

**Report on fourth International Congress of Military Medicine and Pharmacy
: Warsaw, Poland, May-June, 1927 / by William Seaman Bainbridge.**

Contributors

Bainbridge, William Seaman, 1870-1947.
International Congress of Military Medicine and Pharmacy 1927 : Warsaw,
Poland)

Publication/Creation

Menasha, Wis. : Collegiate Press, George Banta Publishing, [1927?]

Persistent URL

<https://wellcomecollection.org/works/k4pypc2j>

License and attribution

Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).

**wellcome
collection**

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

REPORT ON FOURTH INTERNATIONAL
CONGRESS OF MILITARY MEDICINE AND
PHARMACY, WARSAW, POLAND
MAY-JUNE, 1927

BY

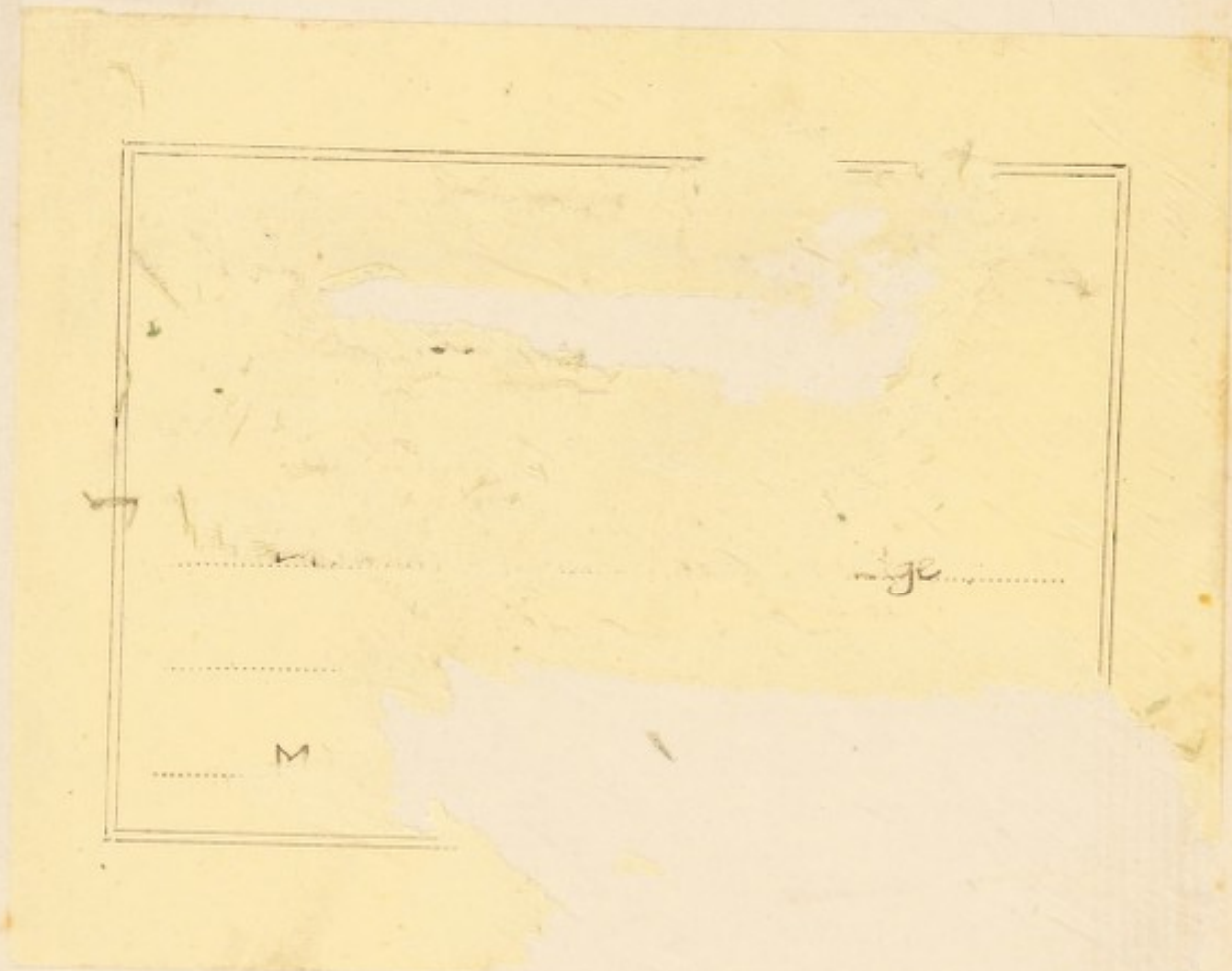
WILLIAM SEAMAN BAINBRIDGE

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

M:
WB3
1927
I61R

M
24788


Dup



M24788



22101898880



Digitized by the Internet Archive
in 2018 with funding from
Wellcome Library

<https://archive.org/details/b29931435>

REPORT ON

Fourth International Congress
of Military Medicine
and Pharmacy

Warsaw, Poland, May-June, 1927

BY

COMMANDER WILLIAM SEAMAN BAINBRIDGE, M.C.-F.
United States Naval Reserve

Member of Permanent Committee
Delegate from the United States

The Collegiate Press
GEORGE BANTA PUBLISHING COMPANY
MENASHA, WISCONSIN

14 730 806

FOREWORD

THERE has been always a bond of sympathy between the Polish and the American peoples dating from the help which Kosciuszko and Pulaski brought to our Revolutionary Army, and therefore the meeting of the Fourth International Congress of Military Medicine and Pharmacy at Warsaw was of special interest to us. It was a satisfaction to us that our country and The Association of Military Surgeons should be represented there by five official delegates. One of these was Commander William Seaman Bainbridge who is also a member of the Permanent Committee of the Congress and has made us his debtor by editing and publishing this full report of the Proceedings of the Congress which constitutes an important addition to the literature of military medicine.

M. W. IRELAND, *Major General*
Surgeon General, U. S. Army
President, The Association of Military
Surgeons of the U.S., 1926-1927.



| | |
|----------------------------|----------|
| WELLCOME INSTITUTE LIBRARY | |
| Coll. | welM0mec |
| Call | |
| No. | M: |
| | WB3 |
| | 1927 |
| | I61r |

M 24788

12619

TABLE OF CONTENTS

| | |
|---|----|
| INTRODUCTION | 1 |
| RULES OF THE FOURTH CONGRESS | 2 |
| LOCAL OFFICERS OF THE CONGRESS | 3 |
| LIST OF FOREIGN OFFICIAL DELEGATES | 5 |
| PROGRAM OF THE FOURTH CONGRESS | 16 |
| INAUGURATION OF THE CONGRESS | 18 |
| PERMANENT COMMITTEE MEMBERS | 20 |
| MEETINGS OF THE PERMANENT COMMITTEE | 21 |

SUBJECTS REPORTED UPON AT THE CONGRESS:

I. EVACUATION IN MOVING WARFARE (OFFICIAL REPORTS):

| | |
|--|----|
| Report by Médecin-Major Carlos Eugenio Guimaraes (Brazil) | 23 |
| Report by Lieutenant-Colonel Dr. Garbowski and Medical Commander Zawadowski (Poland) | 44 |

COMMUNICATIONS

TERRITORIAL INFLUENCE IN MOVING WARFARE.

| | |
|---|----|
| By Médecin Principal de 1 ^{ère} Classe Dr. Spire, Medical Chief of the War High School, Paris (France) | 60 |
|---|----|

THE QUESTION OF THE STRETCHER IN LONG DISTANCE EVACUATIONS IN MOVING WARFARE.

| | |
|--|----|
| By Médecin Principal de 2 ^{ème} Classe Schickele, of the French Army (France) | 61 |
|--|----|

EVACUATION IN THE WAR OF MOVEMENT IN MOUNTAINOUS AREAS.

| | |
|---|----|
| By Colonnello Medico Dr. Prof. Caccia, Director of the Military Hospital in Bologna (Italy) | 63 |
|---|----|

EVACUATIONS IN MOVING WARFARE AND TERRITORIAL OBSTACLES.

| | |
|---|----|
| By Lieutenant-Colonel Médecin Dr. Nadolski, of the Polish Army (Poland) | 64 |
|---|----|

EVACUATIONS BY SEA IN MOVING WARFARE.

| | |
|---|----|
| By Médecin Chef de 1 ^{ère} Classe of the French Navy, Professor of Clinical Surgery, Dr. Oudard (France) | 66 |
|---|----|

AN IMPROVISED MOTOR FUEL

| | |
|---|----|
| By Pharmacien-Chimiste en Chef de 2 ^{ème} Classe, of the Navy, Saint-Sernin (France) | 68 |
|---|----|

MONOGRAPH ON THE DISCREPANT STRETCHER.

| | |
|---|----|
| By Capitaine Pharmacien of the Belgian Army, Henry Disery (Belgium) | 68 |
|---|----|

DISCUSSIONS

| | |
|--|----|
| Major General H. P. W. Barrow (Great Britain)..... | 69 |
| Colonel Professor Dr. Salim Tewfik (Turkey)..... | 70 |
| Lieutenant Dr. Victor Anastasiu (Roumania)..... | 70 |
| Vice-Marshal D. Munro (Great Britain)..... | 71 |
| Médecin-Principal Spire (France)..... | 72 |

| | |
|--|-----|
| II. ETIOLOGY AND PROPHYLAXIS OF INFLUENZA (OFFICIAL REPORTS): | |
| Report by Médecin-Aide Major Jurgens (Denmark) | 72 |
| Report by Colonel Dr. Leon Karwacki, Adjunct Professor in the University of Warsaw (Poland) | 85 |
| COMMUNICATIONS | |
| ETIOLOGY OF INFLUENZA. | |
| By Médecin Colonel of the Roumanian Army, Dr. V. Panaitescu (Roumania) | 98 |
| TUBERCULOSIS REACTION IN INFLUENZA PATIENTS. | |
| By Medical Lieutenant Stanislas Lakmunt, and Medical Lieutenant Anatole Niemyski, of the Polish Army (Poland) | 100 |
| WHITE BLOOD CORPUSCLES IN INFLUENZA. | |
| By Stanislas Lakmunt and Anatole Niemyski (Poland) | 101 |
| THE VIRUS OF INFLUENZA. | |
| By Professor Dr. O. Bujwid (Poland) | 103 |
| ON THE ETIOLOGY OF INFLUENZA. | |
| By Lieutenant-Colonel Dr. Leon Owezarewicz, Military School of Sanitary Service (Poland) | 104 |
| ETIOLOGY AND PROPHYLAXIS OF INFLUENZA. | |
| By Medical Inspector E. Saquepee, Permanent Inspector of the Hygienic and Epidemiological Services of the French Army (France) | 106 |
| CONSIDERATIONS ON THE EPIDEMIOLOGY AND PROPHYLAXIS OF INFLUENZA. | |
| By Médecin-Principal of the Reserve, Professor in the Marseilles Medical School, Dr. S. Costa (France) | 107 |
| VACCINE PROPHYLAXIS OF INFLUENZA. | |
| By Professor Jean Minet, Médecin-Major de 1 ^{ère} Classe of the Réserve, and Dr. A. Benoit, Médecin Aide Major de 1 ^{ère} Classe de Réserve (France) | 108 |
| MOBILIZATION PLAN AGAINST EPIDEMICS. | |
| By Médecin-Major de 2 ^{ème} Classe of the Réserve R. Dujarric de la Riviere, Laboratory Chief of the Pasteur Institute, Auditor to the Superior Council of Public Hygiene of France (France) | 109 |
| FILTERABILITY OF THE PFEIFFER BACILLUS. | |
| By R. Dujarric de la Riviere (France) | 110 |
| INFLUENZA AND DIPHTHERIA. | |
| By P. Lereboullet, Adjunct Professor of the Medical Faculty of Paris, Physician to the Children's Hospital (France) | 111 |
| INFLUENZAL ENERGY. | |
| By Médecin Inspecteur Ch. Dopter, Director of the Val-de-Grâce, and Médecin-Major de 2 ^{ème} Classe H. Jausion, Adjunct Professor at the Val-de-Grâce (France) | 113 |

