Report of fifth International Congress of Military Medicine and Pharmacy : London, England, May, 1929 / by William Seaman Bainbridge.

REPORT ON FIFTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY, LONDON, ENGLAND MAY, 1929

BY

WILLIAM SEAMAN BAINBRIDGE

COMMANDER, M.C.-F., UNITED STATES NAVAL RESERVE

REPORT ON

Fifth International Congress of Military Medicine and Pharmacy

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BY

COMMANDER WILLIAM SEAMAN BAINBRIDGE, M.C.-F.

United States Naval Reserve

Member of Permanent Committee
Delegate from the United States

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FOREWORD

Beginning with the Congress held at Brussels in 1921, when delegates from twenty nations attended, these International Congresses have so increased in value and importance that the 1929 meeting, in London, found delegates present from forty nations.

The increased solidity of the organization and the improved value of the meetings are matters now well realized by all concerned; they are facts pleasant to contemplate.

The delegates have exchanged ideas—ideas based on rich experience—on the many phases of the great purpose of military medicine—that of keeping fit the human elements of war. That such a purpose lessens the atrocities of war, protecting men from the ravaging diseases and conditions of war, and repairing bodies torn by the weapons of war scarcely need be said. That such a purpose brings into play almost the only humane note to be found in warfare lends every argument for the support of that purpose.

The military medical services of the United States, and in turn the military services of the United States of course receive very material benefit from participation in the Congresses. We have been fortunate in being represented by one who has shown such high interest and ability in military medicine. We are also greatly indebted to Commander Bainbridge for bringing home to us this comprehensive report of the London meeting. The time and labor and skill he has devoted to the composition of this report have given us an account which all but takes us to the meeting.

C. E. RIGGS
Rear Admiral, Medical Corps, U. S. Navy
Surgeon General, U. S. Navy

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H.R.H. The Prince of Wales, who, acting for H.M. The King, who was seriously sick, received a specially invited group of delegates—officers of the Congress, members of the permanent committee, and the senior members of the various sanitary services of the officially represented countries.

REPORT ON

Fifth International Congress of Military Medicine and Pharmacy

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By COMMANDER WILLIAM SEAMAN BAINBRIDGE, M.C.-F.

United States Naval Reserve, Member of Permanent Committee, Delegate from the United States

Introduction

THE International Congress of Military Medicine and Pharmacy has been accorded so decided a niche in the medico-military world that, at this stage of its existence, it seems unnecessary to explain its "raison d'être." According to Shakespeare, Brutus, in a conversation with Cassius, remarks: "The eye sees not itself but by reflection." It is only by the reflection of great accomplishment since the first conference in Brussels, 1921, that Belgium, and all the nations who worked with her, can begin fully to comprehend the progress made by, and the future possibilities of these Congresses. Yet Belgium's vision was not clouded when she conceived the idea of these gatherings of men from different countries to submit the conclusions of their experience in the field of military medicine, during and since the World War!

Preceding reports have fully explained the workings of the Congress, but a short résumé may not be amiss. In the beginning, the Allied, Associated, and neutral nations were invited to participate. When, however, the Central Powers became part of the League of Nations, and the Locarno Treaty was signed, they, too, were asked to send delegates, so that today the recognized nations of the world may be represented and have a voting voice in all matters requiring decision.

At every gathering there are five principal subjects for consideration, each having two official reports—one by the country in which the meeting is held and one by another nation, selected at the previous Congress—and brief communications on related topics by any country that

has valuable data to contribute. The official reports and communications are read, subcommittees handle the various details, discussion takes place, all material is submitted to the Permanent Committee, which, after serious deliberation, draws up the general conclusions, refers them to the entire assembly, makes any change or modification necessary, and does not accept any point as final until there is unanimous approval. Thus, the lessons of the war, in all branches of medicine, surgery, and sanitation are being codified and standardized so that they may be used to advantage not only during possible future war, but in peace time, as well.

Aside from the interchange of ideas, experience, and knowledge, each Congress constitutes a veritable postgraduate course, for the delegates and members. In visiting the various hospitals, clinics, and scientific institutions in the different meeting centers, they are kept abreast of the advances in medicine and surgery in many lines, and have opportunity to come in close touch with developments and results of new methods.

It is a great step forward, from the standpoint of individual and national relationships, for the 1931 Congress to be held in Hungary. Through such confraternity, the peoples of the earth who, at certain vital times, do not see eye to eye, may gradually lessen their differences, and the aim of the civilized world, for permanent peace, be brought nearer to realization.

While it has not yet been practical for the United States to extend an invitation to have the Congress within its borders, it is hoped that this can be accomplished in time for the 1933 or 1935 meeting.

The fact that, in 1921 only twenty nations were represented and in 1929 forty countries had delegates present, is evidence of the widening scope and activities of the Congress, and the acknowledged usefulness of what has already been accomplished, as well as the practicality of the vision and ideals towards which it is striving.

Local Officers of the Congress

President

Lieutenant-General Sir Matthew H. G. Fell, K.C.B., C.M.G., K.H.P., F.R.C.S., Director-General Army Medical Services.

Honorary Presidents

Dr. Th. Tuffier,* Member of the Academy of Medicine, Paris; President of the Inter-Allied Surgical Conferences.

* Died October 27, 1929.

Inspector-General Wibin, Inspector-General of the Belgian Army Medical Services; President of the First International Congress of Military Medicine and Pharmacy, Brussels.

Major-General Francesco della Valle, Director-General of Medical Services of the Italian Army; President of the Second International Congress of Military Medicine and Pharmacy, Rome.

Medical Inspector-General Vincent, Inspector-General French Army Medical Services; President of the Third International Congress of Military Medicine and Pharmacy, Paris.

General Stanislas Rouppert, Director of Medical Services, Polish Army; President of the Fourth International Congress of Military Medicine and Pharmacy, Warsaw.

Organizing Committee

Government Departments—

President: Lieutenant-General Sir Matthew H. G. Fell, K.C.B., C.M.G., K.H.P., F.R.C.S., Director-General, Army Medical Services.

Surgeon Vice-Admiral A. Gaskell, C.B., O.B.E., F.R.C.S., K.H.S., R.N., Medical Director-General of the Navy.

Air Vice-Marshal D. Munro, C.B., C.I.E., K.H.S., Director of Medical Services, Royal Air Force.

Major-General Sir Leonard Rogers, Kt., C.I.E., F.R.C.P., F.R.S., Medical Adviser, India Office.

Colonel Sir Lisle Webb, K.B.E., C.B., C.M.G., Director-General of Medical Services, Ministry of Pensions.

A. E. Widdows, Esq., C.B., J.P., Assistant Under-Secretary of State, War Office.

R. J. G. C. Paterson, Esq., C.B., Director of Finance, War Office.

Colonel P. G. Stock, C.B., C.B.E., M.B., Ministry of Health.

Lieutenant-Colonel A. B. Smallman, C.B.E., D.S.O., M.D., Ministry of Health.

Colonel T. R. Elliott, C.B.E., D.S.O., M.D., F.R.S., Medical Research Council.

Major E. N. S. Crankshaw, M.B.E., Secretary, Government Hospitality Fund.

Major E. G. Annis, R.S.M.C., L.R.C.P., D.P.H., Society of Medical Officers of Health.

Captain W. H. Girling Ball, F.R.C.S., Royal Society of Medicine.

Major-General H. P. W. Barrow, C.B., C.M.G., D.S.O., O.B.E., K.H.S., London School of Hygiene and Tropical Medicine.

Lieutenant General Sir Matthew H. G. Fell, K.C.B., C.M.G., F.R.C.S., K.H.P., Director-General Army Medical Services. President of the Congress.

Major-General Sir Alfred Blenkinsop, K.C.B., C.M.G., British Medical Association.

Major-General Sir John Rose Bradford, K.C.M.G., C.B., P.R.C.P., F.R.S., Royal College of Physicians of London.

Sir Aldo Castellani, C.M.G., M.D., F.R.C.P., Ross Institute and Hospital for Tropical Diseases.

Major-General D. J. Collins, C.B., C.M.G., M.D., British Red Cross Society.

Captain S. H. Daukes, O.B.E., M.D., D.P.H., D.T.M. & H., Royal Society of Tropical Medicine and Hygiene.

Captain S. R. Douglas, F.R.S. (late I.M.S.), Royal Society.

Colonel E. B. Dowsett, D.S.O., L.D.S., M.R.C.S., L.R.C.P., British Dental Association.

Major-General Sir Wilmot P. Herringham, K.C.M.G., C.B., M.D., F.R.C.P., University of London.

Lieutenant-Colonel Professor H. R. Kenwood, C.M.G., M.B., D.P.H., F.R.S.E., Royal Sanitary Institute.

Colonel G. A. Moore, C.M.G., D.S.O., M.D., The Order of St. John of Jerusalem.

Major-General Sir John Moore, K.C.M.G., C.B., F.R.C.V.S., Royal College of Veterinary Surgeons.

Major E. Saville Peck, Ph.C., Pharmaceutical Society.

Lieutenant-Colonel C. T. Samman, J.P., R.A.M.C., Society of Apothecaries.

Dr. H. L. Schutze, M.D., Lister Institute of Preventive Medicine.

Colonel Sir William R. Smith, M.D., V.D., T.D., Royal Institute of Public Health.

Major E. B. Waggett, D.S.O., T.D., M.B., late R.A.M.C., T.A.

Organizing Secretary

Major A. D. Stirling, D.S.O., M.B., D.A.D.G., R.A.M.C.

Sub-Committees

Executive

Major General H. B. Fawcus, C.B., C.M.G., D.S.O., K.H.P. (chairman)

Group-Captain H. Cooper, D.S.O., B.A., R.A.F.

Lieutenant-Colonel E. M. Cowell, D.S.O., M.D., F.R.C.S.

Surgeon-Commander A. G. V. Elder, D.S.C., R.N.V.R.
Surgeon-Captain R. W. B. Hall, O.B.E., R.N.
Major-General Sir Wilmot P. Herringham, K.C.M.G., C.B., M.D., F.R.C.P.
Major E. B. Waggett, D.S.O., T.D., M.B., late R.A.M.C., T.A.
Squadron-Leader W. G. Weston, M.B., R.A., F.O.

Exhibition

Lieutenant-Colonel A. B. Smallman, C.B.E., D.S.O., M.D. (Chairman)
Captain S. H. Daukes, O.B.E., M.D., D.P.H., D.T.M. & H.
F. W. Hooper, Esq.
Lieutenant-Colonel Prof. H. R. Kenwood, C.M.G., M.B., D.P.H., F.R.S.E.
Squadron-Leader J. Kyle, R.A.F.
Major E. Saville Peck, Ph.C.
Major J. W. L. Scott, D.S.O., R.A.M.C.
Surgeon-Commander F. Lewis Smith, O.B.E., R.N.
L. Ferris-Scott, Esq., F.C.A.

Propaganda

Colonel P. G. Stock, C.B., C.B.E., M.B. (Chairman)
Major E. G. Annis, M.R.C.S., L.R.C.P., D.P.H.
Group-Captain M. W. Flack, C.B.E., M.B., R.A.F
Surgeon-Captain T. B. Shaw, R.N.
Colonel A. Hope Gosse, M.D., F.R.C.P.
Dr. A. Cox, O.B.E., M.B.

Transport and Entertainment

Major-General D. J. Collins, C.B., C.M.G., M.D. (Chairman)
Major-General Sir John Rose Bradford, K.C.M.G., C.B., P.R.C.P., F.R.S.
Group-Captain M. W. Flack, C.B.E., M.B., R.A.F.
Colonel Sir William R. Smith, M.D., V.D., T.D.
Surgeon-Commander F. Lewis Smith, O.B.E., R.N.

LIST OF FOREIGN OFFICIAL DELEGATES

(Note: No attempt is made to give English equivalents of Military titles, but the list as given by the Committee in London, is adhered to.)

Albania

Malik Libohova, Chargé d'Affaires d'Albanie à Londres.

Argentine

Ricardo Laspiur, Doctor, Head of the Medical Service of Public Works.

Surgeon Vice-Admiral A. Gaskell, C.B., O.B.E., F.R.C.S., K.H.S., R.N., Medical Director-General of the British Navy, and member of the organizing committee of the Congress, to whom a very large degree of credit, for its success, is due.

Australia

J. H. Anderson, Lieutenant-Colonel, C.M.G., C.B.E., Australian Army Medical Corps.

N. H. Fairley, Major, O.B.E., Australian Army Medical Corps.

Bechuanaland Protectorate

D. MacRae, Doctor, Principal Medical Officer of the Bechuanaland Protectorate.

Belgium

P. Demolder, Général Médecin, Commandant du 4ème Corps Médical.
F. M. J. Evrard, Colonel Médecin en retraite.
F. C. De Block, Major Médecin. Ecole Militaire de Bruxelles.
V. Keersmaekers, Major Médecin.
I. I. J. Van der Ghinst, Major Médecin.
J. Voncken, Major Médecin Rapporteur et Secrétaire Général des Congrés Internationaux de Médecine et de Pharmacie Militaires.
E. M. Bouvy, Capitaine Médecin, Hôpital Militaire d'Aix la Chapelle.
Vanderweeren, Capitaine Médecin, Hôpital Militaire d'Aix la Chapelle.
I. Etienne, Capitaine 1er Pharmacien de reserve.
W. F. Proot, Capitaine en 1er Pharmacien.

Canada

J. W. Williams, Captain M.C., Royal Canadian Medical Corps.

Chile

Ramon Vicuna, Surgeon, Captain.

Czechoslovakia

L. Fisher, Général, Médecin en Chef du département du Ministère de la Defense Nationale.

A. Pazderník, Lieutenant-Colonel, Médecin en Chef de l'hôpital divisionnaire, No. 1.

Cuba

Jesus M. Clark, Doctor, Capitan Dentista del Ejército.

Denmark

C. T. Hansen, Médecin principal 1ère classe, Médecin en Chef de l'hôpital de la Garnison à Copenhague.

Ecuador

Octavio Callegos, Docteur.

Egypt

J. C. Collins, El Miralai, Acting Chief Medical Officer of the Egyptian Army.
G. Cattaui, Légation Royale d'Egypte à Londres.

Estonia

A. Stamm, Lieutenant-Colonel, Medical Adviser to the Central Military Hospital.

Finland

L. J. Ollonqist, Colonel Médecin, Médecin en Chef de l'hôpital Militaire à Helsinki.

F. Leiri, Major Médecin.

France

Lanne, Médecin Général Inspecteur, Directeur de l'Ecole du Service de Santé Militaire, Chef de la Délégation Française.

Rouvillois, Médecin Général, Directeur de l'Ecole d'Application du Service de Santé Militaire de Val-de-Grâce, Paris.

Malaspina, Médecin Colonel, Adjoint au Directeur du Service de Santé au Ministère de la Guerre.

A. Vaudremer, Médecin Colonel, de l'Union Fédérative des Médecins de réserve.

Botreau-Roussel, Médecin Lieutenant-Colonel.

Breteau, Pharmacien Colonel, Ancien Professeur à l'Ecole d'Application du Service de Santé Militaire.

Schickelé, Médecin Lieutenant Colonel, de la Section Téchnique du Service de Santé Militaire.

Gravellat, Médecin Lieutenant Colonel, des Troupes Coloniales, de la Direction des Troupes Coloniales de la Guerre.

Maisonnet, Médecin Commandant, Professeur à l'Ecole d'Application du Service de Santé Militaire de Val-de-Grâce, Paris.

Barthet, Pharmacien Capitaine de réserve, de l'Association Corporative des Pharmaciens de réserve.

Auregan, Médecin Général de 2ème Classe, Directeur du Service de Santé de 2ème arrondissement Maritime à Brest.

Oudard, Médecin en Chef de 1ère Classe, Professeur à l'Ecole d'Application, Hôpital Ste-Anne, à Toulon.

Saint Sernin, Pharmacien Chimiste en Chef de 1ère Classe, Chef du Service Pharmaceutique à l'Hôpital Maritime de Brest.

Greece

A. P. Cawadias, Doctor, O.B.E., M.D., M.R.C.P.

Hungary

A. Barcsai, Councillor-Physician.

J. Repka, Vice Councillor-Physician.

International Committee of the Red Cross

G. E. Audeoud, Colonel Docteur.

India

W. L. Watson, Lieutenant Colonel, O.B.E., I.M.S.

Irish Free State

T. McKinney, Major, Army Medical Corps, Acting Director of Medical Services.

C. M. Stuart, Commandant.

Italy

Umberto Riva, Tenente Generale Medico, Ministero della Guerra, Direzione Generale di Sanità Militare.

Filippo Caccia, Professor, Colonnello Medico, Direttore del'Ospedale Militare Principale, Bologna.

Arturo Casarini, Tenente Colonnello Medico, Direttore del Giornale di Medicina Militare, Ministero della Guerra.

G. Ceccherelli, Tenente Colonnello Medico, Rappresentante il Ministero della Marine.

G. Delogu, Tenente Colonnello Medico.

Ignazio Fiorenza, Tenente Colonnello Medico.

Guido Liebman, Console Dottore, Rappresentante la Direzione Centrale di Sanità presso la Milizia Volontaria per la Sicurezza Nazionale.

Alfredo Pagniello, Prof. Dott. Cav. Uff., Tenente Colonnello Chimico Farmacista.

Japan

Saito Tsutomu, Surgeon, Captain, Imperial Japanese Army.

Kambayashi Yoshiharu, Lieutenant Commander, Imperial Japanese Navy.

League of Red Cross Societies

F. Humbert, Docteur, Directeur de la Division d'Hygiène.

Latvia

Snikers, Physician General, Chief of the Military Sanitary Administration.

Mexico

Miguel Garcia Marin, Teniente Coronel, Dr.

José Joaquin Izquierdo, Teniente Coronel, Dr.

Raoul Ortiz, Teniente Coronel, Dr.
Servando Osornio Camarens, Teniente Coronel, Dr.

Netherlands

J. C. Diehl, Major General.

Netherlands East Indies

M. J. Van der Werff, Médecin Officier en Chef de 1ère Classe.
G. A. Sedée, Capitaine.

New Zealand

B. Myers, Lieutenant Colonel, C.M.G., M.D., New Zealand Medical Corps (Retired).

Norway

C. H. Scheen, Major, Sanitary Department of the Norwegian Army.

Peru

Carlos Monge, Major.

Poland

Stanislaw Rouppert, Médecin Général, Chef du Département Sanitaire au Ministere des Affaires Militaires.
E. Hubicki, Médecin Général, Commandant de l'Ecole des Officiers Sanitaires.
J. Kawinski, Lieutenant Colonel Médecin, Chef de Section au Ministère des Affaires Militaires.
B. Zakliński, Lieutenant Colonel Médecin, Délégué de Government et de la Croix Rouge Polonaise.
G. Babecki, Major Médecin.
A. Huszcza, Colonel Médecin, Directeur du Centre des Recherches sur l'Aviation Sanitaire.
E. Krupinski, Pharmacien Colonel, Chef de la Section de Ravitaillement du Département Sanitaire du Ministère des Affaires Militaires.
W. Zawadowski, Médecin Commandant, Directeur du laboratoire Roentgenologique à l'Ecole des Officiers Sanitaires.
W. Jakubowski, Pharmacien Major.

Roumania

G. Parvulescu, Médecin Colonel.
Mamant Dimitriu, Médecin Colonel.
E. Vorell, Médecin Colonel.

M. Capitanovici, Médecin Major.
J. Mihaesco, Lieutenant Colonel Vétérinaire.
P. Popescue, Major.

Salvador

U. L. Feussier, Docteur.

Air Vice-Marshal David Munro, C.B., C.I.E., K.H.S., Director of Medical Services, Royal Air Force. Member of the Organizing Committee of the Congress.

Siam

Damrong Baedyagun, Colonel Physician, R.S.M.C., L.R.C.P., Director of the Hospital Section of the Siamese Red Cross Society.

Spain

A. Van-Baumberghen, Teniente Coronel Medico, Ayudante del Director General de los Servícios Sanitários.

J. Palanca y Martinez de Fortun, Comandante, Instituto de Higene Militar.

L. Maiz Eleizegui, Farmacéutico Mayor, Jefe de la Sección de Productos químicos del Laboratório Central de Sanidad Militar.

J. Sanchez Gomez, Comandante Medico.

E. A. Puertas, Farmacéutico.

Sweden

F. Bauer, Major Général, Directeur du Service de Santé de l'Armée.

G. Nilson, Surgeon Commodore, M.D., Médecin en Chef de la Marine Royale.

Switzerland

C. Hauser, Médecin Colonel.

J. Thomann, Pharmacien Colonel.

T. Brunner, Colonel.

Turkey

Nail Pacha, Docteur, Chef de la Section des Services Sanitaires du Ministère de la Défense Nationale.

Refik Munir Bey, Docteur Professeur, Directeur et Médecin en Chef de l'Ecole d'Application.

United States

J. S. Boggess, Surgeon, United States Public Health Service.

William Seaman Bainbridge, Commander, M.C.-F., U.S.N.R.

Gilbert E. Seaman, Colonel, Medical Corps, Wis., N.G.

Angus McLean, Colonel, Auxiliary Reserve, U. S. Army.

David C. Hilton, Colonel, Medical Corps, Neb., N.G.

H. W. Cattell, Lieutenant Colonel, Auxiliary Reserve, U. S. Army.

Francis E. Fronczak, Lieutenant Colonel, Medical Reserve, U. S. Army.

Edgar Erskine Hume, Major, Medical Corps, U. S. Army.

Uruguay

C. Bocage, Doctor, Medical Board of the Ministry of War and Marine.

Yugoslavia

Georgevitch, Médecin Major.

Lack of space prevents the inclusion here of the names of the very large number of British and other foreign members who attended the Congress, many of whom took part in the various scientific discussions.

PROGRAM OF THE FIFTH "INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY"

All meetings at the British Medical Association House, Tavistock Square, W.C.1. unless otherwise stated.

Monday, May 6.—Meeting of Permanent Committee. Issue of program, official badges, and other documents. Visit of delegates and members to the Tomb of the Unknown Warrior in Westminister Abbey, where a wreath was laid on behalf of the Congress. Inaugural meeting of the Congress. Official opening of the Exhibition. Reception of Principal Official Delegates by H.R.H. the Prince of Wales. Official Dinner to Principal Delegates and distinguished visitors. Official Government Reception at Lancaster House.

Tuesday, May 7.—First Subject—Evacuation of Sick and Wounded by Air and Water. The Role of the Medical Services in Combined Operations.—Separate program for ladies. Visits to Exhibition. Visit to Aldershot by charabanc. Limited to 500. Left Tavistock Square, W.C.1. Hospital establishments, dental center, child welfare center. Army School of Hygiene, R.A.M.C. training establishment. Barracks, regimental institutes, sergeants' mess, etc. Supply and transport organizations, bakeries, butcheries, etc. Two of these were visited, and afterwards all reassembled for tea, and thereafter witnessed a display of physical training. Lecture in Congress Hall by Major Ian Hay Beith, C.B.E., M.C. Subject: The English Sense of Humor. Evening conversazione at the Royal College of Physicians, Pall Mall East. Limited to 500. By invitation. Evening Reception at the Royal College of Surgeons, Lincoln's Inn. Fields, W.C.2. Limited to 500. By invitation.

Wednesday, May 8.—Visits to exhibition. Left by special train for Portsmouth from Waterloo Station. Visit to battleships, naval hospital, H.M.S. Victory, in three separate parties. Limited to 500. No ladies other than wives and daughters of official delegates were eligible. Lunch offered by the Lord Mayor and Corporation of Portsmouth. Separate program for ladies.

Thursday, May 9.—Second Subject—Tropical Fevers of Short Duration. Separate program for ladies. Visit to exhibition. Visit to Halton by charabanc. Limited to 500. Visit, R.A.F. hospital, pathological laboratories, and Medical training center. Barracks, institutes and workshops of aircraft apprentices. One of these may be visited, and afterwards all assembled at the aerodrome for a demonstration of the use of aircraft as ambulances, a display of flying, and for tea. Lec-

ture in Congress Hall by Sir Philip Gibbs, K.B.E. Subject: Experiences of an Official War Correspondent. Conversazione, Royal Army Medical College, Millbank. Visit to hygiene and pathology museums. Reception by Dr. Henry S. Wellcome, LL.D., F.S.A., at the Wellcome Historical Medical Museum, Wigmore Street, W.1. By invitation. Limited to 250.

Friday, May 10.—Third Subject—Wounds of Blood Vessels and their Sequelae. Fourth Subject. In lecture hall of the Pharmaceutical Society of Great Britain, Bloomsbury Square: The Physical and Chemical Analysis of the Glass and Rubber Articles Employed by the Medical Services. Fifth Subject. In the Board Room, British Dental

Delegates leaving Westminster Abbey after placing wreath on grave of Unknown Soldier. Passing statue of Abraham Lincoln.

Association, 23 Russel Square, W.C.1.: The Standard of Dental and Physical Fitness in the Various Services. Separate program for ladies. Visit to exhibition. Visit to the museum of the Royal College of Surgeons. Visit to Pharmacological laboratories and the museum of the Pharmaceutical Society of Great Britain. Lunch given by the Society of Pharmacists other than British. By invitation. Visit to the Wellcome Museum of Medical Science. Lunch to limited number of official delegates at the Apothecaries Hall. By invitation. Lunch to dental surgeons other than British given by British Dental Association. By invitation. Reception for ladies at the Forum Club. Re-

ception and banquet by the Right Honourable the Lord Mayor and Corporation of the City of London at Guildhall. Owing to the large number of members attending the Congress, ladies were not eligible to attend. Limited. By special invitation.

Saturday, May 11.—Final meeting.

Inauguration of the Congress

The Great Hall of the British Medical Association House, where practically all the meetings of the Congress were held, was selected as the place for the opening ceremony, which was presided over by the Secretary of State for War, Sir Laming Worthington-Evans, Bart., M.P. He was supported by the Adjutant-General to the Forces, the Permanent Under-Secretary of State, the President of the Congress, the President of the British Medical Association, the Director of the Military Medical School at Lyons, and the Surgeon General of Poland, President of the Fourth Congress. Others on the platform included members of the Local Organization Committee, members of the Permanent Committee, and some special government and foreign representatives. Addresses were made by Sir Laming Worthington-Evans, Lieutenant-General Sir Matthew H. G. Fell, Inspector General Lanne (France), and General Rouppert (Poland). About seven hundred and fifty persons, representing forty nations, attended the inaugural session.

Sir Laming Worthington-Evans

In welcoming the delegates and members from the various countries, Sir Laming said it was an inspiring thought that, in the field of medicine, at any rate, the nations of the world had reached a unity of aim and endeavor which is still being sought in the realm of international politics. Was not the secret of their success that they were all ranged on the same side against the common enemies of mankind—disease and pain—in a cause which transcended all those rivalries and difficulties which made the statesman's task so difficult? There was an explanation, too, in the fact that, in the sphere of military medicine, they were willing to meet and exchange the fruits of their researches, secure in the knowledge that these would be used only to help humanity.

Sir Matthew H. G. Fell

After greeting and welcoming all who were present, the President of the Congress said that the members of military medical services are

united by the common bond of their profession. These services must necessarily function in accordance with the principles and limitations of the Armies which they serve. But, for all Armies, the main objects are identical—the maintenance of the highest standards of hygiene and sanitation, and the elaboration of an organization which can, with the least possible delay, bring the sick and wounded within the fullest benefits that medical science can apply. In closing, Sir Matthew thanked the President and Council of the British Medical Association for permitting the Congress to make use of their House, and the Royal College of Physicians, the Royal College of Surgeons, the Society of Apothecaries, the British Dental Association and the Pharmaceutical Society for their interest and coöperation.

Inspector General Lanne

The head of the French delegation, in the name of all the foreign delegates, expressed gratitude for the cordial reception given them.

General Rouppert

In the name of the Polish Government General Rouppert greeted the assembly. He stated that the traditions of the Polish Army were severed in the eighteenth century—at a time when military sanitary organizations were in their youth. Therefore, for Poland, these International Congresses of Military Medicine and Pharmacy, are regarded as a unique opportunity for acquiring scientific experience in this sphere.

Prior to the inaugural session of the Congress, the delegates and members, headed by General Lanne and General Rouppert, proceeded to Westminister Abbey, where a wreath, bearing the colors of the forty represented nations, was reverentially laid on the Tomb of the Unknown Soldier.

PERMANENT COMMITTEE

Members

President: Lieutenant-General Sir Matthew H. G. Fell
Secretary: Médecin Major Jules Voncken (Belgium)
Members: Médecin Colonel Malaspina (France) (For Médecin Principal Levy, who was absent.)
Médecin Colonel Filippo Caccia (Italy)
Médecin Lieutenant-Colonel Augustin Van Baumberghen (Spain)
Commander Wm. Seaman Bainbridge (United States of America)
Colonel Pharmacien Jules Thomann (Switzerland)

Major A. D. Stirling (Great Britain)

Honorary Presidents:

General Wibin (Belgium)
General della Valle (Italy)
General Vincent (France)
General Rouppert (Poland)

Meetings of the Permanent Committee

Before, during, and after the Congress, meetings of the entire Permanent Committee, as well as of its various subcommittees, were held.

In accordance with the action taken at the 1927 Congress, held in Warsaw, the secretary of that local organization committee, Colonel Zaklinski, sat in at the meetings of the Permanent Committee of the London Congress, until its last session, and submitted all details and records of the 1927 gathering and up to the time the work was taken over by the local organization committee secretary of the London Congress. This routine will be carried out in the future.

The proposal to hold meetings every three years, instead of two, was rejected.

The necessity for more active collaboration of all the participating nations, in the International Bulletin (official organ of the Congress), was emphasized. Such collaboration consists in submitting appropriate articles for publication, giving publicity to the Bulletin, and securing subscriptions to it.

It was pointed out that the new department in the Bulletin, under the head of "International Inquiries," will afford opportunity for valuable reciprocal information.

The wish was expressed that an international investigation be made of the methods of recruiting and training of officers of the Medical Services.

It was requested that, in the future, all reports be either typewritten or printed, and that the conclusions, which should never exceed two pages, according to the Statutes of the Congress, be translated by the country submitting the report, into the official languages of the Congress.

Many cordial invitations were extended by participating countries, for the 1931 Congress. However, it seemed best to accept that of Hungary and, for the first time since the inception of the Congress, the meeting will be held in the capital of one of the Central Powers.

The Secretary and the American member of the Permanent Com-

mittee were delegated to visit certain countries, in preparation for the coming Congress. Further mention of this will be made in the Supplementary Notes of this Report.

The subjects decided upon for report at the next Congress are:

1. The Recruiting, Training and Advanced Training of Military Medical Officers and Pharmacists (Hungary and Jugoslavia).

2. The Psychoneuroses of War: The Immediate and Remote Effects of War on the Nervous System in Combatants and Non-combatants (Hungary and United States of America).

3. Methods of Hemostasis on the Battlefield. Standardization of First Aid Material and the Mode of Application (Hungary and Italy).

4. The Preparation and Storage of Medicinal Ampoules in Use in the Naval and Military Medical Services (Hungary and Roumania).

5. The Sequelae of War Wounds of the Teeth and Inferior Maxilla. Their treatment (Hungary and Poland).

At the meetings of the London Congress, the chiefs of foreign delegations and the members of the Permanent Committee alternately were invited to take the chair by the President, the actual presiding officer, Lieutenant-General Sir Matthew H. G. Fell.

The following are the subjects reported herein:

1. Evacuation of Sick and Wounded by Air and Water. The Rôle of the Medical Services in Combined Operations.

2. Tropical Fevers of Short Duration.

3. Injuries to Blood Vessels and Their Sequelae.

4. Physical and Chemical Analyses of the Glass and Rubber Articles Employed by the Medical Services.

5. The Standard of Dental and Physical Fitness in the Various Military Services.

EVACUATION OF SICK AND WOUNDED BY AIR AND WATER

The Rôle of the Medical Services in Combined Operations

Official Reports

Elder (Great Britain)

In his report on "The Evacuation of Sick and Wounded by Sea," Surgeon-Commander A. *Vavasour Elder,* D.S.C., R.N.V.R., Great Britain, stated that, in the removal of sick and wounded, no matter where, there are two distinct but equally important factors—the clinical and the administrative. Both must always be carefully considered, in order to comply with the two principal postulates for success in the

operation. The first of these is to attain a maximum speed compatible with efficiency, while the other is to provide the greatest material comfort and safety of patients in the process.

The evacuation of sick and wounded by water, presents all the difficulties encountered on land, with the addition of those created by the sea. Any organized form of water ambulance service may be called upon to deal with three classes of patients—Naval, Military (including official and other civilians), and Air Force. The actual transport of patients by water is, at all times, governed by local and weather conditions, which vary very considerably. It is not possible, therefore, to lay down any particular method for uniform use. In all departments, "preparedness-for-war" should include one or more alternative schemes capable of being brought into immediate action, if the original plan miscarries. For this reason, it is essential that the officers appointed for medical transport duty should be carefully selected, and be invested with sufficient authority to act on their own initiative, according to circumstances as they arise.

There are three stages to be considered in the water transport of wounded—embarkation in the particular craft selected, the transit of this craft to the base appointed, and disembarkation on arrival. The craft used for this purpose may range from a ship's boat rowed, or, more likely, towed by a mechanically propelled vessel, specially constructed self-propelled hospital boats or lighters and, finally, to ambulance carriers and hospital ships. The lighter craft is only useful in protected waters, whereas for open waters, seaworthy self-propelled hospital boats are required. They should have accommodation below for cot and stretcher cases. Companions of extra width should be arranged to facilitate handling. Where ships' boats are used, the method of loading them depends upon pier facilities which, if not actually in existence, will have to be improvised. A naval cutter or ship's lifeboat will take four Naval service cots, laid fore-and-aft, and two abreast; or six military stretchers, three abreast.

A simple way for unloading individual stretchers or cots is to hook the boat conveying them on to a pair of the receiving ship's boat falls and hoist both up together. On reaching the deck rail level, the wounded are taken over by the ship's working party. The reverse is adopted in landing a casualty. The boat, on reaching the water, is released and rowed or towed to its destination.

For general use, the author emphasizes the superiority of a cot tray. Briefly, it consists of a lidless box seven feet long, three feet six inches wide, and one foot three inches deep, as to internal measurements. To

facilitate loading, the end-pieces are hinged to let down, being kept in position by hasps and pins fitted to the side-pieces. They are also suitably slotted to take the handles of a stretcher. At each corner, wire slings of appropriate length and strength, terminating at a central ring, are fitted, and the appliance is complete. The winch wire is hooked into the ring. The guy ropes for this tray should be kept permanently attached at both ends of one side, being coiled up inside when not in use. The tray should be hooked on so that the guy ropes are on the side next to the ship. This gives greater control in preventing the tray from bumping during the hoisting. The advantages of the tray are that it is solid, giving the patient a feeling of security while in mid-air, the depth obscuring a view of anything but the sky; it can be used equally for cots or stretchers and even for non-cot cases. Owing to its area it is not very suitable for removing casualties directly from a loaded ship's boat; the Faulkner sling or bridle are much better for this. All hospital ships and ambulance carriers should be supplied with several trays for general use, as well as a Faulkner sling and bridle for those occasions on which a tray is not suitable.

In this connection, the author proceeds to describe and recommend a stretcher designed for general use in all services—Navy, Army and Air Force. Apart from individual instances, peculiar to itself, every service requires an appliance for the transport, in general, of its sick and wounded. A standard stretcher could be made as follows: to the ends and sides of an ordinary army stretcher, canvas flaps are fixed; those at the head and foot are nine inches wide, while those along the sides measure eighteen inches. The end and side pieces are lashed together by boatlacing, as required. The lacing is kept permanently fastened to each stretcher handle and is part of the appliance. Brass eyelets are let into the flaps. By this means the wooden framework of a naval cot is represented by the two stretcher poles, while its canvas flaps are added to the Army stretcher. When not required, the flaps can be laid flat in the stretcher before the patient is put on it. To permit this appliance to be slung, a bridle, terminating in a metal ring, is permanently fastened to the handles at each end, while a mattress, pillow, and two blankets complete the equipment. Such an appliance would combine the advantageous features of the Army stretcher and the fitted naval cot, while eliminating the undesirable features of either. It would also have the added advantage of service interchangeability, and so do away with the necessity of transferring the patient in the process. Thus a standard stretcher for universal and inter-service use offers manifold advantages.

During the World War, the Navy adopted the system whereby a sick or wounded man was placed in a cot at the "Front," i.e., Ship. He and his cot traveled together to the Base Hospital, without further transfer than directly into the bed in the ward. Each link in the transport chain—ambulances, trains and hospital boats—was fitted to its carrying capacity with empty, clean cots, which were given in exchange for an equivalent number of loaded ones received for transfer. Thus, barring any extra cleansing necessary, each unit was automatically ready for further service immediately after the completion of any particular one. The Base Hospitals cleaned the cots as received and kept up the supply of clean cots, which circulated throughout the whole transport system to the ships at sea, and were eventually returned to the base with a patient. By this system, all moving of a patient after he was placed in a cot, was avoided until the man was actually put to bed in the ward. Through a method of suspension with semi-rigid fixation in the ambulance trains, all jolting and jarring were eliminated during transit and the train could discharge 140 cot cases in twenty minutes, leaving the line clear for other traffic. The many stretcher-transfers between Casualty Clearing Station and Base Hospital were avoided, to the benefit of the patients.

