head of "*remittent.*" Believing them to arise from similar causes variously modified, to assail the system through the same avenues, and to require the same general treatment, these fevers are regarded by this class of reasoners as essentially the same, modified by the intensity of the cause and peculiarity of constitution. This position is strongly confirmed by the oft observed fact, that the natives of our southern cities, in which yellow fever is endemical, possess, in a great measure, an exemption from this malady; for, whilst intermittents and mild remittents prevail among the old inhabitants, yellow fever often manifests itself so exclusively among those lately arrived from northern latitudes, that it has received the name of "*Stranger's Fever.*"

The essential anatomical character of yellow fever, according to M. Louis, as observed by him at Gibraltar in 1828, is a peculiar condition of the liver, which, without much alteration of size or consistence, was yellow, with but little bile in the gall-bladder. In the remittents of warm climates, on the contrary, the liver, generally enlarged and flabby, is always of a dark color, with a gall-bladder generally distended. Another pathognomonic symptom is, that whilst the spleen, in yellow fever, is mostly normal, it is much enlarged and softened in bilious remittent. Again, the fluid black matter generally found in the stomach in the former disease, is absent in the latter.

The opinion of the origin of yellow fever, from miasmatic effluvia, seems to be strongly corroborated by the following facts: 1. Yellow fever always appears simultaneously with bilious remittents; 2. A high range of atmospheric temperature is essential to the generation of its cause; 3. Its first appearance is always in the lowest and most filthy parts of towns, and in localities favorable to the production of miasmata; and, 4. The supervention of storms, heavy rains, or cold weather, puts an immediate check to its progress. These views are sustained by some of the most experienced writers on the subject. It is remarked by Dr. Rush, in relation to the yellow fever of Philadelphia, in 1802, that "intermittents, the mild remittent, the inflammatory, the bilious, and the malignant yellow fever, have, in many instances, all run into each other." Speaking of the yellow fever of the same city in 1803, Dr. Caldwell observes—"as the fever receded from the low ground, and malignant atmosphere of Water street, it became more and more mild and manageable, till its evanescent shades in Second street were, in many instances, much lighter than the common remittent of the country." In the yellow fever of Charleston in 1804, Dr. Ramsay says that "neglected intermittents frequently terminated in yellow fever." In regard to Baltimore, Dr. Davidge states that "the bilious or remitting fever, in its ordinary form, prevailed in that town, and continued until it was gradually lost in the severer form of yellow fever as the season advanced." That the disease was in none of these epidemics, imparted or communicated by contagion, all these writers unanimously agree—a fact which, at New Orleans, the experience of almost every year exemplifies. Situated on a mighty river's bank, formed of the alluvion of its own current, this emporium may be regarded as a healthy locality during nine months of the year. As the summer temperature increases, yellow fever appears almost with the certainty of the varying seasons, and disappears as regularly when the scale of the thermometer indicates its decrease. Although vessels laden with fugitives from malarious pestilence, ascend the stream by hundreds at this period; yet the disease, notwithstanding the fatal *black vomit* appears on the decks as they pass along, is never manifested among fellow-passengers from uninfected regions; nor is it, under like circumstances, communicated to the inhabitants of the district to which they may fly. It is, therefore, purely a disease of season and locality. It may be worthy of observation that whilst, at New Orleans and Gibraltar, the same individual is seldom twice attacked by yellow fever, in the West Indies and on the west coast of Africa, it is said to secure no subsequent immunity.

Whether certain fevers which have, or are supposed to have, their source in vegetable miasms or in effluvia from marshes, ever subsequently spread by contagion, is still a disputed point. In regard to yellow fever, it has been observed that its imputed causes engendered in the holds of ships navigating in hot climates, when suffered to escape at the wharves of our northern cities, will affect those only who come within the sphere of its influence, the disease being never known to spread epidemically. A cause of this kind would no doubt fall harmless upon the inhabitants of a salubrious country locality.

To develope this malignant fever, seems to require the conjoint operation of both local and general causes, constituting an *endemico-epidemic*, which is unsusceptible of propagation by specific contagion; and in the summer atmosphere of a crowded city, more especially if a maritime position, there appears to exist some peculiar agency favoring its development. In these cases, there is generally found an "infected district," which slowly and regularly extends its boundaries, rendering all who come within its limits, subject to this form of fever. In our northern cities, this has been repeatedly observed. Whilst the common remittent fever is found in the United States wherever intermittent fever prevails, the true yellow fever is nearly altogether confined to the Atlantic Plain or tide-water region extending from New York to New Orleans. The experience of several centuries teaches us that the cause of this fever is perennially present in our southern cities. Indissolubly connected with climate, it seems to maintain the same relation towards the human system as the other malarious emanations of our southern low-lands, and to be liable, at any time, to be developed, in different grades of intensity, by the combined operation of heat and other agents. Amid the conflicting evidence in regard to the etiology of this disease, the following conclusions seem to be fairly warranted:—1. That it is solely and essentially of endemic origin; 2. That it is never contagious under ordinary circumstances of cleanliness and ventilation; and 3. That as regards the local causes, at least in the United States, a soil rich in organic remains and perhaps an atmosphere more or less modified by the sea, appear to constitute necessary conditions.

The opinion that yellow fever never prevails at a considerable distance from the sea, is not, however, wholly confirmed by the experience of the United States. Within a few years, it has raged with great malignity far in the interior of some of our southern States; and in the "Statistical Report on the Sickness and Mortality" of our army, it is shown, if the accounts are correct, that it has prevailed in a most malignant degree on the Ohio and Missouri. One of the strongest predisposing causes of epidemics generally would seem to be the summer atmosphere of a crowded city—a result doubtless owing to a diminution of vital energy, as evidenced in the condition of the system termed *Cachexia Londinensis*, though by no means peculiar to that metropolis.

An accurate discrimination of the *varieties* of idiopathic fevers, as in the case of inflammation, is one of the most important improvements which have been lately effected in our knowledge of this subject. The *Congestive* variety, as described by Armstrong and witnessed in our southern and western regions, may be considered that form in which the sedative agency of the remote cause of the disease acts with extreme force; and consequently the symptoms of the first or cold stage assume their maximum of intensity, and the usual reaction is suppressed or obscured. Hence the importance of the practical cautions given by Sydenham and others of the older authors, in reference to the nature of the prevailing epidemic. For example, in the fevers of hot climates, and especially in the epidemics of yellow fever along our southern coasts, the danger, in some seasons, arises chiefly from symptoms denoting an inflammatory action at the brain, the liver, or stomach, or all conjoined, which symptoms are speedily and effectually combatted by antiphlogistic remedies; whilst, in other seasons, in which the febrile depression is more formidable and the danger of debility much greater, the depleting practice not only proves less effectual, but even so pernicious that stimulating remedies, (though unfortunately seldom successful,) are brought into requisition. Hence the particular type must regulate the treatment in the particular case. And hence, certain distinctions relative to idiopathic fever drawn by French authors, are of obvious practical importance; such as the predominant character of certain varieties—in the Fievre Ataxique, the disorder of the nervous system—in the Fievre Adynamique, the weakened state of the circulation—and in the Fievre Inflammatoire, the degree of febrile reaction. In regard to the exanthemata, as for instance rubeola and scarlatina, these remarks are equally applicable.

SYNOCHAL FEVERS.

As this part of the inquiry is intended to elucidate such diseases only as manifestly depend on malarial causes, the following table of *Synochal Fevers* would not be presented, were it not that a complete view of febrile affections is designed. Under the term, *Synochal*, are condensed all the cases registered as synocha, synochus, common continued, ephemeral, and inflammatory fever; but a great majority of them are reported under the last name.

RATIO OF SYNOCHAL FEVERS.

Divisions.	Systems of Climate.	Ratio treated per 1000 of mean strength.				
		First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class. Posts on the Coast of New England,	12	14	6	11	43
	2d Class. Posts on Northern chain of Lakes,	4	5	4	3	16
	3d Class. Posts remote from the ocean and inland seas, - - - - -	11	13	16	6	45
Mid.	1st Class. Coast from Delaware Bay to Savannah,	8	6	6	7	27
	2d Class. South-western Stations,	2	4	14	5	25
Sou.	1st Class. Posts on the Lower Mississippi,	25	15	3	14	60
	2d Class. Posts in the Peninsula of East Florida,	2	2	5	10	18
	Average,	8	8	10	7	33

What strikes the mind at the first view of this tabular summary is, that the four seasons exert nearly the same influence upon this class of fevers, and that they are equally unaffected by difference of climate and of latitude. As these fevers are dependent neither on the exalted temperature of summer nor on that of southern latitudes, it follows that they arise from causes of a nature entirely distinct from those of intermittent and remittent fever. In the Northern Division, the ratio of cases per 1000 is thirty-seven, and the average of the Middle and Southern is twenty-five, whilst the mean of the three is thirty-three. The mortality, however, is greater in our southern than northern latitudes, the proportion of deaths to the number treated being in the former one in sixty-five, and in the latter one in 412. Among all our troops, the annual ratio of mortality from synochal fevers is only three in 10,000. In Canada, Nova Scotia, and New Brunswick, the ratio of cases is ninety-six, and of deaths one and a half per 1000; in England, the ratio of the former is seventy-one and of the latter one; in the Mediterranean Commands, these ratios are 174 and two and a half; in the Bermudas, 108 and two; and in the West Indies, 139 and six per 1000. Some remarks applicable to this type of fever will be found under the following head.

TYPHUS FEVER.

Although *Typhus fever* may be liable to the same objections as Synochal, as regards its introduction into an article purporting to treat exclusively of diseases of malarial origin; yet to carry out the design of presenting a complete view of febrile affections, its consideration becomes necessary in order to show what fevers are *not* of malarial origin. The following table exhibits the ratio of cases reported as *Typhus* in each class of posts:—

RATIO OF TYPHUS FEVERS.

Divisions.	Systems of Climate.	Ratio treated per 1000 of mean strength. First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results.
North'n.	1st Class. Posts on the coast of N. England,	. .	2	2	1	5
	2d Class. Posts on Northern chain of Lakes.	1	.5	.7	1.8	4
	3d Class. Posts remote from the ocean and inland seas, - - -	.3	.1	.4	.08	.9
Mid.	1st Class. Coast from Del. Bay to Savannah,	.7	.3	1.2	1	3
	2d Class. South-western stations, - -	.2	1	1.4	1.3	4
Sou.	1st Class. Posts on the Lower Mississippi,	2	6	3	3	13
	2d Class. Posts in the Peninsula of E. Florida,	.2	. .	. .	.5	.7
	Average,	.5	1	1	1	3.5

Typhus fever is of comparative infrequency; and according to the table, its prevalence is uninfluenced either by the seasons or climate generally. As the term, *typhus*, is subject to vague and arbitrary application, it is no doubt often used to designate a *typhoid* state of fever—a supposition favored by the fact that the ratio is higher in our southern than in our northern latitudes. That it is often caused by the same miasm which produces intermittent and remittent fever, is an opinion advanced by Armstrong—a doctrine which has found but few advocates. When these morbific agents act on a system depressed and debilitated from any cause, a low or typhoid state of fever will be developed; but the phenomena of these fevers do not accord with those which characterize genuine contagious typhus—a form generated by that species of miasmata which is evolved in crowded, ill-ventilated ships, jails, hospitals, and the sordid hovels of the poor, and which when once developed elaborates, there is reason to believe, a peculiar virus communicable to those coming within the sphere of its activity. In our abundant country, real typhus is fortunately very unusual. In the Northern Division, there are reported fifty-four cases and eight deaths, and in the Middle and Southern, 110 cases and twenty-four deaths. Among our troops, the annual mortality from this disease is one in 1476 of the strength; in Canada, one in 4944; in Nova Scotia and New Brunswick, one in 6,635; in the Bermudas, one in 5860; in the West Indies, one in 12,644; in the United Kingdom, one in 1393; and in the Mediterranean Commands, comprising Gibraltar, Malta, and the Ionian Islands, the ratio is one in 10,712.

Continued fevers are modified by such varied combinations of causes both in respect to the individual and external agents, that every attempt at arranging them must necessarily be more or less conventional. The classification into synocha, synochus, and typhus, is perhaps as good as any other. To the majority of American physicians, the fact will appear strange that in the British Islands probably not above one practitioner in fifty entertains any doubt of the infectious nature of continued fever, comprising synocha, synochus, and typhus. In France and Germany, however, the opposite doctrine is generally adopted. The arguments in favor of contagion are drawn chiefly from personal observation, during many years, of the fever at Edinburgh, as well as from the history of epidemics of fevers in other large towns. As no connection can be traced with season, temperature, moisture, winds, barometric pressure, or any other appreciable condition, the opinion that it is irreconcilable with any supposition but its transmission by communication from the sick to the healthy, seems favored. It is maintained that all the forms of primary continued fever are communicable; and that even synocha or pure inflammatory fever, when prevailing with synochus and typhus in the epidemic form, constitutes no exception. The infection of continued fever is, however, generally by no means virulent, cleanliness and ventilation being sufficient to prevent its propagation.

That the purely inflammatory fever of our own country is never infectious, can scarcely be doubted, and the same may be said of the ephemeral synocha of all other regions. The peculiar character given to acute diseases among the working classes of the British isles, by the influence of predisposing causes productive of debility, as will be more fully shown in Section III, is happily among us unknown.

Upon this subject Dr. W. W. Gerhard remarks that "from the information we possess, we should conjecture that the two diseases, (British or Irish typhus and dothinenteritis,) are widely different in their symptoms, anatomical characters, treatment, and mode of transmission. . . . Dothinenteritis is by no means a rare disease in Philadelphia, although less common than in Paris. In the essay alluded to, I have established the identity of the anatomical characters and of the symptoms of the fever occurring at Philadelphia with that observed at Paris. . . The typhus fever which is so common throughout the British dominions, especially in Ireland, is not attended with ulceration or other lesion of the glands of Peyer. . . . For a period of at least ten years, there has been no epidemic of this nature at Philadelphia. In the year 1827, a large number of Irish emigrants were ill of a typhoid fever, with ulceration of the small intestines, which was probably dothinenteritis, and during several successive years there were more or less extensive epidemics of remittent and intermittent fevers occurring in the neighborhood of the city, but not often extending into the central parts of the town. In the winter of 1835–6, a form of fever not commonly met with at the hospitals was observed from time to time. It was characterized by pungent burning heat of the skin, dusky aspect of the countenance, subsultus, delirium, with great stupor and prostration, but there was no diarrhœa, and but few symptoms referrible to the alimentary canal. It was the disease which afterwards appeared as an epidemic. . . . The evidence of contagion was direct and conclusive."

In regard to the classification of fevers, there exists a confusion among writers, which it is impossible to unravel. That the term *typhoid* should have been applied to any distinct form of disease, is truly unfortunate, inasmuch as it has been generally used to designate a condition of prostration and encephalic derangement, liable to occur in many diseases. Understanding, then, by the term *typhoid fever*, the disease described under that name by Louis and Chomel, the especial anatomical character of which consists in a peculiar alteration of the glands of Peyer, it may be regarded as identical with the common continued fever of the northern and middle, if not the whole, of the United States. According to Professor Jackson, of Boston, it would appear to be the prevailing form of fever in that city and its neighborhood, and perhaps in the Eastern States generally. But many pathologists maintain that the intestinal lesion just adverted to, is merely a secondary or intercurrent affection. Recently, however, M. Louis,—the most formidable adversary of the doctrine of the contagious nature of typhoid fever,—has, with a frankness that does him honor, admitted that it may be communicated by contact, and that an isolated case may cause its general prevalence.

Ephemeral fever with us arises from exposure to the sun, vicissitudes of temperature, excessive muscular exertions, emotions of the mind, etc. *Inflammatory fever*, in cold and temperate climates, especially elevated situations, is apt to arise from atmospheric vicissitudes and other causes; but in warm countries, during dry seasons, this variety of fever, in a severe form, may be said to be endemic, more particularly among those from northern latitudes. Those lately arrived in the West Indies, more especially soldiers and sailors, are peculiarly liable to attacks of severe inflammatory fever. The predisposing causes of inflammatory fever consist, *first*, in that condition of the frame known under the name of the inflammatory diathesis, viz., high irritability and tonicity of fibre, more especially when conjoined with vascular fulness and imperfect performance of any of the secreting and excreting functions; and *second*, of those states of climate or season which tend to produce this diathesis. Hence they occur chiefly among the vigorous and plethoric and are most prevalent in cold and dry, or very warm and dry, climates or seasons. The *exciting* causes are—1. Whatever *directly* stimulates, in an inordinate manner, the nervous and vascular systems, as the intemperate use of stimulating liquors, especially in connection with atmospheric heat or vicissitudes—great bodily exertion—violent mental emotion and excitation—change of climate, more particularly migration from cold or temperate to very warm and dry regions. 2. Whatever *indirectly* induces great excitement or vascular action, as the impression of cold when the body is overheated and perspiring. Among our troops lately arrived in southern latitudes from northern regions, it is apt to occur after having lain upon the ground or in the open air, especially when exposed to the night dews—results favored by inattention to the bowels during the voyage, and the use of salt provisions and vinous or spirituous liquors.

Typhus is regarded by some as comprehending all those fevers in which the characters of adynamia or nervous depression, present themselves as the predominant feature of the disease from first to last; whilst others embrace the still more numerous class of cases in which such symptoms show themselves before the close of the first week. Typhus thus regarded is not less important than synochus in point of frequency. Of late years, it has constituted in many epidemics, for example in Britain generally and in France, almost the sole prevailing type. In some epidemics, the symptoms of cerebral congestion manifest themselves so generally and at so early a period of the disease, as to impart a peculiar character to it, described under the distinguishing name of *congestive* typhus. The predisposing and exciting causes of typhoid fevers are not considered to differ specifically from synochoid fevers, the former being more severe. They appear sporadically or epidemically, the animal economy being rendered susceptible to the impression of the exciting causes by whatever depresses or exhausts the vital and moral energies. *True* or *contagious* typhus is often confounded with synochoid and nervous fevers. Of true typhus, the chief cause is animal miasm, generated either by a number of persons confined in a close air, or by the disease itself. Of synochoid and typhoid fevers, the causes prevail more especially in the large manufacturing towns of England and Scotland, and among the poor of Ireland.

The average annual mortality from the whole class of fevers brought under investigation, is, among our troops, $4\frac{6}{10}$ per 1000 of the mean strength. Among the British troops, it is as follows :—Canada $2\frac{3}{10}$, Nova Scotia and New Brunswick $1\frac{5}{10}$, the United Kingdom $1\frac{5}{10}$, the Mediterranean stations 9, the Bermudas 11, and in the West Indies, the ratio of the Windward and Leeward command is 37, and that of the Jamaica command is 102 per 1000 of the strength. Among the white troops stationed at Jamaica, then, the ratio is twenty-five times higher than the average of our own forces; but the black troops which serve on this island enjoy a comparative exemption, the ratio being only 8 per 1000.

DIARRHŒA AND DYSENTERY.

The ratio of *Diarrhœa and Dysentery* is exhibited in the subjoined tabular abstract :—

RATIO OF DIARRHŒA AND DYSENTERY.

Divisions.	Systems of Climate.		Ratio of cases treated per 1000 of mean strength.				
			First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Annual Results
North'n.	1st Class.	Posts on the coast of New England,	14	26	108	22	170
	2d "	Posts on northern chain of Lakes,	34	54	121	49	253
	3d "	Posts remote from the ocean and inland seas,	32	54	163	56	305
Mid.	1st Class.	Coast from Delaware Bay to Savannah,	41	133	204	65	455
	2d "	South-western Stations,	62	185	223	121	597
Sou.	1st Class.	Posts on the Lower Mississippi,	126	135	117	72	456
	2d "	Posts in the Peninsula of East Florida,	111	136	125	124	495
		Average,	54	107	166	75	405

The influence of the seasons and of climate generally upon these affections is very apparent ; for, in the general average of the United States, the ratio of the third quarter is more than three-fold higher than that of the first, and more than twice as high as that of the fourth quarter. Compared with the ratios of intermitting and remitting fever, the laws developed in both exhibit a striking analogy. The average of diarrhœa and dysentery, like that of intermitting fever, is the lowest on the coast of New England, and the highest at the south-western stations ; and, like intermitting and remitting fever, the ratio augments with the increasing temperature of season and the decrease of latitude. Even the *relative* influence of the seasons, taking the average of the United States, is exemplified in proportions nearly equal : thus—

	1st qr.	2d qr.	3d qr.	4th qr.	Annual result.
Intermitting Fever, .	45	75	156	93	368
Diarrhœa & Dysentery,	54	107	166	75	405

In the Northern Division, the annual ratio of cases per 1000 is 269, and in the Middle and Southern, the mean is 526. In the former, the proportion of deaths to the number treated is one in 665, and in the latter one in 141. The mortality per 10,000 of the strength is respectively four and thirty-seven. In the Northern Division, no death from dysentery is reported except at Forts Crawford and Leavenworth—two posts at which intermittents are very prevalent. In Florida, it has been seen that there is presented a singular relation, on comparing the second and third quarters, between intermittent fever and the class of diseases of the digestive organs, which last comprises diarrhœa, dysentery, gastritis, enteritis, etc. Whilst in the second quarter, the ratio of the former is lower than that of the latter, in the third the reverse occurs. It would seem, assuming an identity of cause in regard to the origin of these affections, that the same morbific agents operating in a less intense degree, produce in the second quarter diseases of the digestive organs, and when more concentrated in their action, as in the third quarter, intermittent fever. A reference to the table will show that, in East Florida, the ratio of diarrhœa and dysentery is nearly the same in each season—a result arising mainly from the great prevalence of chronic diarrhœa, which supervenes upon febrile affections, continues throughout the year, and ultimately in many cases proves fatal.

In the West Indies, diseases of the stomach and bowels are very prevalent and fatal. Among the white troops, the ratio of cases per 1000 is 351 and the deaths fifteen; and among the blacks, the former is eighty-nine and the latter six. It is in the Windward and Leeward Command, that this class of diseases prevails most fatally, the proportion attacked annually being 421 per 1000, whilst in England it is only ninety-five; and in the former, the ratio of mortality from this source, which is twenty-one per 100, is forty times higher. The much lower ratio of gastric and intestinal affections in the Jamaica command, in which dysentery and diarrhœa in particular assume a mild and tractable form, is ascribed to the circumstance that instead of salt meat, much fresh provisions are supplied. The statistics of twenty years show that in one command in which the diet, for five days in the week, consisted of salt provisions, the mortality from this class of diseases was nine times as high as among the officers; whilst in another, in which salt provisions were issued but two days in the week, the mortality of these two ranks was nearly alike. In the Mediterranean stations, it is further asserted that at Gibraltar, where much salt provisions are consumed, this class of diseases is both prevalent and fatal, whilst at Malta, where the troops enjoy the advantage of fresh provisions, the disease does not prevail in an aggravated form. Among our troops, as the same ration is issued every where, it is highly probable that a quantity of salted pork which may be eaten with impunity in our northern regions, will become, in our southern domains, the active source of disease. In Canada, Nova Scotia, and New Brunswick, the annual ratio of the class of diseases of the stomach and bowels, is only 123 per 1000, and the ratio of mortality two per 3000 of the strength.