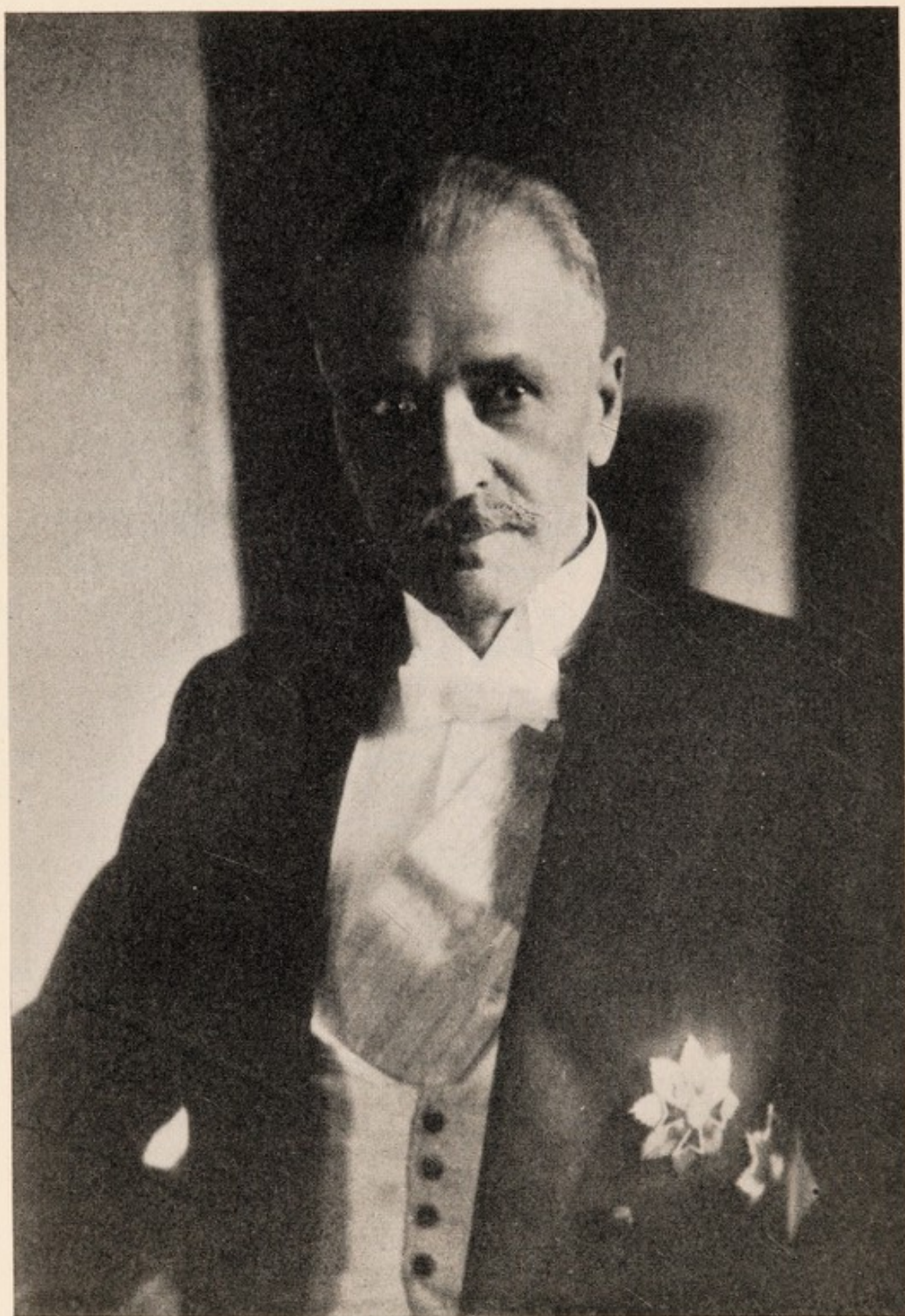
| | |
|---|-----|
| PROPHYLACTIC TREATMENT OF THE COMPLICATIONS OF INFLUENZA. By Médecin-Major de 1 ^{ère} Classe Guibert, Physician to the Military Hospitals, Physician in charge of the Begin Military Hospital, Paris (France) | 114 |
| RULES FOR PROPHYLACTIC PURPOSES. By Richard Erhardt, of Stockholm (Sweden) | 115 |
| ANATOMICAL CHANGES IN EPIDEMIC INFLUENZA. By Dr. J. Olbrycht, Professor Pathologist of the Military Hospital in Cracow (Poland) | 115 |
| THE ETIOLOGY AND PROPHYLAXIS OF INFLUENZA. By Julio R. Garino, Director of the Sanitary Service of the Argentine Army (Argentina) | 117 |
| PROPHYLAXIS OF INFLUENZA. By Colonel Professor Dr. Salim Tewfik (Turkey) | 118 |
| THE UTILITY OF A PERMANENT MEDICO-BIOLOGICAL SECTION FOR INFLUENZA. By Colonel Dr. Vandremmer (France) | 118 |
| NEURALGIC AND ASTHENIC INFLUENZA. By Dr. Richard Hertz, of Warsaw (Poland) | 119 |
| THE PROPHYLAXIS OF INFLUENZA BY ACTIVE IMMUNIZATION. By Colonel Thomann, of Berne (Switzerland) | 120 |
| ETIOLOGY AND PROPHYLAXIS OF INFLUENZA. By Colonel Gilbert E. Seaman (United States of America) | 121 |
| ETIOLOGY AND PROPHYLAXIS OF INFLUENZA. By Major General D. Harvey, Director of Pathology (Great Britain) | 121 |
| INFLUENZA IN THE AMERICAN ARMY DURING THE WORLD WAR. By Colonel Edgar Erskine Hume, United States Army (United States of America) | 122 |
| III. SEQUELAE OF TRAUMATISMS OF THE SKULL AND THEIR TREATMENT (OFFICIAL REPORTS): | 124 |
| NERVOUS, NEUROTIC AND PSYCHIC SEQUELAE OF CRANIO-CEREBRAL TRAUMATISMS AND THEIR TREATMENT. By Dr. Papastratigakis, Past Chief of the Military Neuro-psychiatric Centre, Athens; Physician of the Reserve, and Dr. Aisopos, Médecin-Major of the Army, Chief of the Athens Surgical Center (Greece) | 126 |
| ACTUAL SURGICAL SEQUELAE OF CRANIAL TRAUMATISMS AND THEIR TREATMENT. By Professor R. Weglowski, Médecin-Principal Commandant of the Sixth Regional Hospital in Lwow (Poland) | 144 |
| COMMUNICATIONS THE SEQUELAE OF TRAUMATISMS OF THE SKULL, AND THEIR TREATMENT. Report By Médecin Major 1 ^{ère} Classe, Professor Maisonnnet, of the Val-de-Grâce (France) | 170 |

| | |
|---|-----|
| Report By Medical Inspector Rouvillois, Director of the Sanitary Service of the Tenth Army Corps, Past Professor of War Surgery at the Application School Val-de-Grâce (France) | 172 |
| THE REMOTE RESULTS OF THE TREATMENT OF PREMATURE CEREBRAL HERNIAS FOLLOWING WOUNDS BY SHELL SPLINTERS. | |
| By Médecin-Major de 1 ^{ère} Classe of the Reserve R. Leriche, Professor of Clinical Surgery of the Medical Faculty of Strasbourg (France) | 174 |
| THE REMOTE RESULTS OF WOUNDS OF THE SKULL. | |
| By Médecin-Major of the Reserve, H. Billet, Professor of the Free Medical Faculty of Lille (France) | 175 |
| THE SURGICAL TREATMENT OF THE SEQUELAE OF CRANIO-CEREBRAL TRAUMATISMS. | |
| By Médecin Principal de 2 ^{ème} Classe Weitzel, Consulting Surgeon of the French Army on the Rhine (France) | 178 |
| THE REMOTE SEQUELAE OF CRANAL WOUNDS. | |
| By Médecin-Major de 1 ^{ère} Classe, Lacaze, Adjunct Professor at the Val-de-Grâce (France) | 178 |
| LARGE INTRACEREBRAL CYST TEN YEARS AFTER A PENETRATING WOUND OF THE BRAIN. | |
| By Médecin-Major Courboules, Adjunct Professor at the School of Military Sanitary Service (France) | 178 |
| GRAVE DELAYED COMPLICATIONS OF A CRANIO-CEREBRAL WOUND BY A SHELL SPLINTER. | |
| By Médecin-Major de 1 ^{ère} Classe Dr. H. Gabrielle, Adjunct Professor at the Val-de-Grâce, Adjunct Professor of the Lyon Faculty, Surgeon to the Military Teaching Hospital of Desgenelles (France) | 179 |
| PHYSIOPATHIC DISTURBANCES FOLLOWING UPON CRANIO-FACIAL TRAUMATISMS. | |
| By Médecin-Major de 1 ^{ère} Classe G. Worms, Professor at the Val-de-Grâce (France) | 181 |
| FRACTURES OF THE SKULL AND PARALYSIS OF THE THIRD PAIR. | |
| By Médecin de 1 ^{ère} Classe of the Reserve A. Cantonnet, Ophthalmologist to the Beaujon Hospital in Paris (France) | 182 |
| CEREBRO-SPINAL HYPERTENSION IN CONTUSIONS OF THE SKULL. | |
| By A. Cantonnet (France) | 183 |
| OCULAR SENSORY SEQUELAE OF SKULL FRACTURES BY PROJECTILES. | |
| By Médecin-Major Bertein, Adjunct Professor at the Military School of Sanitary Service (France) | 184 |
| RESULTS OF CRANIAL TRAUMATISMS AND THEIR TREATMENT. | |
| By Colonnello Medico Director Dr. Professor Filippo Caccia, Lecturer on Traumatology (Italy) | 186 |
| CLINICAL AND MEDICO-LEGAL COMMENTS ON THE DELAYED SYNDROMES OF CRANIO-ENCEPHALIC WAR LESIONS. | |

| | |
|---|-----|
| By Tenente Colonnello Medico Professor G. Giarrusso, Clinical Instructor in Nervous and Mental Diseases (Italy) | 186 |
| SEQUELAE OF CRANIAL TRAUMATISMS AND THEIR TREATMENT. | |
| By Médecin Général M. Butoianu, Professor of the Jassy Medical Faculty, Chief of the Military Hospital "Regina Elicebeta," and Médecin-Major C. Stoian, attached to the First Surgical Service (Roumania) | 188 |
| THE MEDICO-LEGAL INTEREST OF DELAYED SEQUELAE OF CRANIAL WOUNDS. | |
| By Médecin-Major de 1 ^{ère} Classe, Fribourg-Blanc, Adjunct Professor at the Val-de-Grâce (France) | 189 |
| STUDY OF THE CAUSES AND PATHOGENESIS OF TRAUMATIC EPILEPSY. | |
| By Médecin Aide-Major de 1 ^{ère} Classe of the Reserve P. Behague, former Adjunct Chief of Clinic of Diseases of the Nervous System in the Medical Faculty of Paris (France) | 189 |
| SOME ANATOMO-CLINICAL CONSIDERATIONS ON THE REMOTE RESULTS OF CRANIAL WOUNDS. | |
| By Médecin-Major de 1 ^{ère} Classe of the Reserve G. Guillain, Professor of Nervous Diseases in the Medical Faculty of Paris, and Médecin Aide-Major de 1 ^{ère} Classe Y. Bertrand, Laboratory Chief of Nervous Diseases in the Medical Faculty of Paris (France) | 192 |
| REMOTE NERVOUS SEQUELAE OF CRANIAL TRAUMATISMS. | |
| By Médecin-Principal 2 ^{ème} Classe of the Reserve O. Cruzon, Physician to the Saltpetriere, Paris (France) | 194 |
| SYNDROMES OF CEREBRAL CONCUSSION, CONTUSION AND EMOTION IN WAR PATHOLOGY. | |
| By Dr. Andre Leri, Adjunct Professor of the Medical Faculty, Physician to Saint Louis Hospital, Paris (France) | 195 |
| PLASTIC OPERATIONS IN LESIONS OF THE SKULL. | |
| By Professor Dr. Leon Krynski (Poland) | 198 |
| SEQUELAE OF TRAUMATIC LESIONS OF THE SKULL. | |
| By Thaddeus Ostrowski, Professor of the Lwow Faculty (Poland) | 199 |
| REMOTE RESULTS OF CRANIAL AND CEREBRAL TRAUMATISMS. | |
| By Henri Higier, of Warsaw (Poland) | 201 |
| WOUNDS OF THE HEAD, WITH RESPECT TO THE EYE. | |
| By Dr. Edmund Rosenhauch (Poland) | 203 |
| SOME ASPECTS OF THE SYMPTOMATOLOGY OF THE OUTCOME OF CRANIO-CEREBRAL WOUNDS. | |
| By Dr. Virginio de Bernardinis, Maggiore Medico, of the Rome Military Hospital (Italy) | 206 |
| DISCUSSIONS | |
| Médecin Major Maisonnet (France)..... | 206 |
| Médecin Major Constantin Papastratigaskis (Greece)..... | 206 |
| Dr. Koelichen..... | 207 |