Apart from the administrative side, there is the clinical side, which is equally important for success in the transport of wounded by water. It is summed up in providing the maximum comfort, during transit, compatible with speed. This includes the alleviation, as far as possible, of pain, hunger or thirst, heat or cold. Annoyance to patients from flies or other pests should be guarded against by suitable means. The sedative effect of tobacco should also be borne in mind, and a supply of matches and cigarettes provided. At the same time, the undesirability of smoking, in cases of gas poisoning, is a factor to be considered, and should be regulated by the Medical Transport Officer. Each intermediate transport unit should carry a plentiful supply of fresh water, to which lime juice, in the proportion of one-in-twenty, has been added. With respect to the final stage of transport from "Front" to "Base," the welfare of patients becomes a matter of Hospital Ship routine.

Conclusions

Two points are essential in the removal of sick and wounded:

(a) To attain the maximum speed compatible with efficiency.

(b) To provide the greatest comfort and safety for patients.

Two distinct and equally important factors enter into this—the administrative and the clinical.

Water transport is invariably subject to local and weather conditions, so that it is impossible to lay down any fixed routine for general use. The general procedure may be divided into three stages—embarkation, transit and debarkation. The means may range from ships' boats towed to their destination, especially constructed hospital craft, and so on to ambulance carriers and hospital ships.

There are three methods of transferring casualties by hoisting. For general purposes, the best is a wooden cot tray. This is a lidless box suspended by wire slings and hooked on to a single fall winch wire from a derrick in the receiving ship. It can be used for cots, stretchers, or non-cot cases.

For naval cots, a bridle with wooden spreader is handy, the cot being hooked on to it and hoisted up. This is useful when ships' boats are used, as the cot tray takes up much room.

Military stretchers are best dealt with by the canvas sling designed by Lieutenant-Colonel Faulkner, R.A.M.C., during the Gallipoli Campaign.

For combined operations, a standard stretcher would diminish transport difficulties and make the naval system, instituted during the World War, applicable to all Services. By it, patient and cot travel together from the "Front" to the base hospital ward without further transfer.

The ideal method of transfer is by gangway connection between the craft concerned, which is not more than an inter-ward transfer. It saves time and does not arouse fear in the patient, as hoisting in the air may do. Hospital ships should have entry ports on each side of decks fitted for patients, ample space being provided for handling stretchers as received. Hospital ships under construction, and others likely to be used as such, should have these ports, and no ships should be employed unless so fitted.

Rubber-tired, two wheel "bogies" on which stretchers are wheeled instead of carried, should be supplied to all hospital ships.

From the clinical side, the use of morphia is important. While its administration cannot be left to the initiative of unqualified persons, the author is convinced that more lives have been lost through unrelieved "shock" than by morphia. Anodyne tablets, as well as morphia, should figure in every medical valise. Whenever used, time and dose must be noted on the patient's tally or label.

Wells (Great Britain)

In his consideration of "The Evacuation of Sick and Wounded by Air," Group Captain Hardy V. Wells, C.B.E., K.H.P., R.A.F.,

remarked that, since the World War, air ambulance transportation has not been used in England on a large scale, owing to hospitals being somewhat easily accessible. In the Air Force it is used where flying stations are situated at long distances from hospitals, or where such method is considered preferable to other means. In the East it serves as the means of evacuation, and proved extremely valuable in war operations, both in the desert and in the hills.

All aircraft for the transport of casualties must be capable of carrying a recumbent patient; and this necessitates the accommodation of a stretcher and fittings for securing the stretcher. Such aircraft must also have an opening, so that a patient can be placed within while in the lying position.

The types of aircraft suitable for the transportation of casualties are: (1) Airplanes of the various types, including Seaplanes and Flying Boats. (2) Airships.

This report deals only with the former, which are divided into the larger and smaller types. The larger types, those with a large and roomy fuselage, must have an opening whereby lying casualties can be placed within; this can be by a side door or an opening in the nose of the aircraft.

The smaller airplanes, of the two seater type, are capable of using landing grounds which are unsuitable for the larger aircraft. Recumbent casualties cannot usually be accommodated, owing to the cross bracing wires of the fuselage. Aircraft of this type, capable of taking a stretcher, are so designed, using the system of hoops, that there are no cross bracing wires. In emergencies, and when other means are not available, a patient can be strapped to the upper surface of the fuselage by means of a special stretcher of the Neill Robertson type.

The transfer of casualties by air is the quickest and most comfortable method. It is particularly valuable where military operations are at a distance from the Base, and in countries where transportation by such means as road, rail or water is difficult, or almost impossible, without a great deal of organization en route. The World War showed the importance of early surgical treatment of grave wounds of the abdomen, head and chest, and unless such treatment can be given within six to eight hours, after the infliction of the injury, the chances of saving life are proportionately decreased. Land transport is often slow and cannot be depended upon; therefore, it is in the interest of life to use the air. Experience has shown that all types of wounded can be taken by air to well equipped hospitals where skilled treatment can be obtained. Central hospitals will, in the future, be able to receive

casualties by air transportation and so deal with patients from wide areas; this will mean a distinct saving in hospitals and staff.

The limitations, in regard to the removal of casualties by air, are few. The factors to be considered are weather conditions and landing grounds. It is essential that there should be landing grounds reasonably near the hospitals, and it must be known for what type of aircraft the aerodrome is suitable.

The "Flying Ambulance" includes all airplanes capable of accommodating a recumbent casualty, and should be designated as "Ambulance Carriers." The most convenient type should carry two or four recumbent patients and one hospital attendant. A well trained medical orderly should form one of the crew and be responsible for the necessary medical equipment. The choice of stretchers utilized in the Ambulance Airplane, is, at present, limited by the agreement between the Navy, Army and Air Force to employ only a common standard type of stretcher. This has many advantages, but the author foresees that the stretcher of the future, for air work, will be a light metal one adjustable to fit all forms of ambulance transport.

Wartime transportation of casualties, by air, can be satisfactory only provided suitable aircraft is definitely available for this work, and under the direct control of those responsible for the removal of the wounded. Therefore, it is necessary for ambulance machines to be constructed at the outbreak of war, with the utilization, during the process of building, of troop carriers and heavy transport aircraft, when not employed on air operations.

The employment of ambulance air craft depends on the type of the war, which must be divided into: (1) Great War, (2) Small War, (3) Tropical War.

In great wars, when large armies are in contact, the areas adjacent to the front line will be continually under shell fire and, therefore, employment of aircraft on ambulance work, in this region, will be impossible. The nearest position for such work will be somewhere out of this area, approaching the vicinity of the advanced mobile hospitals. The landing ground should be reasonably adjacent to these hospitals.

In the small wars, in the case of a force operating from an established base, with columns moving up, it is necessary to transfer casualties from the Field Ambulance to a stationary or base hospital by the quickest method. The main object of air carriage, in such a type of warfare, is to avoid establishing advanced hospitals, by moving the casualties directly to the base hospitals. In the case of mechanised forces operating at long distances from any base or main force, practic-

ally the only means of transfer to a hospital is by air. Ambulances of the smaller type would here be invaluable.

The removal of casualties in tropical warfare is always beset with difficulties, and the only remedy is air transport. It is always possible to secure a clearing or some suitable place for a landing ground for the smaller type of aircraft.

In the removal of the wounded to hospital ships, it is assumed that the line of demarcation of the Naval and Military responsibility was defined before landing. The actual distance of the line of demarcation can be decided only on the spot. If wharves or jetties are available, it is the duty of the land or air forces to take their casualties to these or other settled embarking places. Where operations are in the vicinity of inland waterways, such as estuaries and rivers, and where casualties can be brought down by small river craft or by aircraft capable of landing on water, the question as to whether these can go direct to hospital ships depends on the local and, to a great extent, on the weather conditions. This point must be decided by the naval authority in regard to water craft and, probably, also in regard to air craft. It is probable that the latter would land in the calm water of their selected base and transfer their casualties either to land or water craft, and so come under whichever authority was responsible. In regard to aircraft so employed, this means must be left to the Air Force control until they actually hand over their casualties to one or other of the Services.

Aircraft solely employed in ambulance work should come under the protection of the Red Cross, but a difficulty would always arise as to identification of such aircraft, both from the air and the ground. A large Red Cross on the upper and lower surfaces of each plane might be seen in clear weather, but this would not be easy, especially when visibility is poor. It seems better to paint the whole aeroplane a red color and with white edges outline a Red Cross. At night, navigation lights and, possibly, special identification lights, as are used by hospital ships, would afford protection. It is not practical to restrict ambulance aircraft to any particular height or route.

Conclusions

The method of evacuation of sick and wounded by air has been used only on a small scale in England, but overseas full use is made of it. In Iraq it is the normal method of evacuation and has proved extremely valuable in war operations in the desert and hills.

Airplanes and airships can be used, but only airplanes are considered in this Report. These must be capable of accommodating stretchers and have an opening for placing a recumbent patient within. Airplanes are divided into two classes: (1) The larger type which can carry several casualties; (2) The smaller type, for carrying single patients; useful when landing grounds are small.

Aircraft for ambulance carriage must be constructed on the hoop system and so avoid cross bracing wires, but in emergency, where unsuitable airplanes only are available, transportation on the upper surface of the fuselage, in a special stretcher, can be adopted.

Evacuation by air is the quickest and easiest means and independent of ground transport. Serious cases can be treated early. Hospitals can be centralized, making for economy in hospitals and staff. However, there are limitations, which consist in weather conditions and the necessity of landing grounds adjacent to hospitals.

Air ambulances must have stretcher fittings and means of securing these. The equipment consists of blankets, pillows, water, drinking vessels.

In the larger type of aircraft, a medical orderly should be carried.

A standard type of stretcher, common to all services, is advisable, but for air work, a light metal stretcher has many advantages.

Suitable aircraft must be available and under the control of those responsible for removal of casualties. At the outbreak of war, it is necessary to construct ambulance airplanes.

Wars are divided into "Great War," "Small War," and "Tropical War." In a great war serious cases are removed from the advanced mobile hospitals to the stationary hospitals. In a small war casualties are removed direct from field ambulances to stationary hospitals. In a tropical war casualties are removed from the front area to stationary hospitals, avoiding long delays on narrow tracts and all the accompanying difficulties. Casualties can be removed from a besieged force.

Importance is attached to a clear understanding as to the responsibility for evacuation of sick and wounded, and this point should be previously decided.

The line of demarcation of the Naval, Military, and Air responsibility in the handling of wounded in their removal to Hospital Ships, must be defined before landing and can only be determined on the spot.

Where casualties are brought down rivers by small craft or seaplanes, the queston as to whether they can go direct to hospital ships,

should be decided by the Navy. Aircraft employed on such service must remain under the control of the Air Force.

Aircraft solely employed on ambulance work should come under Red Cross protection. The identification from both air and ground is difficult by day, but lessened by special lights at night. Restriction as to height or route of ambulance aircraft is not possible.

Oudard
Schickele
(France)

Reporting on the "Liaison of the Medical Services of the Armies on Land and Sea," Médecin en Chef de 1ère Classe de la Marine Nationale, Oudard; and Médecin Lieutenant-Colonel de l'Armée Métropolitaine, Schickele, state that medical evacuations by water must be divided into two large classes: those which utilize the interior navigable routes or inland waterways, and those which employ the exterior navigable routes or sea waterways. Conditions are altogether different in the use of these two routes.

A distinction must be made between two kinds of inland waterways—natural (rivers, lakes), and artificial (canals).

The utilization of canals, from the viewpoint of sanitary evacuations, has its disadvantages as well as advantages. The advantages of this mode of transportation are that the evacuated men are transported on a water mattress, without jolts, noise or dust, with a slow and continuous motion. Evidently, these conditions are excellent for the sick and gravely wounded, who can thus support a lengthy transportation, without any harm, under the indispensable condition that they may receive, on the way, all the care required by their condition. The chief inconvenience consists in the slowness of such evacuations. In a general way, interior navigation does not offer absolutely reliable conditions at all times and under all circumstances.

Motor boats are admitted only on large canals and can navigate only with a reduced velocity on ordinary canals, in order not to damage the banks. The hourly speed may reach six to ten kilometers and the medium daily rate may amount to fifty or sixty kilometers. Ambulance trains possess a medium commercial velocity of twenty to fifty-five kilometers per hour, which can be considerably accelerated in various circumstances; its daily range of action may exceed 300 and even 400 kilometers. Comparison with transportation by the water route is entirely in favor of the train.

In a sanitary transportation system, it is necessary to take into ac-

count the time consumed by the vehicle to return empty from the point of destination to the point of departure. This rotation is very long for boats, for the speed on the return trip is not superior to the journey out, and may even be inferior when a water course must be taken upstream. This means a serious inconvenience with respect to the utilization of the personnel, which thus remains unoccupied during an excessive length of time.

For thirty recumbent casualties, the personnel of an ambulance ship must consist of, at least, one physician and four attendants, while a sanitary train of 300 recumbent casualties requires only one physician.

In sanitary evacuations by sea, specialized ships are utilized, which travel according to the ordinary rules of maritime navigation. The use of hospital ships in very variable circumstances must be foreseen. The type of structure, the choice of the sanitary personnel, the interior installation, the equipment of the hospital ship are dependent upon the various uses to which it may be put.

The surgical hospital ship is a boat of medium displacement, capable of receiving, at most, three hundred wounded, first and second degree of urgency; the service is here particularly heavy, and overcrowding is to be feared. Three hundred wounded of first and second degree gravity require four autonomous services, four operating rooms, four surgical staffs. It must be kept in mind that these are recent casualties, coming from aid posts. It may appear excessive for a surgical staff to handle seventy-five recently wounded (first and second urgency), but the calculation must not be made exactly as for a surgical ambulance on terra firma. In the latter case, the constant renewal of the wounded renders the work of the original staff particularly difficult, and limits the number of beds which can be allotted to it. This rule cannot be applied to the hospital ship without detriment. While the staffs will all, at first, be overworked, they keep their wounded, and the first period of urgent intervention is followed by a calendar period of secondary intervention and dressings, this period being more or less prolonged according to the stay of the wounded on board.

In order to make this specialized and well equipped formation really profitable, a strict selection of the casualties at the time of embarkation is necessary, the cases of third degree urgency and the lightly wounded being directed to the mixed hospital vessels. The four operating rooms must be arranged so as to simplify the general service of sterilization and to reduce the number of specialized atten-

dants. A large elevator brings the wounded from all decks to the operating room. Each ward is provided with its own room for dressings and appliances, equipped with wash stands and a bandaging table. A radiographic service is attached to the operating rooms and must permit interventions under the screen. A large supply of serum is available, more particularly antitetanic and anti-gangrenous serum.

The surgical hospital ship may be called upon to function as a stationary surgical hospital. The service on board must be regulated as in a hospital on land; life on board must be subordinated to the harmonious functioning of the hospital. The service can be correctly discharged only when the Chief Surgeon (Médecin-Chef) is actually the chief of this floating sanitary formation. The Captain of the ship remains responsible for the navigation and the personnel concerned in it.

In the course of two years, from the beginning of 1925 to December 31, 1927, in Morocco, as well as in the Orient, a total of 4,167 men were evacuated by the air route. This figure includes three fatal accidents, costing the lives of two evacuated (0.48 per cent of the transported) and six pilots, mechanics or attendants. The total of eight deaths furnishes a general mortality of 1.9 (transportation personnel included) per thousand transported evacuated; these conditions represent a sufficient ratio of security, and are entirely acceptable as approaching the rate of security associated with other modes of transportation, such as the automobile or the railroad.

Sanitary aviation is applicable and useful, in peace time as well as during active military operation. The already accomplished results permit the consideration of sanitary aviation in future as a normal method of evacuation.

The wounded must be protected by means of a closed cabin, which should be spacious, well ventilated, well lighted, and heated, if practicable. Flying at a certain height tends to distress patients with wounds or diseases of the lungs, and the question of oxygenation arises. Suitable apparatus, therefore, should be provided on board the sanitary airplanes. These appliances are already in use for flights at high altitudes, but must be modified so as to begin functioning from the height of 300 meters.

Sanitary airplanes must, of course, possess all the equipment on board of the ordinary flying craft, and should be advantageously provided with apparatus for telegraphy or wireless telephones.

The advantages of this method of transportation far outweigh the disadvantages. The latter consist principally, in poor atmospheric

conditions, which may hinder and, at times, entirely prevent air navigation; and in landing difficulties which are, undoubtedly, very considerable. The advantages may be enumerated as follows:

(1) The comfortable and rapid sanitary airplane is especially suitable for gravely wounded or very sick men.

(2) By this means, it is possible to evacuate the gravely wounded, and they can thus arrive, within a favorable time, in important treatment centers, provided with all modern therapeutic resources.

(3) It is, therefore, possible to relieve considerably the sanitary treatment organizations close to the front.

(4) The advanced sanitary formations are thus given a greater mobility, which is very desirable in moving warfare.

The first conception that the airplane is suitable for the finding of the wounded on the battle field, was decidedly erroneous. It is practically impossible to differentiate, from the air, between fighting soldiers huddled in holes in the ground, and wounded and dead. When the aviator flies high, he cannot well distinguish the difference between the adversaries, especially with the uniforms now in use, all of neutral tints, with progressive utilization of camouflage. When he flies low, the rapidity of speed forbids accurate observation. The utilization of the sanitary airplane for the gathering of the wounded on the battle field must be abandoned. Its use should be restricted to the evacuation of grave casualties.

Based on war statistics, the ratio of the absolutely non-transportable, for whom intervention is imperative within eight to twelve hours following the infliction of the wound, is in a proportion of 5 per cent of the evacuated of the front (four wounded, one gassed). This group is now considered as belonging to the sanitary formations of the Army Corps situated at about ten kilometers from the front.

The ordinary non-transportable casualties, for which intervention is required between ten and fifteen hours after the infliction of the injury, are treated in sanitary formations placed at the heads of the line of evacuation by railroad, at a medium distance of thirty kilometers from the front. Their number, per one hundred evacuated, is estimated as thirteen wounded and four gassed, making altogether seventeen. Airplanes, with a small and medium carrying capacity, can render only limited service. A study of the figures shows that in a European War, the airplane with a large carrying capacity is the most important and the one most likely to prove of advantage in a system of evacuation. However, as the large carrier needs specially organized landing grounds, it cannot approach the front and the evacuated must

be brought to it, usually in automobile ambulances. Possibly, airplanes with a small carrying capacity can be utilized for the purpose of connecting the front with the landing ground, as is already done in Morocco. As to the question of distance to which the airplane may approach the front, it may theoretically do so as far as the point where it finds a suitable landing ground. Practically, this point cannot, apparently, exceed the location of the divisional sanitary unit. To reach the level of the front aidposts seems beyond the domain of reasonable possibilities. Besides the difficulties of the territory, the activity of the enemy would undoubtedly prohibit this. Briefly, the ambulance airplane with a small carrying capacity, may touch the divisional sanitary units (five to eight kilometers from the front); the airplane with a large carrying capacity cannot go beyond the sanitary units of the Army Corps. (Ten to fifteen kilometers from the front).

A close liaison between the Sanitary Service and the Aviation Service is necessary, in order to insure the functioning of evacuations by the air route.

In naval warfare, seaplanes have been repeatedly utilized by France since 1921 for the transportation of the wounded. In a general way, it can be stated that the ambulance seaplane may prove serviceable in all circumstances calling for the utilization of a hospital ship, and in close collaboration with it. In exceptional instances, the ambulance seaplane may even substitute the hospital ship and answer an urgent call from a great distance, for one or several wounded.

Sanitary aviation raises an entire series of important questions from the viewpoint of international law. These questions have attracted the attention of the International Committee of the Red Cross in Geneva, and have been carefully studied by two writers, M. Paul Des Gouttes, Attorney in Geneva, Vice-President of the International Committee of the Red Cross, and Ch. L. Julliot, Doctor of Law, member of the Judicial Committee of the Aero Club of France. At first sight, it would seem that the neutrality of specialized airplane ambulances, exclusively employed by the Sanitary Service, could raise no difficulties. The Geneva Convention preceded the creation of Sanitary aviation, so that it could not foresee its employment and issue rules in this respect. However, its Article 17 provides that evacuation convoys be treated like mobile sanitary units, and Article 14, which deals with the latter, sanctions their neutralization.

The characteristic properties of sanitary convoys cannot be denied in the case of ambulance airplanes, so that it seems natural to treat them as such. The difficulty begins on studying Article 7, of the Geneva

Convention, which specifies that the protection due to sanitary formations ceases when these are utilized to commit acts injurious to the enemy. Meanwhile, an airplane flying over the lines constitutes an aerial observatory, from which it is easy to see what is happening on the enemy's side. The latter has, therefore, the right to consider that

Major A. D. Stirling, D.S.O., M.B., D.A.D.G., R.A.M.C. Organizing Secretary of the Congress and member of the permanent committee.

such an airplane ambulance commits a harmful act and, by application of Article 7 of the Geneva Convention, is authorized in refusing the benefit of neutrality. The argument undoubtedly possesses a certain validity, and an international convention is required to regulate the question. The neutralizing of ambulance airplanes is a new and important reason for not having them too near the front. They should never be permitted to fly over the lines, and the height of their flight

should certainly be restricted in proportion as they approach the front.

Because of the considerable difficulties presented by mountain warfare, it was necessary to search for a mode of transportation capable of evading the obstacles of the terrain. The air route provides a satisfactory solution of the problem, but in the absence of airplanes or balloons, recourse is had to an intermediary, in the form of a cable stretched above the ground and serving as a support for the vehicles gliding over it. This method of transportation was widely employed in the course of the World War in the Italian Army. The French army made some applications of it in the Vosges mountains. The Central Empires made use of it in Macedonia.

Sanitary evacuations in the mountains are greatly facilitated by the employment of the cable "rope ways." Very considerable differences in land levels are thus passed rapidly and in comfort, irrespective of weather and season, without the slightest fatigue, by the transported evacuated. As evacuations take place in the direct descent, while the movements of supplies pass especially in the ascending direction, the "rope way" is ready for use practically at all times for the removal of the wounded. It is possible, however, to reserve certain hours of the day for this purpose. The Sanitary Service must place personnel, and provide suitable shelters, at the terminal stations, for the expedition and the reception of the evacuated. Automobile ambulances must always be in readiness at the lower station to take the evacuated to the sanitary treatment units.

Conclusions

Evacuations by Water

Evacuations by water are made by inland waterways or by sea.

The former comprise natural waterways (rivers, lakes) and artificial waterways (canals).

Natural waterways have a fixed direction and an unchanging course towards the sea. They are affected by geographic formations and by meteorological influences (season, floods, ice).

Artificial waterways connect basins and are permanently navigable. They necessitate engineering works, with obligatory use of locks and of a water-feeding system.

For purposes of evacuation, the Medical Service employs boats in use on the inland waterways, after the installation of suitable equipment. This method of evacuation is not much utilized to date but may be more generally employed through improved methods of mechanical towing.

Ambulance ships may proceed separately or in convoys.

Water transportation is suitable for gravely wounded, previously treated casualties.

Evacuation by sea may be employed in the case of military operations; on national territory, on the same continent or on adjacent continents, at sea, on distant continents (colonial expeditions).

On national territory, evacuation by sea supplements the land on air evacuations or replaces these to connect the ports of the country.

In continental wars, evacuations by sea will benefit the expeditionary force.

In the beginning of military operations, ships may substitute medical units not yet landed or in working order. In this eventuality, it is of advantage to possess small, rapid, surgically equipped ships, where the wounded can be treated on their way to the base.

On the high seas, naval warfare affords scanty opportunity for the use of a hospital ship.

In the case of distant colonial expeditions, military action is usually limited, and the hospital ship serves medical rather than surgical purposes.

Three types of hospital ships must be provided: surgical, medical, combined.

Hospital ships must be very seaworthy, strongly built, very steady and noiseless, with a minimum of vibration. The average size should be, 8,000 tons, the speed fifteen knots. The accommodation for the patients should be as perfect as possible, with special attention to hygiene. The wards should have a capacity of 25 to 100 beds with not less than six cubic meters of air per person. The beds should be movable, not placed one above the other nor coupled in pairs. Isolation rooms, and one or more padded cabins should be provided. The surgical services should be installed on deck, in one or more complete operating groups (sterilizing room, x-rays, bacteriological laboratory).

Hospital ships should be of special construction, and the tanker type (engines grouped astern) seems particularly convenient.

A surgical hospital ship should receive, at most, three or four hundred wounded, carefully selected at the port of embarkation, divided among four services, each provided with a surgical team.

A hospital ship for sick and gassed casualties must readily permit the separation of the different groups of cases.

Service on board hospital ships is the same as in a hospital on shore. The Senior Medical Officer must be the chief, the Captain being re-

sponsible only for the navigation and the crew. The medical personnel must be accustomed to the sea.

There must be a complete and close connection between the medical services on land and sea.

At the port of embarkation, as well as at the port of arrival, there must be a military medical base in addition to a naval one.

The military base arranges the evacuation, and is kept fully informed of the location of the patients fit to be embarked; it has at its disposal means of transport up to the quay.

The naval medical base is informed as to the movements of the hospital ships and is familiar with their type and capacity. With the aid of the marine authorities, it provides the means of transportation from the quay to the ship.

The two medical bases mutually exchange the information in their possession.

When an evacuation by sea is to be made, the military medical base selects the patients to be shipped, and takes them to the quay on the day and hour agreed upon. The naval medical base takes the evacuated on board the hospital ship.

On arrival, landing operations are carried out in the reverse order. The hospital ship informs the landing port in due time, by wireless, of her arrival, and the nature of her cargo.

Sanitary evacuations by sea raise several problems of International Law, and justify a revision of The Hague Convention of October 18, 1907.

Evacuations by Air

Sanitary aviation has rendered such service that it must henceforth be considered as a normal method of evacuation.

Most airplanes can be adapted to the transportation of patients.

A distinction must be made between three types: small, medium, and large carriers.

The fitting of ambulance airplanes must chiefly be concerned with the transport of stretcher cases, the providing of maximum facilities for embarking and disembarking, and the maximum of comfort and safety during flight.

Ambulance airplanes are subject to the limitations of airplanes in general.

The ambulance airplane provides swift and comfortable transportation and, in this respect, is especially suitable for gravely wounded casualties.

In peace time, the ambulance airplane may be used in urgent cases,

either for bringing assistance, or for carrying the sick or wounded rapidly to a treatment center. The small carrier is sufficient for this purpose.

In the colonies, the ambulance airplane may be utilized under the same conditions. The sea plane, or amphibious airplane, will prove advantageous in the presence of extensive bodies of water.

As a rule, the small carrier will chiefly be utilized, but the medium carrier will be useful in the case of military operations.

In overseas engagements, it will be possible for the small carrier to reach the front and take the wounded to landing grounds where medium sized carriers are able to land and evacuate to distant treatment bases.

In the event of a European war, ambulance airplanes must be provided in large numbers and be of the larger type, if they are to enter, on a large scale, into a system of evacuation.

It does not seem possible for the airplane to pass beyond the army corps area.

In certain favorable cases, the employment of the small carrier may have its advantages.

It seems apparent that sanitary aviation must remain a sub-division of military aviation.

The utilization of the dirigible airship for the evacuation of casualties seems to be excluded.

Sea planes will be always less seaworthy than boats and can only be advantageously utilized when the sea is calm.

The landing of the wounded must be carried out by means of a floating stage alongside the hospital ship.

In naval warfare, the use of the ambulance sea plane is very problematical.

The ambulance sea plane must have a careened hull and be of the amphibious type, with twin engines. It must be of large dimensions, but small or medium types are desirable in certain circumstances. The space for the wounded must be sheltered, closed and easily accessible.

The utilization of ambulance airplanes raises several problems of international law, which must be settled. Their neutralization can hardly be disputed.

In mountain warfare, a rope-way may considerably facilitate the evacuation of casualties. Each installation consists of one or several cables, fixed at each end and supported in the interval by pylons. Suitable trucks, slung from supporting cables, are drawn by a traction cable or are simply hooked to a cable in continual motion. Conditions

of safety depend entirely on the resistance and strength of the cables; war risks are inconsiderable. The Medical Service will have to utilize the already established rope-ways for evacuation.

Communications

Bauer (Sweden)

Major-General Fritz Bauer, Director-General of Medical Services of the Swedish Army, in his article on "Sick-Transport by Aeroplane in Sweden," stated that airplanes for the transport of the sick and wounded have been employed in Northern Sweden since 1924, and in the southern part of the country since 1927. The reports regarding the activities of a variety of utilized airplanes from 1925 to the end of February, 1929, inclusive, show that the number of flights was 511, with an aggregate time of actual flying of 357.5 hours, number of kilometers flown, 35,873, and evacuations carried out, 126. The cases transported were very varied, most of them being acute serious conditions, such as peritonitis, appendicitis, gastric or duodenal ulcer with severe hemorrhage, gall bladder disease, empyema, meningitis, serious accidents.

At the station of the flying squadron at Frösön, Ostersund, one of the army planes is specially arranged for ambulance work. For about a year there has existed in Sweden a private company, the Swedish Aviation Society, which has on its program, among other items, an extension of sick-transport by airplane, a matter that more particularly concerns one of its sub-sections, the Ambulance Committee. The endeavors of this Committee are directed towards rendering transport by air as cheap and safe as possible, and available to all who may require it. To attain this, it is necessary to place the ambulance stations preferably at flying fields or at traffic centers. The Ambulance Committee has outlined a plan for the immediate development of sick-transport. A recently purchased ambulance airplane for Frösön will bear the name of the Red Cross.

The International Red Cross Committee was charged, at the recent Hague Conference, to urge the individual National Red Cross Societies to work for the ambulance aeroplane and, thereby, gain experience which will be of use not only in peace time, but in the event of war, as well.

Tuffier (France)

"Some Reflections of a Surgeon in the Use of Aeroplanes in Surgical Cases," were given by Dr. Theodore Tuffier, on the basis of personal experience.

The choice of air craft is extremely important and the author believes that a fighting plane can be quickly transformed into one for the transport of the wounded. In view of the danger of the flying machine in itself, this means of evacuation should be adopted only in case of necessity, depending on: the condition of the wound; the state of the patient; the locality. In reality, there is no more danger in flying than in undergoing a general anesthetic. Under no pretext, however should numerous evacuations be made by plane. They require very well organized apparatus for immobilization, so that it should be an exceptional mode of evacuation. Badly shattered soft parts, fractures of the principal bones (especially near the socket of the arm or the thigh), which require not only perfect and long treatment but immediate care, are the cases requiring transport by air. This also applies to spine wounds, either with or without medullary lesion. Skull or brain wounds should be treated on the spot, but, if evacuation is necessary, the airplane is recommended. The wounds of the chest and abdomen, only the necessity for an urgent operation demands the use of the airplane.

In all these circumstances, the great factor to be remembered is the immobilization of the wound and the surrounding parts. This immobilization can be obtained by Thomas' splints and above all by the Bonnet "gutter" or the Rouvillois apparatus.

One of the great advantages of aviation in surgery is to avoid changing the wounded from one apparatus to another; he should come into the surgeon's hands in the same "gutter" in which he was first placed. Joint fractures, or fractures of the diaphysis, as well as those of the pelvis and the spine, should be most carefully and most perfectly immobilized, so that they will not be aggravated.

Saint-Sernin (France)

"A Cordial for the Shipwrecked of the Air or Sea" is recommended by Saint-Sernin, Pharmacien Chimiste en Chef de 1ère Classe, Chief of the Pharmaceutic and Chemical Services of the French Navy. A medicinal compound of this kind must combine several conditions; it must not have any effect on the aluminum or tin container; it must have the property of stimulating the nervous system. The objective of this stimulating preparation is to fight the sensations of cold, fever, hunger, thirst, fatigue and drowsiness. The remedy advocated by the author is a modified Todd potion, for which credit is due to John Tweedle Todd, of the Royal British Navy, whose famous formula is preserved in all Pharmacopeias, as follows:

Tincture of cinnamon	10 gm.
Tincture of coca	20 gm.
Tincture of cola	20 gm.
Tincture of quinine (Tincture cinchonae rubrae)	20 gm.
Rum	70 gm.

Roch (Great Britain)

Colonel H. S. Roch, C.M.G., C.B.E., D.S.O., gave an interesting account of his experiences with a small military column, 5,000 strong, on the frontier of Kurdistan in 1923. The country was almost inaccessible, and evacuation by any other means than air would have been of the utmost difficulty. It would have meant hand carriage for a period of from two to eight days. However, through the help of the Air Force it was possible to move the casualties the same distance in four hours with the greatest comfort. No landing was possible nearer than twenty-five miles, and there were 150 sick and wounded. The serious cases were carried on stretchers, the others were put on donkeys, and it was three days before advantage could be taken of the help of the Air Force.

TROPICAL FEVERS OF SHORT DURATION

Official Reports

MacArthur, Dudley, Whittingham (Great Britain)

Lieutenant-Colonel W. P. MacArthur, D.S.O., O.B.E., M.D., F.R.C.P.I., R.A.M.C., Surgeon-Commander S. F. Dudley, O.B.E., M.D., D.P.H., R.N., and Wing-Commander H. E. Whittingham, R. A. F., in their point report on "Tropical Fevers of Short Duration" classify in two main groups the obscure short fevers of the tropics: (1) Atypical or abortive attacks of known diseases; (2) Fevers which have still to be described.

The closer the co-operation between the clinician and the pathologist, and the more searching their investigations, the smaller will be the proportion of cases finally allotted to the second group.

Mild and aborting enteric and paratyphoid fevers, particularly when modified by foregoing inoculation, have been found masquerading under a variety of local names; in one district, a short fever known as "coast fever," and usually considered a distinct entity, was shown by one of the authors to be merely mild enteric and paratyphoid fever. This applies also to undulant fever and, indeed, to any febrile disease where infection is reduced to the lowest degree of virulence and the patient is in a state just short of complete resistance.

The initial attack of simple malaria may be characterized by a short continued fever, without the classical paroxyms of the disease and, at this stage, parasites may be sparse in the peripheral blood, and exceedingly difficult to detect; this type caused considerable diagnostic difficulty in the Shanghai Defence Force, especially as the locality was stated to be malaria free, and early cases were regarded as possible examples of a condition known there as "Shanghai Fever," until their true nature was determined.

Another variety of short fever, common in the tropics, appears to be due to a disturbance of body metabolism by heat, and evidenced by a febrile reaction short of heat stroke. Some tropical practitioners of the old school hold the opinion that, in many cases of enteric fever, the disease can be cut short at the beginning by a sharp purge.

Dengue and phlebotomus fever are recognized by most authorities as definite short fevers, although, when analyzed, they are so far from being definite that attempts to estimate the immunity to second attacks are unsatisfactory, owing to confusion with clinically similar types of fever. In Malta, where there is very little indigenous malaria, only about 10 per cent of visitors to the island suffer from second attacks of phlebotomus fever, so that supposed recurring attacks of this fever elsewhere probably indicate mistaken diagnosis, the real infection being malaria, relapsing fever, enteric or undulant fever, occasionally hepatic amebiasis. In this connection, it may be stated that, frequently, those persons showing considerable dermal reaction at the site of phlebotomus bites do not contract the fever; this fact suggests an immunity akin to fixation abscess.

Influenza, even in the tropics, is a source of diagnostic confusion, for the coryza may not be a deciding factor and, though the relative lymphocytosis of influenza chiefly concerns the small variety, while that of phlebotomus fever and dengue is of the larger type, the expected working error in the technique of blood counts is sufficient, usually, to nullify aid in this direction. At times, outbreaks of phlebotomus fever show, as early symptoms, colics, diarrhea, pharyngitis, or bronchitis, and are apt to be mistaken for cases of dysentery or influenza. Inquiries into certain of these outbreaks revealed the fact that patients who presented these leading symptoms suffered at some little time previously, from either dysentery or naso-pharyngeal catarrh. The reappearance of these symptoms may be explained as arising from a general congestion of the body, which selects the weakened parts; the congestion being produced partly by the vaso-dilation, which accompanies phlebotomus and other fevers, and partly by the hot, humid

atmosphere which occurs frequently during the phlebotomus season.

Recent investigations show the importance of spirochetosis as a cause of short fevers in various tropical countries. A series of leptospira, whether distinct species or only variants of the same, can give rise to fever of a variety of types; the fever may be insignificant and never reach 100° F., or may be more marked, last three days or longer, and run a continuous, intermittent, or "saddle-backed" course, with or without relapses. The more severe infections show jaundice, sometimes of a toxic hemorrhagic type. Injection of the conjunctiva and a trace of albumen in the urine seem to be constant signs, even in the milder cases. In some of the Malaya series, the symptoms were so like dengue, that Fletcher considers that some part of the dengue recorded there is really spirochetosis. Leptospira can readily be isolated from the blood during the first seven days of the disease, and from the urine from about the fifteenth to the twenty-fifth day. The relationship of the various leptospira, isolated in such infections, is the subject of controversy; some workers consider that they all represent one species of free-living spirochete, acquired primarily probably from contaminated water, the variations in virulence and in reaction to serological tests being produced by differences in passage, soil, temperature and humidity. Others hold that a series of different species of leptospira is involved, and to these supposed species distinctive names are given. It is wise, perhaps, at the present stage of knowledge, to be conservative and look upon all leptospiral infections as, probably, representing graduations of Weil's disease.

The question arises, is there any simple, practical method by which the average worker can distinguish the more severe forms of phlebotomus fever and dengue from the milder cases of Weil's disease, other than by cultural tests and animal inoculations? Fortunately, there is. One of the authors carried out lengthy investigations into the blood pictures of the pyrexias commonly met within the tropics. The results obtained in many cases simply confirmed the findings of other investigators. Briefly, if the fever is of acute onset, and provided the examination of blood films has excluded the presence of the malaria parasite, or the spirochete of relapsing fever, then a leukopenia with a relative increase of large lymphocytes, points to phlebotomus fever or dengue, whereas a leukocytosis accompanied by an absolute and relative increase of the polymorphonuclears suggests that the pyrexia belongs to the Weil's disease group.