As diarrhœa and dysentery, in France and England, generally assume a very mild type and yield readily to ordinary remedies, we find that the writers of those countries pass over them with comparative neglect. In the United States, however, which has in summer a tropicoid climate, these affections, it has been seen, prevail most extensively, especially south of the 40th degree of latitude.

Without attempting a description of these diseases, it may be remarked that dysentery in temperate and tropical regions presents characters so distinct as to merit separate consideration. The distinction lies in the extent of bowel implicated, a larger portion of the intestine being affected with inflammation in tropical climates. This refers to uncomplicated dysentery, the grades of intensity of which vary from the slight sporadic case, which threatens no danger to life, to the fatal epidemic which has so often proved the scourge of fleets and armies. The complications of dysentery are frequently met with in our southern regions ; and the prevalence of chronic diarrhœa in Florida as a sequela of fevers—a disease that is very intractable in its nature—has just been noticed. The complication of dysentery with typhus, which occurs under the operation of debilitating causes, as want of food, neglect of cleanliness, and ventilation when many persons are crowded into a small space, has often proved more fatal to the garrisons of beseiged towns than the assaults of the enemy. Cleanliness is, therefore, the life of an army, the Jewish code, enjoining ablutions and purifications as religious rites, having been fitly quoted as a system adapted to a camp. The connection of diarrhœa and dysentery with malarial causes in the United States, it is believed, has been abundantly established.

The opinion that *Cholera* (*common or sporadic*) and *Colic* are much dependent on exalted temperature is not corroborated by these statistical researches. In the Northern Division, the annual ratio of cases per 1000 is 145, and in the Middle and Southern 131. In the former, however, nearly one half of the cases (1445) are reported among the cadets at West Point in a mean aggregate strength of

734. Excluding this post, the ratio of the Northern Division is reduced to ninety-six. In the Northern Division, only two deaths in 3221 cases are reported; and in the Middle and Southern, seven in 3282.

Of *Epidemic* or *Malignant Cholera*, there were reported in 1832, 1833, 1834, and 1835, 686 cases, of which 191 proved fatal. This, however, does not include all, as many troops, in the campaign against Black Hawk in 1832, fell victims to the disease, of which no official returns were made. It proved more fatal in the Northern than in the Southern and Middle Divisions, the ratio of deaths being in the former one to three cases, and in the latter one to $4\frac{3}{10}$. It is not, however, to be inferred from this fact that Cholera asphyxia causes greater mortality in cold than in warm countries; for it was in the summer of 1832, when the disease was producing its greatest havoc, that our northern troops encountered it on its first invasion by way of Quebec and the lakes, along which it travelled with post-like regularity. On the contrary, it is a well-established fact that this disease is, in a measure, controlled by exalted temperature, and consequently influenced by causes of malarious origin. This was, at the time of its prevalence, inferred from the circumstances that it prevailed mostly in the summer and followed the course of our rivers; but statistical facts among our troops, in reference to the influence of the seasons, place this opinion almost beyond a doubt. Thus, among the 191 deaths reported, in the four years mentioned above, there occurred in the first quarter 4, in the second 22, in the third 153, and in the fourth 12. But this subject will demand special consideration in the sequel.

Another class of diseases ascribable, in a great measure, to malarious causes, is that of *Dropsies*. In the Northern Division of the United States, there are reported fifty cases and four deaths, and in the Middle and Southern, 206 cases and nineteen deaths, the annual average of cases being in the former two, and in the latter eight per 1000. As these effusions are the result mostly of febrile affections, it follows that malaria is the indirect cause; but in our southern latitudes, much is also attributable to the deleterious effects induced by ebriety. In the West Indies, the ratio of admissions and deaths from these affections, which are mostly the sequences of fevers, is also very high. Compared with England, the ratio in the Windward and Leeward command is nearly as eight to one.

Of *Hepatic Affections*, including acute and chronic hepatitis and icterus, there are reported, in the Northern Division, ninety-eight cases and three deaths, and in the Southern and Middle, 166 cases and four deaths. As these diseases are generally believed to have an intimate relation with tropical temperature and with causes of malarious origin, this comparative result is very surprising; and, indeed, were it not confirmed by the British statistics, the writer would have suspected some error in his own calculations. The ratios of cases and of deaths per 1000 of the strength, given in different countries, are as follows:

	Cases.	Deaths.
United States, - - - - -	6	.2
Canada, Nova Scotia, & N. Brunswick,	8	.2
United Kingdom, - - - - -	8	.5
Mediterranean Stations, - - -	16	.7
Bermudas, - - - - -	14	.5
West Indies,—White Troops, - -	18	1.5
" " Black " - -	5	.7

When we refer to the fact that the high ratios occur among troops from northern latitudes, in the Mediterranean stations, the Bermudas, and among the white troops of the West Indies, it may be fairly inferred that these diseases are little influenced by temperature. In the British army statistics, it is remarked that considering the high temperature of the island of Jamaica, it will seem strange that the ratio of admissions from diseases of the liver, compared with troops in Britain, is only as ten to eight, and the deaths as one to four-tenths. It is in the East Indies that hepatitis finds a climate peculiarly favorable to its development. It is now known that the calculation of Mr. Annesley that the annual per centage of hepatitis in the East Indies is at least treble what it is in the Western hemisphere, falls far short of the reality. It is obvious, however, that the elevated temperature of tropical regions, independent of other causes, is positively detrimental to health. The absorbents of the intestines being maintained in a state of erethism by the constant evaporation by cutaneous and pulmonary transpiration, a morbid condition is readily assumed under favorable exciting influences. Diarrhœa, dysentery, and those bilious derangements which accompany fevers, as well as cholera and hepatitis in a less degree, are consequently prevailing affections.

In reference to the ratio of mortality arising from specific diseases, it may be well to recur to the fact that as the causes of one-eighth part of the deaths among our troops are not designated in the returns, it follows that the averages given are too low ; but as a majority of these unspecified deaths belongs to the class of sudden or casualties, it may be fairly assumed that the ratio of mortality from each disease is not more than a sixteenth or a twentieth below the actual result. These statistical facts will be now concluded with a table exhibiting the relative monthly mortality in the northern and southern regions of the United States, based on the returns made by the commanding officer of each post, during a period of ten years.

Divisions.	Mean aggregate strength.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
Northern.	22240	22	27	26	26	32	28	55	41	39	25	37	40	398
Middle & South'n	24979	77	76	74	61	84	105	117	144	160	139	115	82	1234

In the Northern Division, there is little disparity in the relative mortality of each month, as the high ratio of July is caused by epidemic cholera ; but in the Middle and Southern Divisions, the inequality is great, having considerable relation with the increase and decrease of temperature. The lowest ratio (61) is in April, from which month it increases gradually until September (160,) and then it decreases in the same unvarying gradation, in proportion as the influence of the "sickly season" upon the animal economy subsides, until the re-appearance of April. In this gradation, there is no exception, the increase and decrease being a regular progression step by step. The influences of causes of a malarial nature upon mortality in our southern latitudes is thus illustrated ; but these effects are not manifested in our northern regions, owing to the circumstance that the diseases developed by malarious causes, such as intermittent fever, unlike the violent remittents of the south, do not exert a fatal tendency. In the Northern Division, according to the post-returns given above, the annual ratio of mortality is $1\frac{8}{10}$ per cent., and in the Middle and Southern $4\frac{9}{10}$, whilst the mean of the three Divisions is $3\frac{5}{10}$ per cent. According to the regimental returns, the mortality for the same ten years, is $4\frac{4}{10}$ per cent. In the Middle and Southern Divisions, the ratio of cases under treatment is 50 per cent. higher than in the Northern ; and the proportion of deaths to the number treated is nearly twice as high, the average of the former being one in seventy-five, and of the latter one in 144.

Having completed the investigation of the results afforded by the statistics of the United States troops, so far as diseases imputed to malarious sources are concerned, it remains to make some practical application of the laws developed. The subjoined classification of infectious agents, adopted in Copland's Dictionary of Practical Medicine, is presented merely as expressing the general sentiment of the profession upon the subject. Under the class of *ideo-infectants* or non-disseminating and non-perpetuating infections, his first order of agents, is, *Miasms or mephitic vapors*,—endemic infection acting through the air.

Species of agents.	*Diseases resulting therefrom.*
1. Miasm from decayed vegetable matter aided by moisture, in temperate ranges of atmospheric heat.	Catarrhal fever. Rheumatic attacks. Intermittents. Enlargements of the spleen., and torpid states of the liver.
2. Exhalations from absorbent, or deep exuberant, or marshy soils, suspended in atmospheric humidity at temperate grades of warmth.	Intermittents. Remittents. Simple dysentery. Simple cholera. Bilious fevers. Obstructions and other diseases of the liver and glandular organs.
3. Miasm or vapors from decayed vegetable matter, or from marshes and rich, deep, and humid soils, at high ranges of temperature.	Inflammatory, bilious, and gastric fevers of both a remittent and continued type. Diseases chiefly of the abdominal viscera.

Epidemic and exanthematic typhus and true yellow fever are put under the head of specific infections, which propagate their kind by a diffused and impalpable effluvium or vapor, emanating from the secretions, excretions, and surfaces of persons already affected. It need scarcely be added that the propriety of placing yellow fever in the same category with typhus, may be reasonably doubted. It is probable, however, as already remarked, that fevers which have, or are supposed to have, their source in vegetable miasms, or at least in effluvia from marshes, may subsequently spread by contagion.

Upon what evidence it is asserted that "catarrhal fever" and "rheumatic attacks" arise from "miasm from decayed vegetable matter aided by moisture, in temperate ranges of atmospheric heat," it were no easy matter to determine. In medicine, we are too apt to revere the *verba magistri*, teachers and writers blindly repeating and copying the dicta of predecessors, as if oracular. That catarrhal fever has not the remotest connection with malarial causes, is demonstrated by the statistics of our troops. As the ratio of intermittent and remittent fever is about five times higher in our southern than northern latitudes, and as that of catarrhal affections is twice as high in the latter, it follows that as the results are in an *inverse* proportion, no relation of cause and effect is discoverable. As the classification, however, limits the production of catarrhal fever to "temperate ranges of atmospheric heat, aided by moisture," it may be said that it applies only to our northern regions. In diametrical opposition then to this view, it is found that in the winter, when no "miasm from decayed vegetable matter" arises, the ratio is twice as high as in summer; and that the annual ratio in the moist climate of the lakes and the coast of New England is not more than half as high as that of the dry climate of the regions remote from large bodies of water. In reference to Rheumatism, the same remarks are applicable, but in a less marked degree. Acute rheumatism, it is true, is sometimes complicated in miasmatic districts with conspicuous derangement of the biliary organs, which, like *bilious pleurisy*, is the result of the super-added operation of malaria on the system. And the fallacy of Copland's third division in regard to "inflammatory" fever of a "continued type," has been also established by the most conclusive statistical evidence.

Thus far the writer has dealt pretty much in facts; but in entering upon the investigation of the essential nature of the effluvium from marshes, termed malaria, he feels that he has passed into the regions of speculation. The history of medical science shows that the subject of *Fever* has, at all times, been regarded as presenting the most extensive and inviting field for observation and the exercise of a philosophic mind. This arises from its paramount importance among the long list of human maladies. It is a subject, at the same time, eminently calculated to humble the pride of human reason; inasmuch as the mind of man, engaged upon it for near three thousand years, has failed to determine its essential nature or causes.

The causes of epidemic, endemic, and contagious diseases, have never received satisfactory elucidation. Notwithstanding we are acquainted with some of the laws which govern malaria, we can no more describe the *constitutio aeris*, which gives rise to endemico-epidemics, than we can define the inscrutable vapors which generate typhus fever or small-pox. In these researches, the object has been rather to point out effects than to speculate upon causes; and although some of the laws by which diseases of malarial origin are controlled in reference to the seasons and our systems of climate, have been developed, yet our knowledge of meteorology is wholly insufficient for the explanation of the precise nature or operation of such influences.

As endemic diseases are produced by a concurrence of causes acting constantly or periodically in certain localities, so it may be supposed that the diseases of each are no less dependent upon peculiar physical causes than its animal, vegetable, or mineral productions. As the influence of a certain temperature in connection with the nature of soil gives an inexplicable peculiarity to vegetation,which we cannot imitate by artificial means ; so certain diseases are confined to specific localities,—some appear periodically in certain situations,—whilst others are rife in particular seasons, influenced by the various causes which modify the constitution of climate. Difference of climate, as it regards its agency upon health and the organic modifications which the human frame experiences from this cause, depends not less upon certain emanations from the soil, composed of organic remains and comminuted mineral substances, than upon those other conditions of the atmosphere, arising from its hygrometrical, thermometrical, barometrical, and electrical states. Although the morbific cause may be general and widely diffused, yet it is mostly modified by local influence, constituting an *endemico-epidemic*. An example in point is presented in the history of epidemic cholera, the visitations of which, in the United States at least, were much favored by the high temperature of summer and by the peculiar atmosphere of towns situated on seas and rivers. We sometimes see a district signalized for its salubrity, desolated by a malignant fever, the production of which required a combination of certain local and general causes; but as this precise concatenation of causes may never re-occur, so the inhabitants may remain exempt from a similar scourge. The occasional appearance of yellow fever in our northern cities may be thus explained. When, on the contrary, a particular disease appears every year in a certain locality, it may be presumed that the local causes, influenced by season alone, are always present, and that it requires but little change in the general atmospheric constitution to induce the necessary causation. We may thus account for the high ratio of intermittent fever in many parts of the United States and of remittent fever in the southern regions, and for the annual appearance in some of our southern sea-ports of yellow fever,—a disease which is no doubt indissolubly connected with climate, more especially as modified by temperature and the nature of soil. As an illustration of the remark that malaria sometimes makes its appearance in places which had previously enjoyed a complete exemption, it may be mentioned that, at the Narrows near New York, intermittents and remittents appeared, in 1828, in their severest forms among the laborers employed in the erection of Fort Hamilton; and, at the same time, Staten Island and the elevated coast of Long Island in the vicinity of the Narrows, where a case of intermitting fever had been almost unknown, became so subject to these febrile diseases, as to drive the inhabitants from their possessions. In like manner, on the elevated banks of the Schuylkill, villas were erected at a time when intermittents were scarcely known; but, in consequence of their great prevalence in late years, many of them have been abandoned.

The modifications of the atmosphere which give rise to epidemic, endemic, and contagious diseases, have proved totally inappreciable, by eudiometic researches. That the comparative unhealthiness of low, swampy situations, depends upon an admixture of terrestrial emanations with the common atmospheric elements, is obvious; but these agents, if we except the recent experiments of Majendie, have always escaped the researches of the chemical analyst. As our *false* facts are numerous, the speculatist has consequently found, in the obscurity of this subject, ample scope for hypothesis.

The extensive investigations made by M. Julia of Lyons upon the atmosphere of localities in which ague is prevalent, afford all that is known upon this subject:—1. The air of these situations does not differ from that of the most healthy places in any of the principles which chemical analysis can detect. 2. A principle, which eludes the test of the most delicate chemical re-agents, is contained in the air of marshes. 3. There is reason to believe that the deleterious influence of the noxious vapor, though its nature is unknown, depends on particles of putrid animal or vegetable matter dissolved and suspended in aqueous vapor, or on the gases resulting from their decomposition. 4. The existence of azotic gas, carburetted hydrogen, ammoniacal gas, or, in a word, any of the gases disengaged from bodies in a state of putrefaction, has not yet been demonstrated in marsh air by experiment.

Professor R. Dunglison, in his "Elements of Hygiene," remarks as follows:—"By some writers on malaria, it has been ascribed to vegetable putrefaction; by others, to aqueous or to animal putrefaction, or to different combinations of these; but we shall attempt to show, that there is no positive—no historical evidence—that any one, or any combination, of these varieties of putrefaction does ever occasion, even in marshy districts where the poison exists in greatest abundance, malarious or miasmatic diseases."

Although Dr. D. has brought to the investigation of this subject a philosophic mind, and has demonstrated how little we really know about it, and how fallacious are many of the opinions generally regarded as canonical; yet the unprejudiced mind, in viewing the whole question, notwithstanding the impracticability of demonstrating the precise nature of *marsh poison*, is inclined to adhere, satisfied to argue from effects, to the opinion sanctioned by the general consent of mankind, viz., *that malaria has its source in organic remains.* One fact is evident, viz., that a marshy soil, previously submerged, exposed to the action of solar heat, will develope that mysterious and subtle agent, called *malaria*; and that this emanation is the result of the decomposition of dead organic substances, producing new compounds by the combination of their elements, is an opinion warranted by the strongest evidence short of demonstration. We know from experience that marshy districts in almost all countries, are the *foyers* of disease, and that the deltas of large rivers are apt to teem with malarious exhalations. The *detritus* thus annually brought down rivers, no matter whether united with earths of a sandy, a calcareous, or an argillaceous nature, will give rise to these miasmata; but soils of a humid character are doubtless best calculated to maintain these organic remains in a condition favorable for solar action. It was remarked of old that the inundations of the Nile, at the same time, scatter fertility over the valley of Egypt, and sow with a liberal hand the prolific seeds of disease. The knowledge that we possess on this subject would enable us, on viewing the topography of the Lower Mississippi in connection with its laws of atmospheric temperature and moisture, to pronounce at once upon the true character of the soil; and in surveying the locality of Fort Gibson, originally a cane-brake, formed of the alluvion of three streams, whilst the exhalations of miry lagoons are, during the extraordinary heats of summer, wafted over the fort by the prevailing winds, the presence of the physical conditions causing malarious diseases, would be immediately recognized.

One of the circumstances most essentially connected with the production of malaria, is heat; for, in proportion as the equatorial regions are approached, do febrile endemics become more rife and malignant,—a remark which applies equally to the relative influence of the seasons. Heat alone is not, however, sufficient, inasmuch as the diseases of the Nile never extend into the neighboring desert; and in like manner, in our southern regions, whilst the margins of streams, lakes, and marshes are rife with malarial diseases, the sandy pine woods are exempt from them. Moreover in surveying the topography of the United States, it is found that, in regions decidedly malarial, the military posts which have a dry and sandy soil, possess a like exemption, as will be further shown in Section III. As all those cities and military stations, which have been, in every quarter of the world, the graves of unnumbered thousands, have occupied the banks or deltas of rivers, in low flat countries, it would seem that moisture is also an essential ingredient in its production; but these two agents, heat and moisture, however requisite, are not in themselves adequate causes; for vessels at a small distance from the land, in the rainy season of the hottest climate, will continue healthy, if proper police regulations are maintained. It appears then that heat and moisture, however essential, require the co-operation of other agents. What these conditions are, has been plainly indicated at all periods of the world. The same causes that were in action on the banks of the Nile, the Lernean marshes, and the Campania di Roma, are now found in operation in the rice swamps of our southern States and the marshy low lands that skirt the coast and rivers from Delaware Bay southward, viz., *a soil abounding in organic remains*. In the operation of heat and moisture, however, this striking distinction obtains, that heat acts in proportion to its intensity, whilst excess of moisture is no less inimical to the generation of malaria than its deficiency. Hence it is necessary in considering the conditions most favorable to the evolution of malaria, to distinguish between a moist and a rainy season. To submerge completely marshy lands, it is well known, is one of the means of obviating their insalubrity. Animal and vegetable decomposition is regulated by the degree of heat and moisture combined. If moisture be increased until the air is excluded from the vegetable matter, decomposition is suspended; and the same effect is induced, if the temperature be reduced to the freezing point, or increased until all moisture is dissipated. The body of an animal is no less preserved in the arid deserts of Africa than in the frigid polar regions. In the one case, the fluids are congealed, and in the other so quickly evaporated that it actually becomes a dried preparation.

Although the essential causes of malaria may remain forever involved in obscurity, yet the important agency of heat and moisture in its causation, as shown in the statistics of our troops in the fact that the annual ratio of intermittents and remittents is five-fold greater in our southern than northern latitudes, and that a contrast equally great is exhibited between the first and third quarters of the year, is satisfactorily demonstrated. These laws are confirmed by the results of the British statistics, which, as the average of each month is given, illustrate still more fully the influence of the seasons. As the sun proceeds northward in the ecliptic, bearing in his train heat and moisture, the northern colonies of the West Indies experience later than the southern ones, the period termed the unhealthy season. It has also been observed that in the Mediterranean stations, the ratio of admissions and deaths between July and October is nearly twice as high as at any other period of the year. The statistics of Canada lead to the same result, but in a less marked degree. The most striking exemplification of the law that the "sickly season" coincides with the time when the greatest degree of heat and moisture is combined, is afforded in the fact that positions north and south of the equator, in consequence of the seasons being reversed, become most insalubrious at periods precisely opposite.

In the ratio of diseases of malarial origin, there is great variation from year to year. At Fort Crawford, Wiskonsan, lat. 43° 3′, for example, there were reported, in the third quarter of 1830, 154 cases of intermittent and remittent fever, and in the same quarter of 1836, there occurred but one case, notwithstanding the strength was greater. Believing that temperature had some relation with this wide disparity, the results were arranged as exhibited in the description of Fort Crawford. As there are doubtless many modifying causes, the precise influence of elevated temperature cannot be determined; but it is seen in the table referred to that in 1830, when the mean temperature of July and August was highest, the ratio of intermitting and remitting fever was 72 cases per 100 men, and that in 1836, when the temperature was lowest, the average was only 4 per thousand. The years 1835 and 1832 are the lowest next in order, both in regard to temperature and the prevalence of fevers. The observations on the udometer are too limited to afford data for comparison; but even the facts connected with temperature alone show that if we had, at the same time, observations on the dew-point, some important inferences might be deduced. As a high dew-point not only favors the production of malaria, but renders the atmosphere a good conductor of the positive electricity of the earth, and at the same time checks evaporation from the surface of the body thus causing a marked derangement of its functions, we here behold a combination of circumstances in which the subject of malaria may ultimately find an explanation.

In further elucidation of the influence of temperature, another example presents itself in the island of Jamaica; for as the elevation of the lands in the interior causes a corresponding modification of climate, every degree of salubrity, as already observed, is found. At Maroon Town, elevated more than 2000 feet above the level of the sea, the annual mortality of the troops is only 33 per 1000, notwithstanding many of the deaths originated from disease contracted at other stations; whilst at Montego Bay on the coast, the ratio rises to 179, and at Savannah La Mar, even to 200. On comparing the endemic influences of our Atlantic Plain with the mountain regions on the same parallels, from the Delaware to the Mississippi, common observation not based on statistical facts, points out analogous contrasts.