| | |
|---|-----|
| Lieutenant Colonel Fazil Halid, Chief Surgeon of the Military Hospital (Turkey)..... | 207 |
| IV. THE ARSENOBENZOLS: METHODS OF ANALYSIS AND CHEMICAL DETERMINATION (OFFICIAL REPORTS): | |
| Report by Colonel-Pharmacien D. Blumentals, Inspector of the Military Pharmacy of Latvia (Latvia) | 207 |
| Report By Dr. St. Weil, Director of the Pharmaceutical Institute of the Polish State, and Dr. W. Poplawski, Lieutenant-Colonel Pharmacist-Chemist (Poland) | 215 |
| COMMUNICATIONS | |
| THE CONTROL OF PURITY, THE TOXICITY AND THE THERAPEUTIC ACTIVITY OF THE ARSENOBENZENES. | |
| By Dr. A. Mouneyrat, Adjunct Professor of the Medical Faculties, Docteur-es-Sciences (France) | 224 |
| DIFFERENCE OF RESISTANCE OF SOME STRAINS OF TRYPANOSOMES AGAINST ARSENICAL COMPOUNDS. | |
| By Pharmacien-Major de 1 ^{ère} Classe of the Reserve L. Launoy, Adjunct Professor of the Faculty of Pharmacy of Paris (France) | 227 |
| THE ARSENOBENZOLS: METHODS OF ANALYSIS AND CHEMICAL APPRECIATION. | |
| By Pharmacien Principal de 1 ^{ère} Classe Pierre Breteau, Professor in the School of Applied Sanitary Service of the French Army (France) | 228 |
| THE DOSAGE OF ARSENIC IN THE ARSENOBENZOLS. | |
| By Colonel Thomann, Pharmacien en Chef of the Swiss Army (Switzerland) | 229 |
| INVESTIGATIONS ON NEOSALVARSAN. | |
| By Pharmacien Lieutenant Colonel Dr. C. Cerbulescu, Chief of the Central Chemical Laboratory of the Roumanian Army (Roumania) | 229 |
| THE ARSENOBENZOLS: METHODS OF ANALYSIS AND CHEMICAL DETERMINATION. | |
| By J. Benevenuto de Lima, Capitaine-Pharmacien of the Brazilian Army (Brazil) | 231 |
| DENTAL COMMUNICATIONS | |
| ORGANIZATIONS OF DENTAL SERVICE IN THE BRITISH ARMY. | |
| By Colonel Helliwell, Director of Dental Services (Great Britain) | 231 |
| THE ORGANIZATION OF THE DENTAL SERVICE IN THE WAR OF MOVEMENT AND POSITION. | |
| By Professor J. Filderman, of the Odonto-Technical School of Paris, Military Dentist de 1 ^{ère} Classe of the Reserve, Ch. Wintergerst, Military Dentist de 1 ^{ère} Classe, and L. Viau, Military Dentist de 2 ^{ème} Classe, Chiefs of Clinic in the Dental School of Paris (France) | 232 |

| | |
|--|-----|
| THE DENTAL SERVICE IN THE WAR OF MOVEMENT AND POSITION. THE TREATMENT OF MAXILLARY INJURIES IN BATTLE. By Professor Dr. H. Wilga (Poland) | 232 |
| ORGANIZATION OF SPECIALIZED HOSPITALS FOR THE TREATMENT OF FACIAL AND MAXILLARY CASUALTIES. By Dentist Dr. Goldberg-Gorski (Poland) | 233 |
| THE ORGANIZATION OF THE DENTAL SERVICE IN THE FIELD IN A WAR OF MOVEMENT. By Commandant Dentist Stanislas Beno (Poland) | 233 |
| MISCELLANEOUS COMMUNICATIONS | |
| CONSIDERATIONS ON THE PHYSIOLOGICAL ALIMENTARY REQUIREMENTS OF MAN, NOTABLY OF SOLDIERS. Professor Dr. E. Grimani, Complimentary Physician to the Italian Army (Italy) | 233 |
| RULES NEEDED FOR THE EXAMINATION OF THERMOMETERS, PHARMACEUTICAL GLASS, AND RUBBER ARTICLES. By Pharmacien Colonel D. Blumentals, Inspector of Military Pharmacy in the Latvian Army (Latvia) | 234 |
| POLAND AND ITALY. By Teniente Colonnello A Casarini (Italy) | 234 |
| CONCLUSIONS OF THE CONGRESS | 235 |
| I. Evacuation in Moving Warfare | 235 |
| II. Etiology and Prophylactic Treatment of Influenza | 236 |
| III. Sequelae of Cranial Traumatisms and Their Treatment | 237 |
| IV. The Arsenobenzols. Chemical Methods of Analysis and Estimation.. | 237 |
| SUPPLEMENTARY NOTES: | |
| International Exposition of Hygiene..... | 239 |
| Exposition of the Fine Arts..... | 241 |
| Posen Exposition 1929..... | 241 |
| Tours | 241 |
| Miscellaneous | 243 |
| ALPHABETICAL LIST OF CONTRIBUTORS | 245 |



PROF. IGNATZ MOSCISKI, PRESIDENT OF POLAND

REPORT ON
Fourth International Congress
of Military Medicine
and Pharmacy

Warsaw, Poland, May-June, 1927

By COMMANDER WILLIAM SEAMAN BAINBRIDGE, *M.C.-F., United States
Naval Reserve, Member of Permanent Committee*

INTRODUCTION

WHEN Belgium, in 1921, realized her vision of assembling around a conference table military-medical delegates from various nations, she could hardly have fully visualized the harvest to be reaped. Since the First "Congrès International de Médecine et de Pharmacie Militaires," three others have been held—Rome, 1923; Paris, 1925; Warsaw, 1927. At each subsequent congress a greater number of representatives have attended. A gathering is held every two years, with meetings of the Permanent Committee (composed of eight nations) before, during, and, if necessary, between the congresses.

The reports of the three preceding congresses clearly explain their purpose, which, "based on experience gained in the World War, is to collect, standardize, and codify methods in the prevention and treatment of disease and in the care of the sick and the wounded, not only during war, but in peacetime, as well."

Realizing that, no matter how vast its experience, it was impossible for any one country to cover all the questions to be considered, the Allied, associated, and neutral nations, as well as the new countries, were invited to participate. Thus, the experiences on all sides of the firing line were obtainable, for many of the medico-military personnel of the neutral nations had lent their services to the Central Powers during the world conflict. At a meeting of the Permanent Committee, following the Paris Congress, it was decided to include in the conferences all the countries that had joined the League of Nations.

In order to systematize the effort, every congress has four—and, since the inclusion of the dental corps in the meetings, five—main topics for consideration. On each subject, an official report is presented by the country in which the congress is held and by one or two other nations that have had special experience in the matters under discussion. Short communications on relevant subjects may be presented by any represented country having important data to contribute. When all the articles are presented, the Permanent Committee meets and, after careful consideration and debate, draws up the general conclusions. These are submitted to the vote of the congress and, if necessary, are returned to the Permanent Committee for modification or change, until unanimously accepted. Those points upon which agreement cannot be reached are held over for future congresses, when additional data and experience may solve the issues in question.

The success of the congresses is almost predetermined by their high purposes—to internationalize all knowledge in the healing art, to ameliorate suffering, to save life and limb, to foster brotherhood, and so draw the nations together by a tie of deep humanity.

RULES OF THE FOURTH CONGRESS

REPORTS AND COMMUNICATIONS

1. The countries reporting on the questions under consideration must furnish a single official report, which may have several collaborators.
2. The reports must be received by February 15, 1927. The printing of those articles that are delayed more than fifteen days from this date, cannot be guaranteed.
3. It is recommended that the authors do not go beyond the scope of each question. Each report may not exceed fifty pages of fifty lines of text, regardless of the number of collaborators.
4. The reports may be written in English, Spanish, French, or Italian. The conclusions of each article must not exceed two pages of text; they will be translated into these four languages. It is recommended that the reporting countries furnish their own translations.
5. The reading of each report, during the sessions of the congress, must not exceed twenty minutes.
6. Communications on the questions under discussion are permit-

ted, and must not exceed six pages of text. Ten minutes will be allowed for their reading. Titles and summaries of the communications to be presented to the congress, must be received before April 1, 1927, in order that they may be placed on the program of the sessions.

7. Projection films may be shown.

8. After the close of the discussions, the authors of reports and members who took part in the discussions or who presented communications, will assemble with the Permanent Committee, in order to draw the general conclusions. These general conclusions will be submitted to the vote of the congress.

LOCAL OFFICERS OF THE CONGRESS

President

General Dr. Stanisław Rouppert, Chief of the Eighth Department of the War Ministry.

Honorary Presidents

Médecin Inspecteur Général Wibin, of the Sanitary Service of the Belgian Army, President of the First International Congress of Military Medicine and Pharmacy, Brussels, 1921.

Major General Francesco della Valle, Director General of the Sanitary Service of the Italian Army, President of the Second International Congress of Military Medicine and Pharmacy, Rome, 1923.

Médecin Inspecteur Général Vincent, Member of the Institute, Member of the Académie de Médecin, President of the Third International Congress of Military Medicine and Pharmacy, Paris, 1925.

Commissioners

Colonel Dr. Łubieński.
Colonel Dr. Chlewiński.

Secretary

Lieutenant Colonel Dr. Zakliński.

Vice-Secretary

Major Dr. Zawadowski.

Treasurer

Lieutenant Colonel Sokolewicz.

ORGANIZATION COMMITTEE

From the Active Army

Général de Brigade Dr. Stanisław Rouppert, President.
Général de Brigade Dr. Rogalski, Inspecteur du Service de Santé,

Général de Brigade Dr. Zwierzchowski.

Colonel Dr. Gorczycki, Adjoint au Chef du Département VIII, Sanitaire du Ministère de la Guerre.

Colonel Dr. Hubicki, Directeur de l'École du Service de Santé Militaire à Varsovie.

Colonel Dr. Kollataj-Szrednicki, Chef du Service de Santé du 1^{er} Corps l'Armée.

Colonel Dr. Gąsiorowski, Médecin-en-Chef de la Marine de Guerre.

Colonel Dr. Rudzki, Médecin Chef de l'Hôpital d'Instruction à Varsovie.

Colonel Dr. Kobos, Directeur du Magasin Central du Service de Santé à Varsovie.

Colonel Dr. Zembrzusi, Directeur des Études à l'École du Service de Santé Militaire.

Colonel Pharmacien Krupiński, Chef de la Section d'Approvisionnement au Département Sanitaire.

Colonel Dr. Karwacki, Chef du Service à l'Hôpital Militaire.

Lieutenant Colonel Dr. Miszewski, Commandant du 1^{er} Bataillon Sanitaire.

Lieutenant Colonel Dr. Osmolski, Directeur de l'École Militaire de Gymnastique et des Sports.

Lieutenant Colonel-Dentiste Mieszkis, Chef du Service de Stomatologie à l'Hôpital Militaire.

Médecin Major de 1^{ère} Classe Dr. Baron, de la Mission Militaire Française en Pologne.

Commandant Niemezycki, Officier d'Administration.

Capitaine Cedzyński du Département Sanitaire.

Officers of the Reserve

Général de Division Dr. Hordyński.

Général de Division Dr. Jakesch.

Général de Brigade Dr. Składkowski.

Général de Brigade Dr. Grobelny.

Général de Brigade Dr. Wierzejewski, Professeur de l'Université de Poznan.

Général de Brigade Dr. Horodyński.

Général de Brigade Dr. Gurbki.

Général de Brigade Dr. Bałaban.

Général de Brigade Dr. Aret.

Général de Brigade Dr. Rutkowski, Professeur de l'Université de Krakow.

Colonel Dr. Loth, Professeur de l'Université de Varsovie.

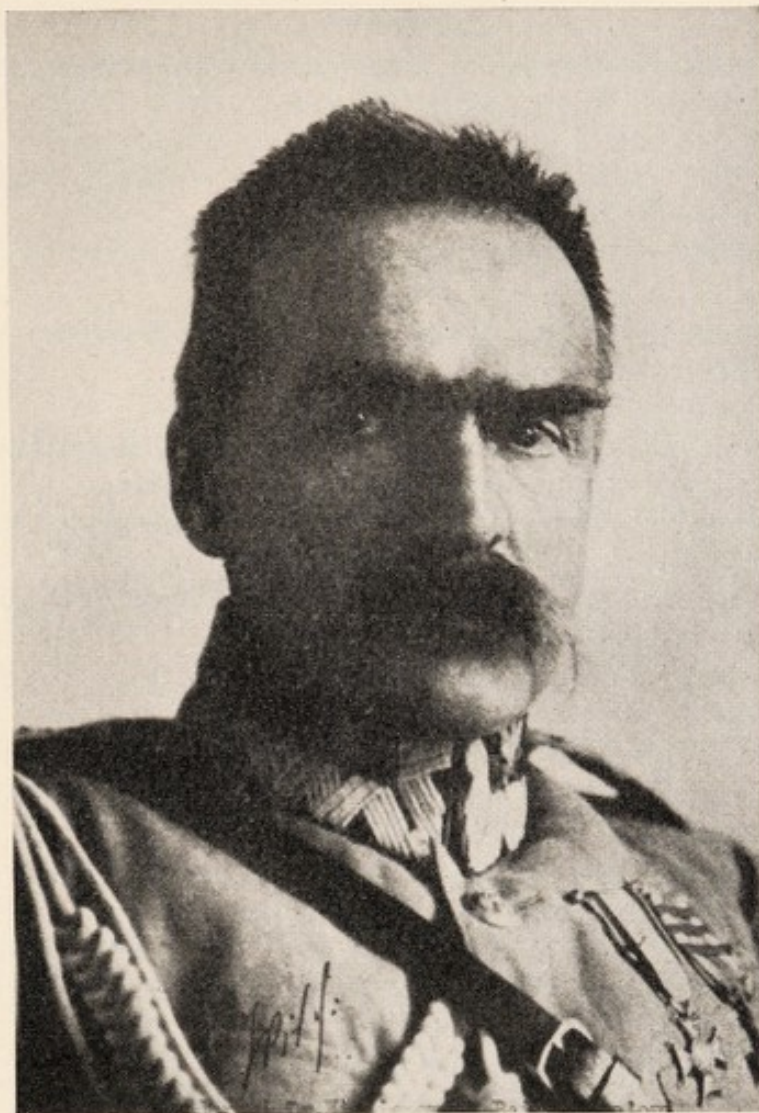
Colonel Dr. Krynski, Professeur de l'Université de Varsovie.