The leukopenia (4,000 per cm.) lasts for the first three to five

days of the disease, followed by a leukocytosis shooting up to 15,000 to 20,000 per cmm. on or about the tenth day of disease. This leukocytosis is transient and disappears in the course of two or three days. The lowest point in leukopenia occurs six to nine hours after the onset of the pyrexia and is a useful aid to early diagnosis. The differential leukocyte count shows a decrease in the number of polymorphonuclear leukocytes, and an increase of the lymphocytes, especially of the large variety. The eosinophiles disappear during the fever and return with defervescence. A late eosinophilia in dengue has been described; it is more commonly seen in Egypt and the Far East than in the Mediterranean littoral—in other words, this post-dengue eosinophilia is found in areas known to be heavily infected with helminthic disease, and may merely indicate a return of the blood picture to its pre-febrile condition.

Furthermore, as Young in West Africa showed, Weil's disease can be distinguished from yellow fever by estimating the amount of albumen in the urine even during the first forty-eight hours of illness—a large amount of albumen indicates yellow fever. Thus a case of suspected Weil's disease showing a solid clot of albumen when submitted to the boiling test is, in reality, one of yellow fever and, conversely, a supposed yellow fever patient with little or no albuminuria is probably suffering from Weil's disease.

The difficulties in sorting out the true undifferentiated short fevers are intensified by an unwillingness to acknowledge failure; this is particularly in evidence in government services, where those responsible for hospital records sometimes prefer a doubtful, or even an erroneous diagnosis to none at all. But when every known and available diagnostic test is tried thoroughly without result, the pyrexia in question is really one of "unknown origin," and this label should be applied, instead of knowingly or subconsciously elevating to casual rank some sign that is only a result of the unknown infection, for at present the "tonsillitis" of one station may be equivalent to the "myalgia" of another, and to the "sand-fly fever" of a third, all really representing the same undetermined disease.

Conclusions

Diseases may be indefinite, because they are atypical examples of well known infections, or because they are separate clinical entities that still await full description. The first class includes mild or abortive cases of such conditions as typhoid, paratyphoid and undulant fever.

Malaria frequently shows a low continued fever, the paroxysms being absent and the parasites so scanty in the blood as to be easily overlooked.

Abortive heat stroke may also account for some ill-defined febrile attacks, in children, and after heavy exercise, in hot climates.

Dengue and phlebotomus fever are recognized as definite clinical entities, but, owing to their lack of definite symptoms, are frequently confused with similar syndromes. Especially in this the case with influenza, which is very common in the tropics, but rarely accompanied by nasal catarrh.

The blood pictures of dengue and sand-fly fever are often not sufficiently distinct from that of influenza to separate these diseases with any certainty.

Recently, spirochetosis, as a cause of short fever, has attracted attention.

The leptospira, as a group, show many variants, which, although indistinguishable morphologically, yet seem able to cause clinical symptoms which vary from a day or two of pyrexia, accompanied by injected conjunctivae and a trace of albumen in the urine, up to a severe toxemic jaundice.

Weil's disease has probably, at times, been recorded as dengue.

The more severe forms of dengue and sand-fly fever should, however, be distinguished from spirochetosis by their respective blood pictures.

Weil's disease, in its turn, can generally be distinguished from yellow fever by the relative quantities of albumen in the urine. If a urine boils solid, the diagnosis is yellow fever; if there is only a trace of albumen, Weil's disease.

The attempts which are being made to distinguish and describe indefinite short fevers are handicapped, and the confusion increased, by the habit which exists in some quarters, of labelling cases in which the diagnosis is really unknown, with a definite name, for the sake of hospital records. If a case, in spite of all possible investigation, remains a "pyrexia of unknown origin," it must be honestly left as such in all sick returns.

Gerards (Dutch Indies)

Among tropical diseases, febrile affections occupy an important place in the opinion of Médecin-Officer de 1ère Classe, J. C. Gerards, of the Dutch East Indies. Their old classification into febrile diseases of

long and short duration is unsatisfactory, and the persistence of this grouping up to the present day is due only to the absence of a better method. The etiological factor, in diseases with persistent fevers, and the different course of their development, permit their identification. Conditions differ in the classification of the acute fevers, such classification being based exclusively on the duration of the course of the fever and, therefore, necessarily giving rise to confusion, especially when the cause of the disease is unknown. With a more extensive knowledge of the etiology of the diseases grouped under this heading, it will be possible to adopt a better classification and nomenclature, no longer based upon a duration of time or a geographical distribution, but on the determination of the pathogenic agent of the disease. Of recent years, a relation has been established in the non persistent fevers, showing that, in several of the diseases belonging to this group, the cause was due to the presence of closely related organisms, all belonging to the group of spirochetes. The author cites the most important of the diseases regarded as belonging to this group.

Yellow fever.—Like the Antilles, the Atlantic coasts of Mexico, Central America, and South America were known for a long time, as endemic foci, from where yellow fever could spread along the coast of North and South America, and penetrate into the interior, following the course of the rivers. The western coast of Africa, also, has long been known as an endemic focus, from where yellow fever spread toward the North and the South. In the eighteenth and nineteenth centuries, several European ports, likewise, knew yellow fever.

Upon the discovery of the transmission of this disease by the aedes argenteus, sanitary measures were taken to render the life of the mosquito impossible, and this, together with the quarantine regulations and the work of the Committee of the Rockefeller Foundation, placed yellow fever under control throughout America, from where it is fast disappearing.

Conditions differ in Africa, where the bad hygenic state of the country permits the fever to maintain its endemic character. The disease attacks the natives while young, in a less severe form, and is either not observed or not recognized. The natives are thus immunized for the remainder of their life and become carriers of the virus. No great epidemics occur. Owing to the restricted number of foreigners without immunity, and the better sanitary conditions under which they live, only small outbreaks supervene. But its endemic character renders yellow fever a constant threat to the country, and to the other countries in which it finds an opportunity to spread.

The mode of transmission of yellow fever was long investigated and, in 1901, the *aedes argenteus*—common mosquito—was shown to be the only responsible agent. In conjunction with this work, of course, the cause of the disease was looked for, and was apparently found by Noguchi, in 1919, in the *leptospira icteroides*. Numerous proofs were advanced, showing that this organism caused yellow fever, which was then transmitted by the *aedes argenteus*. Even the vaccines and sera proved the specificity of this pathogenic agent. The theories of Noguchi had their adherents as well as opponents.

Yellow fever is exclusively distributed in tropical and subtropical zones; a warm and humid climate is necessary for it. During the rainy season, the number of cases usually increases. A racial immunity, as sometimes surmised, does not exist. A persistent immunity is acquired only by persons who have recovered from an attack of the disease and reside in an endemic region.

Infected mosquitoes can be transported from place to place, for example on shipboard. The virus undergoes a course of evolution in the mosquito, lasting about twelve days. The virus is present and infectious during the entire existence of the insect.

A patient suffering from yellow fever is contagious during the first three days of the disease. The onset is usually sudden, after an incubation of three to six days, during which the prodromata are absent or very slight. In unfavorable cases, the patients fall into a somnolent, comatose state and often die under symptoms of uremia. In favorable cases, there is profuse perspiration, the temperature drops, and recovery is rather rapid.

Yellow fever must be differentiated from malaria, Weil's disease, and dengue. The treatment is symptomatic. The destruction of the *aedes argenteus* dominates the entire prophylaxis.

Weil's disease and other spirochetoses.—Investigations of the causes of these diseases date back to the last fifteen years, and numerous theories on the activities and relations of responsible spirochetes have been propounded.

Weil's disease was described for the first time by Weil, in 1886, and occurs especially in Japan. It is found in all parts of the world and has been demonstrated in the majority of European countries. The disease, caused by *leptospira icterohemorrhagiae*, probably originates in such a way that this organism, by means of contaminated water penetrates into the human body, either through cutaneous lesions or by way of the digestive apparatus. After an incubation of five to six days, the onset is acute, accompanied by chills, vomiting, headache, diarrhea,

pains in the epigastrium, pains in the limbs and fever, with a rather typical course. Inflammation of the kidneys is present, sometimes complicated by uremia and anuria. The urine is dark and nearly always contains biliary material, sometimes cylinders and erythrocytes. From the fifth to eighth days, one or two drops of acetic acid in the urine give rise to a strong green reaction. Epistaxis, hematuria, melena and hemoptysis may appear as complications. The leptospira may be observed in the blood on the first days, between the second and third week, they appear also in the urine, and these excretions through the urine may last a long time. The diagnosis can be rendered through the demonstration of the leptospirae in the blood, by the injection of blood into guinea pigs, by the discovery of leptospirae in the urine, finally, by means of serological reactions. The treatment is symptomatic or consists in the employment of a polyvalent serum.

Febris hebdomadis.—This form of fever occurs especially in Japan and particularly at the beginning of the autumn. The disease is caused by the *leptospira hebdomadis,* which is closely related to *leptospira icterohemorrhage,* from which it can be distinguished by serological methods. The field rat (*microtus montebelloi*) is the carrier of the virus. The disease is probably transmitted by a bite of the animal. The leptospira is found, in the first days, in the blood and after the eighth day, in the urine. The symptoms resemble those of Weil's disease. The acute onset is accompanied by fever, prostration, conjunctivitis, digestive disturbances, swelling of the lymph glands, mild leukocytosis and, sometimes, an eruption resembling that of measles and of dengue fever. At the end of five to ten days, the originally high fever rapidly or slowly diminishes. The mortality of the disease is nil. It must be differentiated from Weil's disease and dengue. The treatment is symptomatic.

Epidemic icterogenic African spirochetosis.—The symptoms resemble those of yellow fever and Weil's disease. The transmission is different and takes place through a flea. Two types of this fever are distinguished, namely the icterohemorrhagic type which resembles yellow fever, and the pulmonary type, which presents a pneumonia with icterus. Triple centrifugation demonstrates the presence of spirochetes in the blood, the urine and the sputum. In infected guinea pigs, the syndromes are the same as in an infection produced by the *leptospira hemorrhagiae.*

Hemoglobinuric fever.—According to some investigators, there exists a form of hemoglobinuric fever caused by a leptospira. The disease is acute, with a high fever. Icterus appears promptly, and hemoglo-

binuria supervenes at the same time. There is leukocytosis and a formation of young red blood corpuscles.

Spirochetosis febrilis.—Under this designation, Kouwenaar described a number of febrile diseases observed in Deli by himself and others. Clinically, these fevers appeared with or without icterus; one case was combined with hemoglobinuric fever.

Pappataci Fever.—The carrier of this febrile disease has been shown to be the *phlebotomus pappataci.* The distribution is connected with the presence of this insect, although the disease does not exist wherever the sandfly is found. Pappataci fever appears in Europe especially in the Mediterranean countries; it is also encountered in Asia Minor, in the Northern Indies, where it is described by McCarrison as Chitral fever, in Egypt and in Central America. The cause is unknown. The *phlebotomus pappataci* is a very small insect, of a yellow, brown or gray color. It can easily penetrate through a mosquito net. It bites only at night. Only the female phlebotomus bites, and causes severe pain and a strong reaction of the skin. Infection manifests itself about four days after the bite, the symptoms closely resembling those of dengue. The fever attains its maximum at the end of one or two days, maintains this maximum for a day, and then diminishes. The duration of the fever is often prolonged, sometimes from four to nine days. Its course may resemble that of dengue; it is benign, and grave complications are rare. Convalescence is rather lengthy and accompanied by symptoms of asthenia and depression, as in dengue. The treatment is symptomatic. Prophylaxis must deal with the destruction of the insect and the removal of the foci of infection.

Dengue Fever.—The first data on dengue goes back to the end of the eighteenth century. The disease occurs in all tropical countries; the sub-tropical regions may suffer as much from it as from yellow fever during summer epidemics.

While the disease is known to be transmitted by mosquitoes, the virus of dengue is still unknown. The time of incubation is about five to nine days, sometimes shorter, sometimes longer. The onset is usually hyperacute, with a chill at times; the fever goes up rapidly and becomes rather high. At the beginning of the disease, in the first hours or, at most, in the course of the first two or three days, an eruption appears, which is usually localized on the face, the neck and the chest, sometimes on the palate. At the end of two or three days, the temperature drops, and becomes normal on the sixth or seventh day. After a short remission a relapse occurs, the temperature rises again, the symp-

toms return, a little less distinct, and a secondary eruption makes its appearance. This eruption may have different aspects; a tendency to hemorrhage is rare.

The aspect of the disease is apt to vary in different cases, so that its clinical identity is often difficult to establish. Convalescence is associated with asthenia, physical and, sometimes, mental depression.

The virus is present in the blood and is found there even two or three days before the onset of the symptoms. It is also present in the serum adherent to the red corpuscles.

The aedes is infectious in eleven to fourteen days after sucking the blood of a patient, and, probably, remains infected for the remainder of its existence. The virus is not transmitted in the ova.

Immunity to dengue lasts only a short time after the cure of the disease. During a dengue epidemic, the same individual may catch the disease several times. Dengue and yellow fever have many points in common. They are similar in the mode of transmission, the short duration of the contagion, the time of incubation and the course of the disease. The prognosis is favorable, although it may happen in some epidemics that the dangerous character of the virus induces fatal cases.

No specific therapy for dengue is in existence. Here again, the prophylaxis and destructive measures are directed exclusively against the mosquito.

Diseases belonging to the dengue group:

Fever of van der Scheer or Five Days' Java Fever.—This fever presents a rapid rise of temperature, then a drop on the second day, then another rise, and a repeated drop on the fifth or sixth day. It sometimes lasts two or three days, with accompanying headaches, pains in the joints, gastric disturbances and, towards the end, an eruption. The symptoms may resemble those of dengue.

Ancon Fever.—This fever was described by Deeks in 1912, in the zone of the Panama Canal, as "six days' fever." The onset is hyperacute, with a high fever, which may reach 40C. On the following day, the fever diminishes, to rise again till the fifth day, then subsides by crisis on the sixth day. The febrile attack is, sometimes, associated with transitory icterus which may be very pronounced. The mortality is zero. The disease, in the opinion of Deeks, has considerable analogy with the seven days' fever of Rogers.

Seven days' fever of Rogers.—This fever is described as a sporadic and endemic febrile disease, with its seat of predilection in the ports of the Indies. The symptoms resemble those of dengue. Rogers at first assumed a different disease, but Megaw pointed out that it can-

not be distinguished from dengue, as found in the Philippines and in Australia, so that it cannot be regarded as an independent disease.

The diseases of the dengue fever group have many symptoms in common with dengue. Perhaps here also, diseases caused by the same infectious agent, but experienced by different races and individuals under different climatological and geographical conditions and influences, may eventually present a different aspect and for this reason have received a different nomenclature.

Conclusions

The febrile diseases of the tropics, formerly differentiated by clinical manifestations alone, can now be grouped in a scientific manner, thanks to improved methods of investigation. Duration and geographical distribution as a means of identification, have given place to detection of the causative organism. A rational system of classification and a better nomenclature is now possible. During the last few years, it has been shown that several non-persistent fevers are due to organisms closely inter-related, all members of the spirochete family.

The following is a summary of the more important group:

Yellow fever.—Once endemic in the Antilles, the Atlantic coasts of Mexico and America, penetrating into the interior along the rivers, and on the West coast of Africa; also found in European ports. Thanks to the discovery of the role of *aedes argenteus* as carrier, to anti-mosquito and quarantine measures, and the work of the Rockefeller Foundation, the disease is now under control in America. However, it remains endemic in Africa, owing to bad hygenic conditions.

Great progress was made by the work of Reed, Carroll, Agramonte, and Lazear, with regard to the transmission of the disease by the mosquito. Several investigators hold that Noguchi's *Leptospira icteroides* and *Lepospira icterohemorrhagiae* of Weil's disease are identical. Many observers, however, consider that *aedes argenteus* cannot transmit both leptispirae, and believe that yellow fever, shown, beyond doubt, to be spread by the mosquito, cannot be caused by *Leptospira icteroides.* In 1927 Stokes, Bauer, and Hudson infected monkeys with yellow fever, and proved that the disease was capable of transmission from monkey to monkey by injections of blood, as by the bites of aedes. The clinical signs were identical with the fever in man. Blood cultures were negative, and leptospirae could not be found in the viscera.

Yellow fever is found exclusively in tropical and subtropical zones. There is no race immunity, as once supposed. The virus, which takes

about twelve days to develop, is present and capable of infection during the whole life of the aedes insect. The incubation period of the disease is three to six days. Diagnosis has to be differentiated between malaria, Weil's disease and dengue.

Weil's Disease and other Spirochetoses. —Researches on the causation of these diseases date from the last fifteen years. Inata, Ito and others recognized *Leptospira icterohemorrhagiae* as the causative agent in 1915. Several investigators confirmed this. The combined results of many observers demonstrated that *Leptospira icteroides* and *Leptospira icterohemorrhagiae* are identical, and that the *Leptospira icterohemorrhagiae* of Weil's disease in man is the same as this organism in rats.

Uhlenhuth and Grossmann supposed that the leptospirae lived in dirty water. Baermann and Zueltzer consider that the leptospirae of man, of the rat, and that found in water, were all of the same species, to which they gave the name of *Leptospira icterogenes.* One presumes, therefore, that the diseases are not due to different species; variations of clinical symptoms are explained by different degrees of virulence, dose of toxin, and the individual's resisting power.

Weil's disease.—Described by Weil in 1886; it is found in Japan and in many parts of Europe. The *leptospira icterohemorrhagiae* probably penetrates the skin through abrasions, or enters by the digestive tract. The incubation period is five to six days. The diagnosis is confirmed by the presence of the organism in the blood, in the early stages, and in the urine, later. Phrophylaxis includes sterilization of dejecta, destruction of rats, and prevention of bathing in suspected waters.

Febris hebdomadis.—This is found in Japan, particularly in early autumn. It is caused by *Leptospira hebdomadis,* which resembles *Leptospira icterohemorrhagiae,* but is distinguishable by serological tests. The field rat (*Microtus montebelloi*) carries the virus, which is probably transmitted by insect bites. The leptospira is found in the blood during the first few days of the disease, and in the urine after the eighth day. The symptoms resemble those of Weil's disease. The mortality is nil.

African Epidemic Icterogenic Spirochetosis.—Described by Blanchard, Lefrou and Laigret. It resembles yellow fever and Weil's disease, with two types—one like yellow fever, the other a pneumonia with jaundice. Spirochetes are found in the blood, urine and sputum. It is incapable of transmission by the *aedes argenteus,* and is spread by fleas.

Hemoglobinuric Fever.—According to Schuffner, Blanchard, and Lefrou, there is a form of this disease caused by a leptospira.

Spirochetosis febrilis.—Kouwenaar has described, under this name, some febrile conditions observed at Deli. Clinically, they resemble hemoglobinuric fever, with or without jaundice. Leptospirae are obtained from the blood and urine, and are called *Leptospira pyrogenes* Vervoort. Baerman considers these fevers to be atypical cases of Weil's disease.

Pappataci Fever.—First described by Pym in 1804, Doerr transmitted the disease by inoculation of blood, and showed that the agent was *phlebotomus pappataci.* It is found along the Mediterranean, in Asia Minor, Northern India, Egypt, and Central America. The actual causative agent is unknown. The symptoms resemble dengue. Lambert describes four clinical types of the fever, which is usually benign, but with protracted convalescence.

Dengue Fever.—Good descriptions of this disease date back as far as the end of the eighteenth century. It is found in all tropical countries. Formerly considered as transmitted by *culex fatigans,* it is now held to be carried by *aedes argenteus.* The virus is unknown. Incubation is from five to nine days. Convalescence is slow. The virus is present in the blood for two or three days before the appearance of symptoms. The mosquito is infectious in eleven to fourteen days after biting. The virus is not transmitted through the ova. Immunity is of short duration, and the disease may attack a patient several times in one epidemic. Yellow fever and dengue have several points in common; method of transmission, duration, incubation, and the spread of the disease.

Dengue group of diseases:

Five-day Fever of Java (Van der Scheer).—The symptoms resemble dengue. It is thought to be a polyneuritis-astheno-neuralgic fever, comparable to the astheno-myalgic fever of Bernard, for which he accepts the *Bacillus asthenogens* of Noel as the causative agent.

Ancon Fever.—Described in 1912 by Deeks in Panama Canal zone, and called "six-day fever." It is mild, and resembles "seven-day fever" (Rogers).

"Seven-day Fever" (Rogers).—Described as a sporadic and endemic fever, found in Indian ports. Said to resemble dengue as found in the Philippines and Australia, and not accepted universally as a separate disease.

COMMUNICATIONS

Sacquépée Cristau (France)

"Tropical Fevers of Short Duration in the Mediterranean Basin" were discussed by Médecin Général Sacquépée, and Médecin Commandant Cristau. In tropical regions, fevers of short duration which appear with a frequency, severity, symptom complex and an apparent relation with the climatic conditions, have long been identified and grouped under the general heading of climatic fevers. All these syndromes are not recognized as of infectious character: the climatic conditions intervene only in proportion as they favor the development of the pathogenic germs or the animal carriers. The term "tropical" here assumes a chiefly biological sense, so that the area of distribution of these diseases tends to become greatly enlarged. The pathology of the Mediterranean Basin is suggestive, in this respect, of the tropical regions; there is here, as it were, a transition zone, which manifests itself particularly in the domain of these fevers of short duration. It is noteworthy that the majority of these diseases are found here, in their typical form or in a slightly different form. Two affections known so far are essentially Mediterranean:

1. Three days fever (practically localized in the Eastern Basin of the Mediterranean), with general features approaching dengue and similar syndromes. The virus is probably of the same genus, or a new example of adaptation of a virus to media differing from its original environment.

2. Exanthematous fever of the Mediterranean littoral, observed in the region of Marseilles, now distinctly separated from Brill's disease or benign endemic typhoid fever.

Cazanove (France)

"Tropical Fevers of Short Duration in the French Colonies" were described at some length by Médecin Lieutenant Colonel Cazanove, of the French Colonial Troops, who arrived at the conclusion that these fevers, now recognized through differentiation between climatic fevers and malaria, seems to possess undeniable features of clinical relationship. It is possible that they are caused by germs of the same genus (spirochetoses), differing in their reactions according to the transmitting agents. The tropical fevers of short duration, observed in the French colonies, may be classified as follows:

(1) "Stegomyia" fevers: (a) dengue, (b) yellow fever.

(2) Recurrent flea fever.

(3) Recurrent tick fever.

(4) Fevers with a still unknown transmitting agent; recurrent Senegal fever; icteric Camerun fever, a disease observed among the natives.

Blanchard (France)

"Icterogenic Spirochetosis and the Diagnosis of Yellow Fever in the African Natives" is the title of the communication by Médecin Lieutenant-Colonel Blanchard, of the Colonial Troops, Professor at the School of Application of the Sanitary Service of the French Colonial Troops. The difficulties of the diagnosis of icterogenic spirochetosis may complicate the problem of tropical fevers of short duration in tropical Africa, more particularly since the African Yellow Fever Conference showed the existence of the latter disease among the natives. (Dakar, April, 1928). Quoting his own observations and the findings of other investigators, the author points out the principal symptomatic and diagnostic features of icterogenic spirochetosis, as well as some distinctive features of icterohemorrhagic fever.

Manoussakis (Greece)

In his Communication on "Clinical Research on Dengue Fever," E. Manoussakis, Chief of the Epidemiological Service of the Athens Garrison, Physician in charge of the Military Teaching Hospital in Athens, draws attention to certain characteristics of the recent epidemic of dengue in Greece, notes the general symptoms met with, and endeavors to distinguish these from other febrile diseases. Based on the results of inoculation experiments on volunteers, he considers dengue as a septicemic disease, the virus circulating in the blood for a very short time. The virus is also found in the cerebrospinal fluid, but it does not exist in any secretion and, therefore, no direct transmission of the disease is possible. This virus appears in the blood only a few hours before the onset, persists during the whole course of the disease, and disappears with the period of defervescence, showing that there is no convalescent carrier of the virus. Dengue is transmitted by *stegomyia fasciata.* Other parasites do not play any important rôle. The author succeeded in determining the occurrence of the fever by injecting the filtrate of stegomyia taken from houses in which dengue fever existed, and the fight against dengue is, therefore, a fight against stegomyia; this must take place during the winter, as it is only during this period that these few mosquitoes can be completely destroyed.

Tsutoma Saito (Japan)

Surgeon-Captain Tsutoma Saito, in his Communication on "Tropi-

cal Fevers of Short Duration in Japan," stated that these fevers, for the most part, occur in the southern islands in Japan, such as Formosa, the isle of Pescadores and Okinowa, but may appear sporadically in Korea. However, these tropical fevers are not very frequent. The chief kinds are: (1) Dengue Fever, (2) Tsutsugamushi disease, (3) Febris hebdomadis (seven days' fever).

Dengue fever occurs chiefly on the isle of Pescadores in epidemic form almost every year. The army, as well as the civilian population, is affected by the disease. It is seldom spread over the principal islands of Japan. It has been reduced as a result of malaria prophylaxis, which is being carried out most energetically by the State officials in Formosa, by improving the hygienic arrangements, and by means of protective measures against mosquito bites. Among other measures a water pipe is being laid, on the isle of Pescadores, in an effort to exterminate mosquitoes.

Tsutsugamushi disease occurs only in certain districts in Northern Japan, in epidemic form. As it always ensues after river floods, it is also called the flood-fever. As to the etiology, this disease is carried by six-footed trombidium larvae, the so-called akamushi. The causative organisms are, undoubtedly, contained in the blood of patients suffering from the disease. Moderate attacks are generally followed by recovery. The mortality depends on the form, place, and time of outbreak.

"Seven days' fever" is assumed to be due to infection by field mice (*microtus montebelloi*) the period of incubation lasts from five to nine days. One week after the onset, spirochetes can be found in the blood, although they are comparatively few. Immune bodies are formed in the blood, which destroy the causative organism, *spirochaeta hebdomadis ido.* The prognosis is very favorable.

INJURIES TO BLOOD VESSELS AND THEIR SEQUELAE

Official Reports

De La Cour and Stephens (Great Britain)

After a brief historical survey of the subject, Colonel G. De La Cour, O.B.E., M.B., and Surgeon-Commander H. E. R. Stephens, O.B.E., M.B., F.R.C.S., R.N., Great Britain, point out, in their report on "Injuries to Blood Vessels and their Sequelae," that most of the methods they set forth are hall-marked by the stamp of active service practice, and, as such, are justly entitled to respect, if not agreement.

For the sake of simplicity, the subject-matter is discussed according to the following classification.

(1) General considerations.
(2) Localized contusions.
(3) Wounds of arteries: (a) Lateral, (b), Traversing perforations, (c) complete severance.
(4) Wounds of veins.
(5) Repair of wounded vessels.
(6) Sequelae of wounds of blood vessels: (a) Hemorrhage, (b) Damage of the parts supplied by the injured vessel, (c) Traumatic aneurisms.
(7) Methods of treating injured blood vessels.
(8) Treatment of aneurisms generally.
(9) Treatment of special arteries.

1. *General considerations.*—Two factors render surgical interference difficult in injuries of blood vessels—their relative small size and the constancy of their vital function. Unless an injured blood vessel can be restored to a measure of use, at least, the surgeon works in vain. In all sequelae which may follow injury to an artery, for instance, the severity of the lesion is assessed by the resulting damage to the peripheral parts supplied by that vessel.

(2) *Localized contusions.*—These particular forms of injury to the vessels are more frequently observed in military, rather than civil practice. In the latter, arterio-sclerosis is more common than in the former. These injuries are usually followed by early spontaneous thrombosis; owing to obliteration of the lumen, such lesions are often overlooked and, consequently, not recorded. The actual area of the lesion invariably extends to a far greater degree than ocular inspection suggests. This fact forms their leading clinical characteristic. The following are some examples of their sequeles:

(a) In the slightest grades, the clot forms at the site of the ruptured intima. This thrombus may be the source of emboli, although only a lateral thrombus, not obstructing the entire lumen, be present. Generally the small clot becomes rapidly covered by endothelium from the adjacent intima.

(b) Although the lesion may heal spontaneously, a weak point is left in the wall, which is liable to distension at a later date. This is particularly true when the muscular coat is torn, as well as the intima.

(c) In infected wounds, the presence of a contused or partly lacerated vessel is the most frequent source of secondary haemorrhage.

Such a sequel is, of course, due to diminished local resistance to infection in a delicate structure. At the time of the injury this contusion often passes unrecognized on account of the absence of physical signs.

(d) In either infected or non-infected wounds, if the contusion has been sufficient to destroy the vitality of the tissues of the vessel itself, traumatic aneurism may develop subsequently. The slender construction of the vessel walls with their minute blood supply, only emphasizes how prone this liability becomes.

(e) Thrombosis, either partial or complete, will produce a permanent lowering of the nutrition to the tissues supplied by the vessel. Muscle anemia or anaemic gangrene, according to the degree of thrombosis, follows. In this case the lesion at the periphery depends entirely on the failure in function of an artery situated centrally.

3. *Wounds of the Arteries.*—It is well to bear in mind three salient features: (1) The associated contusion may have lowered the vitality of the margins of the wound of the artery to a degree which ocular inspection and even digital palpation cannot determine. (2) Such injury may be very extensive within the vessel. (3) The intima may have suffered not only by contusion, but, as a result of stretching, by displacement, it may be fissured at a considerable distance from the wound itself.

Lateral wounds of arteries are transverse, oblique, or longitudinal, according to their relation to the long axis of the vessel.

From the surgical aspect, the most satisfactory results are obtained from limited longitudinal fissures, where the coats have been "split" rather than torn. These may often be repaired by suture without material diminution of the lumen of the vessel.

Transverse wounds of the arteries gape widely when more than a quarter of the caliber is involved; when more than half the wall is torn a change of axis of the vessel takes place. Such an event greatly favors hemorrhage, especially as the advantages of complete retraction are prevented by the remaining undivided part of the arterial wall.

In traverse perforations, both aspects of the vessel are wounded.

Complete severance is a very common injury in vessels incapable of much displacement, or when they are struck in a state of comparative tension, as when the surrounding muscle are taut.

4. *Wounds of Veins.*—These differ from wounds of the arteries mainly in consequence of the comparative tenuity of their walls and the small amount of muscular tissue between the intima and adventitia. Owing to the relatively slow rate of the blood stream, thrombosis is

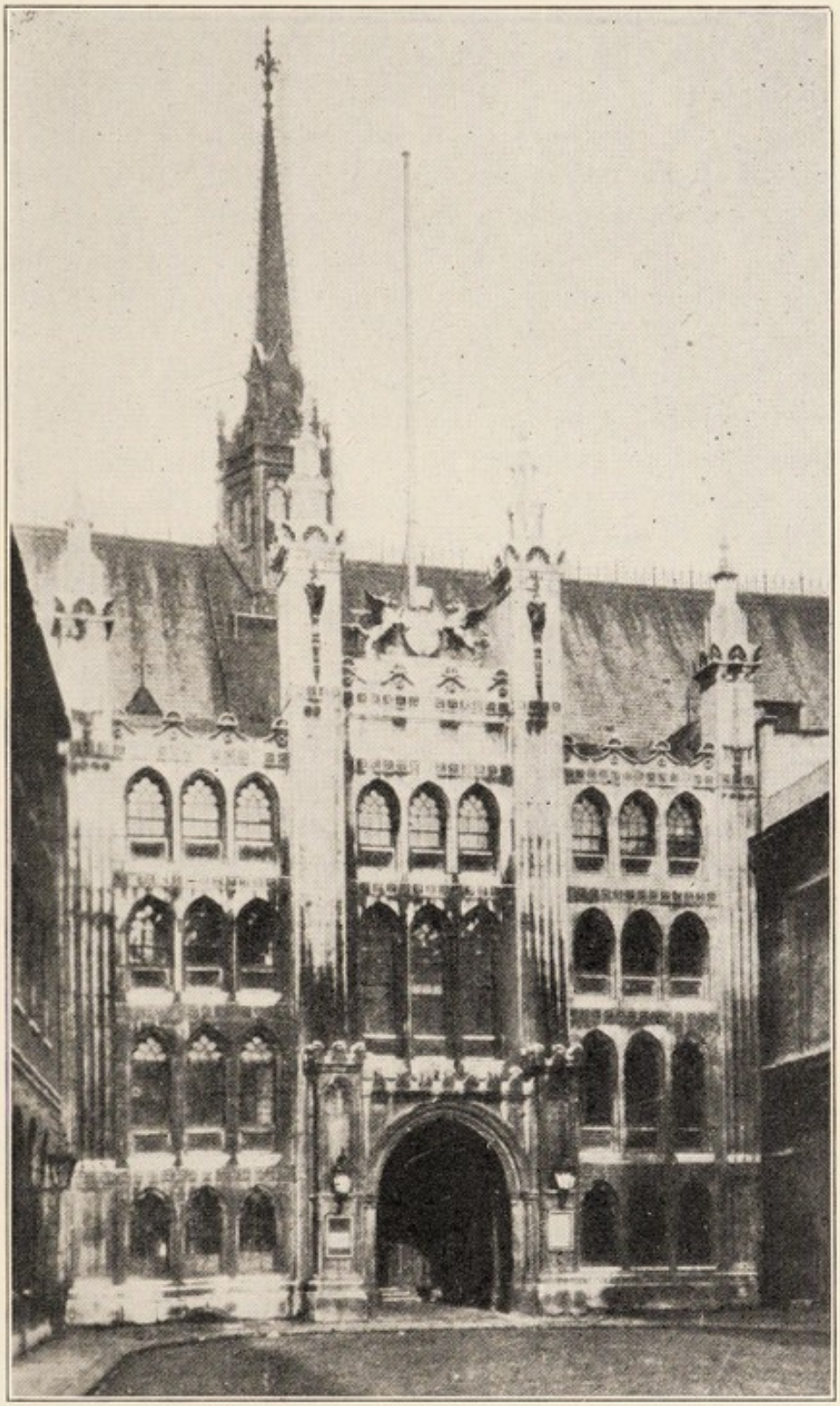
much more common. When lacerated or severed by irregular masses of metal, the wall of a vein may become frayed out into long strips.

5. *Repair of Wounded Vessels.*—Completely divided vessels may heal spontaneously as those closed by ligature. Perforations and small lateral wounds, even of great arteries such as the aorta, may also heal spontaneously. When the openings gape, their edges become regular in outline; the intima and adventitia blend together owing to atrophy of the muscular coat. Thus, an arterial fistula is formed, which commonly communicates with a traumatic aneurism. Spontaneous closure of such apertures may take place by the lateral adhesion of neighboring structures, especially veins or nerves taking a parallel course. Severe contusion or incomplete laceration of the walls of the vessels, is followed by spontaneous thrombosis. In these circumstances, the lumen of the vessel is permanently occluded. A sharp distinction is drawn between such thrombi and those which are attached to a small and localized injury. The latter form no intimate connection with the vessel wall except at the point actually damaged; they contract, allow the flow of blood to resume and, finally, may be completely absorbed.

6. *Sequelae to Wounds of Blood Vessels.*—These consist of (a) Hemorrhage; (b) Damage to the parts supplied by the injured vessel; (c) Traumatic aneurism.

With respect to the temporary control of hemorrhage from wounded arteries, the authors point out that mechanical pressure by an adjacent piece of metal is common, and this explains many cases of recurring traumatic primary hemorrhage. This factor may also be responsible for some cases of secondary hemorrhage, should the wound become infected. Complete obstruction by missiles, which, after entering the heart or a large vessel, move onwards in the circulation to form metallic emboli at the classical sites, is not rare. These emboli become covered with clot and typical signs of local obstruction develop.

In the local treatment of primary hemorrhage, bleeding vessels in an open wound are always ligatured at the earliest possible moment. Possible exceptions to this general rule may be made when the deep vessels in the palm of the hand, the sole of the foot, or the root of the neck, are involved. When injured vessels, especially those of large caliber, are visible in open wounds, they are ligatured whether bleeding or not. If, however, a large vessel is exposed in an open wound, has obviously suffered contusion, and is thrombosed, a ligature is placed above and below the thrombosed segment, and the latter is excised. This method removes any danger of secondary hemorrhage,



Guildhall, where the Lord Mayor and Corporation of the City of London held a reception and gave a banquet in honor of the Congress. Over seven hundred guests were present.

which is impossible to foretell from inspection alone. When evidence exists that a large vessel has been wounded in the course of a track traversing the body or limbs, unless the conditions are favorable, it is not advisable to interfere, primarily if no signs of hemorrhage are forthcoming, or if there are no indications that the vitality of the distal portion of the limb is becoming endangered. In all such cases, although an arterial hematoma and, subsequently, a false traumatic aneurism may result, the later treatment of either of these conditions, under favorable circumstances, is to be preferred to the risks attendant on a primary operation near the front line.

In the local treatment of secondary hemorrhage, direct ligature of the bleeding point is, by far, the most satisfactory practice. Proximal ligature, with the exception of the internal iliac artery, has been proved to be unreliable and, therefore, dangerous. The administration of hemostatic drugs cannot be recommended. On the other hand, forcipressure and plugging are both useful where direct ligature is impracticable; but these may be considered as the last resort of the surgeon.