In the production of malaria, there may consequently be other agents at work equally essential with heat and moisture. Between miasmata and mere effluvia, there is no doubt a wide distinction. The latter, which are nothing more than the elements of a compound body, are generally as innoxious as the compound itself; but the former may be new compounds, resulting from the play of affinities among these liberated atoms. As the ordinary operations of nature do not tend to her own destruction, so organic substances, it may be supposed, are decomposed, and the atoms re-united in such combinations as generally prove harmless to man. The work-shop of the "knacker," whose occupation is to convert dead animal matter to various useful purposes, though repulsively offensive, is not unwholesome; and the tainted atmosphere of the dissecting room, breathed month after month, generates no endemic fever. Morbid action seems, therefore, not to be induced by the mere decomposition of matter, but by the combinations which, under peculiar circumstances, result. Thus it is an ordinary law of nature that the human body, when life is extinguished, shall return to its original elements; but under certain modifying circumstances, it is converted into *adipocire*. The mere effluvia of dead animal or vegetable matter may differ as much from malarial poison, as oxygen or hydrogen does from the various compounds of which it forms a component part. These miasmatic compounds, generated under different circumstances, or the same causes acting upon different constitutions or upon different states of the same constitution, produce, it may be assumed, in one case intermittent fever, in another remittent, and *perhaps* in a third that higher grade known as yellow fever.

Observation has also made us acquainted with certain of the physical qualities of malaria, which, like its general effects on the human system, are known rather by inference than actual demonstration. As it possesses a greater specific gravity than atmospheric air, it cannot ascend into it without being attached and carried up by lighter bodies,—a vehicle which consists, doubtless, generally, perhaps always, of aqueous vapor. Hence persons sleeping on ground floors are more apt to contract malarious disease than such as are lodged in elevated chambers; and hence, too, the greater salubrity of hills than the adjacent low grounds, unless the aqueous vapor of the latter with the miasmata which it holds in solution, impinges and settles on the former. Another of its physical qualities is inferred from the fact that there is a greater liability of contracting malarial diseases from exposure between the rising and the setting of the sun; for then the aqueous vapor, carrying with it the deleterious miasmatic particles, is most abundantly precipitated to the surface of the earth. In confirmation of these views, we also find that whatever is capable of intercepting the progress of aqueous vapor, as the interposition of a grove of trees or of a high wall, will arrest the passage of malaria from its source to other parts. Violent storms and copious floods of rain, likewise, tend powerfully to free the air from malaria,—a result frequently observed in the cessation of endemico-epidemics immediately after such occurrences.

To prove that malaria is not the product of vegetable decomposition, frequent reference is made to the fact observed by Dr. Ferguson, that malarious fevers prevailed to a great extent among the British troops when encamped on the rocky and arid tracts near Lisbon in Spain. "In the month of June and July," he says, "the British army marched through the singularly dry, rocky, and elevated country on the confines of Portugal, the weather having been previously so hot, for several weeks, as to dry up the mountain streams. In some of the hilly ravines, *that had lately been water-courses*, several regiments took up their bivouac, for the sake of being near the stagnant pools of water that were still left among the rocks. Many men were seized with intermittent fever." Notwithstanding a country may be arid and parched, the heavy dews at night, without reference to the moisture beneath the surface, may be sufficient in "*ravines that had lately been water-courses*," to cause the generation of marsh miasmata. As every soil productive of vegetation contains organic remains, so it is impregnated with one at least of the elements of malaria. Should the temperature be low as in winter, no poison is generated. Should moisture be wanting or water super-abound, the same result may be predicted. Even admitting that these "water-courses" were rocky channels, enough of organic remains may have been deposited by the recent "mountain-streams" to produce, when acted upon by the moisture of dews, the results that followed.

In the recent Statistical Reports of the British army, the reporter arrives at the conclusion, from an examination of the subject in every quarter of the globe, that the prevalence of intermittent and remittent fever does not depend materially on the influence of moisture or high temperature; aye, and more than this, it is alleged "that though the vicinity of marshy or swampy ground *appears* to favor the development of that agency [malaria,] it does not necessarily prevail in such localities, nor are they *by any means essential* either to its existence or operation." This opinion is based, among other facts, upon the circumstance that intermittents are very rife in Upper Canada, whilst in Nova Scotia, under circumstances apparently similar, the inhabitants enjoy an exemption; and that yellow fever frequently appears at Ireland island, one of the Bermudas, a rocky and barren spot, containing no marsh and little or no vegetation. In reply to this, it may be said that in reference to the cause of yellow fever, we know but little, and are wholly unauthorized to ascribe it positively to paludal origin; and as to the induction by which intermittent fever is traced to the agency of a marshy locality, notwithstanding the exceptions adduced in Nova Scotia, (a cause for the exemption on the coast of New England having been assigned,) the every day experience of our army surgeons and of the practitioners of our newly settled regions, confirms its truth.

In Canada and the United States, it is a fact well known from their earliest history, that although cultivation renders a climate more salubrious, yet its endemic diseases, for several years after the soil is cleared from its more bulky vegetable productions, often become more severe than previously, and not unfrequently assume an epidemic character. The surface of the earth exposed to the sun's rays, yields a more noxious effluvium than when protected from its action by a dense and exuberant vegetation. That a partially cultivated region is more sickly than a wilderness or country in the highest state of agricultural improvement, is a well known fact. The soldier, the hunter, and the wild borderer, suffer less from disease than the actual settler. The diseases of the former class are mostly of an inflammatory character resulting from fatigue and exposure; but as soon as the permanent settler begins to fell the forest, leaving the branches to undergo decomposition, and to turn up to the action of our intense summer heats the marshy ground, composed of the accumulated vegetable and animal deposition of years, deleterious agents are exhaled, giving rise to the most malignant endemics.

An example of this kind fell under the observation of the author, when stationed at Fort King, in the interior of East Florida, in the summer of 1837. This post, the old Seminole Agency, which had been maintained for some years prior to Indian hostilities, was always remarkable for its healthfulness; but in the latter part of the summer just mentioned, violent fevers of the remittent form and intermittents running into the same type, occurred, ascribable apparently to the circumstance of the smaller trees and undergrowth of a vicinal jungle, called a *hummock*, having been cut down as a precaution against Indian ambuscade. Much of the surface of this hummock consisted of a trembling soil, to many yards of which motion might be communicated by an effort simply of the foot. This crust, which would bear the weight of a dog, would not sustain that of a horse, as was proved by several sad illustrations.

It is remarked by Dr. Rush in reference to the endemics of Pennsylvania that intermittents and mild remittents were converted, from this cause, into bilious and malignant remittents and destructive epidemics; and that it was not until after years of cultivation, that general salubrity followed. Analogous results have been observed throughout the United States, with the advance of civilization. Dr. Heustis, formerly of the United States army, in some medico-topographical remarks on Alabama, thus observes: "For the first three years after my arrival in this State, in 1821, 1822, and 1823, the country was dreadfully sickly, and the mortality great and appalling, more especially near the rivers. The whole country was then new, and the warmth and humidity of the seasons caused a great and rapid decomposition in the recently exposed and turned up vegetable matters. Many flourishing towns upon the rivers, which had risen up, as it were, by the hand of enchantment, received a sudden check, and became suddenly almost totally abandoned from death and desertion. Strangers from every part of the United States, invited by the fertility of the soil, the beauty of the country, and the serenity of the climate, brought together by fortuitous association, with foreign and unseasoned constitutions, were suddenly swept off by thousands. In many families there were not well persons sufficient to attend upon the sick and dying. Never have I known a time of such general calamity." Similar epidemics, which were grafted on endemics as the parent stock, have been noticed by Dr. Hildreth as being of the most fatal character throughout the valley of the Ohio. The epidemic of 1823 and 1824, varying in its attacks from the mildest intermittents to the most malignant remittents, extended east of the Alleghanies through Pennsylvania. The epidemic of 1823, says Dr. Cartwright of Natchez, was probably the most terrible that ever prevailed in the United States.

That our troops suffer less from disease in the region of East Florida, which is still in a state of nature, than in the cultivated district of the south-western posts, can, therefore, be easily understood. It is true that this may in part be ascribed to the circumstance that in the latter the summer heats are higher; but, on the other hand, we find that in the cultivated portion of East Florida bordering on Georgia, as well as in Middle Florida, disease is more rife than in the Peninsula generally.

Allusion may here be made to the recent experiments of Majendie, without attempting to base any argument upon them. He states that having condensed, by means of cold and other agents, a quantity of marsh atmosphere, a considerable residium of animal or vegetable matter was obtained, which had a tendency to run into putrefaction with the greatest rapidity. Having performed a series of experiments upon animals by injecting this matter into the veins, M. Majendie discovered that the lesions pathognomonic of *yellow fever*, were induced. In an animal, which died two hours after the injection of a little putrid matter into the veins, autopsy revealed the following lesions: The blood was liquefied, and the muscles exhibited a remarkable punctuated red coloration, caused by a vast number of petechiæ; and the mucous coat of the intestines was found raised by a deposition of blood in the subjacent cellular tissue, and the surface covered with large patches of albumen and mucus. The partizans of inflammation would, according to Majendie, regard this as a case of decided gastro-enteritis; but he can see nothing more in it than the distension of the capillery vessels with blackish fluid blood, which having become dissociated in its elements, partially transudes the intestinal tunics. These experiments oft repeated presented the same pathological phenomena, more or less marked in proportion to the duration of the disease before causing death.

That these disorders are not the result of a general cause is evident from the fact, that the injection of different substances will produce specific lesions of different organs. Thus subcarbonate of soda disorganizes the thoracic viscera: the lungs become distended with blood, which gushes out when an incision is made into their substance, and a bloody fluid is effused into the pleura, constituting, in the nomenclature of pathologists, a case of pleuro-pneumonia. The blood when liquefied by the subcarbonate of soda, exercises, indeed, a specific influence; for the various tissues and organs of the abdominal cavity are found in a normal condition.

In those cases in which death very quickly follows the introduction of a few drops of putrid water into the veins, causing the ejection by vomiting of a blackish clammy liquid, like that in yellow fever, and the mucous membrane is found covered, throughout its whole extent, with extravasations of blood, Majendie attributes the result to a change in the constitution of the blood, and not to a modification in the properties of the walls of the vessels. This change in the properties of the blood, which is no longer adapted to that of the ducts in which it flows, he regards as the first link in the chain of abnormal actions, whilst the organic lesions are secondary phenomena.

These experiments afford corroborative evidence of the opinion that malaria has its source in organic remains, the connection between which does not depend upon a *limited*, but a comprehensive induction of facts. Heretofore, the etiologist could argue only from effects; and when he found that certain results always followed the conjoint operation of certain causes, he was justified, upon every principle of analogy, to assume the existence of the relation of cause and effect. Now, however, it may be said that malaria has, in a measure, been compelled to put on a tangible shape and to confess its secret power, thus almost demonstrating its effects on the animal economy. The subject, however, is still enveloped in deep obscurity; and to him fortunate enough to enrich science by unravelling its mysteries, a proud immortality is destined.

D.—MALIGNANT OR EPIDEMIC CHOLERA,

An account of its progress through the United States, chiefly so far as the Army is concerned.—Its mortality compared with the statistics of troops in other countries.—Causes by which it was influenced in the United States.

Notwithstanding the numberless observations which have been made in so many different regions of the globe, in regard to the mode of diffusion of this "*nova pestis*," the question is still involved in impenetrable obscurity. It is not, however, intended to enter into a detailed account of this mysterious malady, which, in its gradual diffusion over the civilized and barbarian world, from the centre of

Asia to the interior wilds of America, has surmounted obstacles that have hitherto arrested the progress of the plague. With an equal pace, it traversed the sandy deserts of Arabia and Persia, making its way against the winds in Europe; in spite of the monsoons, it passed the Indian ocean; and subsequently the mighty Atlantic was found to present no barrier. It existed under the most diverse conditions of climate in reference to soil, elevation, temperature, and moisture;—equally on the arid soils of the Eastern deserts and the marshy deltas of the Ganges and the Nile,—equally at the level of the sea and at an altitude of 5000 feet,—equally during the summer heats of the torrid zone and the rigors of a Russian winter,—equally on the humid shores of the ocean and in the dry atmosphere of localities far inland. Although it continually advanced under circumstances so opposite, its characters were always identical; but the fact that the morbid poison spread most rapidly and with the greatest virulence in the low, filthy, and crowded districts of large towns, is a feature everywhere observed in its history; and in the United States, it is equally apparent that it was influenced, as will be demonstrated, by temperature and other causes regarded as of malarial origin. In this country, as well as Europe generally, it ceased mostly within two years of its first invasion, appearing with us in 1832, again, but in a much more limited degree, in 1833, and in the years 1834 and 1835, with a still feebler manifestation,—a fact scarcely explicable on the hypothesis that the disease is communicated by contagion.

As this epidemic has been referred to several times in the preceding pages, it is deemed fitting to present a succinct account of its progress through the United States, chiefly so far as the Army is concerned, extracted from several reports made at the period of its prevalence.

It was in June, 1832, that Asiatic Cholera first made its appearance on the north-east coast of America, and spread with fatal rapidity along the great water-courses on our northern frontier. Whilst one branch of the epidemic passed down the Hudson to New York, another continued west along the great lakes, until, in September, it reached some of our military posts on the Upper Mississippi. As the Sac and Fox Indians, headed by Black Hawk, were at this time in open hostility, our troops in marching towards the theatre of war, became exposed to the influence of the epidemic. Speaking of this event, Major General Macomb, in his annual report, says:—"Unfortunately, however, the cholera was just at this time making its way into the United States from Canada, and infected our troops while on board the steamboats in their passage up the lakes; and such was the rapidity with which this disease spread among them, that, in a few days, the whole of the force sent by the lakes was rendered incapable of taking the field. Some were landed at Fort Gratiot, others were stopped at Detroit, while the principal part reached Chicago in a most deplorable condition. Of the six companies of Artillery which left Fort Monroe, five companies arrived at Chicago, a distance of 1,800 miles, in the short space of eighteen days—a rapidity which is believed to be unprecedented in military movements. The loss by cholera in that detachment alone, was equal to one out of every three men."

The garrison of Fort Niagara, on Lake Ontario, having taken up the line of march for the theatre of Indian hostilities, reached Detroit on the 30th June, on which day, the troops being mustered and inspected, no man was reported on the sick-list. The men were quartered in an old brick building on the banks of the river, in the most filthy part of the town, and surrounded by grogshops and groceries. The soldiers indulged in every kind of excess; and, on the 4th of July, says Assistant Surgeon H. Stevenson, "it may be safely asserted that there were not ten sober men in the command." No case of disease was reported prior to the evening of the fifth day after arriving at Detroit. On the morning of the sixth, the first case of spasmodic cholera appeared; and up to the 20th of July, the whole number of *confirmed* cases treated by Dr. Stevenson was forty-seven, of which twenty-one terminated fatally. The command consisted of seventy-eight men. From the *premonitory* symptoms, there was scarce an instance of exemption. Those of intemperate habits and debilitated constitutions were its first and principal victims.

The cause of the sudden appearance of this disease at Detroit, leaving an intermediate country of considerable extent uninfected, may be difficult to explain. At the time, it was generally believed that the principle of infection existed in the steamboat in which the troops were conveyed from Buffalo to Detroit, this vessel having been employed in transporting crowds of filthy foreign emigrants westward from Montreal and Quebec. The "Henry Clay," among the troops on board of which the disease also appeared, had been engaged in the same kind of service.

In tracing the progress of this disease along the line of the St. Lawrence and the lakes, as given in the "Statistical Report on the Sickness, Mortality, and Invaliding among the Troops in British

America," the most remarkable fact observed is, its progression with post-like regularity. Thus—

POINTS OF OBSERVATION.	*Date of appearance of the Epidemic.* 1832	1834
Quebec	8th June.	7th July.
Three Rivers between Montreal and Quebec . .	Escaped.	9th "
Montreal, 180 miles above Quebec . . .	10th June.	11th "
Kingston, 190 miles beyond Montreal . . .	16th "	26th "
Toronto, 184 miles beyond Kingston . . .	28th "	30th "
Fort George, 40 miles from Toronto . . .	14th July.	13th Aug.
Detroit and Amherstburg, at the extremity of Lake Erie,	6th "	End of Aug.

In view of these facts, combined with the circumstance that it was marked by the same progressive course along the other principal channels of immigration, viz., the banks of the Ottawa, the Richelieu and along Lake Champlain to New York, the doctrine of importation, (more especially as several persons died of the disease on their passage from Ireland,) and its subsequent communication by contagion, was strongly favored.

In its course south, it maintained the same general regularity of progression. It appeared at New York on the 21st of June, at Philadelphia on the 5th of July, at Cincinnati about the 1st of October, and at New Orleans about the latter part of the month.

Along the British frontier, strict quarantine regulations were consequently rigidly enforced, both in respect to the troops and the inhabitants; but although apparently effectual in some instances, in others, as in Europe, it proved of no avail. Prussia, for example, disputed its progress foot by foot, with all the strictness of her well-known military discipline; but despite the triple *cordons sanitaires* of Prussia and Austria, it soon penetrated the capitals of both kingdoms.

Those opposed to the opinion of its propagation by specific contagion, asserted that, admitting that cholera is principally restricted to the high-ways of human intercourse, it is along navigable rivers that localities most favorable for its production, and subjects most liable to become its victims, are most apt to be found. Although the history of the disease in our country shows that malaria had considerable agency in its production, yet it prevailed on the arid sands of Arabia and the rocky ridges of the Caucasus, as well as in defiance of the winter frosts of Russia. It seems obvious, however, that some general distemperature of the atmosphere existed during the prevalence of the disease. Such meteorological conditions may obtain no less than the particular vitiation which produces the "influenzas" that prevail under every variety of season and locality. Who has ever detected by chemical analysis marsh or animal miasmata, or any contagious principle? The epidemic constitution of the atmosphere was doubtless the predisposing cause, which merely required certain exciting circumstances to develope the malady. Thus may be explained the earlier appearance of the disease at Detroit in 1832, as exhibited in the table. In the course of its gradual progression from the east, the epidemic constitution may have been less intense at Detroit than at many points in the rear; but owing to a concurrence of circumstances in regard to the exciting causes, such as the excesses of a camp "surrounded by grog-shops and groceries," the disease may have been developed sooner than under ordinary circumstances. This opinion is favored by the fact, that previously to the prevalence of cholera epidemically, and in many places in which it did not appear, there was a marked disposition to diseases of the digestive organs, as diarrhœa and common bilious cholera.

The close relation existing between endemics and epidemics, most of the wide-spreading diseases having the character of endemico-epidemics, will be pointed out more fully in Section III. This fact, in respect to Malignant Cholera, is strikingly obvious, in our own country, when we consider its relation with high temperature, low situations, and crowded cities. The great amount of disease and mortality induced by the operation of various debilitating causes applied long prior to the commencement of any morbid action, will also be brought under notice. This diminution of vital energy, whether caused by the summer atmosphere of a crowded city, by deficiency of the natural excitements of the human system, or by inebriation or intemperance of any other kind, invariably favored an attack of Asiatic cholera. As whatever tends to disturb the balance of health has the same tendency, the interruption, at Detroit, to the post-like regularity of the progress of this epidemic, seems to find a ready explanation in the causes above detailed.

The contagious nature of this epidemic is rendered still more questionable from the fact, confirmed with little exception, by the whole current of medical testimony in Europe, Asia, and America, that neither physicians nor those in constant attendance exhibited any peculiar liability to it. Medical officers have slept in their hospitals; nurses, to quiet timid females, have shared their beds during the night; the bed-clothes of patients who have died have been immediately used; and yet no bad consequences have followed. At Warsaw, Dr. Foy inhaled the breath, tasted the dejections, and inoculated himself with the blood of patients, without contracting the disease. There remains, however, another fact which seems the *experimentum crucis*, viz., that thousands of persons left infected districts, and died of the disease in various places, without communicating it to the surrounding inhabitants.

It is thus apparent that the origin and nature of epidemic cholera are involved in much uncertainty, and that this seeming diversity of facts can be reconciled only by the adoption of the principles of *Chalin de Vinario*, one of the most celebrated physicians of the fourteenth century, viz., "*that all epidemic diseases may become contagious, and all fevers epidemic*,"—a position confirmed by observers of all subsequent ages.

At Fort Dearborn, Chicago, which was temporarily re-occupied during the campaign against Black Hawk, malignant cholera displayed its most fatal effects among our troops. According to the report of Assistant Surgeon S. G. J. De Camp, 200 cases were admitted into hospital in the course of six or seven days, fifty-eight of which terminated fatally. The strength of the command at this time was about 1000. In regard to the mode in which this disease is communicated, Dr. De Camp inclines to the opinion of its contagiousness, but under circumstances which might give to dysentery a similar character. "Several of the men belonging to Major W.'s command," [which troops did not come from the east,] he says, "took the disease, and two died. Several citizens of the village also died of cholera, although previous to the arrival of the steamboat, which brought the disease to Fort Dearborn, there was not a case of disease of any kind at the fort or in the village. When the troops marched for the Mississippi, they appeared in perfect health, yet on the way it broke out again, and three died. It made its appearance again when the command reached the Mississippi, and became as fatal, I believe, as it had been at Fort Dearborn. That the number of persons in any community susceptible of this disease is not great, appears from the fact that at Fort Dearborn the sick-report was small compared with the number present. As the troops were very much crowded in the fort, and as the disease was making frightful havoc, I advised the commanding officer to have the well men quartered in a barn outside of the pickets, from which time the number of new cases declined. The disease attacked principally those of intemperate habits with broken-down constitutions. In fact, drunkenness was almost certainly followed by cholera. I am, therefore, firmly of opinion that the disease, as it appeared at Chicago, was contagious under certain circumstances, such as predisposition, filthiness, and bad ventilation."

The treatment by calomel, opium, and blood-letting, when it came to be fully adopted, proved so efficacious in the hands of Dr. De Camp, that he regarded the disease as "robbed of its terrors." It may be here added, in regard to the diminution of new cases after the removal of the troops into a barn, that when epidemic cholera prevailed among the troops at Montreal and Halifax, their removal but a short distance was followed by the most happy effects. The same fact has been repeatedly observed in other endemico-epidemics.

Disseminating itself throughout the country, the pestilence soon appeared on our southern borders, spreading consternation by its extreme fatality. From an official report of its appearance among the troops stationed at New Orleans, by Surgeon Thomas Lawson, the following extracts are made:—

"This dreadful scourge invaded Louisiana near the close of October, 1832, the city of New Orleans being the first point attacked, and the last position maintained, by the enemy. Without pretending to determine the cause of this mysterious disease, or its mode of propagation, one fact is certain, viz., that no case of the disease manifested itself among us until the arrival in port of the steamer 'Constitution,' which had several cases on board—a number of her passengers having already fallen victims to the disease. So fearfully rapid was the pestilence in its progress, that in less than forty-eight hours, it reached the lowest plantation on the Mississippi, desolating almost every spot inhabited by man. Like a skilful general, it seems to have advanced upon the capital, leaving the minor posts on the line of march untouched; for it was not until it had ravaged New Orleans, and desolated the lower country, that it made any hostile demonstration above the city. Whether the cause of this mysterious disease was wafted to us in a current of air down the river, or was brought among us pent up in a steamer, or whether the atmosphere of the city, which had been throughout the season very insalubrious, had reached its acme of pestilential explosion, we know not; but one thing is certain, that cholera, at least in that dreadful form which it afterwards assumed, was unknown among us until the steamer 'Constitution' arrived in port.