Colonel Dr. Radliński, Professeur de l'Université de Varsovie.

Colonel Dr. Ciechanowski, Professeur de l'Université de Krakow.

Colonel Dr. Godlewski, Professeur de l'Université de Krakow.

Lieutenant Colonel Dr. Chodźko, Directeur de l'Institut d'Hygiène. Ancien Ministre de la Santé Publique.



MARSHAL JOSEF PILSUDSKI, PRIME MINISTER OF POLAND

Lieutenant Colonel Dr. Modrakowski, Professeur de l'Université de Varsovie.

Lieutenant Colonel Konopacki, Professeur de l'Université de Varsovie.

Lieutenant Colonel Dr. Grodecki.

Lieutenant Colonel Dr. Karaffa-Korbutt, Professeur de l'Université de Wilno.

Lieutenant Colonel Dr. Januskiewicz, Professeur de l'Université de Wilno.

Lieutenant Pharmacien Muszyński, Professeur de l'Université de Wilno.

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 Warsaw, is adhered to.]

Argentina

Julio R. Garino—Directeur Général de Santé de l'Armée.
Carlos M. Mata—Lieutenant Colonel.

Austria

Nicolas Post—Ministre.
Fritz Tintner—Hofrat.

Belgium

Jules Voncken—Major Médecin, Chef de Service de Chirurgie
l'Hôpital Militaire de Liege.

Marcel Biquet—Capitaine Médecin.

Isidore Etienne—Capitaine en Pharmacien de Réserve.

Grégoire Duwé—Lieutenant Médecin de Réserve.

Marcel Mersch—Capitaine Médecin de Réserve, Commandant
d'Ambulance 3 Corps.

Bouvy—Capitaine Médecin, chargé du Service O.R.L. à l'Hôpital
Militaire d'Aix-la-Chapelle.

Felix Evrard—Colonel Médecin, Directeur de l'Hôpital Militaire
belge d'Aix-la-Chapelle.

Brazil

Sebastião Ivo Soares—Général de Brigade Médecin, Directeur du
Service de Santé de l'Armée Brésilienne.

Carlos Eugenio Guimaraes—Major Médecin, Chief de Division
du Depot du Materiel San. de l'Armée Brésilienne.

Manuel Cesar De Goes Monteiro—Major Médecin, Chef de la 2^{ème}
Section de la 1 Division de Directoire de Santé de l'Armée.

José Benevenuto de Lima—Capitaine Pharmacien, Professeur de
Pharmacol. à l'École Vétérinaire de l'Armée.

Czechoslovakia

Lois Fisher—Général, Ministère de la Défense Nationale, Chef de
la Section de Santé.

Klement Zrunek—Lieutenant Colonel, Ministère de la Défense
Nationale.

Rudolf Trenkler—Colonel, Commandant de l'Hôpital, Division N.9
Bratislava.

Antoine Kurka—Colonel, Chef du Service de Santé de la 8 Divi-
sion d'Infanterie.

Francois Knur—Lieutenant Colonel, Médecin en Chef du 26 Reg.
et des Supplem.

Josef Kremar—Capitaine, Médecin en Chef de l'Hôpital Mil. et de
Hippique l'École Mil. à Pardubice.

Aleksander Kosik—Capitaine Pharmacien, Directeur de l'Hôpital
Militaire Nr.1 Prage.

Denmark

C. T. Hansen—Médecin Principal de 1^{ère} Classe, Médecin en Chef
de l'Hôpital de la Garison à Copenhague.

A. Jurgens—Médecin-Major de Réserve, Rapporteur.

Esthonia

Arthur Losman—Général Major, Directeur du Service de Santé.

Henri Multer—Lieutenant Colonel, Médecin en Chef de la Marine.

Anatol Poppen—Colonel, Consultant de l'Hôpital Mil. à Reval.

Alexandre Taumi—Médecin-Major l'Hôpital Militaire à Tallin (Reval).

Romeo Peterhof—Major Médecin, Chef de 2^{ème} Régiment d'Artillerie.

Ernest Saresté—Médecin Capitaine, Professeur de l'Université de Tartu.

Finland

Anders Emil Luukkonen—Médecin Colonel, Directeur du Service de Santé.

Vainö Felix Linden—Médecin-Major, Chef de Bureau du Service de Santé.

Y.T. Seuderling—Médecin-Major Régiment.

Einar Malmstrom—Pharmacien Militaire.

France

Savornin—Médecin Inspecteur, Directeur Central du Service de Santé.

Lanne—Médecin Inspecteur, Directeur Général de l'École du Service de Santé Militaire.

Lascoutx—Médecin Inspecteur Général Permanent du Matériel et des Etabliss. du Service de Santé.

Levy—Médecin Principal de 1^{ère} Classe, Adjoint au Directeur Centr. du Service de Santé au Minist. de la Guerre.

Breteau—Pharmacien Principal de 1^{ère} Classe, Professeur à l'École d'Application du Service de Santé Militaire.

Spire—Médecin Principal de 1^{ère} Classe, Professeur à l'École Supérieure de Guerre.

Baron—Médecin Major de 1^{ère} Classe, Mission Militaire Française en Pologne.

Maisonnnet—Médecin Major de 1^{ère} Classe, Professeur à l'École d'Application du Service de Santé Militaire.

Fribourg-Blanc—Médecin Major de 1^{ère} Classe, Professeur Agrégé à l'École d'Application du Service de Santé Militaire.

Camus—Médecin Major, Chef des Salles Militaires de l'Hôpital mixte de St. Denis.

Defressine—Médecin Général.

Oudard—Médecin en Chef de 1^{ère} Classe.

Saint-Sernin—Pharmacien en Chef de 2^{ème} Classe.

Rouvillois—Médecin Inspecteur, Directeur du Service de Santé de Corps d'Armée.

Henri Léon—Médecin Principal de 1^{ère} Classe, Chef de l'Hôpital Mil. du Camp. de Chalons.

Verhaeghe—Docteur.

L. Baron—Docteur.



SURGEON GENERAL STANISLAW ROUPPERT, PRESIDENT OF THE CONGRESS

Dujarric de la Rivière—Médecin Major de 2^{ème} Classe, Chef de Laboratoire d'Armée.

Victor Louis Candelier—Médecin Major de 1^{ère} Classe de Réserve.

H. Bottu—Pharmacien Major de 1^{ère} Classe de Réserve, Professeur de l'École de Médecine de Reims.

Pinesse—Médecin Major de Réserve.

Paul Ropiteau—Médecin Major de 1^{ère} Classe.

Satre—Médecin Major de 1^{ère} Classe de Réserve.

Jean Minet—Médecin Major de 1^{ère} Classe de Réserve.

Jean Lorgnier—Médecin Major.

Gaston Duchesne—Médecin Major, Redacteur en Chef, Adjoint "Le Concours Medical."

Vergne—Médecin Major, Chef des Services du Musée du Val-de-Grâce.

Jean Charles Coudray—Médecin Major de 2^{ème} Classe de Réserve.

Elie Nodenot—Médecin Major de 2^{ème} Classe de Réserve.

- Pierre Ségelle—Médecin Major de 2^{ème} Classe.
Marius Grodée—Pharmacien Major de 2^{ème} Classe Réserve.
Leon Launouy—Pharmacien Major de 1^{ère} Classe.
Emile Vicart—Pharmacien Major de 2^{ème} Classe de l'Armée Territoriale.
Paul Taclet—Pharmacien Major de Réserve.
Henri Bon—Médecin A. Major de 1^{ère} Classe de Réserve.
Jean Roederer—Médecin A. Major de 1^{ère} Classe de Réserve.
Constant Joseph Delecour—Médecin A. Major de Réserve.
Jean Robert Carré—Médecin A. Major affecté au 1^{ère} Régiment d'Infanterie.
Charles Lequint—Médecin A. Major de 2^{ème} Classe de l'Hôpital Mil. d'Hesdin.
Michel Jean Bouillat—Médecin A. Major de Réserve des Troupes Coloniales.
Jerome Julien Vandembulcke—Pharmacien A. Major.
Henri Clement Doublet—Pharmacien A. Major 1^{ère} Classe.
Alfred Miraton—Pharmacien A. Major de 2^{ème} Classe affecté au Service de Santé de la Gare Regulatrice No. 3.
Georges Boulois—Pharmacien A. Major de 1^{ère} Classe de Réserve.
Adelin Emile Chavigny—Off. d'Admin. de 2^{ème} Classe du Service de Santé 69 Région (res).
Alfred Paul Struyve—Off. d'Admin. de 3^{ème} Classe affecté au Personnel.
Maurice-Marie-Auguste Aubry—Off. d'Admin. de 2^{ème} Classe.
Henri Lorriaux—Off. d'Admin. de 1^{ère} Classe de Réserve.
Henri Paul—Off. d'Admin. de 2^{ème} Classe, Lieutenant de Réserve.
Victor Gustave Joseph Vansteeberghe—Off. d'Admin. de 1^{ère} Classe de Réserve (Docteur en Droit).
Paul Hetuin—Off. d'Admin. de 2^{ème} Classe de 1^{er} Région du Service de Santé.
Alfred Devillers—Off. d'Admin. de 1^{ère} Classe affecté au de 1^{er} Corps d'Armée.
Eugène Bernard—Off. d'Admin. de 1^{ère} Classe de Réserve.
Louis Joseph Henri Allard—Off. d'Admin. de 2^{ème} Classe.
Pierre Charles Thomas—Médecin A. Major de 2^{ème} Classe.
Charles Wintergerst—Le Dentiste Militaire.
Jacques Filderman—Le Dentiste Militaire de Réserve.
Louis Viau—Le Dentiste Militaire.
Guinoiseau—Médecin Major de 2^{ème} Classe de Réserve.
Maurice Grodée—Off. d'Administration.
Auguste Felix Leo Gontrand—Médecin Major.
Jacques Besins—Pharmacien Auxill. 22 Section d'Infirmiers Milit.
Eugene Moignic—Médecin en Chef.
Vaudremer—Médecin Colonel.
Gilbert Dreyfus—Médecin A. Major de 2^{ème} Classe de Réserve.
Costa Sauveur—Médecin Principal de Réserve, Professeur à l'École de Médecine de Marseille.



The British delegation headed by Admiral Chambers. A representative of the Irish Free State and of India are present. Picture taken in front of the Tomb of the Unknown Soldier.

Robert Worms—Médecin A. Major de 2^{ème} Classe de Réserve.

Pierre Lereboullet—Médecin A. Major.

Antoine Mouneyrat—Médecin Major, Professeur.

André Levy—

Maurice Poitterin—

Guilbert—Médecin Major de 1^{ère} Classe.

Association Amicale des Anciens Médecins des Corps Combattants.

Great Britain

Sir Joseph Chambers—Surgeon Vice-Admiral, Medical Director General of the Navy.

D. Munro—Air Vice-Marshal, Director of Royal Air Force Medical Service.

Harold Perez Waller Barrow—Major General, Director of Hygiene.

David Harvey—Major General, Director of Pathology.

Frank Lewis Smith—Surgeon Commander, Royal Navy.

Balek-Foote—Lieutenant Colonel, Royal Army Medical Corps.

Martin W. Flack—Group Captain, Royal Air Force Medical Service.

Greece

Stelios Aissopos—Médecin Major, Chef du Centre Chirurg. d'Athènes.

Constantin Papastratigakis—Médecin Major de Réserve.

Hungary

Rudolf Rasch—Conseiller Médecin.
Franz Géza—Sous-Conseiller Médecin.

India

A. W. M. Harvey—Colonel, Assistant Director General of the Army Medical Service for India.

Irish Free State

Thomas F. Higgins—Colonel, Director Medical Service.
Thomas McKinney—Major, Deputy Director Medical Service.