Short of death of the patient from hemorrhage, the deficiency of the amount of blood, furnished by a wounded vessel to the peripheral circulation, leads to varying degrees of loss of volume of the part affected, to lowered nutrition of the tissues supplied, or even to actual gangrene. These defective functions of the vessel depend upon certain well-defined contingencies. For instance, clots of extravasated blood may exert local pressure on the vessels in their neighborhood; or rapid spontaneous thrombosis may cause sudden obliteration of the lumen. Again, application of a ligature or subsequent narrowing of the vessel, with, perhaps, thrombosis, occurring in the process of cicatrisation may produce effects noticed in the peripheral parts.

The most fortunate of severe cases are those in which one of the forms of traumatic aneurism develops, because time is then given for some readjustment of the collateral circulation, before the need for surgical intervention becomes acute.

The structures in the limbs which suffer most severely from primary anemia, are the muscles. They retain their normal outline, but increase in firmness, in consequence of their assuming a fictitious tone. The latter is produced by rapid nutritional changes, together with an exudation of tissue fluids into muscular sheaths. The muscles may recover to a varying degree but, in some cases, a progressive change continues until a state corresponding to Volkmann's ischemia is reached. Rapid wasting of the limb is rare after a wound of the vessel,

except in those cases where there is a general systemic infection from an associated wound of the soft parts.

Should a vessel suffer obliteration, a certain loss of volume is constant, however good the actual functional result may be. The peripheral blood pressure in the limb is lowered from 10 to 20 mm. of mercury, and the peripheral pulse never regains its former strength and volume.

Some idea of the prevalence with which gangrene follows injuries to large arteries, may be gathered from a series of 992 cases in which gangrene of a varying extent occurred in no less than 178 of the patients of 17.9 per cent. In the series under review, the statistics show how the liability to gangrene varies in different vessels.

	Per cent
Common iliac	100
Popliteal	34.7
Carotid	29.6
Femoral	20.2
Subclavian	8.8
Brachial	4.0
Axillary	2.7

Although these figures compare unfavorably with the 6 to 12 per cent given in textbooks, as following ligature of large arteries, it should be remembered that, during war time, injuries to large vessels are often complicated by large, lacerated, and infected wounds, injuries to large nerves, or fractures of bones.

Many conditions, all common in military practice, predispose to gangrene. For the sake of brevity, they may be enumerated seriatim, thus: Great decrease in the total volume of blood, due to hemorrhage; exposure to cold and exhaustion; prolonged retention of a tourniquet, especially popliteal; infection of the wound, general systemic infection and secondary hemorrhage; associated injury to nerves, especially median and internal popliteal; extent and severity of associated injury to bones or soft parts.

The treatment of war gangrene does not differ in any particular from the lines of procedure followed in civil practice.

Among a series of 1,004 injuries to the great arterial trunks, some form of aneurism occurred in 545 cases, or 54.4 per cent. Observation of a large number of these, during the World War, showed that the cavity of a traumatic aneurism rarely represented the loss of blood

which resulted primarily from the wound of the vessel. The extravasated blood coagulates, the wound in the vessel wall is closed by clot which, in turn, is supported internally by a thrombus. Such a condition may lead to a spontaneous cure. More commonly, the supporting internal clot shrinks and, thus, the opening in the vessel wall is exposed to the full force of blood pressure from within. In this manner a cavity is "hammered out" gradually, in the centre of the mass of external clot. Concentric layers of fibrin are deposited on the inner aspect of the wall of the new cavity until, finally, this becomes covered by an endothelial lining. Meanwhile, the original external clot shrinks, becomes differentiated from the surrounding tissues, and forms the basis upon which a definite sac of fibrous tissue is built.

The mode of formation of the sac in arteriovenous aneurisms simulates the above, the sac being developed, with one exception, in connection with the artery. Artery and vein may communicate with each other in at least eight different ways according to the position of the sac:

(1) Simple arterio-venous anastomosis.

(2) Sac between artery and vein.

(3) Sac on one side of artery and direct anastomosis of artery and vein on opposite aspect.

(4) Similar to above, but second sac between artery and vein.

(5) Sac with artery and vein communicating by a common opening.

(6) Sac with artery and vein communicating by separate openings.

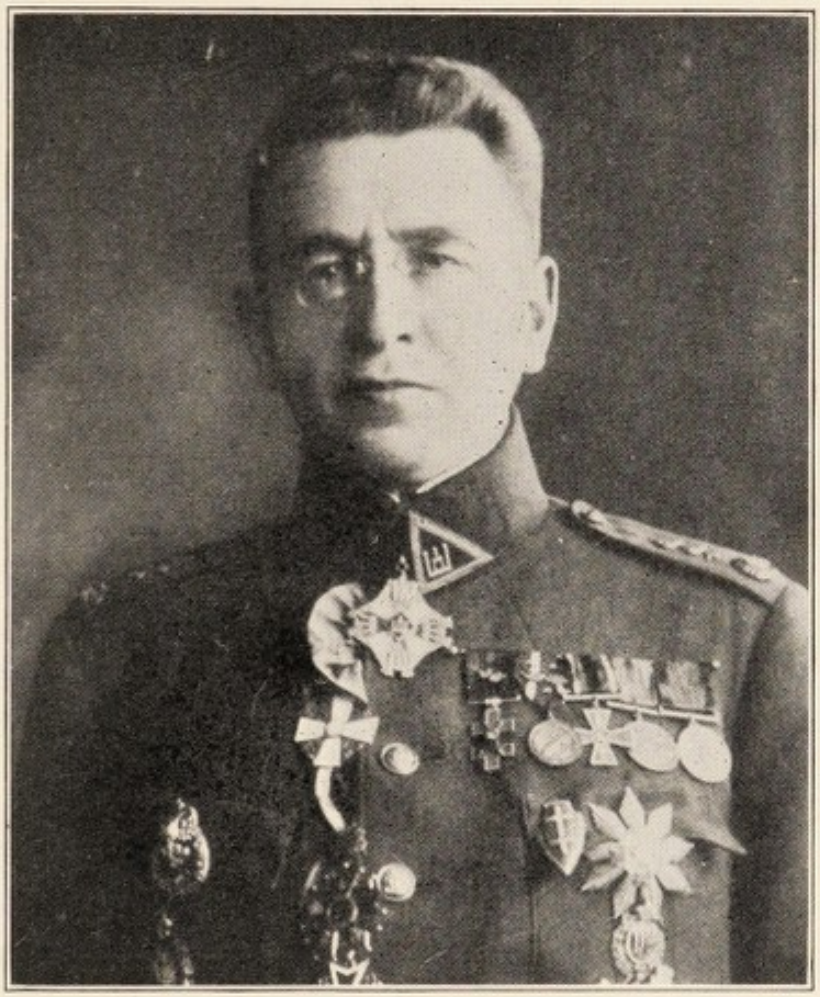
(7) Sac springing from free side of artery and second sac from free side of vein.

(8) Sac springing from artery with which the proximal end of a completely divided vein communicates.

From a practical, as well as a military point of view, considerable differences in the immediate importance of the arterial and arteriovenous forms of traumatic aneurism exist. The arterial is, by far, the more serious because it tends to increase in size more rapidly, and it is more liable to burst on account of the greater internal pressure to which its walls are subjected. Danger from rupture is most likely to occur in the hematoma stage, when the boundaries of the sac are still in a state of imperfect development. During this phase, a movement of the surrounding muscles, such as extension of the limb, may be sufficient to tear the thin margin of the developing sac from the wound

in the wall of the artery. Secondary hemorrhage takes place in consequence, resulting in either external bleeding or rapid extension of the hematoma. The risk of secondary hemorrhage, in the event of infection, is greatly enhanced.

As a result of the tendency of arterial aneurisms to extend and rapidly increase, signs of pressure, either on the vascular trunks themselves or on neighboring structures, much more frequently call for surgical interference than in the case of arterio-venous aneurisms.



Lieutenant General Gyd. Nagevicius, Surgeon General of Lithuania, whose interest was solicited for the Budapest Congress in 1931, and who is planning to head a delegation to it.

The arterio-venous aneurisms are not only less prone to increase rapidly, but they even tend to become localized and diminish in size, owing to the vein's acting as a safety valve, which decreases the full force of the blood pressure on the walls of the sac. Due to their mode of development, the incorporation of important structures in the wall of the traumatic aneurismal sacs is comparatively common, nerves, especially, being liable to become involved in the same injury.

7. *Methods of Treating Injured Blood Vessels.*—At the Inter-Allied Surgical Conference held in 1917, it was concluded that, contrary to the precept accepted hitherto, simultaneous ligature of both artery and vein when both vessels are wounded, does not give rise to increased risks of gangrene. In point of fact, the risk of gangrene is diminished thereby. Facts tend to prove, even when the wound is limited to the artery, that simultaneous ligature of the vein is to be recommended. At certain sites, more particularly the thigh, when primary hemorrhage is free, a temporary conduit, to maintain the circulation, is employed with some success. Tuffier designed a silver tube for this purpose which, after being coated with paraffin, is tied into the divided ends of the vessel and left in this position for three or four days. Although occlusion invariably takes place, valuable time is given for the development of the collateral circulation. Many cases are saved from the onset of anemic gangrene by this device.

Suture of blood vessels is, however, the only method by which ideal results can be obtained. Unfortunately, this procedure can only be undertaken in the primary stage, when there is reasonable hope of maintaining the wounds free from infection. Here, as in many other regions of the body, absolute asepsis forms the keystone in the arch of faultless surgery. As a general rule, intermediate operations are not advised between the second and tenth days.

In performing suture of the vessels, the following maxims are set forth as a guide towards perfecting the special surgical technique required. These have proved to possess a very high and practical value:

(1) Lateral wounds, involving not more than one-third of the caliber of the vessel, are most suitable for suture. If more than one-third of the calibre is injured, then an end-to-end union is attempted, after resection of the damaged segment.

(2) Reconstruction of a vessel, by employing flaps from the adventitious sac of an aneurism, is not advised.

(3) Very fine needles with Japanese silk—size 0000—which has been coated with paraffin, will allow for the best results.

(4) The most satisfactory arteries for suture are the carotid, the femoral, and the popliteal.

8. *Treatment of Aneurisms Generally.*—In the hematoma stage, direct ligature on either side of the arterial wound is indicated under the following circumstances:

(1) Continuous hemorrhage from the wound.

(2) Rapid increase in size or diffusion of blood into the surrounding area.

(3) Obliteration or progressive diminution of the peripheral pulse.

(4) Onset of gangrene.

(5) Pressure on neighboring structures such as veins, nerves or viscera.

(6) Secondary hemorrhage or signs of extending infection of the limiting structures.

Failing the above, an expectant attitude is preferable in the hematoma stage, especially if there was recent and severe primary hemorrhage. The necessary operative measures can be rarely undertaken without further loss of blood, which may be fatal to the limb, or even the life of the patient.

In the aneurismal stage, the treatment may be summarized briefly by quoting specific lines of procedure. Spontaneous consolidation is rare; it occurs most frequently in the case of popliteal aneurisms, but hardly ever in arteriovenous aneurisms.

Direct ligature of the vessels implicated is the method generally applicable to all cases. Proximal ligature is never resorted to, except where circumstances render it unavoidable. Direct ligature may be combined with excision of the sac. This, however, should be avoided, if extensive dissection is required, as injury to collateral branches or neighboring structures may be caused thereby.

Where practicable, suture of the wounds of the large vessels should be considered as preferable to any other method. Only the great length of time required, and the need for particular technical skill prevent the surgeon's attaining an ideal result.

Arterial aneurisms, although they usually show an initial tendency to contract and become localized, invariably enlarge again when the patient resumes his normal life. All require surgical intervention, which is advised during the quiescent period.

Arterio-venous aneurisms, on the other hand, do not show the same inclination to enlarge but, during an active life, the venous obstruction steadily increases. As a general rule, operation is advised.

9. *Treatment of Special Arteries.*—While it is recognized that each individual case must be judged on its merits, the authors consider that the fruits of experience, in these relatively uncommon lesions, may be of some practical value to those who are called upon to decide what is the best method of procedure.

Except in cases of emergency, proximal ligature of the common carotid artery is avoided. The risks of secondary hemorrhage and the occurrence of embolism are very real. In addition, proximal liga-

ture, by itself, frequently fails to effect a cure. The best treatment is ligature above and below. In arterio-venous aneurisms, both the common carotid and the internal jugular vein are ligatured. This is recommended whether the vein be injured or not.

Regarding the axillary vessels, ligature of the artery and vein, immediately above and below the wound, is devoid of danger, and is preferred to ligature of the artery alone. Proximal ligature of either the axillary or the third part of the subclavian may be considered as an emergency operation only.

In considering the gluteal and sciatic vessels, the authors deem it very advisable to ligature the internal iliac artery on the wounded side first, before attempting to find the bleeding point in the buttock. These vessels are very liable to retract into the pelvis, and the patient may die from hemorrhage before the bleeding ends are secured, unless proximal ligature has been performed at the outset.

Bleeding of the femoral vessels is controlled by an elastic tourniquet. The divided ends are then tied. A provisional ligature placed on the common femoral has little influence in stopping hemorrhage from the branches of the profunda. Tuffier's tube furnishes the best results here. Where there is hemorrhage of the popliteal vessels, ligature should be direct. After severe primary hemorrhage, Tuffier's tube may be given a trial. A tourniquet is very dangerous at this point, owing to the probability of gangrene.

The after-treatment of ligature of a large artery in a limb, calls for almost as much care and attention as the operation itself. Immediately the operation is completed, the limb is wrapped up in warm cotton wool. Anything which may interfere with the circulation, such as tight bandaging or splints, is rigidly avoided. Warmth, in the way of constant heat, is supplied by hot-water bottles or electric lamps placed beneath the bed cradle.

Conclusions

(1) *General considerations.*—Injuries to blood vessels differ in no essential particulars from those of soft parts in other regions, but two factors bring exceptional difficulties in the way of surgical treatment; their relative small size, and the constancy of their vital function.

(2) *Localized contusions.*—Much more frequently observed in military than civil surgery. These injuries are usually followed by early spontaneous thrombosis, and such lesions are often overlooked and, consequently, not recorded, owing to obliteration of the lumen.

The actual area of the lesions invariably extends to a far greater degree than ocular inspection suggests. Their practical significance is great, as will be gathered from the following:

(a) In the slightest grades, clot forms at the site of the ruptured intima, and may be a source of emboli.

(b) Although the lesion may heal spontaneously, it leaves a weak spot which is liable to dilate later.

(c) In infected wounds it is the most frequent source of secondary hemorrhage.

(d) A potent cause of traumatic aneurism.

(e) Thrombosis, either partial or complete, will produce a permanent lowering of the nutrition to the tissues supplied by the vessel. Muscle anemia or anemic gangrene follows according to the degree of thrombosis.

(3) *Wounds of Arteries.*—

(a) Lateral.—From a surgical aspect the most satisfactory results are obtained from limited longitudinal fissures. Transverse wounds gape widely when more than one-quarter of caliber is involved, and when more than one-half is damaged, a change of axis of the vessel takes place.

(b) Traversing perforations.—It is remarkable that vessels much smaller in caliber than the bullet itself, may exhibit this class of injurys.

(c) Complete severance.—Very common in vessels incapable of much displacement or when they are struck in a state of comparative tension.

(4) *Wounds of Veins.*—These differ from wounds of arteries mainly in consequence of the comparative tenuity of their walls and the small amount of muscular tissue between intima and adventitia; also thrombosis is much more common.

(5) *Repair of Wounded Vessels.*—Many heal spontaneously. When openings gape, an arterial fistula is formed, which usually communicates with a traumatic aneurism. In severe contusion or incomplete laceration of the walls, there follows spontaneous thrombosis and the vessel is permanently occluded, whereas a small and localized injury or thrombus becomes attached, but has no intimate connection with the vessel wall, except at the point actually damaged; it contracts, allows the flow of blood to resume and, finally, may be completely absorbed.

(6) *Sequelae to Wounds of Blood Vessels.*—These are represented by: (a) Hemorrhage, primary and secondary; (b) Damage to parts

supplied by the injured vessel; (c) Traumatic aneurisms. Some form of aneurism occurred in 54.4 per cent of injuries to great arterial trunks. From a practical point of view, some difference exists in the immediate importance of arterial and arterio-venous aneurisms. Arterial are far more serious, as they tend to increase more rapidly in size, and are more liable to rupture. Owing to their mode of formation, they may leave nerves incorporated in the wall of the sac.

(7) *Methods of Treating Injured Blood Vessels.*—At the inter-Allied Surgical Conference held in May, 1917, it was concluded that simultaneous ligature of both artery and vein, when both vessels are wounded, does not increase the risk of gangrene. In point of fact, risk is diminished. Facts tend to prove, even when the wound is limited to the artery, that simultaneous ligature of the vein is to be recommended. Suture of blood vessels is the only method by which ideal results can be obtained. This can only take place when there are reasonable hopes of maintaining the wound free from infection. The following maxims are set forth:

(1) Lateral wounds, involving not more than one-third of the caliber of the vessel, are most suitable for suture. If more than one-third is involved, then resect the damaged segment and attempt an end-to end union.

(2) Reconstruction of a vessel, by employing flaps from the sac of an aneurism, is not recommended.

(3) Very fine needles and 0000 Japanese silk give good results.

(4) The carotid, femoral and popliteal arteries are the most satisfactory for suture.

(8) *Treatment of Aneurisms Generally.*—In the hematoma stage, direct ligature on either side of the arterial wound is indicated in:

(1) Continuous hemorrhage.

(2) Rapid increase in size or diffusion of blood in the surrounding area.

(3) Obliteration or progressive diminution of peripheral pulse.

(4) Onset of gangrene.

(5) Pressure on neighboring structures, such as veins, nerves, viscera.

(6) Secondary hemorrhage or signs of extending infection of the limiting structures.

Failing the above, an expectant attitude is preferable at this stage, especially if recent primary or secondary hemorrhage has occurred. In the aneurismal stage, direct ligature of vessels is the method generally applicable to all cases. Proximal ligature is never performed

unless unavoidable. Direct ligature may be combined with excision of the sac, but should be avoided if extensive dissection is required. Where practicable, suture of the wounds of the larger vessels should be considered as preferable to any other method. All arterial aneurisms require surgical intervention. This is recommended as a general rule in arterio-venous aneurisms, owing to venous obstruction. Aneurismal varices may often be disregarded; when requiring operation, suture

Delegates arriving at Portsmouth for the Lord Mayor's Luncheon, after inspecting the various sanitary services on land and on the ships. In the foreground are: Surgeon Vice-Admiral A. Gaskell, C.B., O.B.E., F.R.C.S., K.H.S., R.N.; Surgeon Vice-Admiral Sir Joseph Chambers, K.C.B., C.M.G., M.D., B.A., F.R.C.P.I., M.H.P., who headed the British Delegation at the Warsaw Congress; and Surgeon Commander F. Lewis Smith, O.B.E., R.N., one of the Committee on Transport and Entertainment, and Aide to Vice-Admiral Gaskell.

of the anastomotic opening, through the laid open vein, is an easy and effective cure. The after-treatment of ligature of a large artery in a limb calls for as much care and attention as the operation itself.

Maisonnet (France), *Voncken* (Belgium)

Dividing the subject of "Injuries to Blood Vessels and their Sequelae" into two parts, France and Belgium collaborated in the work and presented a joint report—France covering the first part and Belgium the second.

Maisonnet, (France)

In his report on "Wounds of Vessels by War Projectiles in the Front Area," Médecin-Commandant Maisonnet, Professor at the Val de Grâce, France, stated that, among arterial lesions, a distinction is made between lateral wounds; perforations; divisions; shattering.

Lateral wounds are common, whereas perforations are observed only on arteries of large caliber. A single wall may be perforated, the projectile obliterating the orifice or falling into the lumen of the vessel, and passing into the blood stream. The perforation of both vascular walls is much more common than that of a single wall. Such arterial wounds may remain gaping and without tendency to spontaneous hemostasis, although some are capable of becoming obliterated. Total divisions, rare in bullet wounds, are common in those resulting from shell splinters. In contused wounds of this kind, spontaneous hemostasis is sometimes observed. No matter what the nature of the lesion, it is noteworthy that war projectiles, as opposed to the sharp weapons and cutting instruments of peace time, cause lesions with contused, devitalized margins, to a more or less considerable extent; lesions which prevent vascular suture in the majority of the cases.

Venous wounds are comparable to arterial lesions in that they also consist of lateral wounds, perforations, total divisions. A certain number of surgeons have reported venous ruptures at a distance, as a sequel of injuries through war projectiles. These are claimed to be favored by pre-existing venous changes.

Associated arterial and venous wounds are extremely frequent. There are numerous types of these, such as lateral wound of an artery and vein, fronting each other; lateral wound of an artery and a venous perforation or division; lateral wound of a vein and an arterial perforation or division; complete division of both vessels.

The same projectile may damage numerous vessels. This is a very important point in army surgery, for it explains the gravity of the prognosis in such cases as well as the complexity of the intervention. The arterial and venous trunks may be affected at the level of their bifurcation; at the level of the emergence of their important collaterals; and, finally, may be wounded at the same time as vessels situated at a certain distance. Injuries involving several important trunks at the same time, include wounds of the common carotid and the vertebral arteries; the superficial and deep femoral vessels; the anterior and posterior tibial vessels. The existence of multiple vascular lesions modifies the treatment; ligature in the wound must always be accorded the preference, in the treatment of arterial injuries.

Arterial contusions are relatively frequent, and are caused by projectiles traveling at a low rate of speed, by glancing injuries, and by concussion due to traumatism at a distance. A distinction is made between denudation of the vessels with genuine contusions, and arterial stupor (stunning of the artery). In contusions through large shell splinters, the lesions are very extensive and often terminate in sphacelus.

Venous contusions are less frequent than arterial contusions. They often give rise to phlebitis and sphacelus with detachment of scabs, sometimes accompanied by secondary hemorrhage.

Arterial stupor must be sharply distinguished from arterial contusion. This term is applied to a definite state of the circulation supervening in a large artery in consequence of a regional traumatism, without macroscopically demonstrable lesions of the vessel. Three degrees of arterial stupor are distinguished by Veau:

(1) A minimal stage, characterized by simple vasoconstriction, demonstrable only by the sphygmomanometer.

(2) A stage of established stupor, characterized by the momentary arrest of the circulation in a vessel.

(3) A grave stage, characterized by the complete and definite arrest of the circulation. It terminates in a vascular gangrene, without lesions of the artery.

From the pathogenic viewpoint, arterial stupor is, presumably, dependent upon the periarterial sympathetic (Leriche). From the therapeutic viewpoint, it must be emphasized that massage, advocated by Abadie, and atropine have not yielded any decisive results. The surgeon is never authorized to resect an artery in the state of stupor.

The author stresses the importance of the lesions of different tissues or organs, situated in the vicinity of wounds of vessels caused by war projectiles. As a matter of fact, the course of experimental vascular injuries or of wounds caused by stabbing or cutting instruments, as seen in civilian practice, cannot be compared with wounds through war projectiles, which give rise to extensive, often contused, and infected lesions. The coexistence of these lesions is responsible for the very special gravity of vascular wounds in war time; such lesions usually govern the prognosis and direct the treatment.

In a large number of cases, after the ligature of a large arterial trunk, the arterial circulation becomes rapidly re-established, in a more or less complete manner; the life of the limb, if not its function, is preserved. The mechanism of restoration of the circulation requires certain anatomical, physiological, and clinical conditions, the latter

being of capital importance. Leriche states that the condition of the juxta-arterial soft parts is more important in the result of a ligature, than the state of the vessel and its collaterals. Delayed ligatures, in those cases where they are possible, are more satisfactory than immediate ligatures, due to the gradual development of the collateral circulation. Under favorable conditions, the circulation is more or less completely restored below the arterial ligature or the spontaneous obliteration of a vessel.

The application of an aseptic ligature is followed, after a more or less prolonged interval, by progressive improvement, due to:

(1) A remarkable functional adaptation of the ligated artery, whose caliber becomes adjusted to the volume of its content, by contracture or proliferation of the artery;

(2) The definite organization of a new circulatory system which takes place, first, by the progressive dilatation of the reticular collateral passages, situated, especially, in the muscular masses, which play an important part; second, by the production of direct anastomoses passing from one arterial stump to the other, outside of, or even across the obliterated zone.

Clinically, the improvement of the circulatory system manifests itself by the return of the pulse, the better regulation of the temperature and, especially, by the oscillometric method.

In those cases where the arterial ligature is applied in a septic medium, the restoration of the circulation is much more imperfect, the vessels being obliterated to a greater extent, scar tissue strangling the vessels, the sclerosis of the muscles preventing the development of the reticular anastomoses. This observation is of importance, for it shows that in war as well as in peacetime surgery, the prognosis of vascular wounds depends as much upon the course of the injury as of the wound itself; it indicates the necessity not only of hemostasis, but also of a treatment preventive of infection.

It is undeniable that circulatory restoration, after ligature, may be complete, and it seems to be so in a higher proportion after ligature of the large arterial trunks than after that of medium sized trunks. However, this complete restoration is much less frequent than is generally admitted. The author had occasion to look for the different criteria, indicated by Leriche, in ligature cases, and was never enabled to show in these wounded, the absence of functional disturbances of the affected limb, and an equality of the oscillometric index at the level of the two limbs. A *restitutio ad integrum* thus appears to be rare after obliteration of an arterial trunk, and it is probable that

the majority of the wounded who undergo a vascular ligature, present more or less important and easily demonstrable disturbances. These various disturbances may be diminished or removed by appropriate surgical measures.

In the failure of the collateral circulation to re-establish itself, obliteration of large arterial trunks, whether due to ligature, embolism, or thrombosis causes necrosis of the segment of limb supplied by this trunk. This necrosis occurs, especially, as the result of diffuse, voluminous hematomas following on wounds caused by war projectiles, the hematomas constituting an important obstacle against the establishment of the collateral circulation. The necrosis appears under two forms, one, aseptic, representing ischemic gangrene, the other septic, generally manifesting itself in the form of gas gangrene.

Ischemic gangrene supervenes very rapidly after injury or intervention and, usually, begins at the extremity of the limb; its course is ascending, its development relatively slow, and it is often curable, but may assume the moist form of gangrene. Both eventualities are associated with extremely marked general phenomena of toxic origin.

Septic or gas gangrene is a genuine general infection, by anaerobic microbes, which rapidly develop in wound pockets and in a soil whose best defensive measure, namely the circulation of the blood, is totally or extensively suppressed. The production of gas, with infiltration into the various interstices, increases the compression and prevents the development of the collateral circulation. This highly toxic gangrene gives rise to extremely grave general phenomena, and death very rapidly supervenes, unless emergency treatment is instituted.

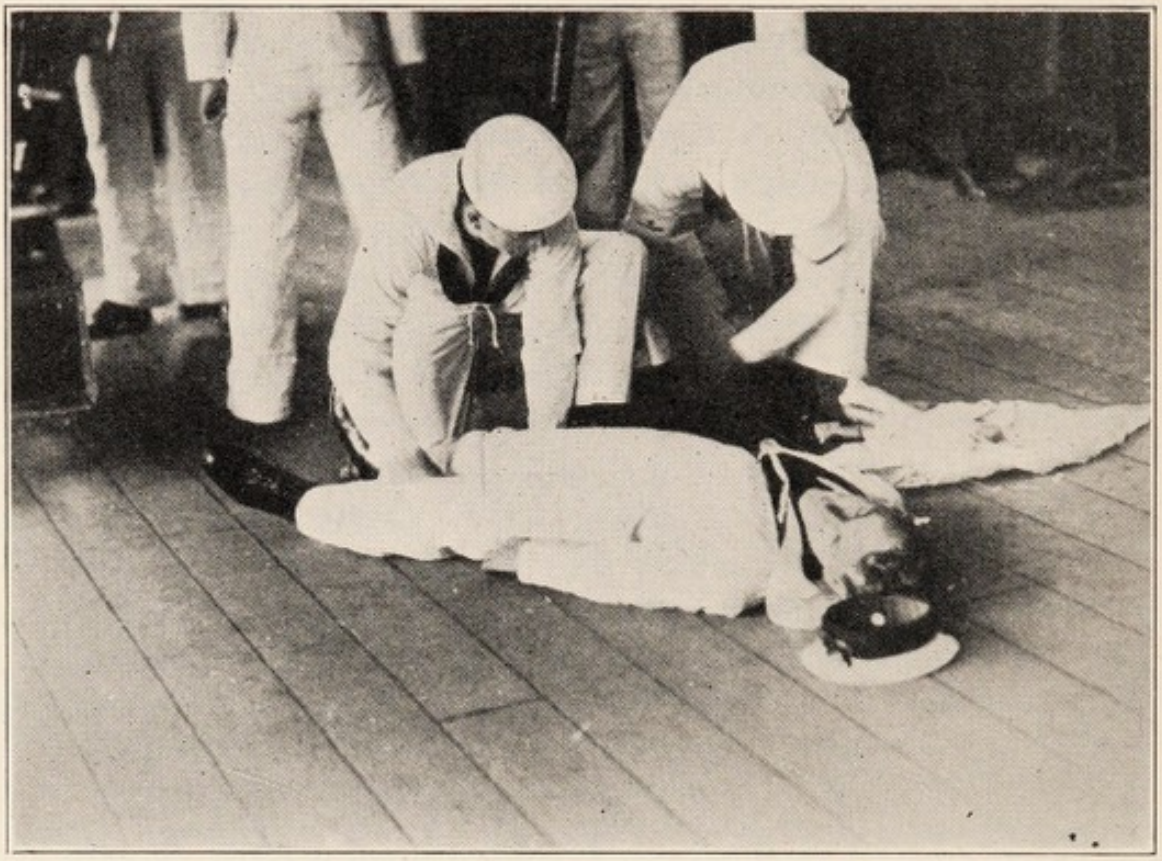
The two forms of gangrene, following upon arterial obliteration, may be combined; in such cases, the affected area is often more limited, the general condition less seriously affected, and the prognosis more favorable.

Certain principles govern the treatment of vascular wounds caused by war projectiles. Every vascular wound, in the presence of hemorrhage, requires immediate or emergency treatment. In war time, provisional and indispensable hemostasis can only very rarely be provided by a surgeon or his helpers (hospital attendants or regimental stretcher bearers). However, this hemostasis, which must be thorough, is not devoid of danger, and it is advisable for soldiers of all armies to be instructed in hemostatic procedures, their indications and dangers.

Provisional hemostasis must be maintained as short a time as possible. All important vascular casualties must be sent, with the

least amount of delay, to a sanitary station capable of applying definite hemostasis and, if necessary, treating acute anemia.

The definite treatment of vascular wounds is essentially surgical and, often, difficult. It must not only stop the flow of blood, but also permit the restoration of the circulation in the territory supplied by the affected vessel. In other words, the surgeon must endeavor not only to save the life of the wounded, but also to protect the life and function of the affected limb. Undoubtedly, this two-fold objective



H.M.S. *Hood,* Portsmouth. Demonstrating the method of transporting the sick and wounded. Illustrating something of the practical side of the work of the Congress.

is theoretically realized in the form of vascular suture, which should be supplied in the majority of wounds of the large arterial trunks. But the ideal operation of vascular suture is only exceptionally practicable in the treatment of wounds by war projectiles. The nature of the anatomical lesions of the vessels, the coexistence of a more extensive injury involving various tissues or organs, the possibility of an infection, all oppose the suture of arteries; so that it is vascular ligature, namely "second choice," which must be resorted to in war surgery, in the enormous majority of the cases. The site of the wound determines the site of the ligature. The persistence of hemorrhage and the prolonged application of a tourniquet, necessitate an immediate inter-

vention. However, whenever this is possible, as in the presence of a nonprogressive arterial hematoma, the surgeon, before proceeding to the ligature of an important vascular trunk, must raise the arterial pressure and, when circumstances permit, delay the intervention, in order to favor the establishment of the collateral circulation. Some technical details are of the greatest importance in the performance of the operation. Infection being the principal factor in complications following ligatures, the preventive treatment of infection is an indispensable supplement to the treatment of the vascular wound. As the circulation is largely restored through the muscular arteries, the resection of a muscle must always be conservative.

In his consideration of the treatment of vascular wounds in general, the author stated that, on the battlefield, the treatment of profuse hemorrhages usually consists in the application of a tourniquet, which is life saving, but liable to induce dangerous complications for the limb and, sometimes, for the life of the wounded. The tourniquet does not act only in its mechanical rôle but, in causing anemia of the tissues, it favors the proliferation of germs, particularly of anaerobes. Below the tourniquet, a reservoir of protein and infectious toxins becomes established in the closed vessel; removal of the tourniquet involves the danger of causing, through the sudden escape of these products into the general circulation, the grave symptoms of shock, or better, traumatic toxemia, according to the definition of Quènu.

The tourniquet is responsible for a large number of amputations following vascular injuries, sometimes of benign character; it is responsible for some deaths—but its employment cannot be banished from war surgery. It must be retained in the equipment, but should be applied only when certain precautions are observed. Various tourniquets have been adopted by the different nations. The available data shows that the problem has not as yet been entirely solved.

Local digital compression of a bleeding vessel may be efficient, but is not readily compatible with transportation and, usually ligature *in situ,* is required. This is rarely possible in war surgery.

When the applications of a tourniquet or direct compression is not practicable, provisional occlusion of the wound must be done, in an effort to transform a large wound, with external hemorrhage, into a vascular wound, which bleeds into a closed cavity. The formation of a hematoma may result in a spontaneous hemostasis, sufficient to permit the transportation of the wounded to the surgical station, where an emergency operation can be performed.

In treating vascular lesions in the surgical stations at the front,

the surgeon must fight the acute anemia; treat the totality of lesions caused by the wounding projectile; insure definite hemostasis. The latter can be done by ligature; by permanent forcipressure; by vascular suture, or, very exceptionally, by vascular grafts.

The technique of vascular sutures is relatively simple, when the vessel, after preventive hemostasis, is properly dissected out. Lateral suture can be utilized in lateral wounds and perforations; and terminal suture, in total divisions of vessels. The technique most generally adopted for total sutures is that of supporting threads, method of Carrel.

The simplest and most practical procedure of vascular grafting is the graft of a vein taken from the opposite limb or, better, if possible, from the satellite vein of the artery.

The decision of the surgeon, with respect to a choice between these different techniques, may vary, not only according to the affected vessel and the site of the injury but, also, to the presence of a large wound with profuse external hemorrhage; a narrow wound with internal hemorrhage; a narrow wound with diffuse arterial hematoma; a dry vascular wound, which often remains undetected; finally, a secondary hemorrhage.

The findings in the World War in a great number of cases of large wounds with profuse external hemorrhage, treated by ligature, showed that the prognosis varied according to the existence of a large wound with external hemorrhage or, on the contrary, of a diffuse arterial hematoma. In the former case, ischemic gangrene was much less frequent than in the latter.

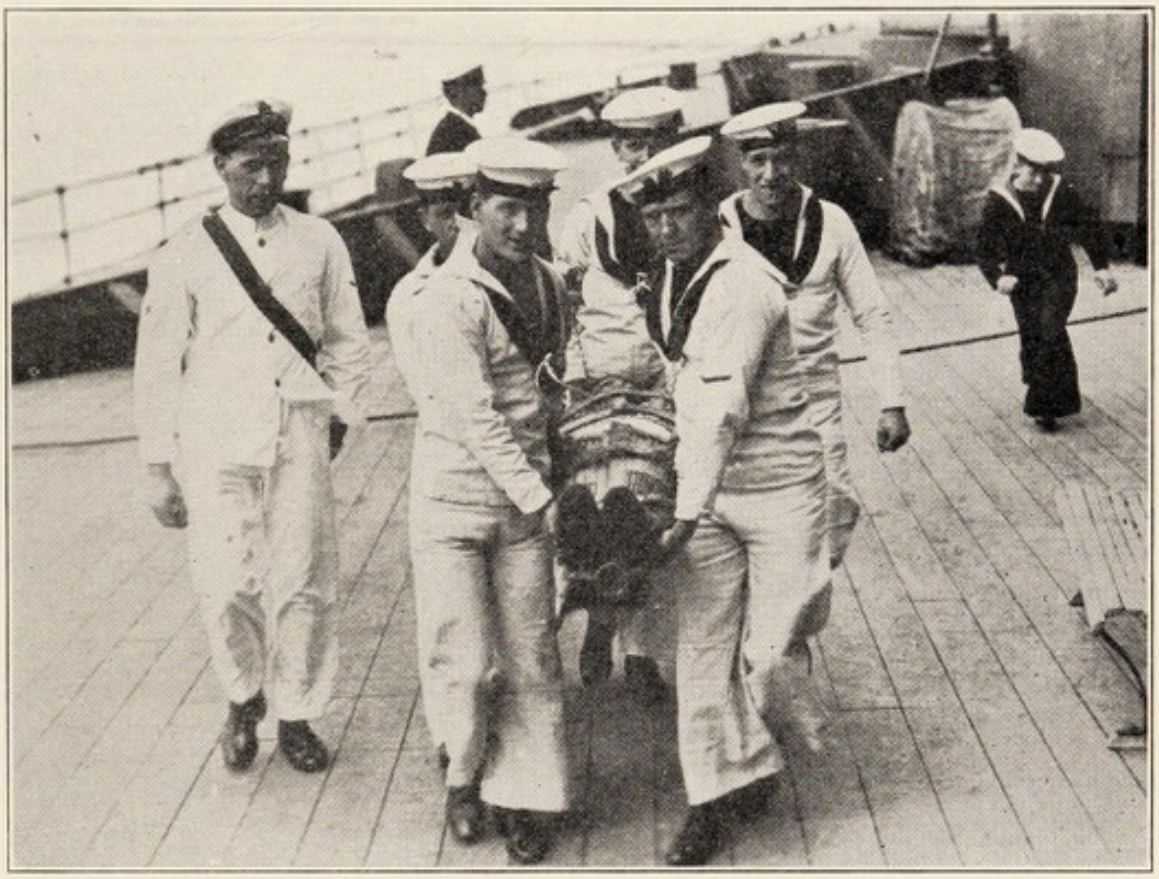
In the author's opinion, vascular wounds caused by war projectiles, treated by ligature, always have a guarded prognosis. Suture would certainly yield more satisfactory results. In the majority of cases, however, the army surgeon must resort to ligature. The accomplished results will be better in proportion to the timeliness of the operation and the quality of the technique. The surgeon must keep in mind the actual, immediate, and remote dangers of ligature, and be prepared to apply vascular suture, in the rare cases where this is practicable.