"One of its peculiarities, observed both above the city and in the lower country, is, that it frequently passes over a village or plantation, whilst the destruction around is terrible; and this, too, without any manifest cause, either as regards the local circumstances or the habits and condition of the people. On the east bank of the Mississippi it advanced, after scourging New Orleans and the lower country, to within a few miles of Baton Rouge; and on the west side, some distance above that point. As it was limited on each side by a range of high hills, it is more than probable that malaria exerts a powerful influence as an exciting cause of the disease.

"In New Orleans, the effects of the epidemic were first manifested among the dissolute and the intemperate; those who were necessarily or accidentally exposed to the inclemency of the weather; those who were without the means of providing themselves with wholesome food and raiment; and the miserable occupants of the damp, filthy, and crowded hovels of the upper Fauxburg. Having desolated the suburbs, the disease invaded the heart of the city, striking down men, women, and children, indiscriminately. Here again the disease exhibited some of its eccentricities; for in many instances a house was wholly exempt from its ravages, whilst those on every side were places of mourning and distress. For three days the ravages of the disease were confined to the upper Fauxburg, and the town proper. On the fourth day, however, it appeared in the lower town with aggravated malignity, sweeping away like a torrent the poor and miserable foreigners held there against their will, whom the yellow fever had spared. The assault upon the garrison occurred simultaneously with that upon the foreigners; and, although the shock was not so sensibly felt at first, its effect upon us was but little less severe in the end."

In the State of Louisiana, the epidemic exhibited itself in its most malignant character. In New Orleans the victims numbered about 6,000, the population being then perhaps 55,000.

How truly is the remark of the learned Dr. Mead—"that it has never been known when the plague did not first begin with the poor"—illustrated in the history of cholera at New Orleans. The *general* cause of this epidemic, in its gradual progress from east to west, was no doubt often diffused over large tracts of country without being developed in its specific form—a fact evidenced in the almost universal prevalence of irritability of the bowels. Hence we have an explanation of its earlier appearance at Detroit and New Orleans than at other places in the rear, both being fairly attributable to local causes, the former referrible to modes of life and the latter to the nature of soil. Not to speak of the diminution of vital energy induced by the atmosphere of large towns, the topography of New Orleans indicates the existence within itself of an abundant source of malaria, the action of which upon the animal economy, like all other depressing agents, gave a predisposition to the epidemic. This opinion is further corroborated by the fact that the disease subsequently extended northward along both sides of the Mississippi, until it encountered high lands.

During the same year (1832), several of the Atlantic posts, more especially Fort Columbus in the harbor of New York and Fort Monroe, Virginia, suffered from the epidemic. With the exception of a few cases at Cincinnati, it did not this year sweep the valley of the Ohio. The influence of the choleric poison was, however, manifested in a peculiar irritability of the bowels, as shown in the general prevalence of diarrhœa. In 1833 and 1834, this epidemic scourge attacked and re-attacked the more populous towns of the west, whilst the sparsely inhabited portions of that region were, in a great measure, exempt from its ravages. Localities favorable to the production of malarious diseases, suffered most severely from its visitations; and, unlike its history in Russia, its progress generally received a check on the occurrence of severe frost. At Jefferson Barracks near St. Louis, the disease appeared in 1832, 1833, 1834, and 1835, being most virulent in the last two years. This is the only point at which the disease was reported in 1835. At Baton Rouge, which escaped the previous year, the epidemic manifested itself in 1833, this place occupying the first high-land found on ascending the Mississippi. At Fort Crawford, Prairie du Chien, on the Mississippi, two miles above the mouth of the Wiskonsan, there occurred, in August 1833, twenty-three decided cases of cholera, of which six proved fatal, whilst very few wholly escaped its influence. In some instances, death ensued in three or four hours from the first attack. Those cases in which the premonitory symptoms continued for some time, terminated favorably. This year it prevailed very generally along our western frontier; for, besides the posts just named, it appeared also at Fort Jesup, situated on the dividing ridge between the Red and Sabine Rivers, Louisiana,—at Fort Gibson, Arkansas, at which post 170 cases were reported,—and at Fort Leavenworth, situated on the Missouri, five hundred miles above its confluence with the Mississippi. And that this universal scourge passed the Rocky Mountains and penetrated to the shores of the Pacific, (having thus completed the circuit of the globe,) spreading death and terror among the aboriginals of the soil, there are several well-authenticated accounts.

Upon the devoted city of New Orleans, cholera renewed its visitation in 1833. In the report of the quarter ending the 30th June, it is remarked by Surgeon McMahon, that "the disease appeared sporadically here in April; it gradually increased until towards the close of May, when it assumed the epidemic form, committing the greatest ravages among all classes of citizens. The timely removal of the garrison saved it from total destruction. The ruinous condition of the hovel in which the troops were stowed, the want of a suitable hospital, and the enfeebled condition of both officers and men, were in themselves sufficient to warrant the anticipation of such a result." In this quarter there are reported forty-four cases of cholera, three of which proved fatal. In the report of the third quarter, Surgeon McMahon remarks, that "yellow fever, or rather a complication of this disease and cholera, appeared shortly after the subsidence of the latter. Amongst the citizens, the average mortality from it has been about seventy per day up to this time." The command having been seasonably removed, none were present but a detachment of recruits, and several staff officers with their families. In the second quarter of 1834, there are again reported three deaths from spasmodic cholera. This report ends on the 15th May, the period at which the command departed for its usual summer encampment. In this year, the disease still prevailed to a considerable extent along our western frontier, but in a much more limited degree than in the preceding year.

The total number of cases of Epidemic Cholera reported during the years 1832, 1833, 1834, and 1835, was 686, of which 191 terminated fatally; but this does not comprise all, as many troops became victims to the disease in the campaign against the Sac and Fox Indians in 1832, of which no official returns were made, in consequence of the death of medical officers. It has been already shown that it proved more malignant in our northern than southern latitudes (see page 301); but this result may justly be ascribed to the circumstance that our northern troops encountered it on its first invasion by way of Quebec, whilst our southern troops were more exposed to the morbid poison during the two subsequent years, when it evinced a less fatal character. It is a singular fact that this epidemic exerted its fatal influence in nearly the same ratio among all the troops whose statistics have been investigated; for example—

	Years.	Deaths per 100 cases.
United Kingdom,	1832, 1833, & 1834	32
Gibraltar,	1834	30
Nova Scotia and New Brunswick,	1834	28
Canada,	1832,	36
"	1834	34
Black troops at Honduras,	1836	32
United States,	1832, 1833, 1834, & 1835	28

In England, according to Sir David Barry, the ratio of deaths to the number of cases is estimated at 38.5 per cent.; in the Russian provinces, the computation is as high as 58.6 per cent.; and on this side of the Atlantic, as for instance at Quebec, Montreal, New York, and Philadelphia, the estimate, according to Professor S. Jackson, is 40 per cent.

The opinion that in the United States malignant cholera was influenced by temperature as well as by other causes regarded as of malarial origin, is also proved statistically. Thus, among the 191 deaths reported, the first quarter gives 4, the second 22, the third 153, and the fourth 12. As its development was favored not only by the exalted temperature of summer, but by the peculiar atmosphere of towns situated on seas and rivers, it follows that the general and widely diffused morbific agent was to such a degree dependent on local influences, that the disease constituted, strictly speaking, an *endemico-epidemic.*

E.—INEBRIETY.

The abuse of intoxicating drinks, as regards their influence in the causation of disease, considered.—To suppress the evil of intemperance among soldiers, the abolishment of the issue of spirits as a part of their ration, essentially necessary.—Pathological effects of ebriety.

Up to the present day, the statistics of intemperance in reference to etiology, pathology, and therapeutics, have been so loose and unsatisfactory, as not to allow of any accurate deductions. At the same time, all admit that among the various causes by which the vital energies of the human organism are impaired, no one is more efficient. The dreadful effects induced by inebriation have been shown in the details of the military posts, in which it was attempted to condense certain cases under the head of *ebriety*; but as some medical officers reported no such cases, except under the general head of "*morbi varii*," the result, as regards the number of cases, falls short of the reality. Its agency, directly and indirectly, in the causation of phthisis pulmonalis and epidemic cholera, has been abundantly pointed out; and its intimate connection with febrile diseases, diarrhœa, dysentery, and hepatitis, although not definitely determined, is yet so apparent that it is constantly dwelt upon in the reports of medical officers. In the Northern Division, the total of cases reported as *ebriety* is 1,370, and the deaths, five, being one in 274; and in the southern, the total of cases is 2,616, and the deaths, fifty-eight, being one in forty-five. Assuming that inebriation prevails to an equal extent in the two divisions, it appears that in northern latitudes it is attended with comparative immunity, as regards its immediate effects; for the deaths from this cause average in the Northern Division two, and in the Southern twenty-three, annually, per 10,000 of the strength. But this subject admits of further elucidation.

Of *delirium tremens* there are reported, in the Northern Division, 102 cases and three deaths, being one in thirty-four; and in the Southern, 306 cases and thirty-nine deaths, being one in eight. The annual mortality per 10,000 is, therefore, in the north upwards of one, and in the south sixteen.

The total of *epileptic* cases, which generally arise from the excessive use of ardent spirits, is, in the Northern Division 166, and in the Southern 188, the annual ratio of each being $7\frac{5}{10}$ per 1000; but in this affection, too, the mortality is higher in southern latitudes, being in the former division one in thirty-three, and in the latter one in twenty-one cases.

Of *apoplexy* in the Northern Division, the total of cases is four, and in the southern twenty-five, the ratio of the latter being six times as high. As the exciting causes of these cases were chiefly the intemperate use of spirituous liquors and exposure to the direct rays of the sun, several being reported as *ictus solis*, the higher average in the south might have been readily anticipated. In the Southern Division, the ratio of deaths to the cases treated is nearly twice as high as in the Northern. As regards *phrenitis* and *meningitis*, it is found that the relative results, on a comparison of the north and south, are very like those of the preceding disease.

These are not, however, the only deaths arising from drunkenness. Of the ten deaths reported as *sudden*, the majority is doubtless attributable to this cause. Of the twenty-five deaths from various *chronic visceral lesions*, the greater proportion has no doubt been induced by the same agent. The eighty-five deaths under the head of *casualties* have been reported principally as drowned, frozen, suicide, homicide, wounds, and injuries—the result, in a great measure, of intemperance. In looking over the details of our salubrious posts, for instance those along the coast of New England, the most striking fact is, the low ratio of those that die from what may be regarded as natural causes. Perhaps four-fifths of the deaths at such stations, as already remarked, are reported under the names of epilepsy, apoplexy, mania a potu, phthisis pulmonalis, atrophia, etc., with the remark to each that it arose from the abuse of inebriating potations. The aggregate of deaths in the table furnishing these data is 1,104, more than one-half of which are traced to that war against nature, which claims more victims than the most fatal epidemics,—epidemics, the visitations of which are viewed with dreadful apprehensions, whilst this moral pestilence is continuously in our midst, almost unnoticed.

An important step in suppressing habits of inebriety among our troops has been effected by the abolishment of the issue of spirits as a part of the daily ration of the soldier. Soon after the establishment of the Medical Bureau in 1818, the late Surgeon General, Dr. J. Lovell, urged, with laudable zeal, upon the then Secretary of War the importance of abolishing the use of whiskey among the troops, and of substituting an equivalent in vegetables or sugar and coffee; and although he repeatedly pressed the subject, maintaining that it was the cause not only of many of the irregularities of the service, but of vast expense to the public treasure by the increase of the sick-list and by premature deaths and discharges; yet it was not until the administration of Mr. Cass, in 1830, that an order was promulgated directing that "the commissaries shall cease to issue ardent spirits as a part of the daily ration of the soldier." When a man was obliged to swallow or throw away his ration of spirits, it was not to be expected that the best directed efforts of commanding officers could effect any thing towards suppressing the evil; and to convert temperate men into drunkards, it were difficult to invent a more successful plan. "To swallow nearly half a pint of spirits daily was," says Henry Marshall, Deputy Inspector General of Hospitals in the British army, "until the abolition of spirit-rations, a part of the *duty* of a soldier; and that this duty might be effectually executed, it was the usage of the service in many stations to have it performed under the immediate superintendence of a commissioned officer, who certified to his commanding officer that he had actually seen each man drink his *drams*."

What a commentary does this chapter afford on the *morale* of the army ! But the explanation is to be found in the fact that those who fill the ranks are mostly such as have proved themselves unfit for the trusts of civil life ; and among British troops, the influence of the depressing passions, as is evinced by the extremely high ratio of suicides,* is still further increased by the hopeless nature of the service, all enlistments being for an unlimited period.

What a long and frightful catalogue of ills follow in the train of this moral evil ; tubercular phthisis,—dyspepsia with its manifold miseries,—inflammation of the stomach, liver, pleura, brain and its membranes,—jaundice, dropsy, diabetes, gout, and delirium tremens ! Among certain causes which are known to increase the tendency to inflammation—*causes of debility*—intemperance in the use of strong liquors, is one of the most prominent. Another effect resulting from habitual intemperance is a peculiarity of constitution, which disposes, in a remarkable manner, to chronic inflammation and slow deposits of solid lymph in the lungs, liver, kidneys, and the lining membrane of the heart and arteries. Again, the fever attending inflammation in such constitutions, is disposed to take the typhoid form.

In the United States, in consequence of the cheapness of ardent spirits and the comparative pecuniary comfort of our citizens, by which the means of this kind of indulgence is placed within the reach of all classes, delirium tremens is a common disease. Very great improvement, however, in the habits of the people in this respect, has been, within a few years, effected.

F.—HEMERALOPIA OR NIGHT-BLINDNESS.

Little known in the United States with the exception of the most northern and southern parts.—Treatment uncertain.

Under the indiscriminate terms of hemeralopia, nyctalopia, and paropsis noctifuga, there are reported in the Northern Division 18

* Among the Dragoon Guards and Dragoons in the United Kingdom, the ratio of suicides is one annually in 1274 of the strength—a proportion more than five times greater than the highest average in civil life.

cases and in the Southern 191. In the use of the first two names, a considerable degree of confusion has always prevailed among authors. The affections here reported are all, it is believed, cases of night-blindness.

Day-blindness compared with night-blindness, is a very rare disease. According to Dr. Hillary, there are many persons in Siam and in Africa, who are of this cat-eyed species. It may arise, however, from a mechanical cause; for if opacity exists opposite the centre of the crystalline lens, the pupil contracting in the open day-light would cause blindness, which would disappear with the expansion of the pupil in the evening. The same result might be induced by a deficiency of the *pigmentum nigrum*, which is supposed to absorb the redundant rays of light which enter the pupil.

With the exception of our most northern and southern posts, this disorder is almost unknown in the United States. As these statistics, however, include but one year of the data furnished by the troops serving in Florida, where the disease is endemic, its prevalence is not fully apparent. The pathology seems to consist in an exhaustion of the power of the retina in consequence of exposure to strong light during the day, or, in other words, vision ceases because the retina, after being exposed to a long and brilliant sunshine, is not excited by the feeble light which continues after sunset. The disease is consequently rarely met with except in southern latitudes or those regions in which the ground is covered many months with snow. In the West Indies, Europeans, more especially those who are soldiers and sailors, suffer much from this affection. The same causes operating here are found to obtain in Florida, such as the full glare of a vertical sun in an unclouded sky, and the reflection of solar rays from the surface of water or a sandy soil. In Florida, according to the observation of the author, its duration varies from one night to six or twelve months, whilst relapses are frequent. The treatment, which is modified in accordance with the accompanying functional derangements, usually consists in confinement to a dark room, the use of emetics and cathartics, and the application of cups and blisters to the temples and nape of the neck; but these remedies, as well as salivation, prove in many cases wholly unavailing. When all remedial means fail in tropical regions, among those from northern latitudes, a return to one's native clime is obviously indicated.

G.—SCORBUTUS.

Little known, at the present day, in the United States.—Until 1796, the universal scourge of the sea.—Land-scurvy equally destructive.—Detailed account of a scorbutic endemic, in 1820, at Council Bluffs, near the junction of the Platte and Missouri, and at Fort Snelling, at the confluence of the St. Peter's and Missisipi.

With scurvy in its more aggravated forms, we are fortunately, in the United States, but little acquainted. Our army, within the current century, has, with the exception of two periods, been nearly wholly exempt from its ravages. In 1809, this disorder complicated with malarial diseases, produced dreadful havoc among our troops on the Lower Mississippi, 600 having fallen victims. Being mostly the sequelæ of febrile affections in which much mercury had been given, the scorbutic symptoms seem to have been much aggravated from this cause. It raged with violence again in 1820, at two of our western posts, Council Bluffs and Fort Snelling, the details of which will be presented.

Although it is not intended to enter into a detailed history of scurvy, yet a few remarks on this point may not be inapplicable. In the narratives of the early English navigators, particularly in those of Sir Francis Drake, Davis, and Cavendish, the destructive ravages of this disease are awfully portrayed. Until the year 1796, it may be said to have been the universal scourge of the sea, having destroyed, it is supposed, more sailors than the terrific consequences of naval warfare and the various accidents incidental to a maritime life, combined. It is mentioned by Sir Richard Hawkins that he had known, within his own naval experience, of 10,000 men perishing by the scurvy; and in the course of his voyage around the world, Commodore Anson lost more than four-fifths of his men. It was in the year 1795 that the British admiralty issued an order for furnishing the navy with a regular supply of lemon juice, from which time we may date the extinction of this horrid disease in that arm of the service. Land-scurvy, which is a form of disease precisely analogous to that developed at sea, was also of frequent occurrence in besieged towns and garrisons, under the united circumstances of defect in the quantity and quality of food, fatigue, anxiety, and exposure to the influence of a cold and damp atmosphere. In the account of the seige of Thorn, at which nearly 6000 of the garrison, besides a great number of the inhabitants of the town, were cut off by the disease, whilst the besiegers, (the Swedes,) were wholly exempt from it, a memorable instance is presented. The prevalence and even the great fatality of scorbutus, at a former period, in our own country as well as in England, though now happily a very rare disease, are abundantly proved by the records of medicine. The early northern colonies in America, as the French in Canada and the English in Newfoundland, were dreadfully afflicted with scurvy. Among the English troops that formed the garrison of Quebec, this disease prevailed to a great extent, in the spring of 1760. So much did this command of 6000 men suffer from cold and the want of vegetables and fresh provisions generally, that before the end of April, 1000 were dead of scurvy and twice that number unfit for service.* Even at the present day, it is occasionally endemic in Iceland and the northern States of Europe, particularly on the shores of the Baltic, where vegetable products form a very insignificant portion of the diet of the inhabitants. In proportion as agriculture and gardening have improved, scurvy has become less frequent; and *on land*, we may regard it now as almost extinct.

This general salutary change may reasonably be ascribed to the united influence of the drainage of the country, the habitual use of fresh vegetables by the people, and to those improvements in our national economy which render the use of fresh meats available at all seasons of the year; and as regards the soldier and the sailor, the operation of these causes is still further promoted by their improved condition in every other respect. The want of fresh vegetables in England even at the beginning of the sixteenth century, is evinced by the historical fact, that, to procure a salad, Katharine of Arragon, queen of Henry VIII., was obliged to despatch a messenger to the Netherlands.†

That scurvy may arise independently of the use of salt provisions, there is abundant evidence to prove; but there is one condition which is necessary for its production, viz., prolonged abstinence from succulent vegetables or fruits, or their preserved juices as an article of food. If this condition is fulfilled, scurvy will arise under circumstances, in every other respect, the most diverse imaginable; and its history shows that the juices of succulent plants and fruits cannot be replaced by any of the other elementary nutritive substances from the vegetable kingdom, as mucilage, oils, starch, gluten, or albumen, or by any of the elementary nutritive substances of animal origin.

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* Smollet, Hist. of England, vol. v., p. 189.
† Hume, Hist. of England, vol. iv., p. 241.

As the history, etiology, semeiology, and anatomical characters of scorbutus are contained in all elementary works, it may be well to bring under view at once the following table, exhibiting the number of cases of scurvy and the consequent deaths in the army, during a period of twenty years:

Years.	1819	1820	1821	1822	1823	1824	1825	1826	1927	1828	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838
Cases.	7	734	86	4	29	..	8	4	2	8	6	16	3	7	5	15	9	17	59	15
Deaths.	..	190	5	..	..	..	..	..	..	1	..	..	..	..	..	..	..	3	1	1

The comparative infrequency and low mortality of the disease are thus shown. The cases reported in the last three years occurred nearly all, either in Florida or amongst troops that had served in those campaigns, for a description of which, as witnessed by the author at Fort King, reference may be made to that post in the preceding section. The relation of cause and effect is here very apparent; for it can be readily perceived that a diet, consisting mainly of salt provisions, in a constitution deteriorated by repeated attacks of intermittent and remittent fever, diarrhœa, and dysentery, will develope scorbutic and cachectic affections. The ration of our soldier, regarded in all its component parts, no doubt disposes the system to scurvy in warm countries; and in these campaigns, whenever it proved deficient in any respect, it was always found to be so in reference to the vegetable portion.

As this disease prevailed as an endemic, in 1820, at Council Bluffs and St. Peter's, its history in detail will prove no less profitable than interesting. The number of men reported at the former post on the first of January, was 788, and at the latter 228, making an aggregate of 1016. The total of cases of all diseases reported for the quarter ending the 31st of March at these two points, was 895. Of these, 503 were of a scorbutic character; and the number of deaths from this cause was 168, of which 157 occurred at Council Bluffs.

The history of the endemic at Council Bluffs is fully illustrated in the annexed extracts from the reports of Surgeon T. G. Mower, of the sixth Infantry, and Surgeon John Gale, of the Rifle Regiment, more especially as these observations are known to have their origin in sound judgment and professional skill:

"The second battalion of Riflemen," says Surgeon Gale, in his special report dated Camp Council Bluffs, October 1st, 1820, "left

Belle Fontaine and proceeded up the Missouri on the 15th June, 1819—joined the first battalion at Cow Island on the 30th August, and arrived at Council Bluffs, a distance of 780 miles, on the 2d of October.

"It will not surprise you to learn that the fatigue endured in transporting loaded boats such a distance in the peculiarly laborious manner of navigating the Missouri, and exposure to the meridian sun, the dews of evening, and the chill air of night, were productive of disease. Nearly every man had suffered severely from sickness, and many experienced relapses, before arriving at our point of destination; nor did we then cease to suffer from dysentery, catarrh, and rheumatism."

* * * * *

"With every exertion, our buildings were not completed until the first of January. At this period, from accumulated suffering, a disposition to despondency was manifest. Nearly all seemed to be reduced by protracted sickness and long continued labor. The sutler's supplies were exhausted, the fresh provisions were nearly all issued, and the hospital stores were inadequate to an emergency. In this situation, when the most nutritive diet was requisite to restore our exhausted energies, the men were compelled to subsist on salted or smoke-dried meats, without vegetables or groceries of any description. To add to our list of sufferings, the weather in January became excessively severe; the mercury, at different periods, for several days in succession, did not rise above zero, and once fell 22 degrees below that point. Under these circumstances, about the 20th January, the scurvy made its appearance, to which all other diseases soon yielded precedence; but it proved fatal in few cases until February, when nearly the whole regiment sank beneath its influence.