Italy

Luigi Trovanelli—Maggiore Generale, Ispettore di Sanità Capo della Delegazione del Min. della Guerra.

Filippo Caccia—Col. Med., Dir. dell'Ospedale Mil. Princ. di Bologna.

Giovanni Saccone—Col. Medico, Diret. di Sanità e dell'Ospedale della R'Marina.

Virginio de Bernardinis—Maggiore Med. in servizio effect. perman. presso l'Ospedale Mil. di Roma.

Arturo Tobia—Col. Medico.

Guiseppe del Vasto—Maggiore Med. rappres. del Min. delle Finanze.

Guiseppe Carimati—Cpt. Medico Secr. del Gen. Med. Ispet. di Sanità partecipante al Congresso.

Alfred Bucciante—Col. Med., Diret. Ospid. Mil. Princ. a Bari.

Cav. Ettore Grillo—Col. Med., Diret. di San. in Posiz. ausiliaria.

Arturo Casarini—Ten. Col. Med., Diret. del Giornale di Medicina Mil.

Angelo di Nolla—Ten. Col. Med., Capo del Servizio San. delle Aviazione.

Nicola Fabrizi—Ten. Col. Med., Capo dell'Ospedale Mil. princ. di Roma.

Gino Delogu—Ten. Col. Med., Capo de la Sect. Med. Ospedale di Fireuze.

Angelantonio Mancini—Ten. Col. Med. di riserva.

Giovanni Cammarata—Magg. Med., Membro Collegio Med. Legale.

Emilio Isola—Magg. Chim. Pharm. Dirigente chimico-farm. l'Ospedale Milit. Trieste.

Alberto Binaghi—Magg. Med., Direct. Infirm. R. Garde de Front.

Federigo Bocchetti—Cpt., Direct. del Sanat. Mil. d'Anzio.

Jacques Mazzaroni—Cpt. Med., Secret. Dir. centr. del Serv. di Sanità.

Clemente Santillo—Cpt. Med. Capo Reparto di Medecine.

Augusto Brunetti—Cpt. Med.

Gugielmo del Fattore—Cpt. Med., Dir. di Serv. San. dans le Reg. Cavalegeri d'Alessandria.



OFFICIAL DELEGATES IN PARADE, MARCHING TO GRAVE OF UNKNOWN
SOLDIER ON WHICH A WREATH OF FLOWERS WAS LAID

Luigi d'Alesandros—Cpt. Med. Chimico-far. Ospedale Mil. Princip.

Dino Giannotti—Cpt. Med., Insp. di Sanità di Firenze.

Ermes Barbieri—Ten. Med., Complement. San. Mil. d'Anzio.

Antonino Nastasi—S. Ten. Med., Assistente del Reparto Inf. dell'Ospedale Mil. Princ. di Roma.

Edouard Bajola—S. Ten. Med., Aiuto di Serv. Dent. del Ospedale Mil. di Roma.

Enrico Grimani—Maggiore Med.

Giovanni Soleri—Maggiore Med.

Pietro de Logu—Dottore.

Alberto Morulli—Maggiore Med.

International Committee of the Red Cross Societies

Albert Reverdin—Docteur.

Vladimir Haering—Delegate of the Czechoslovak Red Cross.

Dzierzkowski—Docteur.

Japan

Ken Hosomi—Méd. Major, Professeur de l'École du Service de Santé Militaire.

R. Koganei—Méd. Cpt. Marine Japonaise.

Jugoslavia

Djordje Vladislavjevitch—Brigadier General.
Antoni Okolicani—Major Pharmacist.
Aleksander Djordjevitch—Captain Surgeon.
Miloran Prodanovitch—Doctor.

Latvia

Peters Snikers—Général, Direct. du Service de Santé de l'Armée, Professeur.
Davis Blumentals—Col. Pharmacien, Insp. de Pharm. Milit.
Albert Brambat—Colonel, Adjoint au Dir. du Service de Santé Militaire.

League of Red Cross Societies

Lotewski.

Mexico

Esteban Pous Cházaro—Lieutenant Colonel.

Norway

Nils Christian Ditleff—Chargé d'Affaires de Norvege.

Netherlands

Johan Carel Diehl—Colonel de l'Armée Néerlandaise.
F. C. A. Kuipers—Cpt. Médecin.

Peru

Pardo Figueroa—Docteur.

Portugal

Vasco de Quevedo—Minister Plenipotentiary of Portugal.

Roumania

Jacob Potarca—Méd. Insp. Gén., Médecin en Chef de l'Armée Roumaine.

Michail St. Butoiano—Méd. Gén. actif., Chef de l'Hôpital Centr. de l'Armée "Regina Elisabeta." Chef du 1^{ère} Service Chir. de l'Hôpital Centr.

G. Sava-Goiu—Méd. Gén., Dir. du Service Sanit. du IV Corps.

Basile Panaitescu—Méd. Col., Chef du Labor. Cen. de Bact. et Anatom. Pathol. de l'Armée, et Chef du Service des Epidémies au Min. de la Guerre.

Constantin Cerbulescu—Lieutenant Colonel, Pharmacien, Chef du Labor. de Chimie de l'Armée.

Victor Anastasiu—Lieutenant Colonel, Chef du Service Sanit. de l'Aeronaut.

Teodoresco—Méd. Cpt.

Nicolas Marinescu—Méd. Col., Dir. de l'Inst. Sanit. Milit., Professeur à l'École Super. de Guerre.

Georges Jurist—Méd. Col. de l'Hôpital Milit. de Galatz du III Corps d'Armée.

Mammant Dimitriu—Lieutenant Colonel, Médecin en Chef de l'Hôpital Milit.

Constantin Marinescu—Lieutenant Colonel, Médecin de l'Hôpital.

Stefan Cazacu—Médecin Major, Chef de l'Hôpital de Causani.

Michail Capitanovits—Major, Méd. en Chef de la Sect. des Maladies Internes à l'Hôpital du VII Corps.

Herman Rappaport—Major.

J. Anghel—Médecin Major de l'Hôpital Milit. "Regina Elisabeta."

Alexandre N. Simionescu—Médecin Major de Réserve et du Min. du Travail.

Dimitrie Alexandrescu—Cpt., Médecin second. de l'Hôpital Milit.

Theodor Popa—Cpt., Médecin second. de l'Hôpital Milit.

Merzianov—Médecin Cpt.

Chirila—Médecin Cpt., Chef du Bureau du VI., Dir. San.

Victor Nicolescu—Cpt. de Réserve.

L. Ursu—Médecin Cpt.

Virgile Duval Demetrescu—Médecin Cpt.

Popovici J. Dumitrescu—Médecin Cpt. de l'Hôpital Milit.

Traian Mihailescu—Médecin Cpt.

Magda Alexandru—Médecin Cpt. de l'Hôpital Milit.

Popescu Buzeu—Médecin Cpt.

Sergiu Dragoiu—Médecin Cpt.

Joseph Dragulescu—Médecin Cpt. Reg. 31 Artil.

Dumitras Aurel—Médecin Cpt. Chef Batal. VI.

C. Iliesco—Médecin Colonel Cadre Actif.

N. Stanescu—Médecin Cpt. Cadre Actif.

M. Enachescu—Médecin Cpt. Cadre Actif.

M. Tanasescu—Médecin Cpt. Cadre Actif.

Josef Pod—Médecin Lieutenant de Réserve.

Salvador

Don Rosendo Moran—Docteur.

Spain

Agustin Van-Baumberghen—Lieutenant Colonel Médecin Adjoint au Général Direct. du Service de Santé de l'Armée.

Cebrian Gimeno Vincente—Médecin Major, Redact. en Chef de "Revista de Sanidad de l'Armada."

Guerrero Rafael Roldan—Pharmacien Premier, Ministère de la Guerre.

Sweden

Sven Richard Erhardt—Colonel Médecin.

Switzerland

Jules Thomann—Colonel, Pharmacien en Chef de l'Armée Suisse.



THE AMERICAN DELEGATION

Paul Vollenweider—Major Médecin.
Georges Patry—Lieutenant Colonel.

Turkey

Emin Suleiman Pacha—Général de Brigade, Chef du Depart. Sanit.

Salim Tewfik—Colonel, Professeur de Méd. Interne et Direct. de l'École d'Application de Méd. Milit.

Fazil Halid Bey—Lieutenant Colonel, Chirurgien en Chef de l'Hôpit. Milit.

Uruguay

Alfredo Navarro—Docteur.

United States

Gilbert E. Seaman—Colonel, Medical Reserve Corps, U. S. Army.

David Clark Hilton—Colonel, Medical Reserve Corps, U. S. Army.

William Seaman Bainbridge—Commander, M.C.-F., United States Naval Reserve.

Angus McLean—Colonel, Medical Reserve Corps, U. S. Army.

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

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

PROGRAM OF THE FOURTH "CONGRÉS INTERNATIONAL
DE MÉDECINE ET DE PHARMACIE MILITAIRES"

| | |
|-----------------|---|
| Sunday, May 29 | Meeting of the Permanent Committee. |
| Monday, May 30 | Assembly of the Delegates at the Polytechnic School. Recording of insignia and documents. Inaugural session of the congress. Visit to the Tomb of the Unknown Soldier. Reception to the official foreign delegates, at the Royal Castle, by the President of Poland. Garden party at the Lazienki Palace. Reception by Marshal Piłsudski. |
| Tuesday, May 31 | Recording of insignia and documents not completed the preceding day. Meeting of the congress: First Subject—"Evacuations in Moving Warfare." Visit to |

the National Museum by the women. Opening of the Exposition of Hygiene and Technical Material of the Service de Santé. Reception at the City Hall. Concert at the Philharmonic.

Wednesday, June 1

Registration at the various Bureaus. Meeting of the congress—continuation of first subject. Visit to medical establishments of the City of Warsaw. Visit to National and Army Museums. Visit to Old City. Demonstration of First Medical Battalion and Central School of Gymnastics and Sports. Visit to Main School of Service de Santé. Visit to Pharmaceutical Department of the Warsaw University. Gala Performance at the opera, followed by reception in the halls of the theater.

Thursday, June 2

Registration. Meeting of congress: Second Subject—"Etiology and Prophylactic Treatment of Influenza." Third Subject—"Sequelae of Cranial Traumatism and Their Treatment." Fourth Subject—"The Arsenobensols. Chemical Methods of Analysis and Estimation." Communications. Visit, by the women, to the Royal Palace and the Cathedral. Visit to Military Hospital No. 1 and to the Marshal Pilsudski Physiotherapeutic Institute. Excursion to Wilanow. Reception at Lazienki Park (weather permitting). Reception, at Lazienki Palace, to the official foreign delegates, by the President of the congress.

Friday, June 3

Last day for registration. Meeting of congress: continuation of work of preceding day. Visit to Hygiene Establishment and "Hygiene Center" at Amelin. Visit to clinics, etc. Visit, by the women, to the Ethnographical Museum. Visit to

General Stores of Military Supplies. Inauguration of Exposition of Battle Paintings.

Saturday, June 4

General Meeting of congress. For the women, visit to Lazienki Park. Farewell Banquet Ball.

Sunday, June 5

For the women, visit to Skaryszewski Park and Poniatowski Bridge. Departure for various excursions.



The Inaugural Session of the Congress. Distinguished Visitors, State Officials, and the Members of the Permanent Committee on platform. In the center, directly in front of the platform, is Marshal Pilsudski.

INAUGURATION OF THE CONGRESS

The inaugural session of the congress was held in the vast hall of the Polytechnic School, which was beautifully decorated with the flags of all the countries participating in the meetings. Over 7,000 persons were present, among whom were War Minister Marshal Piłsudski, the government ministers or their representatives, the diplomatic corps, and representatives of scientific and social organizations.

At the President's table were seated the head of each of the delegations, and the members of the Permanent Committee were included among those on the platform. Addresses were made by Vice-Minister of War, General Konarzewski, who opened the congress; General Rouppert, the President of the congress; Director of the Public Health Service at the Ministry of the Interior, Dr. Piestrzynski; President of the Medical Chamber of Poland, Dr. Baczkiewicz; and in the name of the foreign delegations, Surgeon Vice-Admiral Sir Joseph Chambers, Chief of the Delegation from Great Britain.

KONARZEWSKI

In the name of the President of the Council and War Minister, Marshal Piłsudski, Vice-Minister of War General Konarzewski thanked all the governments for sending such eminent representatives of the sanitary services of their army, naval, and aërial forces. He stated that the sanitary service of all countries has a common flag, under which all hostilities cease—the well known banner of the Red Cross. The unheard of advance of destructive technique necessitates the most efficient methods and considerable effort for the relief of the sufferers from the greatest of evils—War. Gathered here in a humanitarian spirit, and with the loftiest ideals, the most efficient procedures will be sought, and it is hoped that the work will culminate in the best result.