In discussing the treatment of vascular wounds in particular, the author briefly explains the routes of access to the large arterial vessels of the neck and the limbs, as well as the results of ligature of these vessels.

Operators disagree on the results of ligature of the common carotid, some considering complications as rare, and other as extremely common. Certain statistics on ligature of recent wounds of the common

carotid, published during the World War, showed the following results: Recoveries, sixteen; recoveries with hemiplegia, four; deaths, four.

Ligature of the external carotid and its branches is not followed by any disturbances. Conditions differ in the case of ligature of the internal carotid, the carotid bulb, or the two branches of bifurcation of the common carotid. The restoration of the circulation in these cases is extremely difficult, and suture of the internal carotid should be attempted, if practicable, in preference to ligature.



H.M.S. *Hood*, Portsmouth. Second stage in the transportation of the sick and wounded.

Ligature of the subclavian artery does not, as a rule, compromise the vitality of the limb, the restoration of the circulation being well insured in new injuries, by the abundance of collateral branches. However, the frequency of cases of causalgia, after ligature of the subclavian artery, is noteworthy.

Wounds of the vertebral artery are extremely grave, because of deep primary or secondary hemorrhage; death is common.

Ligature of the internal jugular vein is devoid of gravity. Ligature of the external jugular vein is extremely benign, and ligature of the vertebral vein is, likewise, without danger.

In recent injuries of the axillary artery, ligature constitutes the treatment most commonly employed, at least in the upper portion of the vessel, after wide exposure of the axilla, and trimming of the wound. On the other hand, in the lower portion of the vessel, the existence of an undeniable danger zone necessitates the employment of vascular suture, whenever possible. Injuries of the collaterals of the axillary artery do not possess any intrinsic functional gravity; but the combination of a wound of the axillary trunk and one or several of its collaterals, aggravates the prognosis. Ligature of the axillary vein, when this is not involved, may serve as a useful complement to arterial ligature.

The results of ligature of the brachial artery, as applied in the sanitary formations at the front, are not, apparently, very satisfactory.

After injuries of the vessels of the arm, forearm and hand, the circulation is usually very easily re-established. However, there exists a weak point, situated at the upper portion of the brachial artery, where the anastomotic routes are greatly reduced, and in the case of a voluminous hematoma, gangrene is possible.

As to the pelvic vessels and their branches, the common, internal, and external iliac vessels are practically never wounded alone; their injury is usually associated with a fracture of the pelvic girdle or a wound of the pelvic abdominal organs. Wounds of the pelvic vessels are, therefore, only very exceptionally observed in the surgical formations of the army.

The result of ligature of the external iliac artery cannot be regarded as benign, gangrenes and deaths having been observed as a sequel of iliac hematomas, in about one-third of the cases. It is noteworthy that, according to Leriche, ligature of the external iliac gives rise to less complications than that of the common femoral artery. The development of an extensive hematoma, infiltrating the muscles of the buttock in particular, plays an important part in the cause of gas gangrene of this region.

Injuries of the femoral vessels are rather frequently observed in the military surgical formations, but are usually seen under favorable conditions, either because the casualty has worn a tourniquet for a period of time, or a voluminous diffuse aneurismal hematoma has formed. Anatomists explain the easy restoration of the circulation, after ligature of the femoral artery, by the successive anastomoses of the sciatic artery, the circumflex arteries, the perforating vessels, and the muscular branches of the popliteal artery.

The results of femoral ligature, observed during the World War,

are contradictory. On the basis of the different statistics, the author feels justified in the conclusion that wounds of the femoral vessels by war projectiles have a much more guarded prognosis than that of injuries observed in peacetime. Here again, the part played by hematomas, associated lesions and infection, very plainly manifests itself and explains the circulatory insufficiency after the ligature. These different causes, unfortunately, oppose vascular suture, which is capable of giving much better results than ligature.

Ligature of the popliteal artery has long been considered as the most dangerous of all ligatures, and statistics published before the World War give a proportion of 33 to 54 per cent of gangrenes. During the war, the results of such ligature, whether in vascular wounds alone or associated with other injuries, were considered, by the majority of surgeons at the front, as particularly grave, in contrast with an articular or periarticular lesion. On the basis of statistical data, it seems to be an established fact that, at least in war wounds, the prognosis of popliteal ligature must be very guarded, especially in the case of an injury of the lower portion of this vessel. Paraffinized intubation and, especially, vascular suture, must always be tried, when practicable. However, the scanty published results of suture remain mediocre.

Wounds of vessels of the leg and feet are extremely common, but it is noteworthy that they are often associated with considerable lesions of the bony framework or the muscles, particularly at the level of the calf. The difficulty of their treatment and their gravity are referable especially to the complexity of the injuries. Ligature of one of the leg vessels, in itself, is not dangerous, the circulation being easily restored. In lesions of the posterior tibial artery, the anterior tibial takes its place. Moreover, the peroneal artery constitutes a most important secondary route through its anastomoses with the dorsalis pedis and the external plantar artery. It may take the place of either the anterior or the posterial tibial artery. The prognosis is not favorable when the injuries are caused by projectiles. Extensive contusions, numbers of vessels affected, combination with bony and muscular lesions, often prevent the restoration of the circulation. Statistical data clearly indicates that complications and gangrene, subsequent to ligature of the vessels of the leg, always occurred in the presence of polyvascular injuries or of grave concomitant osseous lesions.

Conclusions

(1) Vascular wounds caused by war projectiles are entitled to the serious attention of military surgeons, for they are of frequent

occurrence and, either as a life saving procedure, protection against mutilation, or preservation of function of a limb, require emergency treatment on the battlefield, as well as prompt and, often, complicated surgical interventions.

(2) Injuries of blood vessels are extremely varied and often multiple. Besides the different forms of arterial or venous wounds,

H.M.S. *Hood*, Portsmouth. Third stage in the transportation of the sick and wounded.

the frequency of vascular contusions and the possibility of actual "arterial stupor" or "stunning" must be kept in mind.

(3) The results of arterial wounds are:

(a) External or internal hemorrhages, which threaten the life of the wounded unless hemostasis is insured.

(b) Thombosis, inducing spontaneous hemostasis and sometimes causing genuine, socalled, dry wounds of the vessels.

(c) Aneurismal hematomas, arterial aneurisms, arterio-venous aneurisms.

(4) Obliteration of a blood vessel, whether the result of ligature or spontaneous thrombosis, has variable consequences:

(a) The circulation may be restored completely or only partially, in the presence of a certain number of anatomical, physiological, and clinical conditions.

(b) The lack of restoration of the circulation terminates in ischemic gangrene or gas gangrene.

(5) The prognosis of vascular wounds is improved in proportion to the surgeon's ability to assist the physiological and clinical conditions, which favor the restoration of the circulation. Immediate and provisional hemostasis is a necessity; but it involves dangers and must last as short a time as possible.

(6) On the battlefield, the tourniquet is the most customary treatment for arterial wounds. Direct compression and temporary occlusion of the wound are rarely practicable. Improvised tourniquets are generally injurious, and all nations are endeavoring to produce a perfect tourniquet for the use of armies in the field. All soldiers should be instructed as to its mode of application. All wounded with a tourniquet should be specially reported and turned over, as soon as possible, to a surgical unit.

(7) In the field hospital, the surgeon treats the anemia, dresses the injuries caused by the projectile, and insures hemostasis, usually by ligature. The following technical details are of the greatest importance:

(a) Necessity of temporary hemostasis above the injury.

(b) Necessity of maintaining permeability of the area subjacent to the wound by applying a clamp below the lesion in the course of the intervention.

(c) Trimming of the wound to guard against infection.

(d) Conservative resection of muscle, which is mainly instrumental in restoring circulation.

(e) Ligature of the collateral vein as a useful adjunct to ligature of the wounded artery.

(f) Advisability of dividing the traumatized artery between two ligatures in incomplete arterial wounds.

The surgical treatment of vascular wounds differs in the presence of a large wound with external hemorrhage, a narrow wound with diffuse hematoma, an arterial contusion, or a secondary hemorrhage. In all cases, free access is indispensable for examination and treatment

of the lesion. For this purpose, during the course of the World War, surgeons advocated various techniques, according to the affected region.

(8) The immediate prognosis of wounds of the large vascular trunks through war projectiles, treated by ligature, is always guarded. It is aggravated when the wound is accompanied by a diffuse hematoma or infectious complications, which interfere with the restoration of the circulation. On account of their anatomical relations, ligature of the common carotid, the axillary artery below the origin of the inferior scapular, the external iliac or the femoral at its origin, the popliteal in its lower part, frequently give rise to serious disturbances, due to circulatory insufficiency. There undoubtedly exist "danger zones," the discussion of which has been resumed since the advance of aseptic surgery.

(9) The treatment of vascular wounds has benefited greatly by the general improvement in the treatment of war wounds. The prognosis has improved with the facilities for early and more elaborate treatment now provided in the surgical organization of the army. Nevertheless, there is no comparison between the immediate and functional results so far accomplished in the treatment of vascular wounds through war projectiles, and those obtained in vascular injuries in peacetime.

Voncken (Belgium)

In his report on the "Remote Sequelae of Vascular Injuries," Major-Médecin Jules Voncken, of the Belgian Army, pointed out that, after the lapse of considerable time following the infliction of vascular injuries, various disturbances are noted. These disturbances are of unequal importance, have different aspects and therapeutic indications. The author saw, among old war invalids, men with ligatures of the large vascular trunks, who presented hardly any functional changes. For a given limb, all degrees of functional deficiency may be considered as following upon a ligature of a main trunk. Aside from such deficiency, there is always present an entire scale of alterations which may be the result of general ischemia of the limb (trophic disturbances), as well as of local circulatory insufficiency (for example, through a muscular cicatrix) and of nervous or vasomotor disturbances. In addition, traumatic aneurism must also be mentioned.

Circulatory Restoration

On the basis of animal experiments, during the World War, the author became convinced of the superiority of concomitant ligature of

the vein, in the case of obliteration of the main arterial trunk. His investigations proved that there was better nutrition of the issues after venous ligature. Several articles, since published, give rather contradictory results, not only from the experimental, but from the clinical viewpoint.

According to recent investigations by Holman and Edwards (1927), the venous ligature must not be applied at the same level as the arterial ligature, but near the point of junction of the veins in the region supplied by the collaterals of the obstructed artery.

Whether or not accompanied by venous ligature, an arterial injury, alone, is not the only factor responsible for the lack of circulatory restoration. Muscular lesions cause very variable objective anatomical conditions, which are at the basis of the restoration. An important distinction must, thus, be made between purely vascular injuries, as are often produced by rifle bullets, and wounds with extensive muscular destruction, as those caused by shell splinters. Neighborhood lesions are of primary importance in connection with the remote sequelae of vascular injuries. Pure vascular injuries are exceptional, and the remote disturbances are the outcome of various traumatisms and not of the ligature.

In his report to the Surgical Congress of 1922, Leriche shows the pernicious influence of infection on the physiological process of circulatory restoration, the predominant rôle of the state of the muscles, and the stages of reorganization of the new circulatory régime.

All degrees of functional deficiency, depending upon whether the new circulatory system is sufficient or not for the work required, may expected in a ligatured region. There may be a theoretical *restitutio ad integrum* of a circulatory domain, whose main trunk is ligatured; but the studies of Leriche show that, even in those wounded where there is apparently a good remote result, an important functional deficiency remains. According to Leriche and Moure, a ligatured lower limb is usually incapable of sustained work. In regard to the sequelae of ligatures of the large cervical trunks, there is record of a series of completely cured cases following transitory lesions, such as hemiplegia or facial paralysis.

Circulatory insufficiency should, logically, manifest itself by involvement of the entire region supplied by the ligated vessel. At first sight it may seem that certain cases do not present any disturbance or functional insufficiency; however, it often happens that such trouble appears only after abnormal exertions while, for normal work,

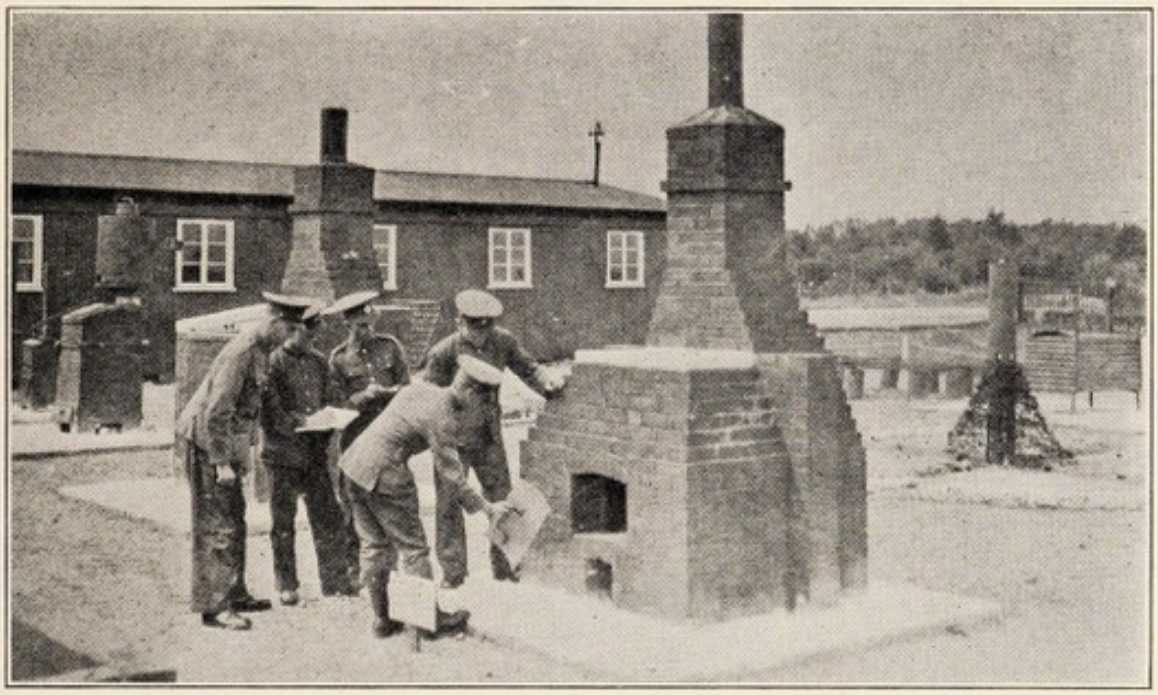
the limb seems to be unimpaired. Intermittent claudication is, apparently, typical of these disturbances. The condition is explained by a vascular spasm, but Leriche is inclined to believe that, following the application of a ligature, the collateral circulation cannot provide a proper supply of blood for a working muscle, which is known to require seven times more than the amount it receives in the resting state.

Disturbances due to modifications of the vasomotor innervation, first described by Leriche in 1917, are noted in ligatured limbs, in the form of rigidity muscular sclerosis, edema, local hyperthermia, as well as continuous or paroxysmal pains, sometimes assuming the characteristics of the causalgia syndrome; other phenomena of trophic type such as ulcerations, characterized by their late appearance, seem to be referable to the same pathogenesis. In certain cases, outside of any vascular obstruction, disturbances analogous to those described in the foregoing, may be observed as a sequel of irritation of the perivascular sympathetic. Still another aspect of circulatory deficiency, undoubtedly due to changes of the vascular coats and probably of the nervous constituent of these coats, consists in the sequelae of frost bite, especially marked in the lower limbs. Instead of an obliteration of the large vascular trunks, there is, here, an obliteration of the terminal ramifications, and the changes induced in the vasomotor equilibrium through the performance of sympathectomy, are followed by excellent results. The author recently reported several personal cases to the Paris Surgical Society (1928), in which periarterial sympathectomy yielded favorable results of prolonged duration.

Certain practical considerations are of capital importance from the viewpoint of the future of ligature cases. All muscular masses adjacent to the injury must be carefully preserved; all incisions transverse to the axis of a limb are prohibited. Measures against infection play an important part, as infection induces cicatrices of sclerotic tissue. The eventual importance of the satellite vein for the nutrition of the limb, attached to a ligature more or less high up, must not be overlooked. Reconstructive vascular procedures, sutures, and grafts, are rarely practicable in military surgery, because of the septic traumatic medium. In his report on the remote results of conservative operations on the arterial trunks of the limbs, Moure (1922) quotes only a few exceptional cases where this suture may be applied in wounds by war projectiles. He concludes that, as infection plays a preponderating part, the objective should be, especially, to guard against embolism or peripheral dissemination of the infection, rather than to endeavor systematically to re-establish the continuity of the

arterial trunk. A good ligature of the two ends of the damaged artery can give nearly as perfect a functional result as a suture.

If it were possible to find at the time of intervention, a very limited segmentary obliteration of a vessel, end-to-end suture, after resection of the obliterated portion, obviously is the ideal method; even vascular grafting, fresh autoplastic venous grafts, may be accomplished; and such cases have been published. But this ideal restoration like the arteriolysis, is rarely possible, for it requires a very localized lesion; too often the thrombosis has reached distant limits and also concomitant disturbances have become established. The therapy instituted can be directed only against these disturbances. It is limited to the treatment



School of Hygiene. Aldershot. Model Incinerators.

of the vasomotor disturbances and the orthopedic treatment of the existing lesions. The former are amenable to sympathectomy (Leriche), a benign and easy intervention, giving remarkable results, particularly in cyanosis, hypothermia, paresis, and trophic ulcerations. It is especially noteworthy that the painful phenomena very rapidly disappear after sympathectomies and arteriectomies.

The treatment of acquired malformations varies with each case, according to the defect to be corrected, and depending upon the tendinous or muscular retractions and deformities of the bony framework. Ultimately, in the presence of intractable trophic disturbances or prolonged suppuration, the only method left is amputation.

ANEURISMS

In war pathology, aneurisms are especially the sequelae of undiscovered vascular injuries, and the World War showed the frequency of these latent lesions. The author observed cases where the wall of the artery was reduced simply to the intima: The projectile, in its glancing course, had stripped the vessel of its adventitia and media, leaving only the thin internal layer to oppose the escape of the blood stream. Such injuries often remained unrecognized and terminated in sudden, delayed hemorrhages, due to rupture of the intima. When the external wounds (entrance and exit orifices of the projectile) healed, the blood stream, finding no external outlet, infiltrated the neighboring tissues and gave rise to an exudate, simple or pulsating (diffuse aneurismal hematoma). The clinical characteristics of these diffuse aneurismal hematomas are, as a rule, less marked than those of genuine aneurisms. Among traumatic aneurisms, a distinction must be made between:

(1) Pure arterial aneurism, with a sac derived from the dilatation of the arterial coats alone.

(2) Arterio-venous aneurism (simultaneous wound of the artery and the vein), with more or less wide or extensive communication between the artery and vein, from a simple communicating fistula to a large common sac, into which open the four ends of the main trunks, as well as numerous collaterals.

(3) Diffuse aneurismal or encapsulated hematoma, where the dimensions of the sac are, sometimes, very irregularly distributed in the muscles and the perimuscular spaces. In such cases the dimensions of the pseudosac always exceed the lesions of the vessel, the two ends of which, sometimes lying very close to each other, may be turned back free into the sac, forming the walls of the hematoma. The size of aneurisms is variable. Arterial aneurisms have a stronger tendency to enlarge than arterio-venous aneurisms, in which a portion of the blood is drained by the venous route.

(4) Cirsoid aneurisms.

Modern projectiles render the percentage of arterio-venous aneurisms more frequent than pure aneurisms. The interpretation of statistical figures varies greatly, however. Besides traumatic aneurisms, due to injuries by war projectiles, there are reports of cases of arterio-venous aneurisms following upon closed traumatisms. Contusions and partial ruptures are undoubted causes of this condition. Aside from violent and sudden traumatisms, such as wounds and contusions of the arteries, chronic contusions have also been held responsible for

circumscribed vascular degeneration, with subsequent formation of an aneurism. In this connection, the persistence of foreign bodies in the tissues, in the vicinity of arteries (shell splinters or bullets), may be at the basis of the formation of an aneurism.

The traumatic origin of cirsoid aneurisms situated in the hairy scalp is much less common than in the other aneurismal lesions. A case of this kind, of undoubtedly traumatic origin, came under the author's personal observation, as the sequel of a shell splinter wound of the skull.

In the treatment of aneurisms, according to the author, the most frequently utilized operation consists in ligature and extirpation of the aneurismal sac or the arterio-venous sac, a procedure generally considered as benign and excellent in its remote results. This was emphasized by Toussaint in 1915 and confirmed by the Inter-Allied Surgical Conference in 1917, as well as in the Report of Moure at the Surgical Congress of 1922. The recent discussion in the National Surgical Society of Paris (1927) shows that, notwithstanding the modern methods, the actual tendencies of the majority of operators are in this direction. The sum total of these observations proves that the ideal restoration of the vessels is rarely accomplished, and the operation is advised by Lecene only for the common carotid (danger of hemiplegia in the case of ligature).

In all the conservative methods, the dangers of secondary hemorrhage are to be feared. The so-called method of quadruple ligature is not actually limited to four ligatures, but, on the contrary, necessitates a very large number of legatures, on account of the complexity of the aneurismal mass. This fact possesses considerable practical importance. Traumatic arterio-venous aneurisms are really, at first, diffuse hematomas, so that one cannot expect to find a distinct saccular wall and, therefore, endoaneurismorrhaphy is impracticable.

The great progress of vascular surgery has profited the treatment of aneurisms, for the infectious factor can be practically disregarded and the surgical technique can be regulated in an entirely accurate manner. For this reason, the scope of vascular sutures has been enormously increased of recent years. Their application to aneurisms can be made according to several methods:

(a) By lateral suture.

(b) By resection of the damaged segment followed by circular suture; the most commonly utilized procedure is that of Larrey's method of triangulation. It consists in stretching out the vascular

incision at three main points and applying a fine, interrupted suture between this triple support.

(c) By vascular graft, which may be a segment of artery or of vein taken from the patient himself. The venous graft becomes arterialized and adjusts itself to the arterial function.

The methods of treatment grouped under the name of aneurismorrhaphy resulted in numerous successful cases, as reported by Matas. These methods were applied especially in pathological aneurisms, but their application has extended to the traumatic type. Endoaneurismorrhaphy certainly possess considerable advantage as compared to ligature for, as pointed out by Moure, when in the course of the intervention the restoration or reconstruction of the arterial trunk appears impracticable, it is always possible to resort to obliterative aneurismorrhaphy. Meanwhile, it is certain that this operation, which is practically equivalent to double ligature of the arterial trunk, suppresses the circulation exclusively in the sac, with maximal preservation of the afferent and efferent segments of the artery and the collateral branches derived therefrom, in the immediate vicinity of the sac. Before attempting any intervention on an aneurism, Matas recommends that investigations be carried out, in order to determine the sufficiency of the collateral circulation, as this governs the operative indications and the selection of a given method. Oscillometry and the Moszkowicz test rank first in these various investigations.

There are a few rare cases where the very special anatomical relations of an arterio-venous aneurism permit the removal of a narrow communication between the artery and the vein; there are other cases where even a wider communication can be removed by two lateral sutures separating the vein from the artery and reconstructing the two vessels; but these are exceptional and, usually, there is at least a co-existent arterial ectasis, which it is advisable to reduce or support by strengthening the wall through an aponeurotic graft taken, for example, from the fascia lata. As a rule, however, there is present an irregular arterio-venous sac.

The ideal surgical technique is, evidently, the resection of the pouch with reconstruction of the arterial trunk by end-to-end suture. This suture, as shown by Moure, is practicable only when the loss of substance does not exceed 4 cm. When this loss is more extensive, recourse must be had to vascular grafting. Encouraging results have been reported, and the operation can no longer be regarded as exceptional. In a general way, however, the technique is, usually, either quadruple ligature with extirpation of the sac, or one of the conservative meth-

ods, such as reconstruction of the artery by means of the venous wall of the sac, through the application of a transvenous suture of the arterial orifice, or through the utilization of a flap from the venous wall for the reconstruction of an arterial wall, as recommended by Matas in his numerous writings on reconstructive endoaneurismorrhaphy.

A noteworthy point, differing from the classical teachings, is the possible presence of clots in an arterio-venous aneurism. The important considerations of this condition are summarized by Moulinie (1928) as follows:

(1) Clinical sequelae, in the form of possible embolism, peripheral (gangrene) or central (pulmonary embolism).

School of Hygiene. Aldershot. Types of Disinfectors.

(2) Therapeutic deductions: In the case of operative manipulations on the sac, extirpation, or quadruple ligature, the central end of the vein must be ligated first.

(3) Developmental consequences: The presence of clots in the sac explains the possible evolution of these arterio-venous aneurisms into arterial aneurisms and an eventual cure.

These same general remarks are applicable to pure arterial aneurisms, and their treatment is based on the same principles as stated in the foregoing; as far as possible, an attempt must be made to preserve the arterial permeability, and the Matas operations here find their most frequent indications.

The special anatomical relations of diffuse aneurismal hematoma call for the application of conservative treatment. In the first place,

such hematoma is difficult to outline, on account of its irregular limits and extensive infiltration into the muscles and fascia. On the other hand, it frequently happens that the two stumps of the torn artery are encountered in the hematoma, that the loss of substance is not considerable, and that all conditions are obtainable for the application of conservative surgery. Here again, endoaneurismorrhaphy renders valuable services, for the opening of the sac, as the primary operative step, permits an accurate inspection of the existing lesions and the eventual application of an end-to-end suture of the artery.

Disability Following Ligatures

All degrees of functional adaptation have been noted, following vascular wounds, and the difficulty of establishing accurate statistics was shown by Sir George Makins, at the Paris Surgical Congress, in 1922. He collected 863 cases, from which he secured the following data:

Cures	751	
With immediate complications	253	or 29.2 per cent
With delayed complications	424	or 49 per cent
Deaths	112	or 12.9 per cent

A comparison of the different publications dealing with ligature of the large vascular trunks, conveys the impression that very satisfactory functional results can be obtained. A superficial examination shows only a very slight functional deficiency in a ligatured limb. External examination and measurements hardly, and not always, reveal atrophy of the muscular masses, and demonstrate only few trophic disturbances. But caution is advised in the formulation of conclusions based on such an examination. In order to estimate the functional disturbances of a ligatured limb, Leriche and Moure believe it is necessary to examine this limb in the course of a test of strenuous work. The upper limb should be studied after an exertion test in the vertical position, with the hand held above the head; the lower limb, after a rather fatiguing walk. Dynamometric and ergographic studies serve from the muscular viewpoint, and the observation of the oscillometric index indicates the value of the circulatory restoration. It almost invariably appears in these cases of a ligatured limb, that the oscillometric index is reduced by one-half. Generally, it seems that all ligatured lower limbs are incapable of performing forced work of any duration. Numerous illustrative cases show that a ligature may be, apparently, well tolerated, but the impossibility of fur-

nishing intensive work of any duration must be taken into consideration in the estimation of the disability ratio.

Conclusions

1. The sequelae of vascular wounds depend upon: (a) Associated lesions (nerves and muscles). (b) Restoration of the collateral circulation.

2. In the case of ligature of the artery, venous ligature applied before the establishment of collateral circulation, improves the prognosis.

3. The blood vessels of the regional muscles constitute one of the main factors in the restoration of the circulation.

4. Delay in the restoration of circulation may result from trophic, vasomotor, or functional causes. The treatment of vasomotor and trophic disturbances is now under investigation. Functional disturbances are amenable to orthopedic treatment.

5. The formation of arterial and arterio-venous aneurisms, diffuse or cirsoid hematomas, constitutes a grave complication of vascular injuries. Generally, the most frequently applicable treatment is resection with concomitant ligatures.

6. The sequelae of vascular injuries are important and, even in the absence of visible disturbances, the function of the limb must be very closely studied by means of the passive movement test and oscillometric investigations.

General Considerations

(1) The immediate gravity of vascular injuries is considerable, and the mortality is higher in war wounds than in peace time traumatisms.

(2) Wounds of the blood vessels require treatment immediately after the infliction of the injury. Notwithstanding its drawbacks, the tourniquet is essential. The invention of a simple, efficient, and harmless tourniquet for vascular constriction and hemostasis is a necessity.

(3) The surgical treatment is complicated. In most cases ligature is necessary owing to the nature of the lesions and their association with other wounds. It is necessary to have thorough access and to employ methods which will produce the most satisfactory restoration of circulation and function.

(4) The ultimate prognosis should be guarded. It depends upon delayed sequelae:

(a) Circulatory insufficiency with its various manifestations: trophic, functional, and vasomotor disturbances.

(b) Aneurisms of different types.

(5) The prognosis may be improved by the treatment of these sequelae:

(a) Treatment of the functional disturbances is still under investigation.

(b) Treatment of aneurisms usually consists in the resection of a portion of the sac, followed by necessary ligatures.

Secondary operations, such as vascular suture, are seldom applicable in military surgery.

(6) These sequelae must be kept in mind when fixing the percentage of disability for vascular injuries.

Communications

Leo (France)

"Dry Vascular Wounds" were described by Médecin Commandant of the Reserve, G. Leo, who pointed out that Fiolle, in 1916, applied this term to wounds, which, while opening the lumen of an arterial or venous trunk, are not accompanied by external or internal hemorrhage or hematoma; the vessel is open but the blood does not flow. The pathogenic explanation of this paradoxical fact was given after the World War, by Leriche, Professor of Clinical Surgery, Medical Faculty of Strasbourg, who showed that three eventual mechanisms may intervene in the production of spontaneous hemostasis in an arterial wound:

(1) The middle elastic coat of the large arteries, after traumatic rupture, may retract and roll itself up, inwards, in the vascular lumen.

(2) A stimulation of the periarterial sympathetic may produce an intensive contracture of the muscular layer. It goes without saying that this can occur only in arteries of muscular type, namely, of medium and small caliber. In arteries of the elastic type, such as the aorta or the common carotid, this phenomenon of muscular contracture cannot take place, because there are no contractile constituents available for this effect.

(3) The artery may "fold" on itself at the level of a lateral perforation, as seen in a single case of the arterial lumen, the wall opposite the perforation made a strong protuberance of valvular type. The histological examination showed that the elastic structures of the wall opposite the passage of the projectile, had become "aspirated,"

as it were. They were ruptured and behaved like a valve in the lumen, the endothelium being lacerated.

Botreau-Roussel (France)

"The Remote Results of a Triple Ligature of the Common Carotid, Internal Carotid, and Right External Carotid, for Knife Wounds of Their Confluent" were described by Dr. Botreau-Roussel, Professor, Médecin Lieutenant-Colonel of the Colonial Troops at the School of Application of the Medical Service of the Colonial Troops. He reported an observation on a young soldier, in whose case he applied a triple ligature of the common carotid, the internal carotid, and the external carotid of the right side. The operative findings and the remote results of the surgical procedure showed that a retrograde circulation had become established in the right internal carotid. This observation supplements the idea of a reflux of the blood from the external carotid towards the internal carotid, by showing that, at least in a certain number of cases, this reflux can take place from the internal carotid towards the external carotid artery.

Botreau-Roussel (France)

Dr. Botreau-Roussel also discussed "The Remote Results of Resection of the Upper Portion of the Popliteal Artery for Traumatic Aneurism, with Concomitant Resection of the Healthy Popliteal Vein." He reported an observation on an atheromatous patient with aneurism of the left popliteal space, the result of a war wound. The aneurism was situated high up on the popliteal artery. Vascular suture being impracticable because of the atheromatous condition of the arteries, the author obtained an excellent immediate result by performing, as recommended by Leriche, an arteriectomy between two ligatures, followed by phlebectomy of the satellite vein. This was succeeded by peripheral vasodilatation and subsequent stasis, which gradually, however, became a source of progressive disturbance for the patient. While the suppression of the popliteal vein was useful for the immediate result, it played an important part in the late postoperative disturbances.

Stabholz (Poland)

"Some Remarks on the Surgical Treatment of Wounds of the Vessels" were offered by Henri Stabholz, Surgeon to the Military Hospital in Kielce, Poland. Summarizing, he pointed out that, in all cases of injury of the blood vessels, vascular suture represents the method

of choice. Only vessels of small caliber can be ligatured, without this involving the danger of necrosis of the peripheral parts. In exceptional instances, ligature of more important vascular trunks can be admitted, especially when vascular suture is prohibited by the grave general condition of the patient, the possibility of profuse hemorrhage, infection of the wound or, finally, difficult anatomical conditions. When the life of a limb is preserved by ligature, its intrinsic function is not impaired in the majority of cases.

General Arthur Lossmann, Surgeon General of Estonia, an active delegate at preceding Congresses, who is planning to send representatives to the forthcoming meeting in Budapest.

The ideal intervention should be delayed three to four weeks; during this time the patient recovers from the effects of the anemia and traumatic shock; the vascular wall of the damaged vessel adapts itself to the septic medium formed by the aneurismal sac; a collateral circulation develops and, if a juxtaparietal bloodclot is formed, the prospects of a compensatory circulation are improved. During the expectant period, the surgeon must always be prepared to lend instant

assistance in the case of an acute hemorrhage. Sudden increase in size of the aneurism, elevation of the pressure in its sac with threatened rupture, aggravation of the inflammatory and nervous phenomena with paresis and paralysis, are indications for immediate intervention.

Parietal suture gives the best postoperative results. When its application is impossible on account of extreme narrowness of the vascular lumen, a pedunculated flap taken from the wall of the aneurismal sac, lined with endothelium, can be utilized. In those cases where, for technical reasons, the employment of lateral suture or a pedunculated flap meets with difficulties, circular suture enters into consideration.

The rule of application of vascular suture exclusively in an aseptic environment, is greatly exaggerated. The grafting of vessels, which requires an absolute asepsis of the wound, belongs to the future, when surgical infection may be under more efficient control.

For suture material, horsehair suture boiled several times in oil of vaseline, can be readily utilized.

Walther (France)

Médecin Lieutenant of the Reserve, Paul Walther, presented a Communication entitled "Treatment of Arterio-Venous Aneurisms." According to the author, indications for surgical interference are based on the conditions which are, evidently, caused by the aneurism, such as pains and cardio-vascular disturbances. In the case of arterio-venous fistula, lateral ligature is utilized. There is a choice of two methods, in the case of true aneurism, either dissection of the sac and quadruple ligature, or incision of the sac and obliterative endoaneurysmorrhaphy.

Yahoub (Turkey)

On the basis of extensive personal experience during the World War, Dr. Yahoub, Surgeon to Constantinople Hospitals, described the "Treatment of Arterio-Venous Aneurisms of the Thigh." The author observed nine cases of this unusual affection.

All cases of wounds of the femoral artery which are not immediately operated upon on the battlefield, and are transferred to the surgical centers, can be radically cured, for collateral arteries are formed by means of which the foot can be nourished and saved from amputation. The casualties with arterio-venous aneurism of the femoral region often reached the author's service after a journey of twenty to thirty days. This delay, caused by long distances traveled

and the lack of facilities for transportation, incidentally helped towards the cure of the patients.

In the first of these cases, the author applied a temporary ligature on the femoral artery but, finally, he saw that operative hemorrhage was nonexistent, the chief ruptured arteries being atrophied and thrombotic. These aneurisms, therefore, could be operated upon like simple blood tumors or hematomas, i.e., merely relieved of their contents, which consisted of enormous masses of black clots, strongly adherent to the muscles, bones and nerves. The shell of the aneurism, formed by muscles or neighboring aponeuroses, could not be dissected out, but it visibly retracted under continuous aseptic dressings. The healing of these blood pouches was tedious and protracted, but was usually definite. In a general way, arterial and venous suture is impossible, for the two ends of the damaged femoral are separated by a few centimeters and, often, are atrophied and thrombotic. The slow but progressive diffusion of the arterio-venous blood is so strong, that not only are the ends of the vessels widely separated, but the muscles are deformed, the nerves are compressed, and the regional anatomy is unrecognizable. As to the prognosis, several weeks are required for the healing of enormous blood pouches, but, with the ultimate use of a few applications of massage or electricity, a complete cure is possible.

Latowski (Poland)

"The Replacement of the Hemostatic Band by Provisional Suture of the Wound" was the subject of the Communication by Lieut. Col. M. Latowski, Chief Surgeon of the First Military Hospital Marshal Pilsudski of Warsaw. The suggested procedure was applied by him for the first time in 1911, and was utilized many times during the World War. He applies a simple, continuous suture of the bleeding wound, without any preliminary preparation. It usually suffices to suture the skin; although, sometimes, the aponeurosis, and even the muscles, must be included in this. At any rate, a simple suture is always sufficient. The arrest of the hemorrhage is complete and the facility of the performance of such a suture is obvious; it can be applied by any surgeon without assistance and general anesthesia, in one or two, or, at most, three minutes. The operation checks the external hemorrhage for twenty-four to seventy-two hours, thus rendering possible the evacuation of the wounded to a great distance. Finally, it is applicable to wounds of all parts of the body, except the abdomen, skull, and chest. It must be emphasized that the proposed provisional suture is not a definite cure for the hemorrhage; it is destined only to re-

place the hemostatic band, for the purpose of rendering possible the transportation and evacuation of the wounded, where the journey requires more than two hours. This operation is meant to be performed only in those cases where it is impossible to proceed to a more serious surgical intervention, such as primary suture or ligature of the vessel. Casualties treated in this manner must be provided with a signal card indicating that they are threatened by hemorrhage.