"This disease continued unabated until the 7th of April, when wild vegetables appeared. After this period, no new cases occurred, and those already affected began to recover. Of the Riflemen, eighty fell victims to the malady, sixty at this place, and twenty between this point and Fort Osage. None died after the arrival of the sick at the latter place.

"That debility, induced by long continued sickness, was favorable to its development, is manifest from the fact, that those who were most debilitated from previous indisposition, were first seized and numbered among its earliest victims. It may also be reasonably inferred that excessive labor and fatigue, and the severity of the weather, had an agency in the production of the disease; for the officers and non-commissioned officers, who experienced less of the former, and were less exposed to the latter, were exempt from its effects. One officer, who had been long confined by indisposition, formed an exception. This was the only case in which there was the least degree of convalescence observable prior to the appearance of vegetables; and this was probably effected by our being enabled to subsist him on eggs, chickens, milk, &c.—presumptive evidence that a nutritive diet will produce a cure.

"Among the causes producing the disease, may also be enumerated the residence of the men in green damp rooms in conjunction with a faulty diet; for the Riflemen, who are more expert in hunting than the Infantry, procured more wild meat and suffered far less. Our hunters detailed especially for that purpose, who resided in the woods and subsisted on game, were in no instance unhealthy. An officer with a detachment, who wintered in a half-faced camp, some distance below this place, and subsisted his men entirely on fresh provisions from the woods, experienced no sickness of any description."

From the special report of Surgeon Mower, dated "Camp Council Bluffs," October 1st, 1820, the following extracts are made :—

"The prevalence of scurvy in the sixth Regiment of Infantry, during the last winter, may be attributed to the following causes, viz., *excessive and long continued fatigue—cold and dampness—faulty diet.*"

Having described the progress of the Regiment from Plattsburgh, New York, at which point it had been cantoned for nearly three years, to Belle Fontaine, Missouri, Surgeon M. proceeds—

"On the evening of the 4th July, the Regiment was again embarked on board of three steamboats and four barges, destined for the Council Bluffs. Without the experience of watermen, the troops had now to contend with a torrent, which, in point of rapidity and natural obstructions, is perhaps without a parallel.

"The narrow channel of the Missouri at low stages of water, combined with its frequent and sudden bends, precludes in a great measure the use of sails. In propelling the barges, the cordelle and setting poles form the principal dependence. This mode of ascending the river requires of the navigator the most active and incessant exertions; while the severity of his labors is not a little aggravated by being frequently compelled to plunge into the water. After the most persevering exertions, the several companies composing the Regiment reached the place of destination between the 3d of October and the 14th of November. To the failure of the steamboats this dispersed state of the regiment is to be attributed.

"It now remained for the troops to shelter themselves from the inclemency of the season, and to secure themselves against hostile aggressions. An alluvial bottom on the right bank of the river, about two miles above the Council Bluffs, was designated as the site for the cantonment of the Infantry and Rifle Regiments. This bottom is skirted by a range of high bluffs, which alternately approach and recede from the river. These bluffs are intersected by several deep ravines and small water-courses, which break through from the highlands. The bottom composed principally of clay, is low and flat, and consequently productive of a humid atmosphere. This region is in its primitive state. With the exception of the bottom just described, and the borders of streams generally, which are covered with a thin forest, consisting principally of poplars, walnut, elm, and some oak, the adjacent country presents a boundless prairie. The extremes of heat and cold inseparable from an inland region, are here increased by the prevalence of high winds, which are favored by the openness of the country.

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"The latter part of December and the whole of January proved excessively cold, the mean of the latter month being 8°.62; and the barracks, hastily thrown up from green materials, opposed but a feeble barrier to the inclemency of the season. Notwithstanding the severity of the weather, the Regiment was still constantly employed in procuring materials for the completion of the barracks, for firewood, &c. Owing to the small number of working cattle and the feeble state of the men, it required the whole strength of the corps to accomplish these objects. It is here proper to remark that no objection can rest against the supply of clothing furnished during the last winter.

"The timber (cotton wood) which composed the greater part of the barracks, although convenient and sufficiently abundant, was particularly objectionable on account of its humidity; the quantity of water contained in this wood is almost incredible. The advanced state of the season, however, compelled the men to take shelter under their rude covers, green, damp, and unfinished as they were.

"The state of our subsistence stores had long been viewed with concern. Fresh beef, which had been issued to the troops since their arrival, in the usual proportion, was in the latter part of January restricted to the use of a few hospital patients. The country not abounding in game, and the Regiment having no expert hunters, little advantage was derived from the chase. The important articles of beans, peas, and vinegar, contemplated to have formed component parts of the ration, failed altogether. Salted pork and beef, bacon, flour, and Indian corn, constituted the substantial part of the ration. By far the greater part of the meat was decidedly in a putrescent state, and absolutely unfit for issue; the smell and taste both rejected it with disgust. The flour, although less objectionable than the meats, and originally of a fine quality, had become musty previously to its issue. The corn, which was furnished in the proportion of two pints to every six rations, was soon thrown aside as a drug. Deprived of vegetables and the usual condiments of the table, the repast of the soldier was, at the same time, deficient in nutriment, unpalatable, and unwholesome.

"The medical supplies of the Regiment, although sufficient in quantity for ordinary seasons, were of a very inferior quality, and by no means calculated to meet the present exigency.

"Previously to the appearance of scurvy, the men had been much enfeebled by dysentery and pulmonic inflammations; and were consequently rendered more susceptible of other ailments. The former disease commenced its attack soon after their arrival, and raged with violence till the close of the year. It was then succeeded by inflammatory affections of the lungs, which prevailed with little abatement till the latter part of January.

"Early in this month (January) a scorbutic taint was perceptible in some of our patients, who were laboring under other diseases. At first the cases were mild, and appeared to yield, in some measure, to treatment. During the whole of this month, it was noticed that the recovery of our patients was peculiarly slow and precarious; in many cases, after the acuteness of disease had been subdued, the sufferer appeared to languish and decline. Early in February the progress of scurvy had become alarming; its baneful influence was rapidly extending to every other form of disease. The situation of the command had assumed a serious aspect. Most of the exciting causes still existed, while the means of relief were beyond our reach. The commandant of the post having been apprized, from time to time, of the nature and extent of the prevailing malady, and of the means best calculated to arrest its progress, organized parties under the direction of officers, and despatched them up the river in pursuit

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of buffalo and other game. Unfortunately the success attending these exertions was very inconsiderable.

"We regret to acknowledge that the firmness of the American soldier should have been for a moment shaken by any concurrence of circumstances. We cannot conceal the fact, however, that during the prevalence of that loathsome malady which afflicted our garrison, gloomy forebodings were depicted on many a countenance; nor were the best directed efforts to counteract this despondency, by introducing diverting games, music, &c., attended with much success. On the 23d of February, the commandant, feelingly alive to the interests of the soldier, summoned together a board of war to deliberate on measures for the relief of the command. Of the result of these deliberations, I am at present ignorant. In compliance with the wishes of this board, I submitted to them a report relative to the health of the Regiment, and the means best calculated to counteract the influence of the disease then unhappily existing. On the 25th of the following month, seventy scorbutic patients belonging to the sixth Regiment were embarked on board of keel boats, under the charge of Surgeon's Mate Nicholl, destined for Fort Osage. At this place it was believed that they would more speedily obtain a regimen adapted to their condition.

"On the removal of these men, we had nearly one hundred patients left, suffering under the influence of the same disorder. During the first week in April, the weather proving favorable, we removed a large proportion of our sick from the Cantonment, and located them on a small stream under tents, about three miles distant. Fortunately, at this period, wild vegetables began to shoot up. These powerful remedies, combined with mild weather, pure air, and change of scenery, soon banished the demon, *Scurvy*, and restored its victims to strength and activity. So potent was the influence of this new state of things, that patients recovered under the most unpromising aspects. Not a single death occurred at 'Camp Recovery,' although several persons were removed thither in a seeming moribund state. In some of them, every tooth had dropped from its socket, and even large portions of the lips had sloughed off. Among the vegetable products first discovered, and most esteemed for its remedial virtues, was the wild onion, a very diminutive bulbous root, not larger than a nutmeg.

"When we reflect on the long and arduous march performed by the sixth Regiment of Infantry,—the unavoidable fatigues which awaited these troops on their arrival at the place of destination,—the vicissitudes of heat, cold, and dampness, to which they were exposed,—the wretched quality of the provisions on which they subsisted,—we cease to wonder that sickness and mortality have prevailed. Had the corps maintained its health, we might be warranted in believing that the age of miracles had returned."

In regard to the botanical character of the "wild onion" alluded to above, the author has recently consulted Professor John Torrey, one of the authors of the "Flora of North America,"—the splendid work now in course of publication. It appears that in Arkansas and Missouri, there are several species of Allium, all of which produce small bulbous roots, and all of which seem to possess nearly the same properties as the ordinary onion. The principal are—Allium Canadense, *Linnæus*; A. ochroleucum, *Nuttall*; A. mutabile, *Michaux.* "I have little doubt," says Dr. T., "that the wild onion to which you allude, is the Allium angulosum of Linnæus, as that species was found abundantly on the Upper Missouri by Lewis and Clark, Nuttall, and other travellers. Other species of Allium doubtless occur in the same region, but this seems to be the only one that has attracted much notice."

Among the scorbutic patients of the sixth Infantry and Rifle Regiment removed to Fort Osage, the number of cases, in the following quarter, not embraced in the previous report, was 119, of which seven proved fatal. The numerical strength of the command was 117, and the sick report, at the close of the quarter, exhibited but twenty-seven cases. The sixth Infantry, numbering 200–250 men, had ninety-two cases, chiefly scorbutic, on the sick list at the previous quarterly report; of these, thirteen died before the 15th of April, after which period no death occurred. The Rifle Regiment, numbering about 350, became remarkably healthy; although the sick report, at the beginning of the quarter, presented seventy-seven cases, principally scurvy, but one death took place.

It thus appears that these troops were exposed to many of the causes, both predisposing and exciting, of scurvy,—a remark that applies equally to the command at Fort Snelling, at the confluence of the St. Peter's and Mississippi. During the progress of the former from St. Louis up the Missouri, and of the latter from Green Bay up the Mississippi, they were not unfrequently obliged to labor in the water beneath the rays of an ardent sun. Sleeping in their wet clothes and exposed to a damp atmosphere impregnated with malaria, they became reduced by disease; and in this state of predisposition to scurvy, they began late in the season the establishment of their winter quarters. The weather during the winter was exceedingly cold, the mean temperature for January at Council Bluffs, (latitude 41°45′,) being 8°.62, and at Fort Snelling, (latitude 44°53′,) 0°.17 of Fahrenheit. At Council Bluffs, they were destitute of groceries and vegetable food, except flour and corn, which were more or less damaged from having been wet; and their animal food, which was principally salted, they were obliged to eat, during a portion of the winter, in a putrescent state. This condition of the meats, however, was as far as practicable corrected by washing and boiling with charcoal. The total of cases of scorbutus reported in 1820, was 734, and of deaths from this cause, 190. The greatest mortality reported since that period was in the following year, the total of cases being eighty-six, and of deaths five.

It may be here remarked that Surgeon T. G. Mower, who has several times witnessed small-pox and epidemic cholera in their most malignant forms, avers that neither is as dreadful as the endemic described in his report. It is not the sight of pale forms, encircled by bloody bandages, that blanches the soldier's cheek, for he knows that such is the chance of battle. Even when the surgeon tells his wounded patient that he must look for help beyond the grave, the transition from time to eternity is borne with calmness and resignation, soothed by the consciousness of having fallen in the discharge of his duty and in his country's cause. But when the wards of an hospital become crowded with ghastly and attenuated frames, victims to a baneful climate or a loathsome pestilence, living skeletons, debilitated and slowly sinking, doomed—

> ———"to feel
> The icy worm around them steal,
> Without the power to scare away
> The cold consumers of their clay,"

how appalling to the living is the spectacle of the dead and the dying! When those, who but several days previously bore their comrades to the grave, are in turn stretched upon the same bier, then it is that the bravest heart quails!

H.—COLICA SATURNINA.

Of seldom occurrence.—Its mode of introduction into the human system.—Details in reference to Forts Delaware and Monroe.

This disease, like the last described, is one of those that are seldom met with in this country. They have both particular reference to military hygiene, which is the art of preserving the health of soldiers and of promoting their efficiency under all circumstances. Colica Pictorum has been not unfrequently observed among our troops, more especially at Forts Severn, Delaware, and Monroe, as referred to in the preceding section.

It is supposed that the lead enters the system chiefly by pulmonary absorption; but that this is not entirely so has been inferred from the fact that those workmen among the preparations of lead who are careful to change their clothes and to practise frequent ablutions, are much less liable than others to the deleterious effects of their occupation. That the stomach may become the avenue of its introduction into the system appears from the circumstances witnessed at Fort Delaware in 1827; for the disease then evidently arose from the use of water collected from an immense roof painted repeatedly with one of the preparations of lead. Seeing the common employment of leaden pipes and cisterns, it would seem that deleterious effects seldom arise from this cause; for, although water may frequently become impregnated with the metal, yet as certain salts, particularly the sulphates and phosphates, by forming insoluble compounds between their acids and the oxide of lead, exert a protective action, it can operate as a poison only when these salts are deficient. That this metal produces a specific derangement of the animal economy, of which the symptoms of colic are only a manifestation, seems warranted by analogous facts; but that this agent may also produce a local disease, manifesting itself more strongly in the part to which it is immediately applied, is no less evident. The cases reported at Forts Severn and Delaware in 1831, were attended with obstinate constipation of the bowels and paralysis of the hand and fore-arm. Now the local effect may be ascribed to the circumstance that as it was necessary to moisten the white lead and apply it by means of a sponge to their belts and gloves, the hands of the soldier were daily exposed to its action; and as the belts were also rubbed with pumice-stone, the constitutional effects may be more directly attributed to the particles of lead inhaled. It is doubtless from the greater exposure of certain parts of the body that one of the distinguishing characters of the disease takes its origin, viz., the tremulousness of the hands, and the weakness of the carpal joint, called by workmen the *wrist-drop*.

In further illustration of this subject, reference will be made to several reports. In the latter part of 1826 and the early portion of 1827, thirty-eight cases of enteritic inflammation resulting from the introduction of lead into the system, are reported at Fort Delaware. In this instance it was believed that the lead was suspended in the common drinking water of the garrison, which was collected from an immense roof that had been painted four or five times during the previous twenty months,—an opinion that was favored by the circumstance that the disease immediately subsided as soon as good water was procured from the Schuylkill. "In most cases," says Dr. S. B. Smith, "the disease was manifested by violent pyrexia, excrutiating pain in the intestines, accompanied with an evident contraction in some portion of its calibre, and an obstinate costiveness, to overcome which baffled, for many successive days, every effort." In some instances, no alvine evacuation could be procured in fourteen days. In the majority of cases, from one to two hundred ounces of blood were drawn, which, with purgatives, anodynes, blisters, and calomel with a view to its constitutional effect, constituted the principal treatment. Three remained with partial palsy, and two died, in one of which dissection disclosed "a mortification of five fingers' breadth all around the arch of the colon; and six lines below it, there was a stricture in the intestine, caused evidently by the inflammatory action of the previous attack."

In 1827, at Fort Monroe, the following remark is made by Surg. Everett:—"The use of sheet lead for covering the boilers and furnaces in the kitchens of two companies, the covers being painted over before each weekly inspection, has produced the most disastrous results. It escaped my observation for two or three weeks, until its effects suggested an investigation. Colic, paralysis, and ulcers in their most frightful and obstinate forms, appeared in more than twenty cases in these two companies. The health of all was much impaired, one death ensued, and several, who still linger in a most wretched state, will, I think, eventually recover."

In 1831, cases of obstinate constipation of the bowels, accompanied in some instances by paralysis of the hand and fore-arm, were so frequently reported that it was deemed necessary to interdict, by a general order, the use of white lead in cleansing soldiers' belts and gloves, and to substitute pipe-clay.

I.—DENGUE.

The history of its progress.—Its appearance at Pensacola described.—Its semeiology, pathology, etiology, prognosis, and treatment.

In the third quarter of 1828, there were reported fifty-seven cases of *Dengue*, viz., eight at Fort Pike, La., fourteen at Cantonment Clinch, near Pensacola, and thirty-five at Fort Moultrie, Charleston. As this epidemic exhibited striking peculiarities, being one of those inexplicable results developed from time to time by a fortuitous concurrence of causes, and perhaps destined never again to occur in the infinite series of such contingencies, the interest of medical science demands that every record of its history should be permanently preserved.

Dengue, Dandy, Rheumatismus febrilis, &c., is an eruptive fever or exanthematous affection, which made its first appearance, in the latter part of 1827, in the Caribbean Islands. Extending westward, it soon spread extensively over the West Indies, and appeared, by the next year, on the neighboring coast of the United States. In the spring and summer of this year, our southern ports, New Orleans, Pensacola, Savannah, Charleston, &c., &c., suffered a severe visitation; and, although some cases are reported to have occurred in Philadelphia and New York, the evidence is unsatisfactory. We have also accounts of its visitation at Vera Cruz and Carthagena; and in 1824 and 1825, there prevailed in Calcutta and its environs an epidemic with features claiming a close identity. Its progress was remarkable for a universality of attack. "In a population of 12,000 souls who occupy the town of St. Thomas," says Stedman, "scarcely a single individual escaped." As it was sudden in its appearance and rapid in its course, so was its duration as an epidemic brief. Towards the close of the year 1828, it suffered a gradual extinction; and, like the *Black Death*, the *Sweating Sickness*, and *Cholera Asphyxia*, it soon disappeared, leaving behind naught save the terror of its name. Fortunately, however, its history, unlike these epidemics, was distinguished less by its fatality than mere suffering. In the annals of medicine, there is not, perhaps, recorded a disease so severe in its accession and duration, and so seldom leading to a fatal issue. In a paper on this affection, as it prevailed in the island of St. Christopher, by John Squaer, Esq., Assistant Surgeon of the 93d regiment, British Army, the writer observes:—"This disease, in all the instances I have witnessed, was considered of a simple, and though a violent nature, yet there was nothing dangerous in it. It has been said to have terminated fatally in one or two instances in this island; in some of the others, it has caused death in several instances." Dr. Dumaresq, in his description of the epidemic at New Orleans, says:—"Out of the many thousands afflicted with it in this city, not more than four or five have died; and in these it appeared to be combined with some organic difficulty, and especially of the liver, which gave it the semblance of yellow fever, and such it was considered by some." According to Dr. Dickson, who gave an account of the epidemic as it appeared at Charleston, S. C.,—"Dengue, indeed, can hardly be said to have ever proved fatal of itself."

Surgeon T. Lawson, in transmitting his quarterly report of sick at Cantonment Clinch, writes as follows:—

"Dengue has prevailed to a very great extent in this section of our country. In Pensacola, scarcely a person of any age, sex, or condition, has escaped an attack. With us in the Cantonment, however, its influence has been less generally felt. The disease was modified somewhat in its character and the intensity of its symptoms, by the peculiar constitution of the subjects attacked. Among the Americans and other persons of vigorous health, the fever usually ran very high, and continued without a remission from twenty-four to thirty-six hours; after which, it subsided, leaving the patient in a state of extreme debility, and laboring under an acute rheumatic affection of the muscular system generally. Among the Spaniards, who are generally less plethoric, the febrile manifestations were, on the contrary, much less intense; but the disease was of longer duration, and the pains throughout the fibrous tissues were infinitely more severe.

"As a general rule among the Americans, one or two efficient cathartics were administered in the early stage of the disease; after which, the repeated use of the warm bath, and frequent draughts of lemonade, were sufficient to complete the cure. Among the Spaniards, no active medicines at all were taken; ptisans and the warm bath were the only remedies employed. A recurrence of the disease, particularly of the rheumatic affection, was very common among all classes; but the relapses, I believe, were much more frequent among those who resorted to no active remedial means. It was always most safe to administer an efficient dose of medicine immediately on the attack; the disease was rendered more manageable, and its duration shortened. The period of its course varies from forty-eight hours to several weeks. Although a very severe, it is by no means a fatal disease; no case terminating in death has occurred within my knowledge."

From the various descriptions of this disease, it appears that it was generally ushered in by the usual manifestations of febrile diseases. Its accession was marked by a painful affection of the joints and muscles, attended by fever of the ordinary inflammatory type. The fever generally declined and disappeared on the second or third day, and the arthritic pains diminished in severity with the subsidence of the febrile exacerbation. The paroxysm terminated in an abundant perspiration, attended occasionally with a rash or military eruption, which, however, was regarded as an incidental symptom. The local pains abated so considerably that the inexperienced were often induced to resume their ordinary avocations. This deceptive interval, however, was but the prelude to the second stage. On the third or fourth day, the fever having generally intermitted, the tongue began to show a yellowish fur, and the stomach manifested considerable oppression, with nausea and sometimes vomiting. These annoying symptoms, on the fifth or sixth day, were relieved by a cutaneous eruption. In the hue and aspect of the skin, it resembled scarlatina more than measles, but was less confluent than either of those affections. The eruption consisted of minute papulæ of a florid red, slightly elevated, and distributed in irregularly shaped patches; and it appeared first on the face and trunk, and then spread to the extremities. A second febrile exacerbation, attended with severe arthritic and muscular pains, supervened on the full development of this exanthem. After two or three days' duration, the eruption gradually disappeared, with some desquamation of the cuticle. In the neck, groin, and axilla, the lymphatic glands, in a good many cases, suffered inflammation and enlargement; and this condition of the glands, as well as the painful affections of the joints, often continued for weeks and months after convalescence. "This was a singular termination of the disease," observes Dr. Dumaresq, of New Orleans, "leaving sufferers from the fever hardly able to move about; and indeed the appearance of persons in the streets must have been truly pitiable to a healthy stranger—the apparently great and often fruitless efforts to make a step; here one would be seen dragging his legs after him, supported on crutches; and there another with limping gait and various contortions of countenance, bespeaking that his tardy progress was made at the expense of his bodily feelings."

As regards the pathology of Dengue, it may be fairly classed among the exanthemata. It is an eruptive fever of a distinct and specific character, united with an inflammatory affection of the joints. Hence, one writer styles it *scarlatina rheumatica*; another, *exanthesis arthrosia*; and a third designates it an *eruptive articular* or rheumatic fever. The vulgar appellation by which it became universally known, it received from the English negroes of St. Thomas. From the stiff affected gait induced in those laboring under it, it was called by them the "*dandy fever*;" and this term, when the disease invaded Cuba, was there corrupted in Spanish pronunciation, into *dunga* or *dengue*.