ROUPPERT

General Rouppert, President of the congress, greeted and welcomed the assembly and expressed the belief that the meetings would bear propitious fruit. He stated that the independent life of Poland had been interrupted for a century and a half, and, after independence was restored, everything had to be reconstructed and reorganized—the administration, the army, the avenues of communication, briefly, the entire domain of social and political life. Indulgence is required in judging the results, for the independent national life of the country recommenced only seven years ago. In the work of organization of the army, the military sanitary service was not neglected. This is an arduous task, for the demands of medical science must be reconciled with those of the military art. War, from the medical viewpoint, is a "traumatic epidemic," at any rate, a powerful factor predisposing the soldiers to all epidemic diseases. Under the influence of these circumstances, the fighting forces undergo a considerable diminution, and their value is weakened. The experience of the World

War showed that, in order to diminish these losses as much as possible, it is not only necessary to treat the wounded or sick soldier, but to restore his fighting ability. Stress must be laid upon the fact that the state of the army and the troops depends upon the functioning of the sanitary service. In view of this extremely important task, and in order to relieve the evils of war, the military sanitary service of the allied and associated countries, as well as those admitted to the League of Nations, unites every two years, to work together in behalf of the highest humanitarian aims. The noble idea of these congresses, initiated by the Belgian Military Sanitary Service, is now here materialized for the fourth time.

As the members left the hall of the Polytechnic, after the inaugural session, two thousand carrier pigeons were released and were sent to all parts of Poland carrying greetings from the congress. Enthusiastic telegrams and messages were received in reply.

The official delegates proceeded to the Place de Saxe and placed a wreath, bearing streamers in the colors of all the nations taking part in the congress, on the tomb of the Unknown Soldier. Near by, a company of pupils of the Sanitary Service School assembled, and the First Sanitary Battalion was drawn up on the Place de Saxe. As the delegates stood before the tomb there was a reverential silence of two minutes.

The meetings of the congress were held in the Army General Inspection Building.

PERMANENT COMMITTEE

MEMBERS

| | |
|-------------------|---|
| <i>President:</i> | Général Stanisław Rouppert |
| <i>Secretary:</i> | Médecin Major Jules Voncken (Belgium) |
| <i>Members:</i> | Médecin Principal Levy (France) |
| | Médecin Colonel Filippo Caccia (Italy) |
| | Médecin Lieutenant Colonel Agustín Van Baumberghen (Spain) |
| | Commander Wm. Seaman Bainbridge (United States of America) |
| | Colonel Pharmacien Jules Thomann (Switzerland) |
| | Colonel C. Balck-Foote (Great Britain) (For Major Stirling, who is on mili- tary duty in India) |

Honorary Presidents: Médecin Major de Goés Monteiro (Brazil)
Général Wibin (Belgium)
Général della Valle (Italy)
Général Vincent (France)

MEETINGS OF THE PERMANENT COMMITTEE

The Permanent Committee as a whole, and various of its sub-committees, held a number of meetings prior to, during, and after the congress.



Preliminary to the Inaugural Session of the Congress, a meeting of the Permanent Committee was held to complete arrangements in regard to the work of the Congress.

It was decided that the secretary of the local organization committee of each congress should sit in at the meetings of the Permanent Committee, in order to assist the president and to help complete all unfinished business following the sessions of the congress.

At one of the executive sessions of this committee, the permanent member from the United States of America, on behalf of the American delegation and in conformity with instructions from General Ireland, President of the Association of Military Surgeons of the United States, brought up the point of working towards the organization of

an International Association of Military Medicine and Surgery. However, while this was considered an ideal towards which to strive, it was found incompatible with existing conditions in certain countries, at the present time, and the proposal was withdrawn.

As a result of the action of the Permanent Committee, the League of the Red Cross Societies is now recognized as an official part of the congress, with its representatives having equal rights as the delegates of the different governments.

For the first time since the inception of the congresses, representatives of the dental corps of the sanitary services were invited to participate in the meetings.

The cordial invitation of Great Britain to hold the 1929 congress in London, was accepted.

The subjects to be reported at the next congress are:

1. "Evacuation of the Wounded by Sea and Air. Liaison of Military and Naval Medical Services." (Great Britain and France.)
2. "Tropical Fevers of Short Duration." (Great Britain and the Netherlands).
3. "Blood Vessel Wounds and Their Sequelae." (Great Britain and Belgium).
4. "Physical and Chemical Analysis of Glassware and Rubber Articles used in the Medical Service." (Great Britain and Spain).
5. "Dental Standards in the different Military Services." (Great Britain and Cuba).

Surgeon Vice-Admiral Sir Joseph Chambers was designated the president of the Fifth Congress.

Although the actual presiding officer of the Warsaw Congress was its president, General Rouppert, at each session the chiefs of the foreign delegations and members of the Permanent Committee were alternately invited to take the chair.

The following are the subjects reported herein:

1. "Evacuation in Moving Warfare."
2. "Etiology and Prophylactic Treatment of Influenza."
3. "Sequelae of Head Traumatism and Their Treatment."
4. "The Arsenobenzols. Chemical Methods of Analysis and Estimation."
5. "Dental Communications."



IN THE FOREGROUND—DELEGATION FROM BRAZIL

EVACUATION IN MOVING WARFARE

OFFICIAL REPORTS

GUIMARAES (Brazil)

Inasmuch as Brazil did not directly participate in the World War, Médecin Major Carlos Eugenio Guimaraes pointed out that his country, therefore, lacked practical experience in the question of "Evacuation in Moving Warfare," but was able to obtain information from valuable sources. The lessons given by the French Military Mission to the Brazilian army proved most useful and important. The speaker stated that the topographical peculiarities of a country are capable of modifying original conclusions in regard to moving warfare. The reverses often experienced by well organized armies, inflicted by irregular guerrilla troops, show the danger of the general application of previously established principles. In conformity with these ideas, the following largely refers to military operations carried out in Brazil, with concrete examples of the observations. The military problem is extremely complicated and varies according to existing circumstances. Its clear and definite solution is still an unsolved problem. Omitting as superfluous all well established and generally

accepted details, except where required for greater clearness, Major Guimaraes divided the subject into the following parts:

I. *General Considerations Regarding Evacuation.*

- (a) Actual status of evacuations. Time and number as factors. Territory, obstacles, weather conditions. Stages of the evacuation. Selection of casualties. Examples of preceding wars.
- (b) Characteristics of medical evacuations in moving warfare.

II. *Some Examples Selected from the Recent Military Life of Brazil.*

- (a) Contribution of concrete cases. General aspect of Brazil.
- (b) Examples of the European war. A military expedition in the littoral zone of the country. Evacuations.
- (c) Example of moving warfare. A military expedition into the interior of the country. Phases of the campaign related to the functioning of the medical corps. Evacuations. Peculiarity of hospitalization and evacuations in this campaign.
- (d) Measures of evacuation most extensively utilized.
- (e) Final considerations.

III. *Conclusions.*

I. *General Considerations Regarding Evacuations.*

A comparative study of the lessons taught by the last wars, the Russo-Japanese War, the Balkan Wars, and especially, the World War, and later, by the military operations in Morocco and the Orient, conveys, at first, an impression of instability in the accepted rules governing the action of the medical corps in the field. This instability, however, is more apparent than real, for it must be kept in mind that these rules have their origin in the incessant adaptation of the medical corps to the ever new and unforeseen conditions of war. It is, therefore, natural that these rules should vary according to the situations and conditions of each war, and the evolution of the military operations in the different phases of the same campaign. As a matter of fact, the means of carrying out the military and medical requirements, in conformity with the possibilities of service,

undergo such rapid modifications that the best installed and most far-sighted organizations suddenly become inadequate. The problems which affect the medical corps in the field, as well as in the encounter, are, without exaggeration, more difficult than the problems confronting any other service in warfare. The medical corps, constantly obliged to adapt itself to the circumstances of the war, must reconcile the primary objective, which is humanitarian, with the military end, which is victory. It must assist the wounded and sick as promptly as possible, in order to maintain the preservation and recuperation of the fighting force. But, as war seeks only victory, and is not waged to help or evacuate the wounded, it usually happens that the tactical and strategic needs almost invariably relegate the urgent demands of the medical corps to the background. Although it is not a task easy of accomplishment, the aim of the medical corps must be the reconciliation of the two necessities of victory and medical assistance. While the two opposite points, military and medical, may often become adjusted, for example, in the war of position, they suddenly clash when the military situation becomes modified, passing from a form of stabilization to a phase of displacement of the front, as in moving warfare. Factors of local type, with regard to the particular condition of the country, must also be taken into consideration; these, likewise, affect the rules which govern the organization and functioning of the medical corps in the field. In proportion as the organization becomes more complex, the necessity grows for closer coordination between scientific and military factors. In the present epoch, the principles governing the methods adopted in sanitary organizations in the field, have their origin in the clinical sense, that is, they are based on a scientific medico-surgical and hygienic knowledge. The increasing ravages of warfare are best overcome by the rational adaption of scientific and clinical principles to the medical organization.

Because of the complexity of its objectives and the difficulty of its execution, evacuation plays a very important part in the functioning of the medical corps in the field. Practically the entire activities of the medical corps are included in such evacuations, as they call, especially, for the placing and functioning of the stations for treatment. It is not only a question of transportation—the distance to be traversed from the firing line to the place where the wounded man is to be hospitalized, but there is always a therapeutic task to be done. The question of evacuation and that of the treatment of the wounded

are, therefore, inseparable, and, hence, the necessity of a combined study of the methods of evacuation and hospitalization in the field. The problem of evacuation revolves around the general rule of the necessity of more or less promptly operating upon the patient, and this involves the possibility of transporting him a little farther or of keeping him a little nearer. Surgical necessity calls for immediate intervention in hospitals provided with all modern resources, which is actually possible only in the army zone. Military necessity demands that the wounded be evacuated from the fighting zone as immediately as is possible for the first transportation, so as to maintain this zone always free and unencumbered. A satisfactory regulation of these two urgent necessities depends, as already stated, on the circumstances of the war. This double end of the evacuation must be the first consideration in warfare and demands a close coordination between the supreme command and the medical corps. Important questions are involved in evacuations, such as orientation of the battle, condition of the roads, available means of transportation. Rapidity and completeness are the two vital points of evacuation.

From the surgical standpoint, time is a very important consideration. In order that the wounded can reach them with the least delay, the sanitary formations must be as close as possible to the front lines. Transportation thus becomes the result of distance, which must be calculated, not in kilometers, but by the number of hours required to travel them. Rapid evacuation with the best possibilities of comfort, is the primary necessity for success. The more rapidly the wounded are operated upon, the less are the probabilities of infection and the greater the prospects of recovery. Number is a factor that profoundly affects all the problems of the medical corps in the field, especially with respect to evacuations. The attitude that may be taken towards a single patient, or even a small number of wounded, is entirely different from that which one is forced to adopt towards hundreds of wounded. The accumulation of casualties occurs with a constantly progressive intensity and rapidity in each engagement. The means of evacuation must permit the flow of the evacuated, no matter what their number, and must be sufficiently flexible for any territory, route, or road.

In speaking of evacuations, one naturally thinks of the territory, obstacles, meteorological conditions, and means of transportation. The important factor of territory includes all the other questions concerning the particular conditions of the country. The considerable influ-

ence exerted by these conditions on evacuations, determines modifications in the application of the regulations. The question of territory will, therefore, be discussed at greater length in connection with examples collected in military expeditions to the interior of Brazil.

The urgent need of caring for the wounded imposes the necessity for stopping places, stations where the men can be re-examined, and have their dressings renewed. Stations are required as resting places for the severely wounded, who cannot continue the journey on account of the gravity of their condition; and for minor casualties, who are soon restored to their regiments. All along the line of communication, a series of medical stations is absolutely indispensable to render services from the front line to the center, in the interior of the country. In a general way, three great stations are to be considered:

(a) Evacuation from the firing line to the first sanitary formation (divisional ambulances). These evacuations must be carried out by divisional transport formations, composed of groups of stretcher bearers, and columns of divisional evacuations, under order of divisional surgeons.

(b) Evacuations between the divisional ambulances and the first hospital formation of the army zone (primary evacuation hospital of the French Army. Army Evacuation Hospital in the Brazilian Organization). The evacuations are made by evacuation carriages of the army, placed at the disposition of the army chief surgeons.

(c) Evacuations from the sanitary stations of the army, carried out in various ways, according to the point of arrival of the railroad or river route.