Gomez (Spain)

In the introductory remarks to his Communication: "Injuries to Blood Vessels and Their Sequelae. Absorbable Metallic Ligatures," Lieutenant Commander Joaquin Sanchez Gomez, Medical Corps, Royal Spanish Navy, stated that, for several years in Spain, and for more than two years in the United States, he has been experimenting with metallic sutures and ligatures. His original system of ligation and suturing is based on the use of metals, which are more easily sterilized than catgut, silk, and kangaroo tendon. These metals can be placed around blood vessels more snugly, and are less in danger of slipping off or becoming untied than the material in common use today. The metal appliances used are both absorbable and nonabsorbable. In the former variety, the time of absorption varies from eight days to three years. In applying these metal ligatures and sutures, forceps of a special make are required; in a general way they are like ordinary Kocher forceps and manipulated in the same way, but on the inside of one blade there is a pocket for the metallic clips, and a special device which pushes the clips out, one by one, automatically, so that they are rolled around the blood vessels by means of the other blade of the forceps, which is peculiarly shaped, at the end, for this purpose. These forceps are very easy to use, especially so in placing deep ligatures. The metals are soft, readily adaptable to any form, and do not act as irritants to the tissue.

Garofalo (Italy)

Five cases of wounds of blood vessels followed by aneurisms were described in the Communication on "Immediate and Remote Sequelae of Vascular Wounds," by Dr. Francesco Garofalo, Assistant in Clinical Surgery, University of Bologna. The first case concerned an aneurism of the radial artery. The second was one of the left great anastomotic artery, which supervened nine years after a shell splinter wound. The third was one of the subclavian artery, due to contusion. The fourth concerned an aneurism of the right carotid, following upon a

wound of the neck through a fall upon a metal hook. Surgical intervention in these four cases proved unsuccessful in the last two. The fifth case was that of an aneurism of the left femoral artery, in a soldier whose foot was amputated for gangrene and who now presents a peculiar radiographic picture of the tibiofibular stump, perhaps due to nutritional changes.

Levit (Czechoslovakia)

In his "Discussion on Aneurisms," Lieut. Col. Prof. Dr. J. Levit, stated that he performed 157 operations on aneurisms, with six fatalities—four after extirpation and two after suture of the blood vessel. He came to the conclusion that, in early aneurisms, suture of the blood vessel is the method of choice, whereas in later stages, when the collateral circulation is established, better results are achieved by ligature. In one case, after suture, there was gangrene, but, after ligature, the cases showed only a slight change in the blood supply of the skin. He examined, systematically, blood coagula in healed aneurisms, and found different microbes and mycelioid growths in numerous cases. He always cleans the wound with Carrel-Dakin solution and advises great caution in operations. The good results, after suture of the blood vessels, are attributed, by the author, to the unconsciously performed periarterial sympathectomy.

Caccia (Italy)

The conclusions arrived at by Colonello Medico Filippo Caccia, in his communication entitled "Wounds of Blood Vessels and Their Results," are as follows:

(1) Vascular wounds, due to rifle bullets, take a distinctly better course than those produced by splinters of artillery projectiles.

(2) The great majority of vascular wounds are of the limbs, with distinct predominance of the lower limbs.

(3) Wounds of the large vessels of the neck are rarely observed in treatment stations, because they usually cause death on the battlefield.

(4) The application of the hemostatic band constitutes a grave danger in war wounds, on account of the tendency to gas gangrene, which always causes the loss of the limb and, very often, threatens the life of the wounded. The avoidance of its application is the best and safest rule and, when its use is absolutely necessary, it should not be left in place beyond one or two hours, at most.

(5) In the cases of ligature for lesions of large vessels, the simul-

taneous ligature of the satellite vein reduces the mortality and the grave disturbances following upon the ligature of the common carotid and, in ligature of the large arteries of the limbs, guards against the development of asphyctic gangrene.

Caccia (Italy)

"Clinical-Statistical Considerations and Medico-Legal Data on the Remote Results of War Wounds of the Blood Vessels" were given by Colonello Medico Filippo Caccia, who examined the remote results (after ten to fourteen years) in thirty-four cases of vascular injuries; concerning lesions of the neck, six, of the upper limb, seven, and of the lower limb, twenty-one. The following conclusions were arrived at:

(1) Early intervention with the associated surgical prophylaxis of the wounds is the principal and most important factor for the ultimate favorable course of vascular, as well as other injuries.

(2) Primary ligature of vascular lesions is the intervention to be accorded the preference in wartime, because this procedure, as shown by numerous observations, is in good conformity with the immediate and remote requirements.

(3) Vascular suture, preferable in the territorial hospitals, does not offer sufficient guarantees in war surgery on the field, particularly because of the enormous number of casualties which demand urgent and rapid assistance. The application of a ligature requires much less time and gives greater security in war wounds.

(4) The great majority of wounds of the blood vessels heal without remote sequelae; this is also the case when important arteries are affected, such as the subclavian or the axillary artery.

(5) Aneurisms of the lower limbs, persisting for many years, usually aggravate the circulatory disturbances of this region; this does not apply to the upper limbs and to aneurisms of the common carotid artery, as these often take their course without notable disturbance.

(6) The remote sequelae of wounds of the venous vessels are few or none, and assume a certain importance from the pension viewpoint, only on the intervention of infectious factors (phlebitis with subsequent obstacle to the return circulation).

de Fourmestraux and Frédet (France)

"Dry Wounds of the Arteries" are considered in the communication by Médecin Lieut. Col. de Fourmestraux and Médecin Lieut. Frédet, Surgeons to the Hôtel Dieu of Chartres. Aside from the well

known classical data on wounds of the large arterial vessels, the World War revealed the existence of, apparently, a paradoxical fact, namely of dry wounds of the vessels. Various theories in explanation of their origin have been propounded, including the intervention of lesions of the periarterial sympathetic. As to the frequency of these cases, one of the authors (de Fourmestraux) in 3,800 operations, applied forty-one ligatures of large arterial trunks, seven of which concerned dry

Delegate from Siam, Colonel Phya Damrong Baedyagun, Director of the Hospital Section of the Siamese Red Cross Society.

wounds, showing a large proportion. The symptomatology remains incomplete, but two signs possess real importance; pain and functional impotence. Concerning the treatment, operative intervention is distinctly indicated when the entrance orifice and the exit orifice of the projectile are in juxtaposition or correspond to the course of a large vessel; in these circumstances, exploration and systematic dissection are indicated, not only because a war wound is usually contused and infected, but also because experience has taught that the temporary

hemostasis in dry wounds—the bloodless wounds of vessels—is precarious and unreliable.

Courbin (France)

"Hydromineral Treatment of the Sequelae of Vascular Wounds" was discussed by Dr. Courbin, physician to the Bordeaux Hospitals. The simplest of these sequelae are represented by the well known symptoms of circulatory deficiency, as demonstrated by diminished strength of the limb, chilling, etc. The best method to raise the arterial pressure consists in the use of warm baths at the proper temperature. Theoretically and practically, the health of the myocardium and the nervous system being ascertained, these baths suffice to induce the desired active vasodilatation. However, on account of their stimulating action on the heart, they are badly tolerated by nervous patients and those with cardiac irritability. In these circumstances, they are advantageously replaced by the Baths of Royat, Bagneres de Bigorre, or Bourbon Lancy, which raise the arterial pressure while diminishing the number of pulsations.

The second large group of sequelae of vascular wounds is represented by the vasomotor type or sympathetic type, shown by pains and trophic disturbances, as well as by perspiration and thermic disturbances. Only too frequently, the two great factors of circulatory deficiency and sympathetic disturbances are found to be associated.

When the arterial obliteration is accompanied by intermittent claudication, or if, otherwise, the heart requires strengthening, the baths of Royat will give the best results. In the presence of trophic disturbances, such as ulcers and amyotrophies, certain French sulphur springs are indicated.

Oudard (France)

Professor Oudard, Médecin Chef of the French Navy, described "The Management of Arterial or Arterio-venous Hematoma of a Limb." Contrary to the opinion of certain operators, who believe that, in the case of a vascular wound without external hemorrhage, the establishment of a collateral circulation should be waited for, postponing the operation for several months after the formation of the aneurism, the author proposes early intervention, in the first ten days, if possible. Such intervention is much simpler, almost without danger, very conservative for the vessels and the collaterals; it prevents the appearance of compression symptoms and vasomotor disturbances. His operative technique has always yielded him excellent results.

Parvulescu (Roumania)

"Injuries of the Vessels and Their Sequelae" were discussed by Dr. Parvulescu, Médecin Colonel of the Roumanian Army. Vascular injuries produced by various causes, may be complete or incomplete, septic or aseptic. These injuries and their sequelae obviously require surgical treatment, in the form of suture or ligature. The surgical treatment must be adapted to the type of the wound, its site, the state of sepsis and, especially, to the different phases of the battle and the preoperative surgical care (preventive hemostasis, local dressings), as well as to the mode of evacuation of the patient and the date of the wound.

In septic wounds of the vessels, no matter of what caliber, ligature is imperative; in aseptic wounds, which are extremely rare, suture may be tried, but only in the large vessels and in fully equipped hospitals, where the operation can be performed by skilled surgeons. In complete vascular wounds, the author considers ligature as preferable to suture, while in incomplete wounds, suture may be recommended. In spite of his acceptance of suture as a means of treatment for injuries of the vessels and for a large portion of their sequelae (hemorrhage, aneurisms, arterial hematomas), he, nevertheless, considers ligature as superior, for in the case of circumferential sutures, a certain stricture will occur precisely in the lumen of the vessel, and, irrespective of its degree, will cause a partial stagnation of the blood propelled by the heart. Thus a dilatation will supervene at this level, which will ultimately require ligature.

In moving warfare, especially in the defensive, it is the opinion of the author that arterial suture in the mobile hospitals is altogether contra-indicated, and that ligature is the only efficient means of emergency treatment. In a war of position, provided the evacuations are actually carried out promptly, sutures may be given a trial, with the drawbacks mentioned in the foregoing kept in mind. With respect to the question of arterial sutures, the last word cannot be said before experimental surgery is ready to present its remote results of such operation. In view of the fact that the majority of wounds of the vessels during warfare are septic, ligature is fully justified.

Tsutoma Saito (Japan)

"Late Effects of Gunshot Injuries of the Blood Vessels" were presented in a communication by Surgeon Captain Tsutoma Saito, of Japan. Cases of gunshot injuries of the blood vessels treated by the Medical Department of the Japanese Army during the Russo-Japan-

ese War, amounted to a total of 608, according to the reports. The author was able to examine, personally, forty-eight of these men, wounded twenty-four years ago, and note their present condition. In a few cases, only the blood vessels and the soft parts were injured; in most cases, there were associated nerve lesions or bone fractures; twenty-two had injuries to the nerves and nine had fractures of bones.

The methods of treatment employed for injuries of the blood vessels were as follows: Ligation of artery, twelve; ligation of artery and vein, six; extirpation or resection of aneurism, twenty-two.

The after effects noted by the author were chiefly disturbances of circulation, such as a sensation of chilliness, dilatation of veins, congestion, diminution of pulse, and retardation of the blood circulation locally. The degree of the disturbance was not very severe in most cases. Apart from the functional troubles, which are a result of the concomitant injuries of the nerves or bones, there was seldom any severe subsequent effects of the injuries to the blood vessels themselves. Therefore, there is hardly any difference in the result, whether only the artery is tied or the vein as well.

THE PHYSICAL AND CHEMICAL ANALYSES OF THE GLASS AND RUBBER ARTICLES EMPLOYED BY MEDICAL SERVICES

Official Reports

Smith, Hooper (Great Britain)

Surgeon-Commander F. Lewis Smith, O.B.E., Royal Navy, and Mr. F. Hooper, M.B.E., Head Pharmacist and Technical Assistant to the Medical Director-General of the Royal Navy, restricted their joint report on glass in medicine to the durability and suitability of glass bottles, ampoules and similar articles, for holding drugs and chemicals used in the medical profession.

In the past, glass was largely manufactured by "rule of thumb," the glass makers depending on experience only, often with results which were far from perfect. It was not uncommon for bottles, particularly those of colorless glass, to devitrify within a few weeks of manufacture. Even when the glass did not become full of cracks, a marked efflorescence and a "slippery" moisture, or only the latter, formed on the surface, according to whether soda or potash was the alkali in excess. Such glass was unsuitable for storing medicines.

The specifications for glass bottles, measures, and the like, used in the Royal Naval Medical Service, were closely investigated by the

officer in charge of the Royal Naval Medical Depot, Deptford, who, in 1888, introduced into the conditions of contract a clause requiring the glass to possess a high lead content—in reality, to be similar in character to crystal glass tableware. This, however, caused so much trouble to the contractors that it was dropped in 1905, when ordinary commercial articles were accepted. The immediate result was a crop of bad bottles.

No records are available of any deliberate tests having been carried out on the durability of the older bottles. There does not appear to have been any complaint of the precipitation of alkaloidal solutions stored in them. Some of the "Stock" bottles in the British Naval Dispensaries are many years old, and these, when freshly cleaned, are the acme of clear lustre. It proves that these bottles were made of good durable glass and, further, when tested by the Narcotine Test or by that of the German Pharmacopeia, these old bottles compare favorably with those of recent manufacture. Indeed, a white glass stock bottle, dated 1889, shows only a very few needles of narcotine, after standing twenty-four hours following the one hour's immersion in boiling water, even standing the test as well as a boiling flask of special resistance glass, dated 1928.

Complaints regarding the quality of bottles, however, were of frequent occurence after 1905, and continued until the great improvement of the past few years, following upon the more general introduction of gas-fired furnaces and the scientific control of factories engaged in glass manufacture. British manufacturers are now making bottles of good quality for general purposes, while the "resistance" glass turned out by the British Chemical Ware Manufacturers' Association is of exceptional quality and excellent for the manufacture of ampoules, bottles, and the like, intended to contain solutions of alkaloids and other drugs sensitive to traces of free alkali. On the other hand, bottles of bad quality have been found in use. In 1923, Richmond reported that potassium carbonate, originally containing less than 5 parts of lead per million, after storage in a glass bottle for nine weeks, contained 150 parts per million. Another sample of the same chemical, after storage in a similar bottle, contained 10 parts of arsenic and 80 parts of lead per million. A sample scraped from the side of the bottle contained 12 parts of arsenic and 500 parts of lead per million. It is obvious that the use of such bottles should be prohibited. Consequently, it is highly desirable that some standard tests should be adopted to insure that the glass containers are of such a constitution that they do not, and will not, injure the drugs or chemicals stored

therein. The test should be of such a nature that it can be rapidly and easily applied, using the ordinary apparatus found in a pharmacy. This test should be, also, somewhat of a quantitative nature, in order that the containers may be approximately assorted into three groups or classes, as follows:

(a) Bottles and ampoules of highly resistive glass for hypodermic solutions and other medicines liable to deteriorate in the presence of traces of free alkali.

THE GREAT HALL, BRITISH MEDICAL ASSOCIATION HOUSE, WHERE THE MEETINGS OF THE CONGRESS WERE HELD

(b) Stock and medicine bottles for ordinary drugs and chemicals.

(c) Those which are not suitable for use in either of the former categories.

Further, it is essential that mechanical defects should receive careful consideration; excessive brittleness and, especially, the presence of bubbles are objectionable faults. A bubble near the inner wall of

a glass container is liable to break and contaminate the contents with sharp flakes of glass, or it may form a pocket from which it is very difficult to remove dirt or remains of the former contents.

At first sight, the practical test of glass vessels would appear to be very simple, arguing that it is only necessary to place in them some of the materials they are intended to contain and then store them under normal conditions for a certain period. Medicines, however, are so many and varied, their deterioration, due to the glass container, is frequently so insidious, that it is quite impracticable to consider such a test as being of any value. It could not be carried out within a reasonable period of time. No matter how slow the process of deterioration may be, it cannot be ignored, especially with regard to glass bottles and containers used on ships. Such containers may have to store drugs for a lengthy period of time under many variations of climate and temperature. It is therefore essential that the drugs they contain be in good condition when required for ordinary use or emergency. It is the custom to test the suitability of the ampoules used in the Royal Navy for hypodermic solutions, the special bottles for morphine solutions and the like, by subjecting them, filled with their proper solutions, to heat in an autoclave for one hour at one atmosphere pressure. If no precipitation or other apparent change takes place at the end of that period, the glass is considered of good quality.

With the exception of the action of strong solutions of caustic alkalis, the results of modern international research work seem to point to the fact that the action of water in an autoclave, at two atmospheres pressure for thirty minutes, is a fair indication as to the durability of the glass for storing medicines at normal temperature and pressure for indefinite periods. It must be remembered, however, that the temperature at which the test should be made, the most suitable indicator, and the means of estimating the amount of hydrolysis which has taken place, are still subjects for debate. Phenolphthalein, Methyl Orange, Methyl Red, Iodeosin, and various solutions of alkaloidal salts, have been suggested as indicators. The temperatures recommended vary from exposure to moist air at room temperature to treatment in an autoclave at twelve atmospheres pressure. For optical glass, the Iodeosin test appears satisfactory, so that it is accepted as a "standard" test. However, its interest is chiefly academic, as it does not appear to be generally accepted for bottles and ampoules, probably because it is essential to have a "weathering" test.

On the whole, the Narcotine Hydrochloride method, suggested by

Kroeber in 1914, appears to be a very satisfactory test, in that it fulfills the requirements of quick and easy application, and does not call for any very special apparatus or great technical skill. A discussion is now taking place between the British Society of Glass Technology and the Deutsche Glastechnische Gesellschaft, in an endeavor to set up a common standard test that depends on the estimation of the amount of alkali extracted by boiling water, under certain conditions.

Turner, Head of the Department of Glass Technology, gives two durability tests on samples of glass tubing used for making ampoules, as follows:

(1) Qualitative test, using Narcotine Hydrochloride. Particulars of the method of testing: A solution of Narcotine Hydrochlorine is prepared by dissolving 1 part of the material in 1,000 parts by weight of hot distilled water. The solution must be made in new resistance glass vessels, or a deposit may be formed at once. The tubing to be tested is sealed at one end so as to form a test tube; it is then washed thoroughly with water, very dilute Acetic Acid, and, finally, with distilled water and alcohol to assist in drying. After thorough drying in the oven, the tube is suspended in a bath of boiling water; the narcotine hydrochloride solution is brought to the boil; it is poured in so as to fill the tube within about 1½ inches from the top, the whole of the narcotine solution column being below the surface of the water in the bath. The mouth of the tube is closed by a plug of cotton wool. Heating in the water bath, at boiling temperature, is continued and the appearance of the solution noted from time to time, until 60 or 90 minutes elapse. If a cloudy precipitate appears within ten minutes, the glass is of unsatisfactory quality; if a precipitate begins to form after ten minutes and increases during an hour, the glass is not sufficiently good to contain alkaloidal solutions. If a few minute needles appear in fifteen to twenty minutes, but do not increase distinctly in an hour, the glass is satisfactory; lack of deposit indicates a glass of good resistance. In carrying out the test, care must be taken that the water in the bath in which the various tubes are immersed, is at the boiling point, and that the temperature is reasonably uniform.

(2) Quantitative boiling water test, using powdered glass. Particulars of the method of testing: The glass to be tested is ground so as to pass a sieve of mesh No. 20, and to lie on sieve No. 30 of the standard sieves of the Institute of Mining and Metallurgy. The glass powder is freed of adhering fine dust by means of compressed air, then 10 grams are weighed into a small cylindrical platinum mesh bag of No. 90 mesh. The bag is agitated in alcohol so as to wash out all

remaining fine particles and dust; the bag and glass are then dried in an air oven at a temperature of about 110 C., and, after cooling the whole, is reweighed. 500 c.c. of distilled water are brought to the boil in a large silica beaker fitted with a silica dish, through which cold water is kept flowing so as to act as a condenser, preventing any loss of steam from the beaker. The bag and glass are suspended in the boiling water and are boiled for one hour. The bag is removed and well washed in warm distilled water, then the bag and its contents are dried in the oven again, cooled and reweighed. The percentage loss in weight of the glass is calculated. The solution in the silica beaker is cooled and titrated against standard Sulphuric Acid solution of N/100 strength, using Methyl Orange as indicator to determine the total alkali extracted from the glass. The percentage Na_2O extracted from the glass is calculated from the titration value.

The great amount of research work being done on the composition of glass in relation to its durability will, perhaps, permit the formulation of specifications for types of vessels intended to contain medicines. There will, however, always be the temptation for glass workers to use "soft" glass, since this enables them to turn out the greatest number of articles with the minimum of labor. Further, it is impractical to make a detailed analysis of every batch of bottles or ampoules purchased. The application, however, of a simple and efficient test would quickly result in the disappearance of the inferior article from the market.

The authors are of the opinion that there should be an international standard brand or mark on all glassware used in medicine. This would be a guarantee of the quality of the articles stamped therewith. Thus it follows that an agreed-upon test or tests should be adopted and admitted to the national pharmacopeias.

Taking up the question of rubber, the authors state that they refer to soft vulcanized rubber as distinct from hard vulcanized and raw rubber. The rubber articles used in the Medical Services are the most difficult to test of any material with which the medical storekeeper has to deal. Even when their reaction to physical and chemical tests appears to be perfect, that is no guarantee they will not become useless in a short period of time. The difficulties of the subject are many, since tests carried out on the articles made from the same formula vary enormously in tensile strength and in their reaction to aging tests.

At least three types of changes take place in the aging of rubber: oxidization; colloidal modification, which may include both aggrega-

tion and disaggregation; and after-vulcanization. Of these, oxidization is the most important.

Some rubbers, during vulcanization, attain a maximum tensile strength which is sharply defined; others have a flat strength or time of cure curve. If a rubber attains maximum strength quickly, at a lower vulcanization coefficient, it is anticipated it will age well. The state of cure is most important. Overcured rubbers age badly and deteriorate rapidly. The introduction of certain dye stuffs greatly retards attack by light. External factors, such as heat, light, tension, size and shape, various chemical agents which attack rubber, especially oxygen, have to be considered in connection with this aspect. Humidity also has to be borne in mind, for dry air and heat are more deleterious than wet air and moist heat; therefore rubber should be stored in the dark and in a damp atmosphere.

In general, the methods of deterioration evaluation covers the whole subject of rubber testing, which is a large field and includes mechanical tests, strain-stress curves, tensile strength, load at fixed elongation, elongation at break or at a fixed load, permanent set, volume increase under strain, resilience energy absorption, hysteresis, hardness, abrasion resistance, and a variety of fatigue and other tests. Special chemical tests, not usually made, concern permeability to fluids, swelling in fluids, and electrical properties.

Changes in combined sulphur definitely occur in all types of aging, but more markedly at elevated temperatures and under the influence of light. Actual loss of sulphur can ensue if volatile sulphur compounds are formed. Oxygen, if combined with rubber to the extent of 1 per cent, will produce deterioration beyond all useful service.

Turning to specialized tests dealing with the properties of rubber not generally examined, the most discussed problems relate to the permeability of gases in relation to balloons, airships, and protective masks (gas masks). As these deteriorate, the permeability decreases, then rises as the rubber hardens to a brittle state.

The action of heat on vulcanized rubber in air, and more so in oxygen, causes marked deterioration, comprising colloidal change after vulcanization and, consequently, heat-aging tests are incorporated in the specifications of most governments, railway companies, and so forth.

In many cases, so far as the medico-pharmaceutical aspect is concerned, conditions are further complicated by the presence of cotton or other fabric as an essential part of the article. Consequently, it frequently happens that when the rubber is quite satisfactory and will withstand the moist heat of a sterilizer in such a manner as to make

complaints unnecessary, the fabric is reduced to a perfectly useless condition, or the sizing used on the fabric prior to "proofing" causes the surface to become sticky or slippery. Many of the steaming tests, especially those of surgical goods, are, of course, more in the nature of performance tests than aging tests. Of such, perhaps the Geer-Evans and the so-called Admiralty Tests are the best known. The former consists of dry heat for one hour at 132° C. and moist heat at 160° C. for three to four hours. A further test, employed by the authors, serves to show, in some measure, whether the articles are likely to be reliable. This is as follows: boiling in water for 15 minutes; heat in an autoclave for 20 minutes at 15 pounds pressure, then a dry heat test at 80° C. and 100° C., respectively, for several days, followed by immersion in alcohol, acetone, ether, and 5 per cent solution of carbolic acid.

It is noteworthy that all these tests are not applicable to every class of rubber goods, which differ enormously in their relative uses, tensile strength, and general physical condition.

The Admiralty Test (Research Association, British Rubber Manufacturers) shows a definite relationship to the keeping qualities of rubber in good storage condition, namely in the dark and cool. Germany, Japan, Austria, and the railway companies of Great Britain and India all employ this test.

To the ordinary consumer, it is frequently necessary to obtain the supply of rubber goods desired from a firm whose articles have proved to have given the greatest possible satisfaction. In some instances, firms have specialized in the manufacture of a certain article or class of articles, and their products stand out as being of high standard. To many it is, therefore, wiser policy to purchase goods from such firms, even at enhanced prices, since it is very difficult to find any series of tests, which can be applied within a reasonably short time, to determine the reliability of an article. Again, the amount of any one article purchased may be such that expensive or prolonged tests would not be justified on economic grounds.

Conclusions

(1) The application of the scientific knowledge of glass is gradually beginning to receive the full attention it deserves.

(2) The modern methods of heating glass furnaces have been an important factor in the development of modern glass industry.

(3) Such tests are required as can be readily applied in the ordi-

nary pharmacies. The most suitable ones for this purpose are the Narcotine Hydrochloride Test and Turner's Test.

(4) For optical glass, the Iodeosin Test is probably the most satisfactory.

(5) An international standard brand or mark is desirable as a guarantee of the quality of glass for bottles, ampoules, and the like.

COLONEL A. BARCSAI

Chief of the Hungarian Delegation, who is active in the preparation of the 1931 Congress to be held in Budapest.

(6) Such a brand or mark would distinguish glass suitable for medico-pharmaceutical work to the elimination of the substitution of unsatisfactory "soft" glass.

(7) Rubber is probably the most difficult of all articles used in the medical, surgical, and pharmaceutical services, so far as satisfactory testing is concerned.

(8) As rubber is affected by external and internal factors, further investigations are required, and simple tests are imperative.

(9) Articles made from the same formula have been found to vary enormously in tensile strength and in their reaction to aging tests.

(10) The tests mentioned in this paper are the simplest which yield satisfactory results, as far as the medical storekeeper is concerned.

Eleizegui (Spain)

In view of the twofold character of the questions involved in *Physical and Chemical Analyses of the Articles of Glass and Rubber Utilized in the Military Medical Services,* Major-Pharmacist of the Spanish Army, Luis Maiz Eleizegui, divides his work into two parts: the first deals with the analysis of the glass articles employed in pharmacy, and the determination of the technical features that they must combine, and the second with the analysis and determination of the characteristics of rubber articles used in military medicine.

Since the early investigations of Lavoisier and Bercelius, it has been shown that laboratory glass is attacked by the action of chemical agents. Stas was the first to obtain a glass (Stas glass) resistant against them. Up to the present day, many methods have been proposed for the testing of laboratory glass ware. Practically all these procedures are based on the study of the action of water, acids and alkalis at different temperatures. The preference is accorded by the author to the methods of Nicolardot, which are recommended especially for the testing of the articles employed in the delicate procedures required in the making of analyses.

Nicolardot's method consists in first washing the material to be tested with water and ordinary filter paper, stirring strongly, then with water acidulated with hydrochloric acid, distilled water alone, and, finally, with alcohol, first rubbing with a dry cloth and then a piece of tissue paper. The articles must be perfectly transparent and insensitive to the action of the moisture of the air. Subsequently, they are submitted to the following tests:

First Series: (1) Boiling on a Bunsen burner, without reflux refrigerant, for three hours, repeating the test three times with distilled water.

(2) Cold water (at ordinary temperature) for one week.

(3) Boiling for three hours, without reflux refrigerant, with a solution of:

(a) Decinormal hydrochloric acid.
(b) Ammonia, 50 per cent.
(c) Decinormal ammonium chloride.
(d) Decinormal sodium carbonate.

Second Series: Heating in autoclave for three hours at 120°, 140°, and 160°, with the foregoing liquids.

Third Series: After the preceding treatment in the autoclave, repeating the first series of tests, in order to observe the difference of the re-used glass.

After the previously weighed material is subjected to these tests, it is weighed again under the same conditions, in order to observe the loss in weight. According to the investigations of Nicolardot, in very resistant glass the total loss in the three series of tests does not exceed 140 milligrams, and in moderately resistant glass, 280. Accordingly, the glass for laboratory use, such as flasks, can be classified in three groups:

(1) Very resistant glass, the total loss of which, taking a 500 c.c. flask as the prototype, does not exceed 140 milligrams.

(2) Moderately resistant glass, with a total loss of over 140 and under 280 milligrams.

(3) Poorly resistant glass, with a total loss of more than 280 milligrams.

Laboratory glassware, especially flasks, must resist sudden changes of temperature without breaking. The procedure generally employed by the author is to heat the glass to 250°-300° with paraffin and then plunge it in water at 15°. It must resist this or another analogous test. It is also advisable to determine the scale of tolerance admissible in measuring flasks, pipettes and burettes.

In proportion with the growing employment of hypodermotherapy, the quality of the glass used for ampoules daily acquires more importance. The large number of medicinal products which are now administered in glass ampoules, their extremely variegated composition, and the manipulations to which they must be submitted in order to obtain a strictly aspetic preparation, necessitate special conditions of manufacture.

As it is chiefly alkaline and earthy-alkaline substances which enter into the general composition of the glass for ampoules, the first changes to be observed in the injection fluids are those with respect to the "alkalinity," caused by the precipitation of the alkaline salts. The water, a general solvent, on coming in contact with the walls of the

ampoule, especially at sterilization temperature, dissolves the alkaline components of the glass, which then, in their turn, alter the medicinal product. It is noted, furthermore, that this dissolving action of the water is greater in proportion to substances, such as zinc, entering into the composition of the glass, which seem to induce an instability of its structural material. Investigations concerning the quality of the glass are directed in this regard, and a variety of reagents and methods have been proposed for the estimation of the degree of alkalinity and the permissible tolerance. However, the investigation as to the degree of alkalinity is not sufficient. Since the findings of Baroni and Mauri, confirmed by other chemists, the determination of the acidity is likewise required, as it has been shown that glass, in the manufacture of which calcium fluoride is used as a base, gives off acid to the medicinal solutions contained in the ampoules, resulting in a change of the contents. In view of these considerations, the following factors remain to be investigated: (a) Alkalinity, (b) Acidity, (c) Lead, (d) Calcium.

The Phenolphthalein test used in the alkalinity determination is applied in various ways. A very simple and sufficiently accurate procedure is that of Baroni (1927). To 100 c.c. of doubly distilled water add 1.5 to 2 c.c. of alcoholic solution of phenolphthalein at 1 per cent, at the moment of the test. The ampoules, filled with this solution, are placed in the autoclave at a temperature of 134° C. for one hour. A persistent pink coloration indicates the alkalinity of the glass. When the liquid remains uncolored, the glass is satisfactory. Hematoxylin is, likewise, proposed by Baroni, as a more delicate reagent than phenolphthalein, especially for glass containing zinc oxide. According to the studies of Tirelli and the author's own tests, this reagent does not replace phenolphthalein, although it is more sensitive in some cases and for certain glasses. The bromo-thymol blue test is based on the change of the utilized solution to blue, when the pH exceeds 7.6, and is, consequently, very sensitive. The solution for the determinations of the pH comes ready made commercially, and, in the author's experience, has given excellent results. The ampoules to be examined are filled with this reagent and, after sealing by flame, are subjected to the action of steam in the autoclave at 134°, for one hour. After cooling, the color assumed by the liquid is observed. It may remain colorless, in which case the glass is very good, or it may acquire a greenish yellow or green color, indicating that the glass is not very good, but acceptable. If it assumes a blue color, the glass may still be acceptable, provided the phenolphthalein test remains without coloration, because

in this case the pH is between 7.6 and 8.2, namely a very weak alkalinity.

The test with alizarine sulphoconjugate-alizarine sodium sulphonate is as follows: to 5 c.c. of water taken from various ampoules, which have been subjected to the autoclave at 120°, add three to four drops of watery solution of the foregoing reagent. If it is alkaline it will assume a red color. By means of a burette, add hydrochloric acid N/100 until neutrality. The result is multiplied by 2 and referred to 100. A glass of superior quality requires less than 1 c.c. of acid, a good glass less than 5, a mediocre glass, less than 10 c.c. This is an excellent indicator.

In other procedures, the salts of alkaloids are utilized, such as narcotine, strychnine, morphine. All those who have had experience with the preparation of medicinal ampoules have nad occasion to observe that, even when strictly neutral glasses are employed, solutions of morphine turn yellow in the autoclave and in a 2 per cent solution, the heat of 100° for one hour causes the liquid to become colored. The oxygen of the air is a factor of equal or greater importance than the alkalinity of the glass, in these changes. The author considers the bromo-thymol blue test and the phenolphthalein test decisive ones for alkalinity.

As glass, manufactured with a base of calcium fluoride, gives off acidity to the injection fluid, the acidity should be tested (even in the presence of a negative phenolphthalein test), either with methylene red or an analogous coloring agent or, better, the pH of the glass should be determined. The methylene red solution comes ready made commercially. The ampoules are tested by letting the solution fall in drop by drop and shaking; a red coloration indicates the acidity of the glass.

The determination of the pH by the electric method is now rather generally used in laboratories, but the procedures with coloring agents are sufficiently accurate for the grading of glassware. All these colorimetric methods simply consist in the employment of sensitive coloring agents, whose change of color is within certain limits of known pH values, and a comparison of the shades by means of a colorimeter (Beaver's) or tubules containing liquids, with the shades of color corresponding to a definite pH (capillator) or graded discs (Hellige comparative).

The determination of the pH of glass ampoules is carried out by subjecting these ampoules, filled with doubly distilled water, for one hour in the autoclave at a temperature of 134°. After cooling, the

contents of the ampoules are emptied into a suitable receptacle and tested, for example, with the "Capillator"; this and the Hellige comparative give the best practical results. If no comparative or colorimetric models are available, the determination of the pH can be made by means of a citrate and phosphate solution. The most desirable kinds usually oscillate from 6 to 8 pH, although some qualified as good in trade, attain 8.4.

Based on all the findings with coloring agents, the following conclusion is drawn: for the examination of the alkalinity and acidity of the glass used for medicinal ampoules, as well as for laboratory material, such as pipettes, the employment of three coloring agents is sufficient for ordinary investigations; methylene red for the acidity, bromo-thymol blue and phenolphthalein for the alkalinity. These very clearly indicate the pH inferior to 5 and superior to 8. According to the result of these coloring agents tests, glass ampoules can be classified in the following manner:

(a) Very good, when bromo-thymol blue and methyl red are left intact.

(b) Good, when bromo-thymol blue is colored green or yellowish green, and methylene red remains unchanged.

(c) Medium, when bromo-thymol is colored blue and phenolphthalein is left unchanged, or methyl red is turned pink.

(d) Bad, if phenolphthalein turns persistently pink, or methyl red, red.

Lead must be absolutely absent in glass used for ampoules, as it is easily attacked by chlorides. In testing for this, the ampoules are filled with a solution of sodium chloride 0.75 per cent (physiological solution) and exposed in the autoclave at 120°, for thirty minutes. After cooling, an eventual precipitate is looked for and, if present, is collected in a filter and dissolved in hot water, followed by testing for lead with one of its reagents. The presence of calcium is really objectionable only in definite cases, for example, in the preparation of solutions of phosphates and other salts. Thus, although its absence from the ampoules is desirable, traces are admissible in the majority of instances. In the preparation of phosphatic solutions, turbidity is easily avoided by the addition of citric acid or ammonium citrate, in order to dissolve the formed tricalcium phosphate.

The delicate thermometers, with their important indications, also require investigations of the conditions of the glass and the details of construction. The nature of the glass of thermometers has an extraordinary influence on the registrations. At the last International Con-

gress of Military Medicine, held in Warsaw, Colonel Blumentals pointed out the principal conditions required of clinical thermometers, as follows:

(1) The glass must be free of lead.

(2) The mercury must be pure and dry.

(3) The scale must be graduated according to Celsius; the gradu-

GENERAL P. SNIKERS
Chief of the Military Sanitary Administration,
delegate from Latvia.

ation must not be less than 7 mm. and must comprise 34° to 42° divided into decimals of a c.c.

(4) Errors above 0.10° C. are not admissible.

(5) Every thermometer should bear a registration mark and the year.

The complex composition of manufactured rubber, the variety of articles made from this material, and the colloid nature of the natural product render the analysis of rubber one of the most difficult problems. Although natural rubber is considered as a hydro-

carbon, commercial rubber contains, in addition, resinous, nitrogenous, glycose, and mineral substances. Furthermore, the series of manipulations to which it is subjected, and the foreign bodies that are incorporated into it, such as sulphur through the vulcanization, the vulcanized oils as substitutes to increase the tensile strength, the vulcanization-accelerators (inorganic and organic), various mineral substances (calcium, magnesium), coloring agents (vermilion, sulphur of antimony), render intelligible the difficulties encountered in the formulation of reliable and rapid methods of testing. In the majority of cases, a complete analysis is practically impossible.