In relation to the origin and specific character of this exanthematic fever, some diversity of opinion obtains. Whilst one class of writers refers it to an epidemic constitution of the atmosphere, another maintains it to be a malady of a specific and contagious nature. In support of the latter position, it is stated that its career was uninfluenced by season, locality, or atmospheric change, and that its progression was gradual from place to place, following "the great routes of commercial intercourse." Professor Dickson is an advocate for its contagiousness; but all the evidence adduced is far from conclusive. Dr. Osgood, who saw the disease at Cuba, is strangely "led to consider the specific cause of dengue, and that of yellow fever to be the same;" and Dr. Waring, of Savannah, maintains its close analogy with the "breakbone fever of 1826 and the epidemic fever of 1827," which last, like the *breakbone* fever of 1780, described by Rush, is a plain bilious remittent fever. That this "nova pestis" did, however, in the West Indies and along our southern coast, bear a strong resemblance to remittent or to yellow fever is very probable; for it is a fact, which did not escape the notice of that sage observer, Hippocrates, that diseases dependent on the nature of soil will always impress their peculiar character upon epidemics.

In reference to the prognosis of dengue, it has been already said that it scarcely ever proved fatal, unless complicated with some incidental lesions. The aged and debilitated suffered most severely; and amongst the intemperate, it not unfrequently ushered in *delirium tremens*. The population of some places experienced an almost universal attack. Neither age, sex, nor any condition in life, was exempt from its invasion. Its visitations were equally made to the hovels of wretchedness and the airy habitations of comfort and affluence—

——— æquo pulsat pede pauperum tabernas
Regumque turres.

In regard to the treatment, there does not seem to have been much diversity of opinion. To control the violence of the attack, the lancet was generally employed during the inflammatory stage. Cathartics and diaphoretics were almost universally prescribed. In the earlier stages, it was usual to give antimonials, and subsequently Dover's powder and other stimulating diaphoretics. Anodynes, in the form of opium and pulvis Doveri, were generally resorted to with the most happy effect,—a remedy loudly demanded by the pain and anguish of the sufferer.

K.—MORBILITY AND MORTALITY.

Table exhibiting the mortality of the United States Army for the period of ten years.—Laws of morbility and mortality in the United States.—Compared with the results obtained in other countries.—The profession of arms during peace involves no greater risk of life than civil pursuits.—The fact that the positions occupied by each regiment, illustrates the relation between mortality and locality.

The ratio of mortality and the relative degree of sickness in each class, are exhibited in the following table, the divisions being limited to two, the Northern, and the Middle and Southern :—

Divisions.	Systems of Climate.	Aggregate mean strength.	Annual rat. of mortality per 1000 strength		Total of cases reported.	Ratio per 1000 mean strength under treatment
			Adj. Gen. returns.	Medical returns.		
North'n.	1st Class. Coast of New England, .	4279	20	15	13.053	2,185
	2d " Posts on North'n chain of Lakes.	6377	13	9	7,004	1,912
	3d " Posts remote from the ocean and inland seas, ...	12790	14	8	39,104	3,103
	Average,	23446	15	9	59,161	2,660
Sou. Mid.	1st Class. Coast from Del. Bay to Sav.	6740	34	30	16,907	2,890
	2d Class. South-western Stations, .	11739	45	36	39,030	3.504
	1st Class. Posts on the Lower Miss.	3810	53	44	9,669	2,860
	2d Class. Posts in the Pen. of Florida.	4781	39	26	11,341	2,461
	Average,	27070	42	34	76,947	3,080
	Mean of the United States,	50516	30	22	136,108	2,882

It thus appears that in the Northern Division, the mortality, according to the Adjutant General's returns, is $1\frac{5}{10}$ per cent., and, according to the medical returns, $0\frac{9}{10}$ per cent.; and in the Middle and Southern Divisions, according to the former, the mean is $4\frac{2}{10}$, and according to the latter, $3\frac{4}{10}$ per cent. In this calculation, the deaths from epidemic cholera have been excluded from both classes of returns; and from the medical reports, such deaths also as arose from homicide, suicide, asphyxia from cold, submersion, etc. The former exhibits the ratio of mortality from *all* causes, with the exception of Asiatic cholera, as reported in the post returns by the commanding officer; whilst the latter, as it shows the mortality arising from diseases chiefly, may be regarded as a pretty fair expression of climatic influence. In the Middle and Southern Divisions, the ratio of mortality, according to the medical returns, is nearly four-fold greater than in the Northern, and according to the post returns nearly three times higher. Our northern latitudes exhibit little variation in the annual mortality; but the southern, in consequence of more fatal epidemic visitations, show great extremes. It must be borne in mind that in the latter the troops consist mostly of northern constitutions impaired by intemperate habits. In the above abstract, the aggregate of deaths is 1104, more than one-half of which, as already remarked, may be traced to the effects of inebriation,—a vice which, according to these statistics, may be indulged in our northern States as contrasted with the southern, with comparative impunity. The laws here developed in respect to the relative mortality of our northern and southern regions, are confirmed by similar investigations, embracing the four years ending with 1825, being compiled from a report showing the number of deaths and desertions in the army, made to Congress by Adjutant General R. Jones. These results, in which the latitude of Washington city is taken as the line of division, also show that whilst the *absolute* mortality in the north is low, and the fluctuations in the annual ratio slight, the mortality in the south is high and the annual oscillations great. Thus in the former division, the variation in the annual ratio of mortality per 1000 is from 17 to 20; whilst in the latter, the oscillations extend from 39 to 138. In 1822, this relative mortality of the north and the south, stands as 19 to 138, and in 1825 only as 20 to 39, whilst the relative mean of the four years is as 19 to 66.

In regard to the comparative degree of sickness among the troops, this table affords the following conclusions:—The ratio per 1000 of mean strength annually under treatment in the Northern Division being 2,660, it follows that every man, on an average, was reported sick once in every four months and a half. Pursuing the same calculation in respect to the Middle and Southern Division, the period is found to be very nearly four months; whilst the average of all posts included in these statistics is four months and a sixth. Assuming this ratio of sickness as an index of the comparative salubrity of the several regions represented by each class of posts, it is found that the coast of New England is on the lowest extreme, and the southwestern stations on the highest. The high ratio of the third class of the Northern Division is more apparent than real, inasmuch as an extraordinary number of slight affections are reported among the cadets of the Military Academy. It has been already shown that, as diseases differ in their tendency to a favorable issue, this average is liable to lead to error; thus, although the extent of disease in the class of posts on the Lower Mississippi is comparatively low, yet the mortality, owing to the malignant nature of febrile diseases, is higher than in any other class. During the ravages of epidemic fever, the mortality may be very great without the average number in the hospital being materially augmented. In the Windward and Leeward command of the West Indies, for example, the mortality is six times as high as in the United Kingdom, although the extent of sickness, as shown by the number of admissions into hospital, is but twice as great.

The disproportion between the relative extent of sickness among the military and civilians was brought under notice in considering the general results of the second class of the Southern Division; but this striking disparity, it was shown, is ascribable to peculiarities of condition not apparent at first view. The extent and duration of sickness among the working classes have frequently engaged the attention of British legislators. In regard to the influence of age on disease and mortality, it has been determined that from birth to the age of puberty they decline, and that from this period they increase slowly, but in geometrical progression, up to the fiftieth or sixtieth year, and then more rapidly to the end of life.

In the official "Statistical Report," from which these facts are chiefly derived, are given tables which exhibit the mean strength of every regiment of the United States army, and the deaths in each for the period of ten years, (from 1829 to 1839,) compiled from the monthly returns in the Adjutant General's Office. From these calculations, it appears that the annual ratio of mortality among our troops generally, from all causes—"ordinary, killed in action, died of wounds, and accidental"—is $4\frac{4}{10}$ per cent. Thus—

Years.	1829	1830	1831	1832	1833	1834	1835	1836	1837	1838	Average.
Ratio of deaths per 1000 of mean strength aunually.	36	32	29	68	30	57	49	48	53	42	44

This average is a fraction higher than the ratio of the four years ending with 1825, which is $4\frac{1}{10}$. The mortality of the four years commencing with 1819, although not precisely determined, is considerably higher. Compared with the results obtained in other countries, considerable diversity is presented. In the West Indies, the mortality of British troops, on an average of a period of twenty years terminating with 1836, is $9\frac{5}{10}$ per cent., and among the black troops $3\frac{8}{10}$ per cent., the mean being $7\frac{8}{10}$ per cent. This ratio, both among white and black troops, is about 50 per cent. lower than during the preceding twenty years. In British America we have the following results, based on the statistics of twenty years, ending with 1836 :—the Bermudas, $2\frac{2}{10}$ per cent.; Nova Scotia and New Brunswick, $1\frac{4}{10}$ per cent.; Canada, $1\frac{5}{10}$, and Newfoundland, (on an average of twelve years,) $3\frac{8}{10}$ per cent. In the Mediterranean, on an average of twenty years, the annual ratio of mortality at Gibraltar is $2\frac{1}{10}$ per cent.; at Malta, $1\frac{1}{10}$, and the Ionian Islands, $2\frac{4}{10}$ per cent. The rate of the British troops serving at home, being the result of the statistics of seven years commencing with 1830, is $1\frac{7}{10}$ per cent. In the East Indies, at Bengal, the mortality of European troops is $5\frac{7}{10}$ per cent., whilst that of the native troops in the Madras Presidency is only $1\frac{4}{10}$ per cent. The mortality of the French army on the home station is about 2 per cent. In the Prussian army, the ratio is $1\frac{1}{10}$ per cent.; but this low scale of mortality is attributable less to greater salubrity of climate than to the circumstance that the soldiers are almost entirely between the ages of twenty and twenty-five. The mean ratios of the following British stations, on an average of six years, from 1831 to 1837, stand thus : Ceylon $4\frac{8}{10}$, Mauritius $3\frac{5}{10}$, Cape of Good Hope $1\frac{8}{10}$, Bombay $3\frac{3}{10}$, Madras $5\frac{2}{10}$, and New South Wales $1\frac{4}{10}$; and in the Australian Colonies, on an average of twenty years, it is only $1\frac{4}{10}$ per cent.

The mortality of British troops on the western coast of Africa shows that region to be decidedly hostile to European life. The most striking climatic features are extreme heat and moisture. "Upwards of 300 inches of rain," according to the British Army Statistics, "have frequently fallen during the wet season; and more has been measured in two nights than falls in Great Britain during a year." The principal military stations are, Gambia, Sierra Leone, and the Isles de Loss. Of 1,685 white troops which arrived on this coast in 1822, 1823, 1824, and 1825, there died from 1823 to 1827 inclusive, 1,298, and 387 were invalided. Of the latter, seventeen died on their passage home, and only thirty-three of the remainder were, on inspection, found fit for further service. Of officers, 209 per 1000 died annually, and 197 per 1000 returned home invalided. On the average of healthy and unhealthy years, upwards of a fifth have died, and nearly an equal proportion have been invalided annually. So fatal is the influence of this climate on European constitutions, that two-fifths of the white troops are annually cut off by fevers, whilst the blacks are almost exempt. The natives, however, are subject to many diseases from which Europeans are exempt, more especially small pox. Among the black troops, on an average of nineteen years, the mortality was only three per cent.

The profession of arms during peace, as shown among the troops serving in the United Kingdom, involves no greater risk of life than that which attends civil pursuits. The ratio of mortality among the Dragoon Guards and Dragoons, whose average age was from 29 to 30, is $15\frac{3}{10}$ per thousand of the force annually. Taking a mean of the Carlisle Tables, the Government Annuity Calculations, and the Population Returns, the mortality among civilians at this period of life amounts to $11\frac{1}{2}$ per 1000; but as this calculation is based on the average of town and country, whilst the troops are quartered principally in towns, the ratio is nearly equal. Marts of commerce have been truly designated "the sepulchres of the dead and hospitals of the living." The unfavorable influence of density of population on health, is apparent from the single fact, that the average of seventeen of the principal towns in Great Britain, taken from Parliamentary returns, shows the mortality of the civil population to be, instead of $11\frac{1}{2}$, upwards of 16 per 1000. The result is, therefore, in favor of the military.

In the tables showing the mortality of each regiment, some striking facts are presented. The extremes of mortality are exhibited in the 4th and 5th regiments of Infantry. The latter, which has had a kind of *home* station on our northern lakes, gives an annual rate as low as $1\frac{3}{10}$; whilst the former, which has borne the "tug of war" in climes less genial, shows an average of $7\frac{6}{10}$ per cent. The attention is also arrested by the results presented in the last three years; for, it is seen that the Florida war, as already shown, has not augmented the general mortality. The average of these three years is about the same as the ratio of ten years.

Having now completed the investigation of the general medical topography of the United States and the special topography of the military posts, and also determined the ratios of morbility and mortality in each system of climate, we are enabled to study with profit, in proportion as a correct knowledge upon these points has been attained, their relative connections. In the official Report, a detailed account is given of the mortality of each regiment, and the various positions occupied by each during a period of ten years, (from 1829 to 1839 ;) and also for a period of four years, ending with 1825. It is there shown that the results in reference to mortality obtained from the statistics of the military posts, are confirmed, in the most marked degree, by the mortality of each regiment at both periods.

As M. Carnot, who was deeply skilled in the art of war, was wont, in making a comparative list of eminent French Generals, to place opposite an illustrious name the remark—"*he is well acquainted with the map* ;" so in the case before us, it is only he who has studied well the topography of our country that can fully appreciate the detailed observations of the official Report. Having once attained a correct and extended knowledge of the relative influence of various chains of localities, he will invariably find that, in proportion as he prosecutes his investigations, will his principles be confirmed by a succession of similar results.

The high mortality of our army, compared with that of British troops at home, in the Mediterranean, and in British America, is, in a great measure, susceptible of explanation. Although our troops are better paid, fed, and clothed than those of any other nation, yet, as they are distributed along a sea-coast of more than 3000 miles, and an inland frontier of perhaps equal extent, and as the condition of our Indian tribes and other causes demand their frequent removal from one extremity to the other, the duties of the soldier are often very arduous. A regiment recently, in the course of one year, marched 4000 miles, 1000 of which were performed on foot. Independent of marching and fighting, the duties required of the soldier are generally very laborious. Cutting roads, building bridges, constructing forts, etc., also fall to his share of duty.

Scarce a year passes without some hostile demonstration. In 1829, the unsettled state of the Creeks, and the intrusion upon the lands of the Cherokees, required the advance of troops ; and to afford protection to the trade carried on with the Mexican States, a detachment was ordered to escort the caravans as far as our boundary line. In 1830, our troops were kept in motion by Indian disturbance on Red River ; by threatened hostilities among the tribes inhabiting the country around Prairie du Chien ; by the lawless intruders upon the mineral district of the Cherokees within the limits of Georgia; and by negro insurrectionary movements about New Orleans. In 1831, we had disturbance among the Sac Indians, and servile insurrection in Virginia. In 1832 came the war of Black Hawk, when the most formidable enemy encountered was cholera. In 1834, Colonel Dodge's command, in his expedition among the Camanches, Pawnees, and Kiowas, suffered much from sickness. In 1835 the Dragoons, divided into three squadrons, made tours through almost the entire extent of our territory west of the Mississippi, below the 44° of latitude. In the same year occurred Dade's disaster. In 1836, we had the Seminole war, Creek and Cherokee difficulties, and threatened hostilities on the Texian frontier. In 1837, the Florida war and Cherokee troubles continued; and, in 1838, in addition to these difficulties, disturbances were manifested on the Canada frontier.

As regards the ratio of cases in the Northern Division, on the one hand, and the Middle and Southern, on the other, it is found that the latter is fifty per cent. higher than the former. In reference to the proportion of deaths to the number treated, the former is one in one hundred and forty-four, and the latter one in seventy-five; and as respects the average mortality compared with the mean strength, the latter is three times higher than the former. The highest mortality presented in the United States is at Baton Rouge, which, on an average of six years, gives a ratio of 208 per 1000, and in one year (1822) a ratio of 258 per 1000. In the West Indies, the highest average, on a mean of twenty years, is exhibited at Savannah la Mar on the coast of Jamaica, being 200 per 1000. At several of the posts along the coast of this island, it has often happened, in a particular year, that a half or a third of the garrison has been swept off by a febrile epidemic. On the western coast of Africa, as has been shown, the mortality among European troops is still higher. The fact, as reported in the British army statistics, that at certain posts at which the strength was maintained at 1000, there died in one year fifteen hundred, seems to surpass credibility. The relative monthly mortality in the United States has been already exhibited in the chapter on malarial diseases. It was shown that in the Northern Division, little disparity is presented; but that in the Middle and Southern the inequality, which is great, maintains a close relation with the increase and decrease of temperature. The most striking exemplification of endemial influence in the United States, is not, however, exhibited in these statistics, viz., the region of the Atlantic Plain compared with

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the parallel plateau and mountain-crests. Did we possess the requisite data, it would be exceedingly interesting to determine whether the laws revealed, under like circumstances, in other countries, in reference to deaths, marriages, and births, are here confirmed.

SECTION III.

ENDEMIC INFLUENCES IN GENERAL.

A correct knowledge of endemic diseases, a desideratum in our professional literature.—As endemic influences are dependent on a multiplicity of diversified causes, the effects are correspondently modified.—Physical circumstances modify the human frame.—The animal economy injuriously impressed by unaccustomed endemic influences.—Climate so modifies the human frame as to become assimilated to its endemic agents.—Chief sources and effects of endemial influences as manifested in the production of pulmonary and malarial diseases.—The unequal prevalence of malarial diseases under the same atmospheric laws, attributable to geological formation and the nature of soil.—In the marshy districts of our southern low-lands, the physical and mental constitution suffers great deterioration, and the mean duration of life is shortened.—In these localities, the population is only temporarily diminished, the void being filled up by a greater annual average of marriages and consequently of births, as well as by an influx of strangers.—The relative influence of the seasons in regard to mortality.—Bronchocele, nyctalopia, scorbutus. milk-sickness, etc.—The modus operandi of endemic influences on the animal economy.—The mode of preventing their production and of counteracting their effects.—The removal of troops but a short distance from the locality in which an endemico-epidemic is manifested, often causes its sudden cessation.—Influence of the progress of civilization on mortality.

Believing that the subject of *endemic** diseases presents a field that well deserves to be farther cultivated,—that a knowledge of those peculiarities of physical circumstances, the aggregate of which constitutes climate, which co-exist with certain forms of disease, is a department of medical science that includes some of its essential principles,—the attempt has been made, in the preceding pages, to

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* This word is derived from ενδημιος, domestic, native, endemic, from ενδημεω, to be at home, from εν, in, and δημος, people or territory.

supply, so far as the data would allow, this desideratum in our professional literature. Were the facts sufficiently precise and numerous for scientific generalization, it would prove a profitable inquiry to trace the various relations of the endemic diseases of different countries, with all those physical causes and moral agencies which influence the human organization. This has been attempted in part, (and with what success the reader will have judged,) by a comprehensive induction of facts in regard to pulmonary and rheumatic affections, intermittent and remittent fevers, diarrhœa, dysentery, etc. The object then of these concluding remarks, is to present a condensed summary of the more important facts developed, inasmuch as isolated facts are only valuable so far as they tend to establish general laws.

Endemic Influences are recognized rather by their effects than demonstrative properties; and as they are the result of the conjoined operation of physical phenomena and moral conditions which constantly vary, the effects are correspondently modified. When we reflect that endemial influences are the consequences of a multiplicity of causes, as temperature, prevailing winds, locality as regards elevation or the vicinity of large bodies of water, geological formation, soil, vegetation as respects culture or a state of nature, etc., in their various conditions and combinations, in connection with the influence exerted on the human frame by occupations, modes of life, and moral agencies, the diversity and importance of the resulting effects can no longer excite surprise. In the investigation of endemic causation, it is necessary to consider the social, moral, political, and intellectual conditions of the inhabitants—their privations and comforts—their states of filth or cleanliness—as well as the agency of these diversified causes in developing or counteracting one another. Thus the influence of locality is exhibited in the comparative effects of mountainous situations and low malarious positions upon the physical and moral condition of their inhabitants respectively; and conversely, these moral and physical conditions, as has been demonstrated both in the Old and the New World, are improved by the alterations effected in the face of nature by the march of civilization. A similar result is witnessed in the beneficial effects of change of air from a crowded city to the open country. No sooner does the permanent resident of a large city, laboring under that deterioration of health which has been termed *Cachexia Londinensis*, leave the

> "chaos of eternal smoke
> And volatile corruption from the dead,
> The dying, sick'ning, and the living world,"

than the etiolation or blanching, stamped upon the countenance, vanishes, and the glow of ruddy health usurps its place. As in the corporeal structure, different effects result from the dry and restless air of the mountain, compared with those evidenced in the moist and sluggish atmosphere of the valley; so, as regards the mental manifestations, the observation of the poet is philosophically correct—

> "An iron race the mountain cliffs maintain,
> Foes to the gentler manners of the plain."—GRAY.

That the physical frame is not independent of external causes, and that the moral and intellectual phenomena of man are not independent of the former, are opinions that rest upon conclusive evidence.

The definition of climate as given by Cabanis, in consideration of its comprehensiveness, may be here inserted :—*L'ensemble de toutes les circonstances naturelles et physiques, au milieu desquelles nous vivons dans chaque lieu.** This correct view of the subject was taken even by Hippocrates, in his treatise entitled, "*de aeribus, aquis, et locis.*" The influence of climate upon our physical organization, even in many of its detailed effects, was observed by him. To this agency, he ascribed, on the one hand, the indolence and effeminacy of the Asiatic, and, on the other, the activity and the courage of the European. He even observed that the inhabitants of mountains in warm climates resemble those of very cold regions; and also that political institutions are much modified by local circumstances. He was aware that cold and temperate climates augment the muscular forces, at the same time that they diminish the power of sensation; and that very hot climates, on the contrary, produce temperaments in which the sensibility predominates over the motive forces. Hence the former induce energy and industry, and the latter, indolence and inactivity. Fertile lands, in which the temperature is mild, exercise a happy and cheerful influence upon the physical, mental and moral constitution; whilst a soil of a sterile nature, by requiring a constant exercise of industry, renders a people sober and reflecting.

As the health and constitution of the natives of a particular locality are modified by its physical circumstances, so also does the native frame become so assimilated to the climate as not to be inju-

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* Rapports du Physique et du Moral de l'homme. Par P. J. G. Cabanis.

riously affected by its endemic influences. On the western coast of Africa, for example, the climate is excessively destructive to the British troops, whilst it is genial to the African constitution. This susceptibility of the animal economy to be injuriously impressed whenever exposed to endemic influences to which it is unaccustomed, is evidenced by all the races of man, and in all changes of locality when this change involves a change of the physical conditions of nature. Man, at the same time, is a cosmopolite. Although more readily assimilated with particular climates than any other animal, yet the natives of every region do not possess the faculty in an equal degree. The natives of tropical regions, on the one hand, and of polar countries, on the other, are speedily cut off by removal to the opposite extreme. The constitution of the negro, for instance, is little fitted to adapt itself to foreign climates. When those from the interior serve at Sierra Leone, on the sea-coast of their own continent, the mortality, according to the British army statistics, is double the ordinary ratio of other troops serving in their native country. In 1817, a regiment of black troops was sent from the West Indies to Gibraltar, on the ground that their services would be especially important in relieving the British soldiers from such duties as require exposure during the heat of the day; but it was soon discovered that the constitution of the negro is unfitted for that climate, as the annual mortality was four times greater than among the European troops during the same period. The inhabitants of the middle latitudes, on the contrary, owing to their habitual exposure to extremes of temperature, and consequent greater vital energy, manifest, in the highest degree, that pliability of functions by which man is rendered a cosmopolite. The plants of temperate regions are also endowed, in the highest degree, with the faculty of accommodating themselves to all climates, for the obvious reason that the transition from this point to either extreme is less violent than from one extreme to the other.