Usually, when transportation by roads is the only method of reaching the hospital center of the line of communications, the chief of the medical service of the L. of C. is charged with the management. When it happens that one or several army evacuation hospitals can be served by the railway, the task of evacuation concerns the chief surgeon of the regulating station. If, on the contrary, the railroad does not reach the evacuation hospital of the L. of C. (secondary evacuation hospital of the French Army), the transportation of the evacuated, as far as the railway, or to the nearest river, must be attended to by the medical service of the line of communication. If, finally, the entire supply front does not possess available routes for transportation, the chief of the medical service of the L. of C. is responsible for the evacuation as far as the limit between this zone and that of the rear. From this limit on, the fourth bureau of the

headquarters of the army group regulates the evacuation in the zone of the rear and distributes the management among the representatives of the medical service of the territorial commands concerned. Every director of the army medical service and the inspector of the medical corps of the army group have, at their disposal, a reserve of means of sanitary transportation—automobiles or horse-drawn vehicles—according to the cases or requirements of the moment. The purpose of the reserve is to reenforce, if necessary, the divisional, army, or L. of C. trains. The evacuation service must be so distributed in an army, that each chief in charge has to deal only with conditions in front of him; he must be freed from all details that pass in the rear.

The foregoing brief summary of the evacuation stations is an extract from the *Regulations* of the medical corps of the Brazilian Army in war times.

The selection of casualties is one of the most important steps in the function of the medical corps and perhaps the basis of its success. Selection, evacuation, and hospitalization constitute the three capital features which govern the service for the recuperation of the fighting force. A good functioning of evacuation depends upon a properly conducted selection of the wounded. The *triage* (classification of casualties) may be compared to a filter, which, on the one hand, prevents an escape of the wounded to the rear and, on the other, accurately propels the wounded and sick to their destinations. A classification of the wounded and sick, based upon their nature and on the possibilities of evacuation, is needed. The technical principle of *triage* is this: The wounded or sick must be given, as soon as possible, the destination where they may find the definite care required for the existing wound or disease. The selection cannot be made immediately; it is carried out and improved in the several stations of evacuation and hospitalization. Obviously, it would be ideal if a single selection could be made in the proximity of the front, but this is prevented by the numerical factor, and the military necessities, which demand the rapid removal of the wounded from the dangers of the fighting zone.

As a result of the Russo-Japanese War, the principle of extreme evacuation came to prevail. The Balkan War, on the contrary, gave, as a useful sanitary lesson for future wars, the theory of hospitalization of the severely wounded, in the army zone. In the localities where the latter theory could be practically applied, its results were more favorable than those of extreme evacuation to a great dis-

tance. The hospitalization, near the army zone, of casualties with minor injuries, and of the sick, permitted the retention of a considerable number of men, likely to recover in a short time, in proximity to the front. This was very favorable for the preservation of the fighting force.

In the course of the World War, the regulations of evacuations underwent continuous development, because of the necessary adaptation to the ever new conditions which arose. At the beginning of hospitalization, the general rule could be summarized in a single word: evacuation. In the first place, it was necessary to evacuate the wounded as rapidly as possible, and to a distance, not only to clear the fighting zone, but, also, to take proper care of the casualties. During the period of moving warfare, the rapid changes, necessitated by the military operations, permitted only the decision of systematic evacuations. Only the wounded with grave anatomical lesions were considered as unfit for evacuation, and were treated in stationary ambulances; the others were transported to great distances, without regard to the possibility of infection. This was the general principle of minimum hospitalization and maximum evacuation, based on the experience of the preceding wars. The danger of such a procedure, which delayed primary treatment, became very evident in the form of wound infections and gas gangrene.

In the period of stabilized warfare, which lasted three and a half years, after the front of the hostile armies had once been settled, new and unforeseen factors were taken into account, and permitted the prompt establishment of surgical formations from the front to the evacuation hospitals and hospital centers of the army. It then became possible to establish surgical services of real value, which previously existed only at the rear and in the zone of the interior. These means of hospitalization and treatment approached perfection, leading to the local maintenance of nearly the sum total of the wounded, who often remained until fully recovered, in the army zone itself, where real care could be given as promptly as possible. The transportation system was considerably improved by the use of sanitary ambulance sections near the front; the entire question of sanitary trains was thus suitably regulated, as was also the surgical connection between the centers in front, those at the rear, and those in the interior.

This principle of maximum hospitalization and minimum evacuation is possible only in a war of position, and presents, from the medical viewpoint, besides undeniable advantages, serious drawbacks. This

becomes perceptible in the case of an unexpected change of situation when there is an accumulation in the front zone of the best hospital resources, with a collection of large numbers of sick and wounded. In the first great German advance, at the end of March, 1918, the Allies lost numerous sanitary formations with their personnel and material, and moreover, tens of thousands of wounded were taken prisoners by the enemy. The medical corps had to adapt itself to the new situation created by the military operations from March to November, 1918, where the great early retreats were followed by stabilization, resumption of the offensive and, finally, the victorious general offensive. The then prescribed methods of evacuation were, surgically, less perfect, but the only ones compatible with the military situation. So as to retain the fundamental idea of primary treatment of the wounded, prior to any distant evacuation, sanitary foreposts were established, the proportions of the evacuation hospitals were reduced, and the heavier formations were transported farther back. The surgical activity of the front formations was limited to extremely urgent operations, while the surgical activities of the evacuation hospitals, primary and secondary, reached its maximum development. It was a return to the principles established at the beginning of the war, but with better adapted means and more coordinated provisions for the avoidance of the objectionable routine evacuations. The transportation of the wounded at the front was attended to by a considerable number of automobiles. Severely wounded and non-transportable casualties were evacuated to the advanced ambulance groups; the others were sent directly to the evacuation hospitals, where a strict selection was made. Those formations retained only non-evacuatable casualties and insured the establishment of hospital trains. These trains traveled by the most rapid routes towards the great surgical centers, which were easily accessible in less than fifteen hours and where all necessary operations were immediately performed. By proceeding in this manner, carefully attending to the wounded during the trip and at the regular medical railroad stations, results were accomplished which approached the perfection attained during the phase of stabilization.

The evacuations to the interior suffered from the consequences of the methods adopted in the several phases of the war. As a result of the rule of minimum hospitalization in the army zone, the formations of the interior received, in the beginning, a considerable number of wounded and sick directly from the front. Later, during the war of position, only the zone nearest to the armies received the recently

wounded, and the remote zone was destined for secondary evacuations of already-treated wounded and sick; in the last phase, all the wounded could be operated upon in the limits of the army zone, in the vicinity of which Paris was included. Methods, regulating evacuations combined with regional hospitalization, continued to be a problem difficult of solution and for which it is impossible to lay down any fixed rules. There will always be major casualties unable to support fatigues of transportation, no matter how much the measures of evacuation are improved and perfected. Moreover, very early evacuation procedures may severely endanger the health of some patients who do not appear seriously sick. On the other hand, the intensive transportation of casualties overburdens the railroad service and absorbs an important human material, the utilization of which may be required by the movement of the troops and by strategic or tactical maneuvers. For this reason, the extensive use of regional hospitalization must be recommended and followed whenever circumstances do not contravene encumbering the front; for this procedure renders the formations too ponderous and impairs their mobility in the case of a necessary rapid change of location. Aside from the enormous number of men who have to be evacuated as a whole, and hurriedly, in the case of a retreat, the encumbering of the zones in the proximity of the front often constitutes an actual imprudence, especially when not protected against the fluctuations of the battle. In order to avoid this danger, the hospital formations of this zone must not be allowed to lose their original flexibility, and more ponderous formations must be kept at the rear, where they are subjected to less frequent displacements. Hence, the system adopted in certain armies, of an extensive organization with various connecting lines, causing a division of the zone of the rear of the army, and of the interior, into sectors, each with a general technical direction relative to the surgical organization.

The methods of evacuation in force in the last phase of 1918 certainly would have been modified if the World War had continued. This statement is confirmed by the subsequent observations in the military operations in Morocco and the Orient.

The functioning of the medical corps does not adapt itself very well to movement. The instability of the front line of a fighting army, now advancing, now retreating, does not permit the medical corps to function, except in a very hazardous manner, particularly at the front. The movement prevents organization, the perfecting of installations, and the securing of a smooth running service. In stabi-

lized warfare, organization is possible; in moving warfare, improvisation alone is possible. Consequently, the instability, aside from the conditions of the war itself, is responsible for the determining factors of an insecure situation. The functioning of the medical corps is rendered difficult by the mobility of the troops in action, especially in the regimental and divisional stations, which require extra flexibility to adapt themselves to the fluctuations of the battle. In moving warfare, the gathering of the wounded who have fallen in an exposed territory and along an extensive firing line, becomes a very complicated and dangerous procedure, demanding the greatest devotion and highest courage on the part of the medical personnel. Enormous difficulties are encountered, not only through exposure to the enemy's fire, but also on account of the nature of the territory, the great distances to be traversed, in the transportation by arms or stretchers in exposed ground, where every movement attracts the enemy's fire and where the stretcher bearers cannot protect themselves (by running or lying down) when surprised by a machine gun volley or barrage fire.

The evacuation of casualties in moving warfare has all the general characteristics of moving warfare itself, that is, a maximum of the unexpected, constant changes of the firing lines and occupied territories at the rear. Hence, there are constant changes of the sanitary arrangements and means of transportation to be employed; in the case of an advance, a constant, sometimes considerable, lengthening of the roads of evacuation and supply.

The general features of evacuations in moving warfare may be summarized as follows:

(1) The unforeseen prevails to a maximum degree. It is necessary to be always ready to modify one's plans, go backwards, to the right or left. Hence, study the battle in advance and obtain information as to conditions of the territory.

(2) Instability of the roads of evacuation, the means to be employed, relays, concentration points of the sick and wounded.

(3) Obligation of the Medical Corps to foresee the various contingencies to be anticipated:

(A) Take into account the territory, changes of evacuations, the various available resources, the military situation.

- (B) Have ready an ample reserve of the most varied means of transportation, because:
 - (a) In the continual changes of territory, the best means of transportation are never the same:
 - (b) It is necessary to allow for a considerable lengthening of the roads of evacuation in the case of an advance, before the army evacuation hospitals can go forward.
- (C) Foresee less casualties than in the war of position, but in the case of an advance, it is necessary to take into account the wounded and dead of the enemy, who must be attended to, nearly always without the assistance of enemy sanitary personnel (supplementary loads). In compensation, in the case of a retreat, there are the wounded and dead who will fall into the hands of the enemy (diminished loads).

Thus, in moving warfare, one proceeds to a great extent in the unknown; nothing can be accurately foreseen and prepared, either in the sense of placing the sanitary formations in advanced positions, or as to the exact routes to be taken by the evacuations. It is, therefore, necessary to make special arrangements applicable to the functioning of the various sanitary stations, especially of the divisions:

(1) Be constantly in touch with the military situation of the moment and become familiar, at least on the map, with the different roads of evacuation which can be followed, either forwards or backwards.

(2) Maintain a permanent connection between the medical organizations placed directly in front and at the rear.

(3) Do not install the posts too rapidly, particularly those of the front; supply only the indispensable emergency material, which can be rapidly packed up again, in case the movement is resumed; make a complete installation only when the battle has definitely started.

(4) Constitute reserves of personnel and material to be ready for reenforcement when the acting personnel becomes insufficient, and which can also accompany the front line, so as not to leave it without its necessities during the time for re-grouping and supplying the centers, surprised, in the midst of their functioning, by a sudden order to move.

The application of these rules lends a very different behavior to



KOSCIUSZKO'S MONUMENT. WAWEL, CRACOW

the functioning of the medical corps in moving warfare from that noted in a war of position. Moving warfare must be considered as normal, especially in countries like Brazil. Stabilization is only a phase of the war in which the fighting forces find themselves in a state of mutual exhaustion and until one army can triumph over the other. Consequently, one must always count on a war of movement, and the medical corps must endeavor to adapt themselves to the requirements of such a war, and to avoid, in the case of an eventual phase of stabilization, the loss of the necessary flexibility which permits them to accompany the fluctuations at the front.

II. *Some Examples Selected from the Recent Military Life of Brazil.*

Upon being allotted the theme of evacuation in moving warfare, the Brazilian delegation was of the opinion, for reasons already indicated, that the question should be considered preferably from a particular viewpoint, utilizing the instructive lessons of concrete cases. It would be erroneous, however, to assume that military expeditions made into the interior of Brazil are always of a nature to furnish complete or, at least, sufficient information for the elucidation of such a complicated problem as the one under consideration. These expeditions are far from presenting the aspect of a real war. Nevertheless,

due to the attendant circumstances, the cases cited are no less rich in profitable experiences. In the Brazilian campaigns against revolutionaries and fanatics, the troops constitute only a part of the peacetime army and, therefore, neither a mobilization nor a state of war, with its familiar inevitable consequences, is involved. The number of wounded is naturally directly proportionate to the number of men engaged in the fight. The same is true for the utilized quantity of war material, notably transportation vehicles, which are often the principal cause of encumbering the roads of communication. Before describing the manner in which the evacuation of the wounded was conducted in these campaigns, it is necessary to give a general idea of the physical aspect of the territory.