The author limits his remarks to a practical classification of the rubber articles most frequently used by the pharmacist and to a description of the features of centesimal composition they must combine, as well as of the analytical testing methods which, in his opinion, possess actual importance and are relatively easy of application. The most important point is to determine the composition, especially the proportion of rubber, substitutes or artificial products, sulphur and mineral substances present. The classification and standardization outlined at the Warsaw Congress by Pharmacist Colonel S. Blumentals seems most acceptable for this purpose and is endorsed by the author.

Rubber articles are classified as follows:

(1) Articles of red rubber: (a) Tubes, drainage tubes, pyriform syringes, Politzer syringes, and others; (b) Catheters, sounds, tips of clyster pipes, syringes; (c) Irrigation tubes.

(2) Articles of black rubber: Tourniquets, rubber bandages.

(3) Articles of gray rubber: Ice bags, hot water bottles, air cushions, air beds.

While the preceding articles are made of rubber alone, another group comprises the various rubbered fabrics and tissues, including surgeons' gloves.

The centesimal composition, with the quantity of raw material forming the different classes of rubber, is regulated according to the classification of Blumentals, as given above.

The two essential properties for which rubber is utilized in pharmacy and medicine are its elasticity and its impermeability. Consequently, the examination of these characteristics must be very carefully carried out in rubber articles; the former, especially, for tubes or sounds, and the latter for rubber tissues. The high quality of the rubbering in tissues, and the smoothness of the surface, especially in articles such as sounds or catheters required to penetrate into certain

organs, are physical conditions which must be strictly tested. The dynamometric resistance of rubber tissues must also be carefully ascertained, with determination of their breaking point.

The complete chemical analysis of rubber is very complicated, including many determinations, some of doubtful value, and, in most cases, impracticable. For this reason, the author endorses exclusively those which, in a particular case, can give an approximate idea of the quality of rubber.

Conclusions

Glass objects:

(1) The glass of laboratory material such as flasks, is classified into three groups: (a) Very resistant, when the total loss on being submitted to the Nicolardot tests (taking as a type the flasks of 500 c.c.) does not exceed 140 milligrams; (b) Medium resistance, if the total loss is over 140, but does not exceed 280 milligrams; (c) Small resistance, when the total loss exceeds 280 milligrams.

(2) The resistance of glass, especially flasks, to changes in temperature, must be sufficient to withstand a sudden decrease of from 250° and 300° to 15°.

(3) The scale of tolerance in the capacity of the flasks, pipettes and burettes employed in analysis should be as follows:

FLASKS (measuring)

Capacity in cc.	1000	500	400	300	250	200	100	50
Tolerance cc.	0.25	0.10	0.11	0.11	0.08	0.08	0.08	0.05

PIPETTES

Capacity in cc.	100	50	25	20	10	2	1
Tolerance cc.	0.07	0.05	0.025	0.025	0.020	0.006	0.006

BURETTES

Capacity in cc.	100	50
Tolerance cc.	0.08	0.04

(4) The glass of laboratory material and of thermometers must be free from lead.

(5) The glass of medicinal ampoules must be free from lead and may contain only traces of calcium.

(6) The pH of the glass of ampoules should not be below 5 nor above 8.2.

(7) The indicators methyl red, phenolphthalein, and bromo-thymol blue allow the glass of ampoules to be classified in the following manner: (a) Very good, when the solution of bromo-thymol blue re-

mains unchanged at 134° C., and the methyl red at an ordinary temperature; (b) Good, if the bromo-thymol blue turns green or greenish yellow at 134° C., and the methyl red does not change at an ordinary temperature; (c) Fair, if the bromo-thymol blue turns blue at 134° C., the phenolphthalein does not change, and the methyl red solution assumes only a pink color; (d) Bad, when the phenolphthalein persistently turns pink, and the methyl red, turns red.

(8) The glass employed in the preparation of medicinal ampoules should be colorless.

(9) The mercury of thermometers must be pure and dry.

(10) The thermometric scales of clinical thermometers must be graduated according to the Celsius system*, and the graduation must comprise 34°-42° divided by decimal scale.

(11) This scale must be within the glass tube; its error should be below 0.10° C.

(12) All clinical thermometers should bear a registration mark and the year.

Rubber articles:

(1) Rubber articles for use in the Military Medical Service, according to the quantity of raw material they contain, may be classified into two groups, which in turn may be:

First group (of rubber alone)

A. Of red rubber:
   (a) Catheters, sounds, drainage tubes.
   (b) Syringes, irrigation tubes.

B. Of black rubber:
   (a) Tourniquets, rubber bandages.

C. Of gray rubber:
   (a) Air cushions, ice bags.

Second group (of rubber and other materials)

Rubberized fabrics and tissues.

(2) The quantity of raw material which forms the different classes of rubber is determined according to the classification of Blumentals, given above.

(3) The acetone extracts of the articles in group A, and those which, in their application, may be in direct contact with the interior of the body, obtained in accordance with the instructions of the *Standard Methods of the American Chemical Society,* should never be more than slightly colored, and, after subtraction of the free sulphur, the dry residue should not exceed 5 per cent.

* The Centigrade scale is meant.

Delegates to the Congress

(4) The chloroform extract of the same articles should be only slightly colored and not exceed 1.5 per cent.

(5) The alcoholic potash extract should not exceed 10 per cent.

(6) The vulcanization sulphur should be 5 per cent at the maximum.

(7) All the articles of group A must be free from arsenic and lead.

COMMUNICATIONS

Saint-Sernin (France)

Physical and Chemical Analysis of the Rubber Articles Utilized by the Medical Services was presented in a Communication by Albert Saint-Sernin, Doctor of Pharmacy, Pharmacien-Chimiste-en-Chef de 1ère Classe of the French National Navy. As regards conditions of construction, no special procedure of manufacture or particular composition is prescribed for the various articles in use in the Hospital Services. However, the material employed for the fabrication of all these articles must be pure rubber, of the best quality and the best reputed brands; the mixture must not contain re-used material or substitutes. In order to meet with requirements, the rubber must be well washed with aseptic fluids and freed, as soon as possible, from alteration products, such as putrefactive nitrogenous material and resinous substances, results of the natural oxidation of rubber. Additions to the rubber may consist only in the necessary sulphur for vulcanization and certain mineral substances. No injurious products may be utilized for the "charging" of rubber, such as lead and arsenic compounds. Organic adjuvants are prohibited. The rubber must leave nothing to be desired with respect to the fabrication and the homogeneous character of the material; it must be flexible, compact, and free from all defects harmful to its employment or its durability.

As most of the articles entering into the equipment of the Medical Services are destined, at any time, to come in contact with steam or hot water, they should be subjected to the moist heat test, in the form of boiling for ten minutes, or sterilization in a moist incubator at 120 to 125 degrees. In a more severe test, strips of rubber taken from the articles to be tested, are placed in a glass test tube, which is enclosed in an iron tube, half filled with water, and closed by a screwed-in stopper; the whole is heated for two hours in an oil bath at 170 degrees, at most. This treatment may be replaced by the following: the rubber is left for six consecutive hours in the steam of a kettle registered at 2 kilograms. After either of these tests, the rubber must

have preserved the properties of a good vulcanized rubber; it must neither be sticky nor brittle. Articles destined for use in warm and humid countries, or even simply on shipboard, where the conditions of preservation are not favorable for rubber, should be subjected to a supplementary test, in order to offer every guarantee of quality and durability; for example, for three days, six consecutive hours each at 80 degrees during the day, put in an oven of dry heat, and cool during each night. After this test, the article must not present any cracks on its surface. As the Medical Service equipments are ample, a prolonged durability must be guaranteed.

In order to insure the selection of rubber of the best quality, which does not alter spontaneously, the receiving committee after each delivery, and in the presence of the one furnishing the material, must take samples from the supplies, for examination at the expiration of the term of guarantee. At least 2 per cent of the furnished articles are to be taken for this purpose, to be sealed up and marked with the date of delivery. The Service must protect these articles as well as possible against light, excessive dryness or humidity, or extremes of temperature. When tested one year after their delivery, they must not show distinct change.

Thomann (Switzerland)

In his Communication entitled *The Control and Quality of Medical Thermometers at Maxima,* Colonel Thomann, Pharmacien-en-Chef of the Swiss Army in Bern, reported his experiences concerning the control of fever thermometers (socalled thermometers at maxima). His investigations covered the thermometers for use in the army, and aimed at the detection and removal of all deficient instruments. Two kinds of faults were chiefly noted: inaccurate indications compared with those of a registered normal thermometer, and certain faults of construction, such as breaking of the mercury column at one or more points.

During the World War and the succeeding years, a large quantity of products of inferior value were produced and distributed. The very low price charged for this ware was suspicious. In order to restore normal selling conditions, the Ministry of the Interior of the Reich decided, on January 27, 1925, that all thermometers destined for exportation were, also, to be subjected to an obligatory control.

The principal rulings of this decree are: The fever thermometers submitted for control must meet the following conditions:

(a) The instruments must be made of Jena 16 glass or an equiva-

lent glass, and admitted by the state Physico-Technical Institute in Charlottenburg.

(b) They must be divided, according to the legal scale, in 0.1° and bear the inscription C or Celsius; they must generally mark the temperatures comprised between 35 and 42. The length of a degree must be, at least 6 mm., and must not be less than 5 mm. for thermometers whose length is less than 8 cm. Thermometers destined for exportation may also be divided in 1/5° C. or 1/5° Fahrenheit.

The conclusions arrived at by the author are as follows:

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(1) The control of medical thermometers must be made, at least, at two different temperatures, as compared with a normal thermometer. The test is preferably made at temperatures of about 37° C. and 39° C.

(2) Thermometers presenting ± 0.15° of divergence from the standard thermometer are inexact and cannot be employed.

(3) Among the fever thermometers on the market, only those are reliable which bear the stamp of an official control station. Thermometers without this official control stamp should no longer be employed.

Alarcon (Spain)

In his Communication entitled *Physical and Chemical Analysis of Glass and Rubber Articles Employed in the Medical Services,* Enrique Alarcon Puertas, Pharmacist of the Spanish Army, arrived at the following conclusions, with respect to glass destined for the manufacture of injection flasks:

(1) For hydrolytic compounds of the cocaine type, neutral glass

must be utilized, namely, glass which does not give off any demonstrable alkalinity to the water in the sulphoconjugate alizarin test, under ordinary conditions of sterilization.

(2) For saline solutions which, through double decomposition, form insoluble compounds, glass without calcium content must be employed, namely, glass with a base of zinc, magnesia and aluminum.

(3) For solutions of chlorides or iodides, glass containing lead must be rejected.

(4) For not very changeable solutions, such as sodium cacodylate or salts of spartein and strychnin, slightly alkaline glassware must be employed, which does not give off more than 5 cc. of centinormal soda per 100 cc. after treatment in the autoclave for half an hour at 120°.

(5) If, on determining the pH value in an ampoule, a value equal or inferior to 5 is encountered, such flasks must be rejected, because their acidity is decidedly harmful.

(6) The methods hitherto officially employed for the testing of ampoules are insufficient, because the acidity was not ascertained; such acidity, when present, neutralizes the alkalis and, therefore, gives an insignificant dissociation index. It follows that the determination of the alkaline losses alone, in the glass, sometimes gives rise to inexact results.

(7) Commercial ampoules, whose neutrality is only apparent, although they are neutral according to the official methods of examination, are therefore, in existence.

The articles made from rubber must be elastic. In order to guard against their hardening, they must be kept protected from light, in glass receptacles, which can be closed, and with a little petroleum. When a portion of the rubber is placed with six parts of petroleum benzine in a closed vessel, it must yield, at the end of a few hours, a homogeneous, thick, and turbid liquid. The quantity of ash must not exceed 2 per cent, in rubber of a good quality. The quantity of water must be very small. The rubber must become completely and rapidly absorbed in synthetic ethylene bichloride. It must be free from sulphur. In order to test for the presence of sulphur, 1 gram of rubber, cut into small pieces, is allowed to fall slowly on a mixture of sodium carbonate and nitrate, contained in a thin walled iron crucible. The resulting mass must be entirely soluble in water, and this watery solution, acidulated with nitric acid, must not become turbid through a solution of barium nitrate.

Moreau (France)

Pharmacien Colonel Moreau contributed *Considerations on the Establishment of a "Charge Book" concerning the Acceptance of Manufactured Rubber Articles* and stated that the manufacturers carefully keep the secret of the conditions of fabrication, the composition of the utilized mixtures, and the exact conditions of vulcanization. However, the satisfactory preservation of the articles depends upon these factors. It is, therefore, desirable to investigate the nature of the utilized rubber, to limit the ratio of retrieved material, and to reveal the procedure of vulcanization.

Bruère (France)

The Preservation of Manufactured Rubber and the Softening of Articles in the Course of Induration was discussed by Pharmacien Colonel Bruère. The rubber material must be kept protected against light and heat (activating factors of physicochemical alteration processes), and guarded against all permanent causes of extension and compression. Vulcanization aims at the retardation of the natural process resulting in socalled "stickage," which renders the rubber useless, and is hastened by light and heat. Sulphur in excess in vulcanized rubber may lead, through aging, to hypervulcanization, which hardens certain articles, or to a sulphur deposit. Experience has shown that the application, with a brush, of paraffin oil between 110° and 115°, resulted in the restoration of articles which had lost their flexibility. Before utilizing this procedure, all mechanical factors, through bending, swelling, pulling, must be avoided, as liable to lead to persistent breaks after the softening treatment.

Bruère (France)

In another Communication entitled *Colorimetric Test of Glassware by a Triple Coloring Agent* Bruère stated that the actual reaction of the glassware used in the Medical Service for bottling and laboratory investigations, is rapidly and reliably determined by means of a mixed indicator (methylene red, bromo-thymol blue and phenolphthalein in balanced proportions), whose golden yellow color is capable of turning orange pink in an acid zone, and up to violet in an alkaline zone. The absorption band demonstrable in the green-blue with the hand spectroscope, its intensity increasing with the alkalinity of the glass, permits a systematic classification and comparison with the standard samples. For these tests, the author has established an alcoholic parent solution (triple coloring agent), which is diluted fifty times with neu-

tral distilled water, in order to obtain the indicator of a yellow color (pH = 6).

Popawski, Fabicki (Poland)

The Chemical and Physical Analysis of Glass was the Communication by Lieutenant-Colonel Pharmacien Chimiste W. Popawski and Doctor of Pharmacy J. Fabicki, who pointed out that the selection of glass suitable for a given purpose, has been shown by long experience to be of great importance for the conservation and preservation of medicinal agents, especially in military mobilization stocks. Under the influence of alkaline glass, the fats (oils) undergo a saponification process, and the infusions or liquid extracts give off efficient constituents, losing, in this manner, their pharmacodynamic properties. Solutions of the salts of strychnine, morphine and cocaine, when kept for a long time in alkaline glass, become turbid during sterilization. A solution of adrenalin hydrochlorate, preserved in basic glass, loses its physiological properties; chloroform and ether, in the same circumstances, give off compounds which exert a harmful and, sometimes, toxic action during general anesthesia. These changes, occurring in the medicinal agents themselves, are explained from the chemical viewpoint, either by oxidation, hydrolysis, isomeration, or by the liberation of free alkaloid bases. It has also been demonstrated that physiological salt solution gives off lead chloride as a result of the presence of lead in the glass, which, in the form of an often invisible but water-soluble residue, may become the cause of symptoms of intoxication. It is also known that solutions containing phosphates form, on contact with calcium glass, phosphate residues of alkaline earths, while liquids and nutrient media prepared in basic glass, change even their concentration of hydrogen ions.

Based on long experience, acquired during the study of glass of all sorts of derivation: French, German, Czechoslovakian, Italian and Polish, as well as on observations concerning the influence exerted by glass of a given type on the preservation of liquid medicinal agents (solutions), the authors have arrived at the following conclusions: Glassware, serving as containers for medicinal agents and, especially, for their preservation in military stocks, must be studied with respect to their alkalinity, the presence of calcium, the presence of lead. The glass must not change on being subjected for one hour to a temperature of 180° Celsius.

Sagajllo, Pikulski (Poland)

The Communication by M. Sagajllo and Lieutenant A. Pikulski, Master of Pharmacy, is entitled *The Methods of Physical and Chemical Analysis of Articles made of Vulcanized Rubber.*

The conclusions of the authors are as follows:

Every country must elaborate its own quantitative requirements and conditions for the acceptance of vulcanized rubber products employed in the Medical Service. These conditions concern:

(1) The mechanical qualities.

(2) The chemical composition.

(3) Resistance against aging.

It is recommended:

(1) To employ, for the testing of the mechanical qualities, the dynamometer of Schopper.

(2) To employ, for the testing of the chemical composition, the method of chemical analysis consisting in a gradual elimination of the constituents of vulcanized rubber, with the idea of a direct definition of the hydrocarbon of this rubber in the raw product and in simple mixtures.

(3) To employ, for the testing of the resistance against aging, the method of Bierer and Davis.

(4) To carry out an entire series of investigations in order to determine which of the normal socalled charges, accelerators and antioxidizing agents may be utilized in the manufacture of medical articles made of vulcanized rubber.

In the military laboratories in Poland, a method of chemical analysis is employed similar to the *Standard Method of Analysis of Rubber Goods,* published by the Rubber Department of the American Chemical Society. It comprises a successive elimination of the compounds forming a mixture of soluble rubber in special solvents. For the determination of the resistance of the rubber against aging, the method of Bierer and Davis is employed in Poland. This consists in heating the examined rubber in an atmosphere of oxygen under pressure of two atmospheres at a temperature of 60° Celsius. This method in the authors' opinion gives results most closely approximating the phenomena of normal aging which take place in storage, as well as under the influence of atmospheric factors. It is generally known that the duration of the life of rubber is limited. Depending on their composition and their vulcanization, these products may last a year or a year and a half, after which time they can no longer be utilized.

Pagniello (Italy)

In *Physical and Chemical Analyses of Glassware and Rubber Articles Utilized in the Medical Services,* Tenente Colonello Professor Dr. A. Pagniello, Director of the Military Chemico-Pharmaceutic Institute in Turin, restricted himself to a single group of glassware and one of the most important rubber articles, widely employed in the Medical Services.

Glassware, entitled to the highest consideration, is represented by receptacles destined for the preparation and preservation of liquids for hypodermic injections; these containers, especially on account of the sterilization which they must undergo, are placed under the most favorable conditions for giving off some substances which enter into their composition, capable of altering the purity, the constitution and, therefore, the biological action of the medicinal agents contained therein.

Among the enormous number of elastic rubber articles widely and currently employed for medical purposes, the author concentrates his attention on "impermeable rubberized tissue," which has been extensively studied, because of the number and complex character of the investigations required for the determination of the superior quality which it must possess, and on account of the superior quality and the large quantities employed, aside from other medical purposes, in the makeup of the individual military sanitary package. As a matter of fact, this rubberized tissue constitutes the protective covering for the insurance of indefinite impermeability of the standard type package, according to the final rulings of the International Conventions of the Red Cross in 1926, 1927, and 1928.

Saito (Japan)

Physical and Chemical Tests of Glass and Rubber Articles is the Communication presented by Surgeon Tsutoma Saito. At the Medical Matériel Depot of the Imperial Japanese Army, the testing of all glass, such as test tubes and rods, is generally carried out by the following methods, although other tests, if necessary, are employed for reference purposes:

(1) No change in quality of the article should occur when heated for one hour in steam at about 150° C.

(2) No change, whatever, should occur when the article is dipped in iced water at about 0° C. immediately after it is taken out of boiling water at 100° C. in which it has remained for thirty minutes.

(3) An almost even degree of transparent refraction must be shown when the article is examined by means of polarized light.

(4) Even if the article is boiled for five minutes in a solution of 10 c.c. of sodium chloride (glass rods or glass tubes must be broken up and boiled with 5-10 c.c. of the sodium chloride solution), the so-

LIEUTENANT COLONEL C. SAMMAN

Master of the Apothecaries Society of London, who presided at the Special Banquet given to some of the delegates at Apothecaries Hall.

lution should hardly be colored by the addition of one or two drops of phenolphthalein solution. This test is not applied to medicine bottles; those which stand the heat of steam or boiling are admitted as fit for use.

In regard to tests for rubber, no deterioration in quality of rubber cloth and ice bags, or similar articles, should occur when placed in a solution of alcohol and carbolic acid. Although the rubber may turn to a yellowish red color after heating for one hour in steam at 150° C., no change in quality, such as stickiness with a disagreeable

odor, or excoriation should occur. The rubber should not change its color to brown after exposure to ultra-violet rays for one hour. No stiffening or stickiness of tubes, stoppers, tires, tissues made of rubber, should be caused when heated for two hours at 135° C. or for three hours in steam at 170° C. When the cohesive strength of rubber tubes and the like is measured with a test piece of 30 m.m. in length, the result must conform generally to the following standard:

External diameter mm.	*Cohesive strength* kilogram
not less than 15	30
10	13
8	9
7	5

As to the stretching capacity of rubber tubes, when the elasticity is measured with the test piece, 30 mm. in length, the stretching capacity must be ten times or more that of the control piece. Finger sacs or caps made of rubber should not become sticky or harden when steamed at 150°-180° C. for one hour.

THE STANDARD OF DENTAL AND PHYSICAL FITNESS IN THE VARIOUS MILITARY SERVICES

OFFICIAL REPORTS

Wood, Woods, Colbran (Great Britain)

Collaborating in their report on "The State of the Teeth in Relation to Physical Fitness in the Different Military Services," Surgeon-Lieutenant-Commander (D.) J. T. Wood, Royal Navy, Captain H. S. Woods, Army Dental Corps, and Lieutenant-Colonel C. L. Colbran, Royal Army Dental Corps (Temp. Wing Commander, R.A.F.), stated that physical fitness depends, in the main, on two chief factors—the functional efficiency of the organs of the body and the normal health of the tissues forming the organs. For the purpose of this paper, the teeth and their attachments are regarded as the essential tissues of an organ, the function of which is adequate mastication of food, in order that the maximum nourishment may be obtained from it. This masticating organ will adversely affect the physical fitness when its functional efficiency is inadequate for its purpose, or when its component parts are diseased and become a focus of systemic infection. The degree of efficiency and tissue health of the organ is determined by the state of the teeth and, in the different military services, is controlled by three factors:

(1) The dental standard for enlistment into that service.

(2) The average dental condition of the men enlisted.

(3) The provisions made to deal with this condition on enlistment and, subsequently, throughout military service.

The dental standard for a Service defines the minimum degree of dental efficiency considered compatible with physical fitness in that service, and its determination is influenced by the following considerations:

(1) The primary need for maintaining establishments at full strength.

(2) The average dental condition of the men available for enlistment.

(3) The provisions made for treatment.

(4) The period of engagement entered into.

(5) Any special Service qualifications possessed by the individual.

(6) The advantages and disadvantages of dependence upon artificial dentures.

The importance of efficient mastication has long been recognized, and regulations governing enlistment into the different Services stress the basic principle of adequate natural masticating power. In the Royal Navy, the standard is a sliding scale according to the age of the candidate, and the period of the engagement.

Age	*Usual conditions for rejection*
Candidates for entry below the age of 17 as boy ratings for continuous service	5 deficient or unsaveable teeth
Other persons below the age of 17	7 deficient or unsaveable teeth
Above 17 years	10 deficient or unsaveable teeth

Credit is given for unerupted teeth in candidates under 17 years of age. All classes must possess adequate masticating efficiency. Men dependent on dentures are not accepted for entry, but may re-enter or re-engage if below the numerical standard, provided they have well fitting dentures.

Ten unsaveable or deficient teeth will, usually, cause the rejection of a candidate, above the age of 17, for a commission. The candidate must possess some sound opposing molars and incisors, and credit is given for unerupted teeth.

In the Army, the standard, since 1923, is based on the value of the functioning natural teeth present. The authorities considered that a natural masticating power of 50 per cent efficiency, was the minimum compatible with the maintenance of physical fitness. Since 1924, men

presenting themselves for enlistment, who are dependent on artificial teeth for efficient mastication, are accepted, provided their dentures are well fitting and satisfactory. A candidate for commission is required to possess, at least, ten sound or soundly restored upper teeth functionally opposed to ten, similar lower teeth. Two of these teeth in each jaw must be molars.

In the Royal Air Force, enlistment is open to boys and adults. Boys aged 15 years, with seven deficient or unsaveable teeth, are regularly rejected. There must be sound opposing molars and incisors on both sides. Men, unskilled in an Air Force trade, must possess sufficient or restorable natural teeth for efficient mastication, with adequate molar occlusion. Men, dependent on dentures, are not accepted. Men, skilled in an Air Force trade with well fitting dentures to provide molar articulation, may be accepted. Credit is given for unerupted teeth in boys and unerupted third molars in adults. Carious teeth, gingivitis and pyorrhea alveolaris must be successfully treated before acceptance of a candidate for a commission. Dentures do not disqualify, provided they are efficient for mastication.

The present dental condition of the (British) nation, as a whole, is not good, and this is reflected in the men who present themselves for enlistment. It is too soon to expect any appreciable improvement in the general dental condition of recruits which can be attributable to the institution of ante-natal and school dental clinics.

The following comparative figures give the percentage rejections for purely dental reasons in the three Services:

Year	Royal Navy	Army	Royal Air Force
	Percent	*Percent*	*Percent*
1924	4.57	3.8	6.7
1925	5.12	3.3	5.9
1926	6.10	3.4	6.9
Average	5.3	3.5	6.5

With regard to the figures for the Royal Navy, it must be noted that these apply only to recruits referred for examination to the Final Examining Medical Officers. The total percentage is, therefore, higher than the figures shown. The smaller percentage of rejections in the Army is probably due to the uniform selection of recruits being made possible by the introduction of a precise dental standard, and also, to some extent, to the relation between the supply of recruits and the demand. The average recruit has a neglected mouth and has had no treatment except an occasional extraction for the relief of pain.

A recruit is routinely examined by the dental officer, his dental

condition is accurately recorded and treatment is begun as soon as possible. During this treatment, the recruit receives instruction in the importance of oral hygiene, and he eventually leaves the training center dentally fit. Thereafter, he is examined periodically and treated as the occasion arises. In the Army, it is found that, on an average, 1.25 of a recruit's teeth are affected by caries each year, and that continuation treatment is essential to maintain the efficiency and health of the dental tissues. Before proceeding abroad, for a tour of foreign service, he is again examined and all necessary treatment is done before he embarks. In the Navy, particular attention is given to the oral hygiene and masticating efficiency of personnel engaged in the submarine service and as divers, a very high standard being insisted upon. In the Royal Air Force, similar attention is directed to personnel actually engaged in flying, in order to insure the highest possible oral health.

The objects of the Dental Services are to render the men enlisted dentally fit and to maintain this condition of fitness throughout their service, by periodic examination and treatment. The realization of, or approach to this ideal state of the teeth of a Force will depend, to a great extent, on the number and distribution of the dental officers in that Force. The lower the dental standard and the average condition of the recruit, the greater will be the volume and pressure of treatment required.

The two main dental conditions which affect the physical fitness of a Force are: deficient masticating power and the effects of dental disease on the general physical state. Once dental sepsis is established in the masticating organ, the effects produced on general health depend on the inter-relation of four main factors:

(1) Virulence of the infective organisms, namely, the intensity of attack.

(2) Volume of toxins absorbed, namely, the extent of attack.

(3) The time factor, namely, the duration of attack.

(4) The resistance of the body, namely the defence.

When dental sepsis is present, the health of the individual is not affected provided the toxic products are neutralized and the micro-organisms are destroyed. It is the unneutralized toxic substances and infective organisms that escape the body defences, which bring about constitutional symptoms.

As only picked men are dealt with in the military services, their resistance should, normally, be at a maximum. Dental sepsis may be present and cause no ill effect, but any lowering of the body defences,

by disease or other factor, will upset the balance and a "vicious circle" may be induced, in which the effects of the dental condition will increase the systemic lesion. In such cases, it is frequently noted that recovery from the constitutional symptoms is only partial, but that the subsequent elimination of dental sepsis results in a rapid and complete cure.

The various conditions associated with or influenced by infection of the tissues of the masticating organ, may be differentiated as follows:

(A) Those resulting from lymphatic absorption.

(B) Those resulting from alimentary absorption.

(C) Those resulting from direct extension, because of anatomic relationship.

In all cases of closed dental sepsis, the toxi products are absorbed directly by the lymphatics of the periodontal membrane and bone. It is the absorption of toxins into the circulation which brings about so many of those systemic lesions which, hitherto, were not considered as connected with dental conditions. In open dental sepsis, there is a certain degree of absorption of toxic products by way of the lymphatics of the affected tissues, but the main volume is discharged into the mouth, and swallowed. The bacteria which escape the normal defences of the alimentary system, are absorbed into the circulation.

In cases of open dental sepsis, several, or all the teeth present are usually involved. The volume of toxin dosage is, therefore, generally greater than in the closed variety, but the virulence is probably less. A study of many cases tends to show that absorption from open sepsis, by way of the alimentary system, gives rise to those indefinite lesions grouped under such headings as general debility, rheumatism, anemia, chronic indigestion and gastritis, rather than the more localized lesions resulting from lymphatic absorption.

Conditions resulting from direct extension embrace affections of the maxillary antrum. eyes, ears, throat, nose, sinuses and the neuralgias. The main factor differentiating them is the anatomic relationship of periosteum, mucous membrane, bones, blood vessels, lymphatics and nerves.

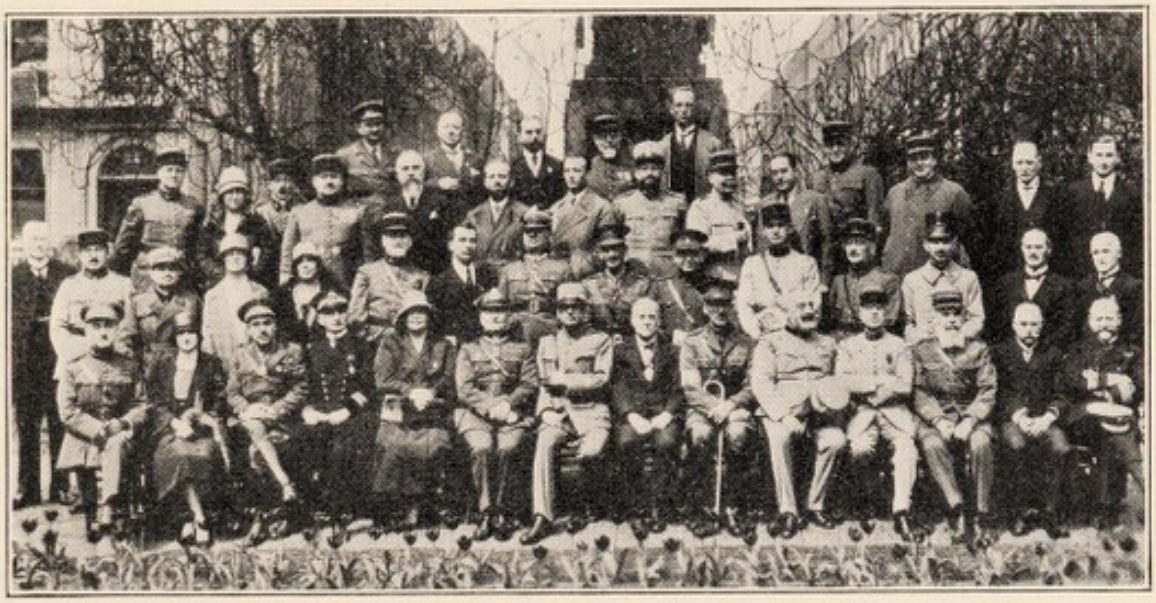
Conclusions

Dental defects may adversely affect health in two ways:

(1) By loss of masticating power and consequent interference with nutrition, due to deficiency in the number of teeth. Although this may be remedied by the early provision of artificial dentures, the need for these appliances presents a very serious problem in the Serv-

ices, as any sailor, soldier or airman, who is dependent on them, is potentially inefficient. In order to minimize, as far as possible, these difficulties, each of the Services has a dental standard for enlistment, with the main object of rejecting all recruits who do not possess sufficient teeth for efficient mastication, namely, those who are dependent on artificial dentures.

(2) By disease of the dental tissues, due to infection. The in-



DELEGATION OF PHARMACISTS

fection may produce either "closed" or "open" dental sepsis, or combinations of the two. The effects on physical fitness caused by pathological changes in the dental tissues, due to infection, depend on four factors: the virulence of the infection; the volume of toxic products absorbed; the time factor; the body resistance. The interrelationship of these factors may be expressed thus:

$$\text{Effects on physical fitness} = \frac{Virulence + toxin + dosage + time\text{-}factor}{\text{Resistance.}}$$

The secondary or constitutional symptoms produced by dental sepsis fall into three main groups, according to the paths of systemic infection:

(1) Conditions due to the absorption of toxic products via the lymphatic system, as in closed dental infection. These conditions are usually the more severe and localized lesions, such as infective arthritis, toxic heart, toxic neuritis.

(2) Conditions due to the absorption of toxic products by way of the alimentary system, as in open dental infection, of which pyorrhea alveolaris is the main manifestation. The symptoms, apart from

secondary infections of the alimentary system are usually not localized.

(3) Conditions due to direct extension, because of the anatomic relationship, namely, affections of the antrum, ear, nose, throat.

The systematic treatment now afforded to the personnel of the Navy, Army, and Air Force throughout their service, should eliminate any serious effects from the absorption of toxic products from the teeth or associated tissues.

Clark (Cuba)

In his report on "The State of the Teeth and Physical Fitness for the Different Military Services," Dr. J. M. Clark, Captain Dentist of the Cuban Army, stated that, every military district in Cuba, of which there are eight, is served by an odontological officer. The service is regulated according to present needs and requirements, but the rulings are not all definite, being subject to future modifications and improvements. The Dental Service in the Cuban Army has been gradually perfected so that, at the present time, each district has an excellent surgery. However, there are certain technical defects in the Cuban Military Dental Service for it has not advanced in the understanding of the progressive importance of stomatology. This branch of medicine plays a decisive part in public health, including that of future generations.

In order to obtain a better dental service, whether military or civilian, it is necessary to get rid of obsolete regulations which remain far behind in scientific progress, although they may still retain their administrative value. The best of regulations, from the economical and material viewpoints, are not sufficient for matters which are distinctly progressive and changing. It is not advisable to restrict, in a particular way, a point which depends so much on other considerations.

Armies should possess a technical corps, administrative and executive, composed of a technical staff and, eventually, of other authorities. It should assist in and partake of the progress of science and enjoy the collaboration of the other units, medical or otherwise. The fact must not be overlooked that the Army is not an isolated community within a nation, but rather its vital power, and, undoubtedly, its school. For example, it is necessary for the dental authorities in armies to insist that the mineral matter needed for the nutrition of hard organic tissues, be introduced into the soldier's rations; to secure from legislative bodies and health boards, laws and regulations with re-

spect to marriages and births, aiming at the improvement of future generations.

A healthy set of teeth is essential, with respect to physical fitness for military service. It may be said, perhaps without exaggerating, that good teeth influence all phases of life, discipline, action and efficiency of the Army, in garrison, during maneuvers and in war time, from the moral as well as the physical viewpoint. All that can be done must be done, in order to obtain healthy teeth. The desired improvement can be accomplished only by means of careful prophylactic and curative measures. Propaganda on buccal hygiene and care of the teeth must be carried out among the troops, and a Hygienic Service should be created, in order to wage an intensive campaign, through all possible measures, such as by demonstrations, films, pamphlets and circulars. The Hygienic Service should be composed of men who have passed a preliminary course of instruction in minor dental work.

In all domains of the dental profession the patient must collaborate in the work of the dentist. Almost everything depends on the voluntary and intelligent co-operation of the soldier. To convince the individual of the advantages of conservative and preventative prophylaxis, means success. The high goal aimed at presupposes a more complex organization, such as, for example, the institution of a dental card for each soldier, and the formation of a large subaltern corps, competent to deal with the following requirements:

Periodical general inspection, at short intervals, of the teeth of all soldiers. Annotation on cards.

Observation of the frequency of certain ailments (caries, tartar, mobility, defective position, loss of teeth).

Reports to the Dental Officer of the District.

Cleanliness of the teeth.

Embrocations.

Application of analgesics.

This service also would anticipate the regulation supply of individual pocket dental cases for all members of the Army, containing; dentifrice; tooth brushes; dental floss; litmus paper; tincture for the gums. The dental officers in this organization should possess full control and receive reports on the work accomplished. They should give the final decision as to the admission of a recruit into the Army; instruct and train the hygienists; make visits of inspection; propose and establish regulations in conformity with the data revealed by the cards; prepare and edit the statistics and, by means of lectures and

periodic lessons, directly or indirectly (through the hygienists), instruct the men on certain points—such as, for example, the use of the contents of the dental case, the testing of the salivary reaction by means of litmus paper, the choice of the dentifrice (two types) according to this reaction; the use of the tooth brush; the use of the dental floss; indications for the use of liniment for the gums, briefly, the proper care of the mouth.

To obtain a better dental service, based more on prophylaxis than on the healing art, it is necessary for the dentist to have a wider power of decision than is now possessed by him, with respect to the examination of recruits. Repeatedly, individuals are admitted whose first and second upper and lower molars are missing, because the preservation of the incisor teeth results in a good "front" view.

After supervising the examination of the mouth of the recruit who presents himself for enlistment, the dentist should make a monthly inspection in his unit, in order to remedy eventual dental deficiencies and to impose certain disciplinary measures on the negligent or careless. The excellent plan of posting notices in barracks, with instructions on cleanliness of the teeth and the objective of collective teeth cleaning at a given time, in the presence of an officer, should be intensified. In every military post or detachment a delegate hygienist, responsible for the enforcement of these measures, should be appointed.