This susceptibility to the impression of endemial influences is said to be most marked in early years, diminishing with the advance of age; but at the latter period, when the change is made to a more unhealthy locality, the powers of life sink more readily.

As respects the effects resulting from locality, we find, on comparing the inhabitants of northern and intertropical climates, certain peculiarities of organization and functions, that must strike the pathologist as having an intimate relation with the character and treatment of their diseases respectively. In the natives of the torrid zone, the skin assumes a more extensive function than in those of northern regions, thus compensating by its activity for the diminished operation of the lungs, liver, and kidneys, as compared with the northern man. This general connection of climate with the development and activity of these functions, we discover, in our own country, on instituting a comparison between our northern and southern regions, or even between the warm, moist, and malarial atmosphere of the Atlantic Plain and the parallel mountain regions. In the warm and moist climate, the changes produced by respiration are diminished, whilst those effected by the cutaneous and intestinal mucous surfaces are increased. In the opposite locality, an augmented activity of all the functions is experienced; in the nervous and circulating systems, increased tone is evinced—respiration is performed most effectively, and animal heat is generated with a rapidity corresponding with the expenditure on the external surface,—thus giving to the constitution a phlogistic diathesis. An explanation of the effects arising from change of locality is thus afforded. The human frame as last described not being assimilated to the warm and humid atmosphere, and consequently not adapted to its endemic influences, some functional lesions will necessarily ensue. The cutaneous surface not being so constituted as to be qualified to perform the compensating action, the liver evidently acts with increased energy, eliminating the effete elements which accumulate in the circulation. The system of the negro, as his skin is a much more active organ of depuration than that of the white man, is consequently better adapted to the warm, moist, and miasmial climates of the tropics; but, at the same time, we find that this condition of the skin, notwithstanding a protection against the causes of the endemic fevers so fatal to the British troops, renders him peculiarly liable to diseases of that tissue, from which the whites in the West Indies and on the western coast of Africa, are comparatively exempt. In the cold and dry atmosphere, on the contrary, muscular frames and plethoric habits of body predominate, giving to diseases the sthenic character,—phenomena which plainly point for an explanation, when we consider the relative electrical states in the opposite system of climate, to an accumulation of positive electricity in the human organization.

Chief sources and effects of endemic Influences. These have been pointed out to a considerable extent in the preceding Section. In regard to the causes productive of the class of pulmonary diseases, it has been satisfactorily shown that, with the exception of tubercular phthisis, they are dependent chiefly on atmospheric laws. That the ratio of catarrhal affections, pleuritis, pneumonia, and chronic bronchitis, increases and decreases in proportion as the seasons are contrasted, thus maintaining a direct relation with the extreme range of the thermometer as connected with the seasons, seems to have been fairly demonstrated; or, in other words, it would appear to be a law that in proportion as the high temperature of summer makes an impression upon the system, do the lungs become susceptible, so far as phlogistic diseases are concerned, to the morbific agency of the opposite seasons. These constitute the *predisposing* causes, to which the *exciting* ones of atmospheric moisture and variability of temperature are subordinate. Hence we have an explanation of the fact long since observed, that the diseases generally of the pulmonary organs are less rife along our northern frontier than in the middle States, and less prevalent in our northern region, in the moist and changeable climate peculiar to the sea-coast and large lakes, than in the dry atmosphere of the opposite locality; and hence, too, is afforded a rational explanation of the advantages to be derived from change of climate in the way of a winter residence. These various deductions, however, have been so fully elucidated under the proper head, that to dilate upon them here were a mere repetition. In regard to rheumatic affections, the laws developed bear a considerable analogy to those of the lungs; but this analogy would, no doubt, be more marked, if the inquiry were limited to cases of the acute form, the term, rheumatism, being generally loosely applied to a host of disorders characterized merely by pain.

The next class of diseases investigated are those of malarial origin, which are dependent not on purely atmospheric causes alone, but on some of those other physical phenomena which concur in forming the climate of a locality, as the geological formation, the nature of the soil, the abundance and exuberance of the vegetable creation, and the state of agricultural improvement. The soils most productive of endemic diseases are those abounding in organic remains, as low marshy places and grounds subject to inundation,—the deep alluvial earth found near the level and shores of the sea or large lakes, on the banks of rivers more particularly at their embouchures, and in the bottom of valleys, more especially if these soils have an argillaceous substratum,—and lastly, thick wood or jungles, particularly in warm climates. But the development of these influences has a close relation with the degree of temperature, the condition of moisture, as well as the extent of exposure to the direct rays of the sun. Rice-grounds are found to be particularly insalubrious, from the circumstance that a low, wet, and rich soil, abounding with vegetable matters undergoing decay, is exposed, after repeated irrigations and inundations, to the action of a powerful sun. Whilst the inhabitants of our northern States are much subject to endemic diseases, when exposed to localities in our southern States, which admit only of a rice-cultivation, the dark races, owing to the adaptation of their organization to these physical circumstances, are little liable to them. Inundations producing an admixture of fresh and salt water, from the circumstance that the latter contains a great quantity of animal matter, are supposed to render low grounds, when the surface becomes exposed to the sun's rays, particularly insalubrious.

A low, moist, and rich soil, when exposed to the action of the sun, by being cleared of its vegetable productions, especially in tropical climates, emits more noxious emanations than in its unreclaimed state, until it is completely brought under cultivation. This point has been particularly dwelt upon in the preceding pages, which furnish numerous proofs of the position that, although cultivation renders a climate drier and more salubrious in the end, yet, for some years after the forest is cut down and the ploughshare turns up the soil to the action of the sun, its endemic diseases, in every portion of the United States, assume a more severe form. Protected, in a great measure, from the sun's rays by the exuberant vegetation, which also by the evaporation and transpiration from the leaves diminishes the temperature, the surface yields less noxious exhalations, (a great portion of which seldom rises above the higher foliage of the trees,) than when the earth itself, in its cleared state, becomes exposed, during our intense summer heats, to a much more exalted temperature. Added to which, the constituents of the soil, so far as regards animal and vegetable remains, are much richer than the decayed vegetable matter on the surface.

Among the various circumstances connected with the production and diffusion of noxious exhalations from the soil, it is generally believed that the presence of dead animal matter, when mingled with vegetable remains in a state of decay, gives rise, in warm countries or in the hot seasons of temperate climates, to miasms, especially during humid states of the atmosphere, of a more deleterious character than those resulting from vegetable remains alone. The same causes which render vegetation luxuriant, bring into existence immense swarms of insects and reptiles, the exuviæ and dead bodies of which mingle with the decayed vegetation. In addition to high temperature and humidity favoring decomposition, they, in conjunction with richness of soil, produce succulent plants, which, as they contain largely of saccharine and oleaginous principles, rapidly pass through the alternate processes of growth and decay. Moreover, marshy places and alluvial soils, in warm countries, yield vegetable productions which contain less of tannin, resin, the terebinthinates, &c., than in cold climates, in which these antiseptic principles abound; whilst the former also contains a much greater proportion of animal matter undergoing decomposition.

Many of the circumstances connected with the production and diffusion of malaria, as the degree of atmospheric temperature and humidity, and its state as respects horizontal and vertical currents, have been noticed. Sometimes the most pernicious exhalations arise when there is no humidity in the atmosphere, but then the protracted dryness has caused fissures in the upper strata of the soil, through which the noxious moisture of the lower, especially if absorbent or argillaceous, is exhaled. If the atmosphere is often renewed, the concentration of the effluvia emitted, however productive their sources may be, is prevented. High winds and thunder-storms are the means employed by nature to dilute or entirely dissipate these noxious agents. It has been long since observed, especially in warm climates, that when the air, hot and moist, has been long undisturbed by these violent commotions, endemic diseases assume the most aggravated character. Electricity also seems to have an intimate connection with endemic causes. If the atmosphere is warm and moist, there arises a disturbance in the equilibrium of its electrical conditions, as well as its electrical states relative to the animal economy. The presence of aqueous vapor, mingled with the pure atmospheric air, which is a non-conductor, gives it the opposite quality; and thus evaporation is the cause of the disturbance of the general equilibrium of the globe, giving a surplus of the positive fluid to the air and leaving the earth surcharged with negative fluid. Hence the unfavorable influence of some winds, as the north-east monsoon, arises from their relatively low electric condition or their being in a negative state, thus attracting the positive electricity of the animal frame. During the prevalence of the sirocco, the dew-point has been known to fall from ten to twenty degrees. "The walls of houses, stone floors, and pavements," says Hennen, "invariably become moist when the sirocco blows. I have seen the stone floors at Corfu absolutely wet without any rain having fallen." The influence of the weather on the human frame is consequently not to be estimated merely by thermometrical changes in the atmosphere.

These diversified circumstances just enumerated, which operate with such intensity in our southern low lands, are not devoid of influence, especially during the high temperature of summer, in our northern regions; but here, during low ranges of the thermometer and particularly in the system of climate characterized by great dryness of the atmosphere, the human frame no doubt enjoys a complete immunity from terrestrial emanations; and here, as an accumulation of positive electricity in the human frame is experienced, the activity of all the functions is increased, the constitution acquires the phlogistic diathesis, and diseases present the sthenic form.

As regards the effects of endemial influences respecting malarial causes, these have been already illustrated in reference to several forms of fever, diarrhœa, dysentery, &c. Endemic fevers are modified, from the mildest intermittent to the most malignant remittent, by the particular circumstances in which they originate, and by the constitution and predisposition of the patient. As these vary, so do intermittents present every type and complication, and remittents, numerous grades and forms. The one may pass into the other, and either be followed by dysentery or other lesions. They may commence mildly and insidiously, passing rapidly into dangerous complications; they may begin in great excitement, and terminate speedily in death or recovery; they may present great depression *ab initio*, the powers of life never rallying, with a tendency to rapid dissolution of the body as soon as respiration ceases.

The facts developed in regard to intermittent fever are of more than ordinary interest. As the region of New England,* New Brunswick, and Nova Scotia is exempt from this variety of fever, whilst in that of the great lakes, both on the American and British side, it is very prevalent, and as the coast of the former exhibits climatic features similar to the other, so far as regards temperature and humidity, it follows that a solution of the question must be sought in the admixture of terrestrial emanations dissolved or suspended in atmospheric moisture. Now these diverse results must be influenced not only by the nature of soil but the geological formation. If the latter consists of the *debris* of sand stone and other

* See note at end of volume.

rocks, forming a coarse and gravelly substratum through which the rain percolates and flows off, favored still more by the undulating surface of a soil which is dry, sandy, and gravelly, no deleterious agents will be exhaled; but if the geological structure consists of tertiary and cretaceous secondary deposits, with a deep, rich, clayey, and absorbent soil, more especially if low and flat with an argillaceous substratum impervious to water, it will yield by evaporation nearly all the rain which falls upon it, thus carrying into the atmosphere a portion of decayed animal and vegetable matter, (the decomposition of which its moisture promoted,) or perhaps some new resulting compound. Now we find that the region of New England, as it has, with little exception, a primitive formation with a sandy and sterile soil, is comparatively destitute of organic remains; whilst that of the lakes has not only a geological structure of secondary origin, but mostly a deep, rich, and humid alluvial superstratum. If we follow the Atlantic Plain and the parallel mountain region from the Delaware to the Mississippi, the same law in regard to malarial diseases is found to obtain; for the one has a temperate climate, a soil comparatively free from organic remains, and a surface which allows no stagnant waters; whilst the other, consisting of tertiary and secondary cretaceous deposits, all abounding with marine fossil shells, with an argillaceous and alluvial soil covered with marshes and furrowed by sluggish streams, has a hot and sultry atmosphere. A similar contrast within limits still more circumscribed, is afforded in the well-known fact that the resident of our southern low-lands is peculiarly subject to malarial diseases along the margins of streams, lakes, and marshes, whilst he is exempt in the adjacent sandy pine woods; and this observation finds farther illustration, from the author's personal knowledge, in portions of two adjoining counties of Maryland, viz., Frederick and Baltimore, the former with an exceedingly fertile soil being very rife with malarial diseases, whilst the other, termed the "*barrens*," with a sterile, sandy, and undulating surface, being wholly exempt.

Proceeding up the Mississippi and its tributaries—a valley of secondary formation and alluvial soil—we find that malarial diseases still prevail; and on the prairies of the far west, and even the table-lands of Ohio, the summits of whose highest hills are rich in organic remains, but more especially along the margins of streams, the same class of diseases are dominant. Moreover, if further evidence were necessary to establish the connection between organic remains and what have been classed as malarial diseases in the foregoing pages, it is only necessary to refer to the fact that even in the malarious region of the great lakes, those posts which have a dry and sandy soil, as Forts Brady and Mackinac, are almost exempt from these diseases ; and so upon the Atlantic Plain, we find a similar exemption at Forts Monroe and Moultrie, each situated on a sandy tongue of the sea-coast. Lastly, the history of Augusta Arsenal, which was removed from the Savannah river to the "sand hills"—a distance of only two miles—illustrates the same law.

As malarial localities are generally connected with a high dew-point, it has been lately attempted to account for the production of the fevers ascribed to this source, solely by the check thus given to evaporation from the cutaneous surface ; but, although the existence of an aerial, intangible poison is by no means disproved, yet we here obtain a glimpse of the complicated mechanism by which those fevers are set in motion. In the opinion of Dr. Charles A. Lee, who is now conducting some experiments on this interesting subject, an atmosphere saturated with moisture acts chiefly by preventing the separation of carbon by cutaneous and pulmonary transpiration, whilst it at the same time gives efficiency to malaria by checking its elimination from the system. The increased biliary secretion in hot climates is obviously referrible to a continual high dew-point.

Recently the origin of the fatal febrile diseases of tropical climates has been referred by Professor Daniell of King's College, London, to sulphuretted hydrogen, which, when mixed with the atmosphere in the proportion of a fifteen-hundreth part, has been experimentally found to act as a direct poison upon small animals. He has brought to the notice of the Admiralty "the existence of an extraordinary impregnation with sulphuretted hydrogen of the waters of the ocean, and of the embouchures of rivers along the coast of Africa, through an extent of more than sixteen degrees of latitude." This excessive impregnation is referred to two sources by the Professor—"first, a submarine volcanic action, in which case the evolution might be considered direct or primary; and secondly, a re-action of vegetable matter upon the saline contents of the water, in which case it would be secondary." Mr. Malcomson says that he has observed "the same phenomena in the salt water of inlets along the Indian coast, wherever the bottom contained argillaceous and carbonaceous matter." Professor Daniell farther remarks that "decayed vegetable matter abstracts the oxygen from sulphate of soda, and a sulphuret of soda is formed. This again, acting upon water, decomposes it, and sulphuretted hydrogen is one of the products of the decomposition."*

To say any thing more in regard to the specific diseases of this class, which have been already investigated, is deemed unnecessary. It has been seen that whilst the southern region of the United States is productive of diseases affecting chiefly the abdominal viscera and the circulating and secreted fluids, the northern districts favor the development of disease in the thoracic viscera and in the muscular and circulating systems—a contrast also observed on the same parallels when we compare the Atlantic Plain with the elevated, temperate, and dry localities lying adjacent. In the one, as the passage of electricity from the earth to the clouds is favored, the vital powers, as already shown, are lowered; and in the other, as it accumulates in objects on the earth's surface, diseases of a phlogistic character are induced, as fevers of an inflammatory type and inflammation of the lungs and the serous and fibrous structures.

In conformity to a law of the animal system, that its natural susceptibility to be influenced by morbific agents diminishes by a gradual and protracted exposure, we find that among the acclimated, in warm countries, the agency of malaria may be compared to a slow and concealed combustion, whilst in the unacclimated, its effects are evinced in a raging and rapidly consuming flame. Those assimi lated to the climate are consequently liable mostly to agues, affections of the bowels, enlargement of the spleen, etc.; but those who have removed thither from cold or temperate regions, are subject to fevers of a violent and often malignant character: and *vice versa*, the endemic influences of mountainous districts are most deleteriously exerted upon those who have recently migrated from warm malarious situations.

It is said that although the white races of the human family may reach, in warm countries productive of endemic influence, advanced years; yet their offspring will seldom attain maturity, or if so, will very rarely arrive at old age. In these localities, as is often observed in the tide-water region of our southern States, the human frame is weakly constituted or imperfectly developed, the mortality of children is very great, and the mean duration of life is comparatively short. Along the frontiers of Florida and the southern borders of Georgia,

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* *The Influence of Tropical Climates on European Constitutions.* By James Johnson, M. D., and James Ranald Martin, Esq.

as witnessed by the author, as well as in the low-lands of our southern States generally, may be seen deplorable examples of the physical, and perhaps mental, deterioration induced by endemic influences. In earliest infancy, the complexion becomes sallow, and the eye assumes a bilious tint. Advancing towards the years of maturity, the growth is arrested, the limbs become attenuated, and the viscera engorged. Boys of fifteen years may be seen bowed down with premature old age—a mere vegetating being, with an obstructed, bloated, and dropsical system, subject to periodical fevers, passive hæmorrhages, and those other forms of disease which follow in the train of malaria. But these are extreme cases, which consequently afford no warrant for the exaggerated statement made in two recent British works of deservedly high repute. In the Cyclopædia of Practical Medicine, we are told that "in the marshy districts of certain countries, for example Egypt, Georgia, and Virginia, the extreme term of life is stated to be forty; whilst we learn from Dr. Jackson, that at Petersburgh, in the latter country, a native and permanent inhabitant rarely reaches the age of *twenty-eight*." And in Copland's Dictionary of Practical Medicine, the same story has received an additional shade of exaggeration; thus—"Dr. Jackson states that white persons, born and residing in the more unhealthy districts of Lower Georgia, seldom live to forty; and that at Petersburgh, in Virginia, they rarely reach *twenty-five*."

That the continued operation of these endemic influences, as in the low-lands of our southern States, would ultimately depopulate the country, might be naturally supposed. Observation, however, has taught us that here, as in epidemics which cause great mortality, the population is only temporarily diminished; for as the means of subsistence for those who survive have become more abundant, the void is filled up in a few years by a much greater annual average of marriages and consequently of births, as well as by an influx of strangers. Between endemics and epidemics there is a close relation, most of the wide-spreading diseases having the character of endemico-epidemics, the latter being grafted on the former as the parent stock. This fact did not escape the notice of that sage observer, Hippocrates. Speaking of the diseases dependent on the nature of soil, he remarks that if any epidemic should arise, they will have sufficient influence to impress upon it their peculiar character. Destructive epidemics occur most frequently and most violently in low situations and crowded cities—a fact observed, in our own country, in regard to epidemic cholera. Whilst these influences increase the deaths and diminish the mean duration of life, they tend directly, as just remarked, to augment the ratio of marriages and births: in addition to which, as the means of sustenance and employment in low and alluvial regions, are more abundant than in barren and mountainous districts, the excess of deaths over births is equalized by the influx from more healthy parts. This statement is well illustrated by the following statistical table, furnished by M. Bossi, Prefect of the Department of Ain in France, which he has divided into four zones in accordance with its topographical features:—

Locality.	1 death annually to inhabitant.	1 marriage annually to inhabitant.	1 birth annually to inhabitant.
In the hilly districts, . .	38.3	179	34.8
Along the banks of rivers, &c.	26.6	145	28.8
In cultivated grounds, . .	24.6	133	27.5
In marshy places, &c. . .	20.8	107	26.1

Now did we possess the data requisite to enable us to institute a comparison between the sterile and healthy region of New England and the fertile and less salubrious western States, or between the Atlantic Plain and the parallel mountain regions, these laws would doubtless be confirmed statistically, as they are already by ordinary observation.

As regards the influence of the seasons in the production of fatal diseases, a comparison of our northern and southern latitudes shows a marked distinction. It has been seen that whilst in the former, there is little disparity in the mortality of each month, in the latter the inequality is great in close relation with the increase and decrease of temperature, the ratio increasing from April to September and then gradually decreasing until the re-appearance of the former month. The influence of malarial causes upon mortality is thus illustrated; for, notwithstanding this morbid poison may be generated in our northern regions, yet the diseases developed, as for instance intermittent fever, exert no fatal tendency. As malarial diseases are dominant in southern Europe, so the aphorism of Celsus, conformably to the rule laid down by the Greek and Roman authorities, accords with the relative salubrity of the seasons in the United States, and more especially in our southern latitudes; thus—*saluberrimum ver est,—proxime deinde ab hoc, hiems,—periculosior aestas,—autumnus periculosissimus.* In London, at the present day, according to the Registrar-General of Births, Deaths, and Marriages," we find this order of salubrity nearly reversed, the fatality of the seasons standing thus—winter, spring, autumn, summer. This is, however, not the case in our northern cities, as, for example, Boston, New York, and Philadelphia; and as regards our northern military posts, it is also found that in the malarial region of the great Lakes the ratio of mortality is always highest during the summer, whilst at the posts on the coast of New England, which is exempt from malarious causes, there is little difference in the ratio of cases reported each quarter, the winter being often the most insalubrious season. At Fort Gibson, Arkansas, on the contrary, the ratio of sickness is twice as high in summer as in winter. The same degree of temperature will consequently produce very diverse results; for to the agricultural inhabitants of a non-malarial soil or to the residents of a city equally favorably situated, winter may prove the most unhealthy season, whilst in marshy districts or cities abounding in dead organic matter, summer will be the most insalubrious. The influence of very cold climates on the human constitution is, to destroy the feeble and invigorate the strong; for if the source of animal heat is enfeebled or exhausted by the effect of low temperature acting on the surface of the body, the constitution will be correspondently enfeebled or life quite destroyed; but if the source of animal heat is so powerful as to resist this external agency, the powers of life will be invigorated. This explanation, for which we are indebted to Professor Pelletan, is equally satisfactory in regard to the phenomena of what is called *reaction* against cold, as well as the effects of cold as a hygienic agent in strengthening the human frame.

There are other agencies, which do not fall within the preceding descriptions, productive of diseases *sui generis*. That the base of lofty mountains constitutes a locality favorable to the development of *bronchocele*, was well known even in the days of Juvenal, as appears by the line—

Quis tumidum guttur miratur in Alpibus?

but its etiology is equally inexplicable now as then. This disease, which has been observed in many parts of the world, prevails endemically in our own country, in Vermont, the western portion of New York and Pennsylvania, on the great Lakes, and in Virginia. The old idea, universally entertained, that this disease arose from the drinking of snow-water at the foot of lofty mountains, has been effectually dispelled by the fact that the disease exists in countries in which snow is unknown. The recent opinion of its connection with localities the water of which is impregnated with calcareous salts, is gnerally confirmed in our country.

To the same class of endemic diseases, the causes of which are generally no less inscrutable, belong, the pellagra of Italy, the cretinism of the Vallais, the hepatitis of Coromandel, the elephantiasis of Malabar and other places, the plica of Poland, the beriberi of Ceylon, the tarantalism of Apulia, the frambœsia or yaws of the negro race in Africa and the West Indies, the opthalmia of Egypt, the Radesyge of Norway, or the malum Alepporum, etc. Of these affections, no one has been observed in the United States, with the exception perhaps of the *yaws*, which has been seen by the author among the negroes of Florida. Some of these disorders may be imputed to obvious physical causes, as the opthalmia of Egypt to the reflected heat and the impalpable sand in the air—pellagra to dirty habits, unwholesome food, etc. Lesions of the nervous system, frequently implicating the mental manifestations, as well as typhus and typhoid fevers, occur oftener in large and crowded towns than in the country, and much more frequently than in states of society not completely civilized,—effects resulting from a confined and impure air co-operating with the exhaustion arising from dissipation or mental exertion, the luxuries of refinement, and the excitement of the various passions and moral emotions. According to Mr. Farr, as shown in a letter appended to the First Annual Report of the Registrar General of Great Britain, in which a comparison is made among seven millions of persons, one half of whom dwell in towns, and the other half in counties, the mortality from epidemic diseases and disorders of the nervous system is doubled by the concentration of population in cities. In towns, as compared with counties, the mortality from consumption is increased thirty per cent.,—from child-birth, seventy-one per cent.,—and from typhus, two hundred and seventy-one per cent.

Besides the endemics here enumerated, there are several others observed in our own country deserving of notice. In our southern latitudes, but more especially in Florida, *nyctalopia* may be regarded as endemic, and also, though in a less degree, along our northern frontier where the ground is covered many months with snow. To the mode in which these causes operate, reference has already been made. To the same class pertain *colica pictorum* and *scorbutus*, observed from time to time among our troops, as detailed in the preceding pages.

A remarkable endemic peculiar to the western portion of the United States, being seldom or never observed east of the Alleghanies, is a disease known under the appellation of *Milk Sickness*. This name had its origin in the circumstance that the disease is frequently communicated to man by the use of the milk of an infected animal, though it will be as readily produced by eating the flesh. Beef cattle, horses, goats, and sheep, are the animals in which it has been mostly observed. In cattle, in consequence of the trembling motion manifested by the voluntary muscles, the disease is generally known by the name of the "*Trembles*." Sometimes, the first symptom observed, as described by Dr. G. B. Graff, of Illinois, is, that the animal staggers and falls, when death may immediately supervene, or in less fatal cases, life may be prolonged several hours, or recovery ultimately take place. The disease, however, may exist in a latent condition, the animal evincing no morbid manifestations, whilst its flesh and milk will cause the development of the disease in the human system. In man the disease is generally developed from the third to the tenth day from the period of the reception of the morbid poison. The disease is preceded by a peculiar and indescribable fœtor of the lungs as a premonitory symptom; and so constant is this symptom in its appearance, that it may be regarded as pathognomonic of the forming stage. The general symptoms vary much. Most usually there are first loss of appetite, restlessness, pain in the head, and intolerance of light, followed in a few days by violent and distressing vomiting, obstinate constipation of the bowels, and general febrile action. A change of volume in the tongue, which quickly attains an inordinate size, being soft and flabby in its texture, and filling the mouth completely, may be considered as characteristic of the second stage. With the disappearance of the peculiar odor from the lungs, the disease no longer presents any specific characters; but now either the vital powers evince mere extreme prostration, or a low typhoid form of fever supervenes. A large majority of cases terminate fatally; and when recovery does ensue in severe attacks, convalescence is very tedious, and often the constitution never regains its former vigor. After recovery, nothing which transpired during the progress of the disease, and even for some days prior to its active development, can be called to mind by the patient.

In regard to the etiology of this singular disease, nothing certain has been determined since it was first noticed by the French missionary, Father Hennipin. It has in turn been supposed to be of mineral, vegetable, and aerial origin; but all observations tend to show that it is somehow indissolubly connected with the nature of soil. Occurring at all seasons of the year, the limits of its prevalence, according to Dr. Graff, are often confined to an isolated spot, comprising an area of one or two hundred acres, but more commonly to a narrow tract extending even a hundred miles; and the boundaries separating the healthy from the infected districts are the same now as at the first settlement of the country; nor has any locality previously exempt been ever known to acquire the property of causing this endemic. In the State of Ohio, however, it is alleged by Professor Daniel Drake that the cause, whatever it may be, will be infallibly eradicated by transforming the surface by the hand of art. Amongst the early immigrants, whole communities, on account of the prevalence of this malady, were often compelled to seek another location; and, even at this day, those who venture within the boundaries of an infected district, are constrained, as a condition of their residence, to abstain from the flesh of the cattle living within the same limits, as well as their milk and its preparations. Of the milk of an infected cow, or the butter or cheese made of it, a very small quantity will suffice to develope the disease in the human system. It is believed to have been produced even by the cream used in the coffee drunk at a single meal. In some of these infected districts, it is said that the inhabitants, with a recklessness of human life that seems incredible, carry the butter and cheese, which they dare not themselves venture to eat, to the markets of the western cities; and that thus are induced morbid symptoms and even death, regarded by the unsuspecting medical attendant as some new or anomalous form of disease. Notwithstanding the infected localities are usually distinctly circumscribed, and the inquiry in regard to the cause of the disease has been prosecuted with much zeal, large rewards having been held out by legislative bodies as an inducement to its successful investigation, yet the endemic agent remains shrouded in mystery.

Quite recently, Dr. Seaton, of Kentucky, has written a treatise in which he endeavors to prove that Trembles and Milk Sickness have an arsenical origin; but as his theory does not rest on positive facts, it is far from conclusive.

Equally involved in uncertainty is the pathology of this disease; and in regard to the proper therapeutic means, so much discrepancy exists that it can be accounted for on the supposition only that the morbid manifestations are modified by the nature of the endemic influence. So unsuccessful are practitioners generally in the treatment of this disease, that by many of the inhabitants of infected districts, dependence is placed entirely on domestic remedies.

By Dr. Drake, however, it is believed that undue importance has been attached to this disease. "There can be no doubt," he says, "that more persons annually die in the West, from autumnal fever, than have died of Milk Sickness, from the commencement of its settlement."

Cholera Infantum, regarded by many as peculiar to this country, remains to be noticed. According to Copland, this disease is not uncommon in London; but in Paris, it would seem to be unknown. (*Billard.*) It is the great scourge of our summer months, prevailing to a great extent in Boston, New York, Philadelphia, and Baltimore, but in a less degree in Charleston and New Orleans. As regards its etiology, the agency of heat cannot be considered as the sole cause; for in country situations on the same parallel with our northern cities, it is comparatively rare, nor does it increase with the decrease of latitude. The same facts show that it has little or no relation with the class of malarial diseases, inasmuch as we find it very rife at Boston compared with our southern cities. The chief predisposing cause is doubtless the extremes of the seasons, in conjunction with the deterioration of health induced by the morbid poison of a city atmosphere, more especially when favored by the irritation of teething; for the two reasons that it seldom occurs in infants under three months, and is limited mostly to the crowded and filthy habitations of confined alleys and courts. In addition to the great extremes of the seasons and alternations of temperature which characterize our climate, there are other physical causes that promote the prevalence of infantile diseases; such as, a want of adaptation in the structure of our houses to climatic peculiarities, and on the same ground, as regards almost the entire manner of living, the sacrifice of comfort to foreign fashions. In the construction of our houses, we should combine the architectural conveniences both of the Russians and the Italians, so as to be equally adapted for a winter and a summer residence. To maintain an equality of temperature within doors, and to obviate the admission of moisture, thick solid walls covered with cement are especially necessary. And in regard to the clothing of children, let us bear in mind that beauty consists in the fitness and harmony of things; and that hence the exposure of the breast, shoulders, and greater part of the arms in the tender frames of infants, however tasteful beneath the genial glow of a southern sun, is with us, in the northern States, if we except the short season of summer, an act approaching infanticide.

In regard to the mode in which endemic influences produce their effects on the animal economy, there is of course as much difference as there is in the nature of the causes operating. One of the most important circumstances connected with this subject is the remarkable predisposition given to acute diseases by the previous influence of causes productive of debility; such as excessive and exhausting excitement, as watching, fatigue, or intemperance of any kind; or deficiency of the natural excitements of the human system, as impure air, deficient exercise, imperfect nourishment, long-continued heat or cold, or permanent mental depression. These various influences have been fully illustrated by statistical inquiries into the health and probability of life of the different classes of the community in France and England, and of the inhabitants of towns as compared with those of the country, thus demonstrating that the operation of these debilitating causes, applied long prior to the commencement of any morbid action, gives rise to a great amount of disease and mortality. Hence it follows that in all epidemics, as, for example, malignant cholera, the permanent residents of large towns are peculiarly susceptible; for, in all epidemics, it may be laid down as certain, that whatever tends to disturb the balance of health, favors an attack of the prevailing disease. In respect to the endemic influences which constitute the exciting causes of disease, an equally wide field of inquiry is presented. By Cullen, they were supposed to be direct sedatives, not merely depressing the vital powers, but also inducing spasm of the extreme capillaries; and that to overcome this spasm, reaction supervenes, (unless the vital energy be completely overpowered,) and thus fever is developed. That malaria acts as a specific poison inducing specific phenomena, there can be little doubt; but the endemic causes of mountain regions productive of such diseases as have their origin in a phlogistic diathesis, cannot be regarded as of this character. By Majendie and Stevens it is maintained that fevers produced by marsh miasm have their origin in a disorganized state of the blood; but that this is the first link in the chain of morbid phenomena, has not been clearly established. We know at least that the effects of malaria on the living body, both immediate and consecutive, are evinced in depression of the vital powers, contamination of the circulating and secreted fluids, and diminution of the cohesion or vital affinity of the soft solids. And its effects upon dead animal matter is somewhat analogous; for not only has the body, in some malignant forms of endemial fever, a tendency to run rapidly into dissolution as soon as respiration ceases, but in all dead animal matter, in malarious localities, decomposition advances with rapidity, and even articles fabricated of animal substances, as silk or wool, very speedily undergo decay, and lose their cohesive property. These effects, however, doubtless have their origin in part in the same causes which favor the generation of malaria.

When we consider the multiplicity of endemial causes and their various combinations, it follows that the branch of the subject having reference to the preventing of their production and the counteracting of their effects, is one of very great extent. A few words, however, must suffice. As abject poverty is the soil in which most endemic diseases spring up, so they diminish with the progress of civilization and the increase of the comforts of life. It is a remark of the learned Dr. Mead, "that it has never been known when the plague did not begin with the poor"—a remark confirmed by every pestilential epidemic subsequent to his time, and strengthened by the history of yellow fever and cholera in every country, and of the epidemic fever in the British isles, particularly in Ireland. It is, indeed, very obvious that the action of endemic influences generally is not so powerfully exerted on the rich as on the poor. The diminution of endemic diseases is more especially observable in prisons, in hospitals, and on board of ships, resulting chiefly from stricter attention to diet, cleanliness, and ventilation,—circumstances to which the less prevalence of scurvy, dysentery, and cutaneous affections, is mostly ascribable. A host of physical evils, for example among the poor of the British isles, might be avoided, if luxury would but make a trifling sacrifice of self-indulgence to the public good; and thus by relieving want and suffering, prevent the operation of those debilitating causes which lay the foundation of much disease and mortality. Fortunately in the United States, in which equal rights obtain, these endemic influences arising from the oppression of man by his fellow man, are not evidenced. With us the chief endemics are of strictly climatic origin; as those of the class of pulmonary organs, with the exception of tubercular phthisis, arise from atmospheric conditions without reference to the nature of soil, whilst those of malarial origin are the result of both conjoined.

From what has been already said it is obvious that if malaria is exhaled from marshy grounds, the most efficient means of preventing it, is either to drain them or inundate them completely;* but it must

* This mode of prevention is of very ancient origin. Empedocles, the Sicilian philosopher, according to Diogenes Laertius, freed the Saluntinians from pestilential diseases, by conveying two streams of running water into the stagnating river round their city.

be borne in mind that the mud and soil exposed to the action of the sun's rays, are at first fruitful sources of endemic influence. If inundations from the sea or a river give rise to the marshy locality, the means of prevention will be found in an embankment. In regard to clearing the soil of its vegetable products, it has been seen that the insalubrity of a district is thus, for a time, greatly aggravated; and hence this measure will be beneficial only in the end, and the sooner in proportion as the mode of cultivation requires less irrigation. In a newly built city in a malarious locality, as for example New Orleans, the development of this poison may be prevented, in a great measure, by protecting the soil from the action of the sun by a closely laid pavement—by removing the exuviæ and other impurities, by means of drains and sewers, so as to obviate the escape of emanations from them in the confined locality of a dense population—and by having places of sepulture beyond its outskirts.

It appears, however, from observations made in the city of New York, that marble or limestone cemeteries are wholly free from the objections usually urged against such establishments in populous cities, more especially when built in a dry and sandy soil. In these vaults containing bodies deposited during periods varying from several days to as many years, no offensive or noxious exhalations are discoverable. The soft parts become gradually dry and hard, as in the arid and sandy deserts of the East, so that the physical features of the dead are, for a long period, preserved.†

Besides preventing the production of malarial poison, there are means of counteracting its effects. Thus high houses or walls, or a range of trees, may serve as a protection. That trees absorb the noxious exhalations was remarked by Pliny; but whether they actually absorb the malaria, or simply obstruct its transit, or act in both ways, the fact as to the result is indisputable. Consequently the removal of screens which confine the exhalations to their sources, will often cause great insalubrity. From this cause, many localities recognized by the ancients as the sources of malaria and guarded against accordingly, have become more unhealthy; but this increased unhealthiness may also have been promoted by the accession of alluvial soil washed down from higher grounds, in the event of a decrease of population and consequent neglect of drainage and cultiva-

† See statements of Drs. Francis and Donnel, and E. Merriam, Esq., in Document No. 15, of the Board of Aldermen, 1838.

tion, or by the accumulation of organic remains and mineral detritus at the mouths of rivers. It has been remarked, and no doubt correctly, that the climate even of Egypt, when it was formerly well cultivated, was more healthy than that of Rome in its decline.

Besides these means, there are others which both destroy and counteract the causes of endemic maladies. For instance, in the case of impure water, the filtering of it through charcoal; and when drains, sewers, etc., cannot be removed or completely covered, the use of the chloruret of lime.

As our chief endemics are of malarial origin, it may be remarked further that the healthiness of a locality, especially in warm climates, depends much on its relation to the course of prevalent winds. The bad effects of a position to the leeward of a malarious source, even temporarily, has been often experienced by encampments or ships at anchor. In the choice of residences, where the winds blow from particular quarters at certain periods of the year or day, and especially at night, a position to windward of the principal sources should of course be selected. When exposed to noxious exhalations, the diet should be nourishing and easy of digestion. Animal food should be sparingly used, and wines and liquors not at all. Attention should also be paid to the due regulation of the mind; for as the equable state opposes most successfully the impression of both endemic and epidemic influences, so the depressing passions and all undue excitements should be avoided. The susceptibility to infection, in a word, is increased by fear and the depressing passions, general ill health, derangement of the digestive organs, and whatever else impairs the vital powers.

It may be well also to mention a fact of practical importance in relation to yellow fever and other endemico-epidemics. According to the medical reports of the United States Army, it is found that the removal of the troops but a short distance from the locality in which the disease originated, frequently causes its sudden cessation. Remarkable instances of this kind are also furnished in the history of the epidemic fevers at Gibraltar; and the statistics of the British troops further show that, in the West Indies and Ionian Islands, whilst one station suffers severely from yellow fever, others within a few miles are entirely exempt. In the epidemic cholera at Montreal and Halifax, the removal of the troops but a short distance was followed by the most happy effects. As the morbific agency manifested in the epidemic form, seems to be often limited to particular localities, it were always advisable on the part of the officer having charge of troops, on the sudden invasion of any serious disease of this character, to take into immediate consideration the expediency of a removal of the command.

One of the most interesting statistic views in reference to the natural history of man in health and disease in various countries, is that in which the influence of the progress of civilization is exhibited, by comparing the mortality with the population of the same country at intervals sufficiently long to admit of a decided social amelioration. Since 1650, all the countries of Europe; as well as the principal towns, present a gradual diminution of mortality. The value of life has doubled in London within the last century. As good bills of mortality have been kept at Geneva since 1560, we have conclusive statistical evidence that the probability of life to a citizen has gradually become five times greater. Similar evidence is afforded not only by the bills of mortality of many other cities, but especially by the British Insurance offices. This increased salubrity in many countries may, with good reason, be referred to the following causes:—The improved condition of the lower classes of society, as regards food, clothing, and fuel,—better habits as respects cleanliness, ventilation, and the use of spirituous liquors,—and improved medical practice, more especially in reference to the introduction of prophylactic means, as for example vaccination. In these circumstances may be found the exemption of Great Britain, for nearly two centuries, from those desolating epidemics which had appeared from time to time; and as there has been no recurrence of the plague in London since 1665, which was the year preceding the great conflagration which destroyed those narrow streets in which it was practicable to shake hands from the attic windows of opposite sides, we may trace the cause in the improved system of medical police that followed.

The time-honored opinion that poverty is conducive to longevity—that the rich are less favored by the blessings of health than the poor—finds no confirmation in statistical investigations. As moral and physical evil has a close relation, so also does misery bring in its train disease and death. It has been satisfactorily determined by M. Villerme of Paris, that in periods of prosperity the ratio of mortality has decreased, and that of births has increased, whilst the mean duration of life has been augmented; and, on the contrary, when the people were suffering from any cause, opposite results were invariably witnessed.

In bringing to a close this concluding Section, the author may justly claim the indulgence of the reader. In regard to the human organization and the surrounding physical circumstances, how innumerable and complicated are the relations! Upon most of the branches of meteorology, what is indeed the extent of our positive knowledge? And in regard to the influence which these complex agents, acting upon living organs still more complex in their functions, exercise, what has been effected by the boasted application of the Baconian philosophy to medicine? There are doubtless physical circumstances which cause the shape of to-day's cloud to differ from that of yesterday; but these circumstances, like many endemic causes, have thus far defied our limited powers of observation. It is a noble thought and nobly expressed:—*Pulchra sunt quæ videntur, pulchriora quæ sciuntur, sed longe pulcherrima quæ ignorantur.* But will it never be permitted to man, in his present state of existence, to penetrate the mysteries of Nature more deeply? It will. As "the possible is immense," so the human mind, if the legitimate object of all science, (which is to observe facts and to trace their relations and sequences,) is kept steadily in view, will be continually verging towards Truth in the investigation of physical causes.

NOTE RELATIVE TO INTERMITTENT FEVER IN NEW ENGLAND.

Since the last sheet has been in type, the author has become aware that the quotation on page 278, from Dr. Joseph M. Smith's work on the etiology of epidemics, is not consonant with truth. In Holmes' Prize Dissertation on the Intermittent Fever of New England, which the writer regrets not having previously seen, it is clearly established, contrary to the statement made by Dr. J. M. Smith, (which error was first promulgated by Professor Nathan Smith, in his work on Typhus Fever,) that intermittent fever has prevailed on the Connecticut river from our earliest colonial history. Dr. Holmes shows from historical evidence that, in 1671, fever and ague prevailed at Boston, and also at New Haven on its "first planting." In regard to the latter place, the historian remarks that "upon these southern coasts of New England it is not annual, as in Virginia, there being sundry years when there is nothing considerable of it, nor ordinarily so violent and universal." The author's attention has been drawn to these facts by Dr. Stephen W. Williams of Deerfield, Massachusetts, who shows that this locality, on the Connecticut river, which was once the bed of a lake and subsequently became converted into marshes and meadows, was in former years rife with fever and ague. Within the last sixty-five years, however, few cases have occurred, and at present it is unknown—a result ascribable to the gradual drying up of the marshes. Dr. Holmes' Dissertation is accompanied with a map of New England, showing the localities in which intermittent fever has been at any time indigenous; and the fact that but twenty-seven such points, including three on Lake Champlain, are laid down over this wide extent of territory, proves of itself the extreme rarity of the disease. Moreover, one-half of these localities are on the Connecticut and Housatonic rivers, which have rich *alluvial* tracts, whilst along the shore of Long Island Sound, between the mouths of these two rivers, a narrow *alluvial flat* extends. These facts, then, instead of disproving, confirm the conclusion arrived at in this volume, that a region of primary formation with a sandy soil and an undulating surface, is exempt from fever and ague. The occasional prevalence of this disease in the valley of the Connecticut river, affords, indeed, a happy illustration of the ancient axiom of the exception proving the rule; for here, contrary to the general geological character of New England, we have a secondary instead of a primary formation. "The valley of the Connecticut," says Bradford in his Illustrated Atlas, "is occupied by a basin of *secondary* rocks of about fifteen miles in average width, consisting of red shales, argillaceous sand-stones, and beds of conglomerates crossed by numerous dykes and ridges of trap." As this formation has an alluvial superstratum, we discover a marked geological analogy between this valley and the Atlantic Plain on which malarial diseases are dominant. Now as it is remarked on page 280 that the region of New England, *with little exception*, has a primitive formation with a sandy and sterile soil, does it not afford a striking confirmation of the validity of the author's deduction, to find by subsequent facts that this *excepted* portion is the one in which fever and ague have always been more or less generated? As the disease is no longer known at Boston, Deerfield, and some of the other localities laid down on Holmes' map, we are warranted in the belief that the endemic, wherever it may have been indigenous in the New England States, is attributable to peculiar local causes; as, for example, at Deerfield there formerly existed an accumulation of organic remains in the marshes and meadows formed by the bed of an ancient lake.

EXPLANATION OF THE PLATES.

PLATE I.

This map requires no farther explanation than to say that it illustrates the general laws of temperature throughout the United States, without reference to any modification induced by the elevation of the Alleghany and Rocky Mountains.

PLATE II.

In this diagram, the different laws of temperature at Key West, sixty miles south west of the southern point of Florida, in latitude 24° 33′, and at Fort Snelling, Iowa, in latitude 44° 53′, are exhibited.

No. 1.—Curve of mean annual temperature traced through each month, at Key West.
" 2.—The same at Fort Snelling.
" 3.—Monthly extremes of temperature at Key West.
" 4.—The same at Fort Snelling.
" 5.—Curves of the seasons at Key West.
" 6.—The same at Fort Snelling.

Each plate, however, will find its best explanation in the context.

ERRATA.

Notwithstanding the utmost care on the part of the author, some errors have crept into the text. As most of these, however, are obvious at the first glance, it has not been deemed necessary to correct any but the following:—

Page 61, line 24 from top, for "*all cut one another*," read "*are confined within a few degrees*." As the plate was altered after the sheet was printed, the former words find no application.

Page 133,	line 26	from top,	for *concluding* read *next*.	
" 166,	" 26 & 27	from top,	the word *above* in the latter belongs to the former.	
" 191,	" 5	"	for 81° read 31°.	
" 203,	" 34	"	for *exclusively* read *excessively*.	
" 208,	" 17	"	for *west* read *east*.	
" 280,	" 19 & 20,	"	the words *average of* in the latter belongs to the former.	