In some countries, a large percentage of individuals have not the habit of cleaning their teeth. When these men enter the Army, where, for the time being, they must be admitted, even when their teeth are in an undesirable condition, it is a very difficult, tedious, and laborious task to make them understand that cleanliness of the teeth is even more important than general cleanliness, in making a physically efficient soldier. Hygienic measures themselves, may prove harmful when applied injudiciously. The employment of dental lotions suitable for the reactions of the buccal medium in a given case, the composion of the dentrifrice itself, and the proper use of the tooth brush, are details of the greatest importance. The hygiene of the mouth cannot be considered separately from general hygiene in its effect on the vitality and improvement of the individual and of the race.

Conclusions

Preservation of the health of the mouth and the teeth is closely connected with the maintenance of general health; consequently, an indi-

vidual who fails to keep his masticating apparatus, his mouth and teeth, in perfect condition, cannot be a good soldier.

Much discussion, theoretical and practical, is being waged on the advisability of extracting or restoring more or less diseased teeth. No definite decision has, as yet, been arrived at, but the author personally inclines to the view of those who hold that the presence of a well restored natural tooth is preferable to its absence and even to the best substitute.

In numerous countries—Great Britain, the United States, France, Italy, Spain, Germany, Brazil, the Argentine Republic—the number of dental officers is increasing day by day, for in proportion to the advance of dental science, the great importance of the care of the mouth is becoming better understood. In Cuba, although there is a decided tendency toward such additions to the force, the number of dental officers will always seem limited, but this must be considered in conformity with the comparatively small size of the Cuban Army.

Rules, restricting the extension of the service to the soldiers, by the Military Dental Corps, should be revoked, and the men should be given all necessary treatment to preserve their fitness for military service.

The dental officer should have charge of this service, from the simple periodical examination to the most difficult and complicated prosthetic apparatus; from a particular affection or lesion of the mouth to general disease, the possible cause of the local phenomenon.

Communications

MacCallan (Great Britain)

"The Eye as a Danger Signal of Dental Sepsis" was discussed by A. F. MacCallan, C.B.E., M.D., Cambridge, F.R.C.S. (formerly Major R.A.M.C.) Assistant Ophthalmic Surgeon Westminster Hospital, Assistant Surgeon Royal Eye Hospital. The close association between dental sepsis and various affections of the eye, was emphasized by the author on the basis of extensive experience. Diseases of the eye resulting from various forms of dental sepsis, are iritis, cyclitis, and chorioiditis. In his hospital and private practice, illustrative cases are common, but many other ocular diseases can be caused or greatly exacerbated by dental sepsis, such as ulceration of the cornea, a very common affection among the laboring classes in Great Britain. The sepsis must be removed in order to prevent a continual flow of pyogenic organisms from the mouth, by way of the pharynx, nose and lacrymal duct, to the conjunctival sac.

With respect to the etiology of cataract, the earliest sign of which is the appearance of slight opacities in the crystalline lenses of the eyes, these changes are present in an unexpected number of persons between twenty and forty years of age. In all such cases which the author had adequate time to examine, he found a focus of sepsis, usually dental. Other ocular conditions which, in his opinion, are usually caused by focal sepsis, are detachment of the retina, thrombosis of the retinal vein, and embolism of the central artery of the retina.

Caries (France)

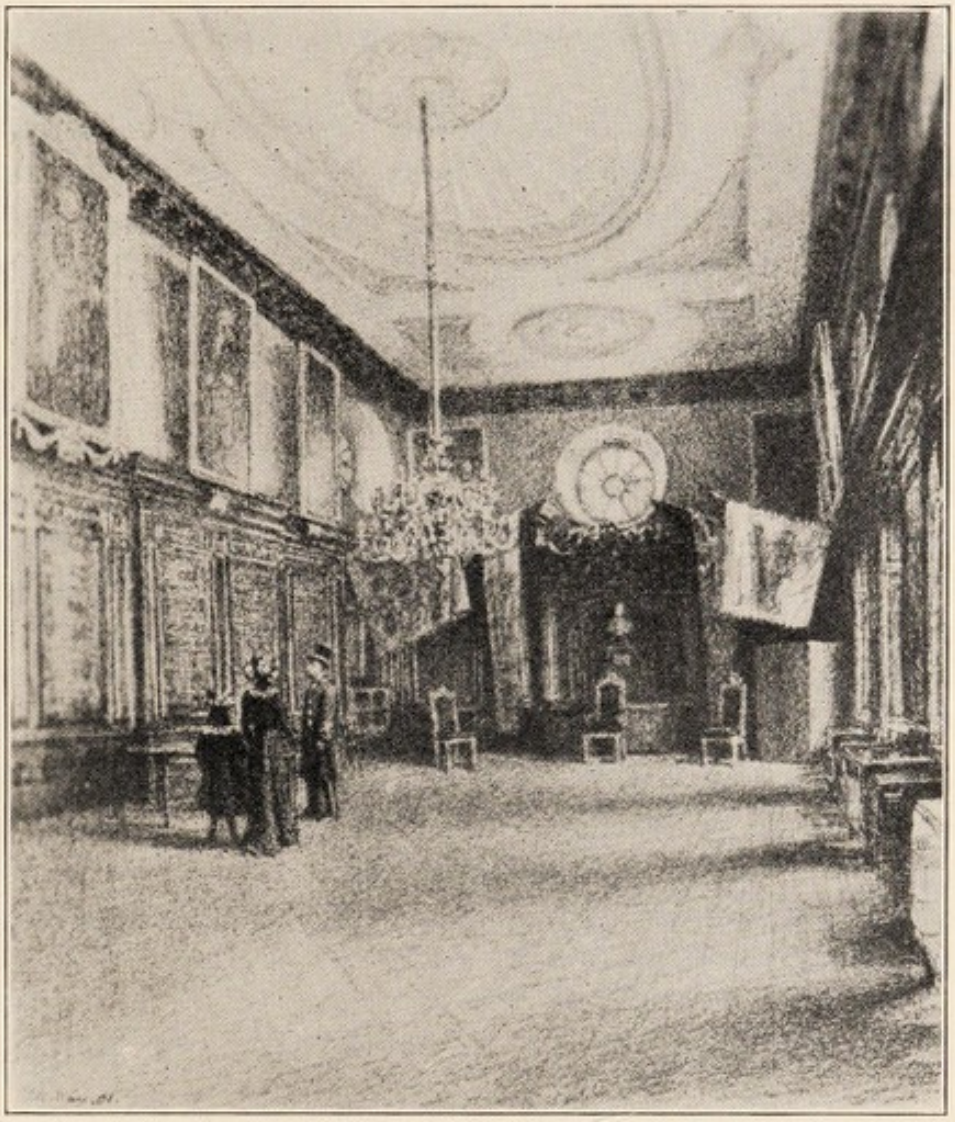
"Conditions of Physical Fitness from the Dental Viewpoint in the French Army" was discussed in the Communication of Dr. Caries, Médecin Commandant of Colonial Troops (Chief of Stomatological Service in the School of Application of the Medical Service of the Colonial Troops. He pointed out the advantages obtained in the Medical Service of the French Army through the regulations on physical fitness, passed in January, 1925. No man can be exempt or discharged solely on account of alteration or loss of the teeth. The medical examination is based upon the state of general nutrition of the individual, and the coefficient of mastication, determined according to definite rules. Dental equipment of the individual is called for when this coefficient is below a minimum limit or when the general nutrition is modified by the state of the teeth. This new regulation permits the retention of a relatively considerable number of young men for service in the Army.

Charlet (France)

A Communication rendered in the name of the Friendly League of Army and Navy Dentists, was presented by Military Dentist of the Reserve, Robert Charlet, Commissaire Général of the First International Congress of Medical Aviation, under the title of "State of the Teeth and Physical Fitness of the Flying Personnel of Military Aeronautics; Bucco-Dental Indicator Charts; Practical Identification Procedure." In view of a number of considerations, such as the reaction of the pathological bucco-dental condition on the general health of the individual, more particularly the auricular, ocular and naso-laryngeal organs, as well as the facility of curing bucco-dental disease, and the necessity of protecting the flying personnel of Military Aeronautics against pathological or physiological disturbances of dental origin, it seems necessary to attach a specialized practitioner to the

medical personnel of this Force. Such practitioner should be charged with the examination of candidates for license to enter the flying personnel, and their medical supervision during their service. This adjunct should be a military dentist or a stomatologist.

The principal causes for temporary rejection consist in the following:



ONE OF THE ROOMS IN APOTHECARIES HALL, LONDON

(1) The presence of wisdom teeth in the course of abnormal development.

(2) The existence of penetrating caries (exposed or gangrenous pulps).

(3) The presence of roots capable of maintaining or provoking local irritation or infections of the vicinity.

(4) The diagnosis of specific, ulcero-membranous or suppurating gingivo-stomatitis.

Helliwell (Great Britain)

Colonel J. P. Helliwell, C.B.E., Assistant Director-General Army Medical Services (for the Dental Service), in his Communication entitled "The Relation Between Dental Disease and General Health in the Army," stated that the causes of ill health, due to preventable dental defects, come under two main headings, namely:

(a) Dental disease due to the neglect of the individual.

(b) Abnormal dental conditions arising from or aggravated by previous dental treatment.

The results of the loss of many teeth, provided the mouth is otherwise healthy, are not comparable in their gravity, with those caused by actual septic foci in the mouth. The two varieties of dental sepsis are roughly classified as "open" or "closed" sepsis, and are very frequently present in the same mouth, causing various symptoms. The author emphasizes that the definition of the particular kind of dental sepsis present in a mouth may be of considerable value for diagnostic purposes, and that it is of great importance that the exact variety of sepsis present be clearly stated. From the practical curative viewpoint, there is now a uniform system of treatment in the army, which should reduce to a minimum the ill effects of dental disease among soldiers.

Watry (Belgium)

That the dental standard should be part of the general standard of physical fitness was emphasized by Dr. F. Watry. He believes it should be modifiable for each individual and that the period of military service ought to be used to inculcate habits of oral hygiene in the personnel of all the forces.

Waggett (Great Britain)

Major E. B. Waggett, D.S.O., T.D., believes that a lower "Standard of Dental Efficiency" might be adopted; the man on campaign is better off with a denture than with gaps in his mouth. There is no serious risk of broken dentures, but small dentures are a source of great danger, as they are apt to be swallowed.

Boissier (France)

Dr. R. Boissier is of the opinion that too many extractions are made and that conservative treatment should be the ideal. In war, state necessities overrule all other considerations.

CONCLUSIONS OF THE CONGRESS

In accordance with the system as carried out at the four preceding Congresses, after the official reports and communications were read and discussed, subcommittees were formed to draw up the conclusions. These were submitted to the Permanent Committee, and after debate and necessary modification, the following were unanimously agreed upon by the entire Congress:

I

Evacuation of Sick and Wounded by Air and Water
The Rôle of the Medical Services in Combined Operations

(1) Certain passenger or cargo boats should be designed, before construction, for eventual use as hospital ships in war. The advice of representatives of the Medical Services should be sought with regard to the plans.

(2) The representatives of the Medical Services should give advice, in peace time, as to ships capable of adaptation to hospital use in time of war. The plans for their conversion and details of mobilization should be worked out by the Medical Services concerned, in consultation with competent authorities.

(3) The officer in medical charge of a hospital ship should be the Commandant of the ship and responsible to his Government, the Captain remaining in control of the navigation and the crew.

(4) Certain points in the Hague Convention, which are badly defined or indefinite, in regard to the organization of hospital ships, should be revised, with a view to clearing up the doubtful questions.

(5) The medical representatives of nations represented at the Congress, should favor the development and extension of the transport of patients by aeroplane, so that this excellent means of evacuation may both now, and in the future, be utilized to the fullest extent.

II

Tropical Fevers of Short Duration

(1) Diseases may be indefinite, because they are atypical examples of well known infections, or because they are separate, clinical entities that still await full description.

(2) The first class includes mild or abortive cases of such conditions as typhoid, paratyphoid and undulant fever.

(3) Malaria frequently shows a low continued fever, the paroxysms being absent, and the parasites so scanty in the blood, as to be easily overlooked.

(4) Abortive heat stroke may also account for some ill-defined febrile attacks, in children, and after heavy exercise, in hot climates.

(5) Dengue and phlebotomus fever are recognized as clinical entities but, owing to their lack of definite symptoms, are frequently confused with similar syndromes. Especially is this the case with influenza, which is very common in the tropics, but rarely accompanied by nasal catarrh.

(6) The blood pictures of dengue and sandfly fever are often insufficiently distinct from that of influenza, to separate, with any certainty, these diseases.

(7) Recently, spirochetes, as a cause of short fevers, have attracted attention.

(8) The leptospira, as a group, show many variants, which, although indistinguishable morphologically, yet seem able to cause clinical symptoms, which vary, from a day or two of pyrexia accompanied by injected conjunctiva and a trace of albumen in the urine, to a severe toxemic jaundice.

(9) Weil's disease, at times, probably has been recorded as dengue.

(10) The more severe forms of dengue and sandfly fever should, however, be distinguished from spirochetosis by their respective blood pictures.

(11) Weil's disease, in its turn, can generally be distinguished from yellow fever by the relative quantities of albumen in the urine. If the urine boils solid, the diagnosis is yellow fever; if there is only a trace of albumen, Weil's disease.

(12) The attempts which are being made to distinguish and describe indefinite short fevers, are handicapped and the confusion increased, by the habit, which exists in some quarters, of labelling cases in which the diagnosis is really unknown, with a definite name, for the sake of hospitals records. If a case, in spite of all possible investigation, remains a "pyrexia of unknown origin" it must be honestly left as such in all sick returns.

III

Injuries to Blood Vessels and Their Sequelae

(1) The immediate danger of wounds of blood vessels is considerable, and the mortality higher from war wounds than from similar peace time injuries.

(2) Wounds of blood vessels demand immediate treatment, administered on the spot. The tourniquet, in spite of its disadvantages,

is necessary. Further research is needed to devise a simple tourniquet, which will be effective and without danger.

(3) Surgical treatment is not simple. The nature of the lesions, and the association of other injuries, render ligature necessary in most cases. The wound must be freely opened and operative procedure adopted which favors the re-establishment of circulation and restoration of function.

(4) The ultimate prognosis must be guarded. It depends on late developments: (a) Deficient circulation with its various manifestations—trophic, functional, and vasomotor; (b) Aneurisms of different kind.

(5) The prognosis can be improved by treatment of these sequelae. (a) The treatment of functional disturbances is still the subject of research; (b) The treatment of aneurisms generally consists in resection of part of the sac, with the necessary ligatures.

Reconstructive operations and vascular suture can seldom be carried out in military surgery.

(6) The various sequelae should be studied very thoroughly in order to arrive at the percentage of disability for wounds of blood vessels.

IV

The Physical and Chemical Analyses of Glass and Rubber Articles Employed by the Medical Services

(1) The application of scientific knowledge concerning glass is, gradually, beginning to receive the full attention which it deserves.

(2) It is necessary to have tests which can be readily applied in an ordinary pharmacy. The most suitable ones, for this purpose, are the Narcotine Hydrochloride Test and Turner's Test.

(3) Glass, for laboratory articles and clinical thermometers, should be free from lead and have a pH of 5 to 8.2.

(4) The graduation of clinical thermometers should be according to the system of Celsius (Centigrade scale), and have a scale of 34°–42° marked in tenths. Only thermometers bearing an official stamp should be considered as sufficiently exact.

(5) The analysis of rubber articles should, primarily, bear relation to their physical qualities and chemical composition. It is recommended that, for the mechanical tests, the Dynamometer of Schopper be used and, for chemical analysis the "Standard Methods of the American Chemical Society."

All red rubber articles should be free from arsenic and lead.

V

The State of the Teeth in Relation to Physical Fitness in the Various Military Services

In consideration of the fact that it has been generally agreed that a relation exists between the state of the teeth and general physical fitness for service, it is desirable that:

(1) As a condition of admission to the strength of a combatant unit, a fixed dental standard should be demanded, and measures to maintain this standard be taken.

(2) In countries where conscription is general, the period of service, however short, should be utilized to continue preventive work and popularize instruction in dental hygiene.

Supplementary Notes

Exhibition of Service Medical Equipment

The new extension of the British Medical Association House was used for the exhibition of Service medical equipment, and of drugs, surgical instruments, dressings, and medical books. This was visited with deep interest by those who attended the Congress, and many practical points were noted.

Representation on International Commission for the Standardization of Medical Equipment

In order to establish a liaison between the International Congress of Military Medicine and Pharmacy and the International Commission for the Standardization of Medical Equipment, it was proposed and unanimously carried, that the Secretary General of the Permanent Committee of the Congress become a member of the Commission. This has already become effective, and Secretary-General Voncken will represent the Congress at the coming meeting of the Commission in July 1930, at Liege. Thus, through the International Bulletin, military medical officers can be kept in touch with the work of the Commission.

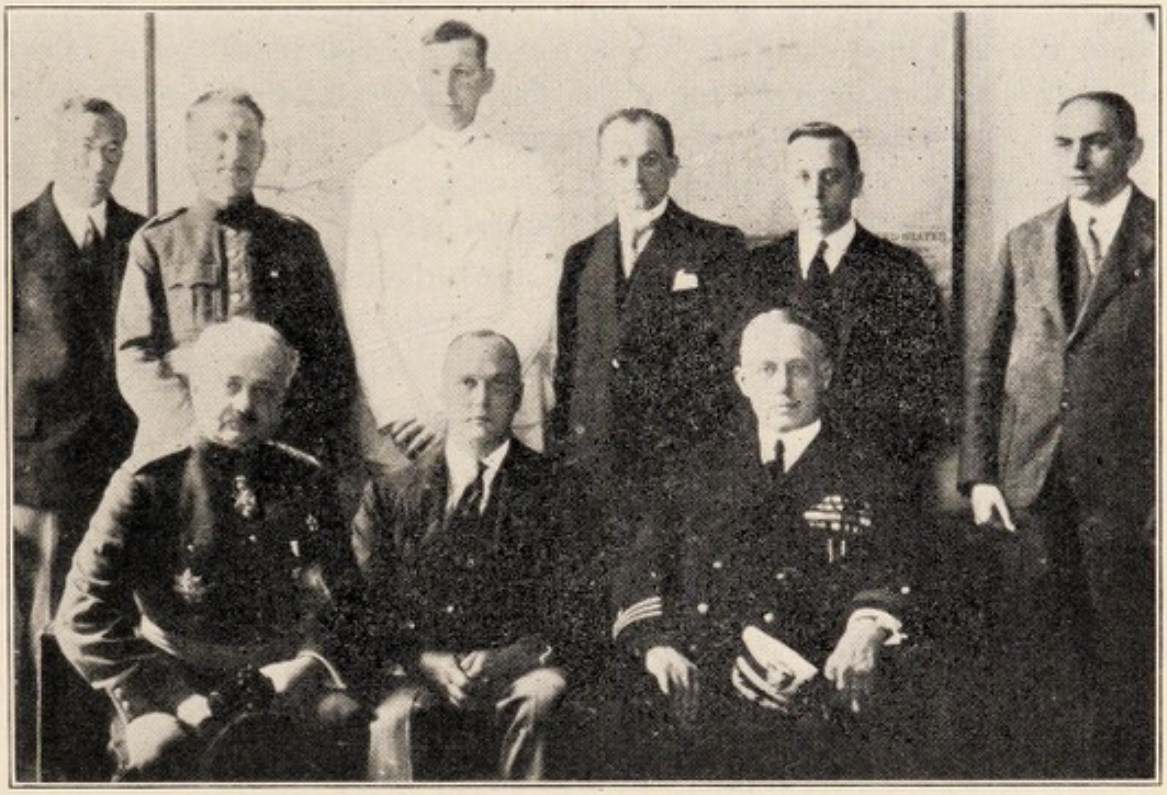
Suggested Change of Name of Congress

It was proposed by the Dental Section that, as the Medical Services of most countries, consist of Medical Officers, Pharmacists, Dentists, and Officers of Administration, the official name of the Congress be changed to International Congress of Military Medicine. Definite action was not taken in regard to this proposal, but is to be considered

by the Permanent Committee and reported upon at the Budapest conference.

Tours

About four hundred members of the Congress, divided into groups, visited Aldershot and looked into the various phases of military medi-



Following the meetings of the Congress, the American member of the Permanent Committee, acting as Representative of the Association of Military Surgeons of the United States, went to Prague and presented Surgeon General L. Fisher, of Czechoslovakia with the medal of the Association to which he had been elected to Honorary Membership.

Seated, left to right, are General Fisher, Commander Gittings, Secretary of the Legation of the United States, representing the Minister, who was absent, and Commander Bainbridge. In the rear are the other members of the Legation Staff.

cine and hygiene there. They went through the Royal Army Medical Corps Depot, the Cambridge Hospital (360 beds), the Army School of Hospital Cookery, Army School of Hygiene, where various disinfector and sterilization models were demonstrated, Mons Barracks, considered the most modern type in the Command, and the Supply Depot. Every facility was afforded the visitors by the authorities in charge.

In Portsmouth, visited by about five hundred members, an "action" was staged on H.M.S. "Hood," to show the Naval methods of dealing with the wounded. The guns were manned by their crews and rapid firing was carried out. "Enemy shells" caused many "casualties." First Aid was rendered and the men were removed from

the decks by the stretcher parties. A demonstration was given of the method of evacuating stretcher and cot cases from the ship to an ambulance boat alongside, for transfer to a hospital or hospital ship.

The delegates were most appreciative of the opportunity of visiting H.M.S. "Victory," Nelson's historic flagship.

The very interesting Royal Air Force School of Technical Training for Apprentices, at Halton was seen by about five hundred of the men, divided into groups. There are some 2,500 boys at the school who, in addition to receiving a general education, are taught mathematics, mechanics, and applied science.

Preparation for Sixth Congress, Budapest, 1931

It was decided and carried out, that the Secretary of the Permanent Committee, Major Voncken, and one of its members, Commander Bainbridge, were each to visit certain countries in Europe to complete the work of the London Congress, and to interest them in sending good sized delegations to the Sixth Congress to be held in Budapest in 1931. The American delegate held conferences with the heads of States or chiefs of the Medical Services, of seventeen nations.

On arriving in Poland a trip was made to the Posen Exhibition, in celebration of the tenth anniversary of the rebirth of Poland as an independent nation. Thousands of school children, from every part of Poland, were guided through the exhibition grounds and saw the achievements of their country and its progress in the last decade. In Warsaw, a conference was had with Surgeon-General Rouppert, President of the Fourth Congress, who will send a strong Polish representation to Budapest.

While in Poland, Commander Bainbridge acceded to the request of the Polish American Chamber of Commerce and other organizations, and delivered an address at the memorial services in honor of the fallen American members of the Kosciuszko Squadron, who died in defence of Poland, in 1920.

At Kaunas, Lithuania, General Nagevicius, the Surgeon-General, was most interested and helpful. He promised to send a delegation to the 1931 Congress and may head it, himself.

In Riga, Latvia, Surgeon-General Snikers escorted the American delegate to the hospitals for the war wounded and others of the Lettonian Army and Navy, for inspection. The sulphur and mud baths in this country are very remarkable. General Snikers, the Lettish delegate to London, will endeavor to have a larger representation from his country, in Budapest.

Surgeon-General Arthur Lossmann, of Estonia, delegate to the London Congress, and other officials, escorted the American member of the Permanent Committee to the Minister of War, who was most cordial. The Army Hospital at Tallinn, the Military School for officers, etc., were visited with much interest. A delegation will go from here to Budapest, for the next Congress.

Colonel Ollonquist and Major Leiri, acting for their chief, Colonel Luukkonen, who was seriously ill, were most helpful in Finland, and will assist in arranging for their country's representation in Budapest.

Visits were made to the Military Hospitals and other institutions. There is a great deal of tuberculosis in this country and experts are endeavoring to discover the cause. High on a hill, one of the largest and most up-to-date tuberculosis hospitals has been erected. A very active organization in Finland is the "Lotta-Svaerd" composed of the thinking women of the country, banded together, quietly working for the stability of their land. This organization really acts as a liaison between the civilian population and the leaders of the State, Army, and Navy. The members take courses in nursing, cooking, secretarial work, etc., so that, in the event of war, they may act as an auxiliary force.

In Prague, at the American Legation, Commander Bainbridge, representing the Association of Military Surgeons of the United States, presented Surgeon-General of Czechoslovakia, General Ludvik Fisher, with the Badge of the Association, in which he had been given Honorary Membership. General Fisher inaugurated the Czechoslovakian Medical Corps, consisting, at the present time, of nineteen hospitals and seven spas. Born a Czech and educated abroad, he practiced in Chicago for a number of years and became a citizen of the United States. However, he relinquished this in order to be of help to the new Czechoslovakian Republic. Because of his activities, Austria put a price on his capture, though, later, the Republic of Austria, gave him a high decoration. He will arrange for a representative delegation for Budapest.

Colonel Barcsai was actively at work when seen in Budapest. Many points were discussed and plans suggested for 1931, based upon the experience of the five preceding Congresses.

Other countries visited promised active cooperation; for the first time, Germany will send a delegation. In all the countries every courtesy was extended and the authorities were alive to the importance and influence of the Congress. A large and impressive gathering seems assured for Budapest.

First International Congress of Sanitary Aviation, Paris, May, 1929

The meetings were attended by many who were at the London Congress, including a few of the American delegates, who went as official representatives of the Association of Military Surgeons of the United States. The following questions were discussed.

1. Sanitary Aviation on the Exterior Theater of Operations.
2. Sanitary Aviation to the Colonies.
3. Sanitary Aviation in Naval Warfare.
4. Sanitary Aviation; Means of Evacuation in Time of War.
5. Immunity of Sanitary Aviation During War.
6. Physiologic Conditions for Air Transport.
7. Considerations in Regard to the Treatment of the Sick and Gravely Wounded During Transportation by Air.
8. Sanitary Aviation in Time of Peace.
9. Material for Sanitary Aviation.

Memorial services were held at the Val de Grâce for Colonel Robert Picqué, who was a leader in Sanitary Aviation, and who lost his life while on duty. Colonel Barcsai of Hungary, representing the International Congress of Military Medicine and Pharmacy, delivered a stirring address on this occasion.

Congress of the Royal Institute of Public Health, Zurich, May, 1929

Colonel Gilbert E. Seaman, Colonel E. E. Hume, Colonel Francis E. Fronczak and Commander Wm. Seaman Bainbridge, of the American Delegation to the London Congress, were the official representatives of the Association of Military Surgeons of the United States, at the Thirty-Third Congress of the Royal Institute of Public Health, Zurich, May, 1929. Most of the meetings were held in the University of Zurich. The many important papers and discussions covered State Medicine and Municipal and Social Hygiene; Industrial Hygiene and Industrial Diseases; Child Welfare, School Hygiene and Women and Public Health; Bacteriology, Pathology and Biochemistry; Tuberculosis, Climatology and Sports Hygiene; Veterinary Medicine and Meat Hygiene.

The complete report of this Congress, when published, will be a most valuable addition to the literature on Public Health.

Miscellaneous—London Congress

The members of the Permanent Committee and the heads of delegations were graciously received by H.R.H. the Prince of Wales, for H.M. King George V, who was seriously ill at the time. They

were presented, in the Throne Room, by the Secretary of State for War, Sir Laming Worthington-Evans, Bart., M.P.

On the evening of the opening of the Congress a dinner was tendered, by special invitation from the Government, to the heads of delegations, the members of the Permanent Committee, and distinguished visitors. Speeches were made by the Secretary of State for War, General Rouppert (Poland), and Général Médecin Demolder (Belgium).

A reception and banquet, which proved to be magnificent ceremonial functions, were given by the Lord Mayor and Corporation of the City of London, in honor of the Congress, in the historic Guildhall. About seven hundred guests were present. An inspiring address was delivered by Lord Moynihan, President of the Royal College of Surgeons of England, who gave the following figures in regard to the medical services of the British Army in France during the World War.

Total wounded	1,983,748	
Wounded returned to duty	1,602,033	(80.7 per cent)
Total sick	3,494,165	
Sick returned to duty	3,260,056	(93.3 per cent)
Sick and wounded returned to duty	4,862,089	

Responses were made by Médecin Général Inspecteur Lanne (France), Colonel Gilbert E. Seaman (United States of America), and General Umberto Riva (Italy).

Sir John Rose Bradford, K.C.M.G., C.B., F.R.S., President of the Royal College of Physicians of London and Lady Bradford, held a reception in honor of the delegates, as did Lord Moynihan, President of the Royal College of Surgeons of England, and Lady Moynihan. The delegates were very graciously received and were shown many interesting features of scientific value, as well as beautiful works of art, on these two occasions.

The delegates had an opportunity to view the laboratories of the Royal Army Medical College, as well as its museums and library. Much interest was shown in the special pathological and hygiene exhibit.

A visit was also paid to the Royal Hospital, Chelsea, where army pensioners are treated. Old veterans of many wars are accommodated here.

The Wellcome Historical Medical Museum, where the delegates were received by Dr. C. M. Wenyon, C.M.G., C.B.E., F.R.S., in the absence of Dr. Henry S. Wellcome, F.S.A., was of particular interest from the standpoint of medical history. Specimens, bearing on the

history of medicine, are collected here from all parts of the world, dating back to the earliest times. On behalf of the delegates and members of the Congress, Major-General Sir John Moore, K.C.M.G., C.B., F.R.C.V.S., and Commander Wm. Seaman Bainbridge of the United States Naval Reserve, expressed thanks for their cordial reception.

The Society of Apothecaries of London entertained a number of the principal delegates and the members of the Permanent Committee, at a luncheon given at the Apothecaries' Hall, Blackfriars. The Master of the Society, Lieutenant-Colonel C. Samman, after welcoming the guests, gave a brief history of the Society. It obtained its Charter from James I and its particular duty was to test and qualify the practitioners of medicine, to manufacture drugs of the highest purity, and to inspect those sold by others. It is now devoting its energies to the advancement of medicine. Major General Tobia (Italy) and Commander Bainbridge (U. S. of America) expressed the thanks of the delegation for the hospitality received.

The British Dental Association, and the Pharmaceutical Society of Great Britain, entertained, respectively, the dentists and pharmacists who attended the Congress.

The Ladies' Committee arranged most attractive programmes for the ladies who accompanied the delegates and members. Visits were made to all centers of interest, receptions were held in their honor, and extensive plans were made for their enjoyment.

Most interesting lectures were given by Major Ian Hay Beith, C.B.E., M.C., and Sir Philip Gibbs, K.B.E., the former on "The English Sense of Humor," and the latter on "Experiences of an Official War Correspondent: The Psychology of War."

A pamphlet, dedicated to the Royal Army Medical Corps, in which a real tribute is paid to the British Medical profession, was presented during the Congress, by Lieutenant-Colonel A. Casarini, Italian Military Medical Service, Editor of the Italian Journal of Military Medicine. The article was entitled "La Signora dalla Lampada (Florence Nightingale).

It is difficult to say which particular person, group, or section, made for the remarkable success of London Congress. Rather, the coordination of all, the ability and graciousness of the President, the energetic and almost superhuman activities of the Organization Committee Secretary, Major Stirling, the excellent work of the different Subcommittees, were the factors that resulted in the brilliant outcome. Praise and appreciation are due all who worked so zealously for the

Congress and showed such whole-hearted hospitality to the strangers who came in their midst, to bring their offerings, and to receive the result of the experience of those who joined with them at the conference.

The motivating factor in these gatherings is the union of the nations in the ceaseless fight against disease, suffering, and death. It is a clarion call to service, a field of practical usefulness, a definite step on the ladder of progress for the aid of all humanity.

ALPHABETICAL LIST OF CONTRIBUTORS

Alarcon, Enrique Puertas—Pharmacist of the Spanish Army. (Spain)

Bauer, Fritz—Major-General, Director-General of Medical Services of the Swedish Army. (Sweden)

Blanchard—Médecin Lieutenant-Colonel of Colonial Troops, Professor at the School of Application of the Sanitary Service of the French Colonial Troops. (France)

Boissier, R.—Doctor. (France)

Botreau-Roussel—Professor, Médecin Lieutenant-Colonel of Colonial Troops at the School of Application of the Medical Service of the Colonial Troops. (France)

Bruère—Pharmacien Colonel. (France)

Caccia, Filippo—Colonello Medico. (Italy)

Caries—Doctor, Médecin Commandant of Colonial Troops, Chief of Stomatological Service in the School of Application of the Medical Service of the Colonial Troops. (France)

Cazanove—Médecin-Lieutenant Colonel of Colonial Troops. (France)

Charlet, Robert—Military Dentist of the Reserve, Commissaire Général of the First International Congress of Medical Aviation. (France)

Clark, J. M.—Doctor, Captain Dentist of the Cuban Army. (Cuba)

Colbran, C. L.—Lieutenant-Colonel, Royal Army Dental Corps (Temp. Wing Commander, R.A.F.) (Great Britain)

Cristau—Médecin Commandant. (France)

Courbin—Doctor, Physician to the Bordeaux Hospitals. (France)

de Fourmestraux—Médecin Lieutenant Colonel, Surgeon to the Hôtel Dieu of Chartres. (France)

De La Cour, G.—Colonel, O.B.E., M.B. (Great Britain)

Dudley, S. F.—Surgeon-Commander, O.B.E., M.D., D.P.H., R.N. (Great Britain)

Elder, A. Vavasour—Surgeon-Commander, D.S.C., R.N.V.R. (Great Britain)

Fabicki, J.—Doctor of Pharmacy. (Poland)

Fredét—Médecin Lieutenant, Surgeon to the Hôtel Dieu of Chartres. (France)

Garofalo, Francesco—Doctor, Assistant in Clinical Surgery, University of Bologna. (Italy)

Gerards, J. C.—Médecin-Officier de 1ère classe. (Dutch Indies)

Gomez, Joaquin Sanchez—Lieutenant Commander, Medical Corps, Royal Spanish Navy. (Spain)

Helliwell, J. P.—Colonel, C.B.E., Assistant Director-General Army Medical Services (for the Dental Service). (Great Britain)

Hooper, F.—M.B.E., Head Pharmacist and Technical Assistant to the Medical Director-General of the Royal Navy. (Great Britain)

Latowski, M.—Lieutenant-Colonel, Chief Surgeon of the First Military Hospital Marshal Piłsudski. (Poland)

Leo, G.—Médecin Commandant of the Reserve. (France)

Levit, J.—Doctor, Lieutenant-Colonel, Professor. (Czechoslovakia)

MacArthur, W. P.—Lieutenant-Colonel, D.S.O., O.B.E., M.D., F.R.C.P.I., R.A.M.C. (Great Britain)

MacCallan, A. F.—C.B.E., M.D., Cambridge, F.R.C.S., (formerly Major R.A.M.C.), Assistant Ophthalmic Surgeon Westminster Hospital, Assistant Surgeon Royal Eye Hospital. (Great Britain)

Maisonnet—Médecin-Commandant, Professor at the Val de Grâce, Paris. (France)

Maiz, Luis Eleizegui—Major-Pharmacist of the Spanish Army. (Spain)

Manoussakis, E.—Chief of the Epidemiological Service of the Athens Garrison, Physician in charge of the Military Teaching Hospital in Athens. (Greece)

Moreau—Pharmacien Colonel. (France)

Oudard—Médecin en Chef de 1ère classe de la Marine Nationale. (France)

Pagniello, A.—Doctor, Tenente Colonello Professor, Director of the Military Chemico-Pharmaceutic Institute in Turin. (Italy)

Parvulescu—Doctor, Médecin Colonel of the Roumanian Army. (Roumania)

Pikulski, A.—Lieutenant, Master of Pharmacy. (Poland)

Popawski, W.—Lieutenant-Colonel Pharmacien Chimiste. (Poland)

Roch, H. S.—Colonel, C.M.G., C.B.E., D.S.O. (Great Britain)

Sacquépée—Médecin Général. (France)

Sagajllo, M.—(Poland)

Saint-Sernin, Albert—Pharmacien Chimiste en Chef de 1ère classe, Chief of the Pharmaceutic and Chemical Services of the French Navy. (France)

Saito, Tsutoma—Surgeon-Captain. (Japan)

Schickelé—Médecin Lieutenant-Colonel de l'Armée Metropolitaine. (France)

Smith, F. Lewis—Surgeon-Commander, O.B.E., Royal Navy. (Great Britain)

Stabholz, Henri—Surgeon to the Military Hospital in Kielce. (Poland)

Stephens, H. E. R.—Surgeon-Commander, O.B.E., M.B., F.R.C.S., R.N. (Great Britain)

Thomann—Colonel, Pharmacien en Chef of the Swiss Army in Berne. (Switzerland)

Tuffier, Theodore—Doctor. (France)

Voncken, Jules—Major Médecin of the Belgium Army. (Belgium)

Walther, Paul—Médecin Lieutenant of the Reserve. (France)

Waggett, E. B.—Major, D.S.O., T.D. (Great Britain)

Watry, F.—Doctor. (Belgium)

Wells, Hardy V.—Group Captain, C.B.E., K.H.P., R.A.F. (Great Britain)

Whittingham, H. E.—Wing Commander, R.A.F. (Great Britain)

Wood, J. T.—Surgeon Lieutenant-Commander (D.) Royal Navy. (Great Britain)

Woods, H. S.—Captain, Army Dental Corps. (Great Britain)

Yahoub—Doctor, Surgeon to Constantinople Hospitals. (Turkey)