Brazil, the largest country of South America and, at the same time, the largest Latin country of the earth, has two geographical characteristics: in the North and in the Center, there is a vast plain, while the eastern coast is high plateau land with rivers running into the ocean. The appearance of the coast, with its many flourishing cities, good roads, and other resources, contrasts with the interior of the country, its thinly scattered population, and remote cities without rapid means of communication for transports and provisions. This contrast suggests the variable type of an eventual war in this country; the aspect of an European war, if waged on the coast or near it; that of a colonial war, if waged in the interior of the continent or even at the frontier. In view of this dual aspect, the author has decided to present for study as concrete cases, the military expedition of some years ago in the State of Sao Paulo, namely, in the littoral zone, and the very recent Parana expedition into the interior and the southern frontier of the country.

The military expedition into the littoral zone of the country a few years ago, consisted of regular troops, constituting a division whose objective it was to take the town of Sao Paulo. The military operations were conducted in one of the richest and most densely populated regions near the capital of the country, and reached by several large roads. The town of Sao Paulo is connected with Rio de Janeiro by a railway, about five hundred kilometers in length, which runs through numerous cities, all provided with important local resources. The acting division functioned in the place of an army, and a medical corps was provided. The functioning of the medical corps approached, as far as permitted by circumstances, the regulations of the regular Brazilian army.

Taking, as an illustration, the situation of the last phase of the fight, when the front line was already at the city gates, the evacuations were conducted as follows: The regimental surgeons, with their stretcher bearers, collected the wounded, to whom they applied individual dressings, and the tourniquet, if necessary, after light disinfection with iodine tincture. The wounded were then transported to the advanced post of the group of divisional stretcher carriers, by the available means, litters, wheelbarrows, and other contrivances. On their arrival at the advanced posts, the casualties had their dressings renewed, heart tonics were injected, and nourishing beverages were



AFTER THE CONGRESS WAS OPENED THE PRESIDENT OF POLAND RECEIVED THE OFFICIAL DELEGATES IN HIS PALACE

administered, after which they were transported to the central post, where they invariably received antitetanus injections, as well as other necessary care. The antitetanus injection was given at the central post, because it was generally reached within the first hours after the infliction of the wound. Here a detailed description of the wound and the nature of the assistance was taken. The patient was given hot milk with a dash of rum, which had excellent results, especially in cold nights, as it stimulated the organism and gave the man a certain moral support. After renewal of the dressings, the wounded were evacuated to the hospital group at the Villa Mathilde, which

functioned as a primary evacuation hospital, and was, in this capacity, subdivided into a hospitalization section and an evacuation section, in order to increase its efficiency. The service of the hospitalization section was installed in requisitioned houses, supplemented by barracks. It received wounded and sick expected to recover in a short time; moribund cases, and those whose condition required immediate surgical intervention followed by absolute rest (non-transportable cases). All the others were examined, their dressings renewed, tourniquets removed, and hemostasis secured by ligature or direct compression, and then evacuated by rail to the evacuation hospital in Mogy das Cruzes, a journey of fifty minutes. The evacuation section attended to the transportation of these cases to the Mogy evacuation hospital and utilized improved sanitary trains for this purpose. At the Mogy railway station, the evacuated were received by the personnel of a small local infirmary, all to be transported later on in automobiles to the evacuation hospital. This hospital, which was installed in four large requisitioned buildings, functioned as a secondary evacuation hospital, and received all the wounded or sick coming from advanced formations. It received both the recuperable casualties and those who needed urgent intervention, evacuating the remainder to the rear and towards the interior. In the transportation of the evacuated in sanitary trains, from the evacuation hospital to their destination, they were accompanied by medical students who acted as auxiliary surgeons, to render medico-surgical assistance and distribute the victuals during the journey. Permanent military hospitals in the interior of the country, notably that of Juiz de Fora and the central hospital of the army, in the federal capital, functioned as points of evacuation. The journey was always made at night and lasted about twelve hours from the evacuation hospital to the central hospital of the army.

The military expedition of Parana furnishes an example of a colonial campaign, a war of movement. This campaign was waged in a vast region of the interior of the country, where multiple obstacles, immense size of the territory, the difficulty of transportation, the absence of good roads and extensive railways, the scantiness of towns and villages, the rarity or total absence of inhabited areas, the constant and sudden meteorological changes, militated against an effective military procedure and a good functioning of the medical corps. The expedition was composed of a division, operating as an army, and consisting of several detachments, having the functions of divisions, and

therefore, provided with all the services. It was formed by regular troops of the army, and auxiliary troops from the military police of some states. The working of the medical service in the military operations of the Parana expedition can be divided into seven phases of the conflict, each phase comprising: (a) the situation of the fighting forces; (b) the functioning of the medical corps; (c) position of the sanitary formations; (d) evacuations; (e) distances; (f) territorial features and obstacles having an influence on the evacuations.

The most important part of the campaign extended until the fall of Catanduvás. From this time on, it was impossible for the medical corps to act with desirable regularity and system, especially since it was impossible to utilize automobiles for transportation. Automobiles had to be replaced by carts utilized in this entire region of the country, and called Polish carts, perhaps because there are numerous centers of Polish colonists. These carts were used on a large scale in this entire campaign, for the transportation of food, as well as by the medical corps, for the evacuation of venereal cases, convalescents, and the wounded. In the most intensive phases of the conflict, when the enemy's attacks were very severe, the wounded were usually collected a short time after the infliction of the injury, especially those who fell in the trenches or their vicinity. At the time of assault and advance, there was a delay, which was caused not only by the difficulty in collecting the wounded in the open field, but also on account of the insufficient number of stretcher bearers, and the nature of the territory—virgin forests, uncultivated areas, and narrow passes—all of which added to the hardship. Usually, the wounded were operated upon two or three hours after the infliction of the injury, which is remarkable considering the great distances and the difficulties of transportation. In spite of all this, the results accomplished were largely adequate.

The medical work of the stretcher bearers was very limited and, due to deficient special instruction, their assistance was restricted to the application of individual dressings, transportation, and the administration of a stimulant. The most extensively utilized means of transportation were litters and carrying in the arms, especially the latter, because of the, usually, very irregular territory, covered with wild vegetation. The stretchers were of various models, some of them improvised. The Frank model was the most in use. Improvised stretchers, made with hammocks of canvas, proved more serviceable than simple hammocks. The aid posts were usually installed in

barracks. In the case of absolute impossibility of evacuation, an aid post was installed a kilometer from the firing line and, equipped with the necessary personnel and material, functioned as a surgical ambulance. In one of these aid posts, nearly thirty gravely wounded men were operated upon under the enemy's fire, and all recovered. As the functioning of the sanitary formations was modified by the special circumstances of this campaign, it became necessary to create a special type of hospital, which was named "mixed hospital." According to circumstances, these were utilized as surgical hospitals, as an advanced evacuation hospital, and, sometimes as a hospital group, serving both purposes. At the beginning of the campaign, when the troops operated in more or less inhabited areas, the installation of these hospitals could be made in buildings reenforced, or not, by barracks. But in proportion as the troops advanced into the less inhabited interior, the installation could be made only in barracks and, sometimes in simple woodsheds, lighted by petroleum lamps.

The distances between the sanitary formations were calculated, not by kilometers, but by the hours needed for the transportation of the wounded from one to the other. Transportation, in the zone of the divisional service, was regularly effected, as far as Catanduvás, by automobiles; the calculated time was six to eight hours between each hospital, but there were intermediate posts. As the fighting usually occurred during the day, the wounded arrived in the divisional sanitary formations in the afternoon.

Certain peculiarities influenced the transportation and evacuation of the wounded in this campaign, as the necessity of adapting the activity of the medical corps to the military circumstances of the moment, resulted in a modification of the accepted principles. In view of the duration of the campaign, the number of wounded was relatively limited, though this does not mean that there were no periods of intensive work. In spite of the difficulties of all kinds, the wounded, as a general rule, were operated upon and treated in accordance with the principles of war surgery. The lessons of the World War were utilized, and the results were excellent. Evacuations generally took place in the day time, by the single available road, the convoys passing in both directions. The automobile convoys, which constituted the improved medical corps, traveled, at most, one hundred kilometers a day. Horse-drawn vehicles, generally consisting of requisitioned wagons of the Polish type, reserved for venereal cases, convalescents, and crippled, made at most forty kilo-

meters daily. Transportation on the backs of pack animals, as used in forest paths, could not exceed thirty kilometers daily. Automobiles of the service of supply, returning empty, were employed for the evacuation of the minor wounded and sick, and made a daily trip of one hundred and eighty kilometers. The utilized means of evacuation in this campaign were nearly all improvised. In the entire first line, transportation in the arms, stretchers, or hammocks, the latter in emergencies, was most extensively employed. The official stretcher was that of the regulation type—the lightest model.



ON THE DAY OF THE INAUGURATION OF THE CONGRESS. MARSHAL PILSUDSKI WITH SOME OF HIS STAFF OFFICERS

As the medical corps in Brazil are obliged to make use of all possible means for the transportation of the wounded, studies on military aviation must figure in the first rank, as this will be of the greatest importance in future wars. In a country like Brazil, where innumerable obstacles are interposed between the routes of evacuation, such as interminable virgin forests, steep mountains, and immense stretches of sand, no other means of communication, except in the air, can solve the difficulties of the problem.

This recent military expedition into the interior of Brazil, although not possessing all the features of a true campaign, as it involved neither mobilization nor a state of war, can nevertheless demonstrate, on a reduced scale, the impossibility of the absolute employment

at any moment and in any place, of methods based upon the principles established during the World War. With respect to the medical corps and, more particularly, evacuations, the dominant point was that of a minimum hospitalization and maximum evacuation; but in view of the enormous distances, other interesting and unusual peculiarities intervened. This experience showed that Brazil needs a larger number of adjacent sanitary formations, in view of the impossibility of otherwise securing rapid evacuations at long distances. It is impossible to enumerate all the obstacles to evacuations observed during this campaign. They were of all kinds and occurred at all times. The vast region, which served as the theater of military operations, presents the most varied aspects and possesses resources of all descriptions. Besides areas rich in towns, populations, and routes of communication (roads, railway), there was, for instance, another region in which the most important part of the campaign was waged, which was barely served by a single road used, at the same time, for all other transports and movements of the troops. In many other areas, the absence of roads was complete, and no special way of evacuation was possible. Fortunately, in the latter circumstances, the number of wounded to be evacuated was naturally smaller than in actual war, because of the practical impossibility of launching into these regions enormous masses of men.

III. *Conclusions.*

(1) Moving warfare (guerilla warfare) is to be considered as normal, in a country which presents the conditions that exist in Brazil. Stabilization is merely a phase of the campaign in which the fighting forces find themselves in a state of mutual exhaustion, and until one of the belligerents succeeds in overcoming the other. Consequently, a war of movement must always be reckoned with, and the medical corps must endeavor to adapt itself to the requirements of such a war and, in the case of an eventual period of stabilization, to guard against the loss of the necessary mobility permitting it to accompany the changes of the front.

(2) The peculiarities which characterize moving warfare and distinguish it from a war of position, are not the only ones which influence the functioning of the medical corps, and consequently of evacuations. It is necessary to foresee a number of other circumstances, which depend upon the dissimilarity of the theaters of military operations, and sometimes constitute insoluble problems, since

each new phase in a war of movement may have special and unlooked for aspects.

(3) Evacuations in guerilla warfare present all the characteristics of the war itself: a maximum of the unforeseen, constant changes of the firing lines and the occupied territories at the rear. As a result, there are frequent changes in the sanitary provisions and means of transportations to be employed; in the case of an advance, constant, and sometimes considerable, lengthening of the routes for evacuation and renewal of food supplies.

(4) The displacements of the battlefront give rise to changes in the routes, the methods to be employed, relay stations, points of concentration for the sick and wounded. The medical corps is thus obliged to provide for variations in its existing plan, according to the eventualities, and to take into consideration: (a) the territory, meteorological changes, various resources at the disposal of the medical corps, military procedures; (b) the necessity for having at its disposal a large reserve of the most varied means of transportation, in light but numerous formations with reduced material, not only because, in the constant changes of the territory, the best measures of transportation are never the same, but also because it is necessary to provide for a considerable lengthening of evacuation routes, in case of an advance.

(5) In moving warfare, the losses are less than in a war of position, but, in the case of an advance, it is necessary to provide for the enemy's dead and wounded (supplementary loads), who must almost invariably be cared for without the assistance of enemy medical personnel; in compensation, in the case of a retreat, there are also the wounded and dead (diminished loads) who fall into the hands of the enemy.

(6) Although the military expeditions into the interior of Brazil, did not present all the features of an actual campaign, as there was neither mobilization nor a state of war, they serve to demonstrate, even in their reduced proportions, that it is impossible to employ *in toto*, in all places and at all times, the methods established by the World War.

(7) Moving warfare in western Europe will always be different from moving warfare in Brazil. A war in the interior and at the frontier of Brazil will be very different from one along its coast. While in Europe, the local resources and facilities of transportation permit great efficiency in the evacuation of a large number of

wounded, the cause of this multitude of wounded finds its explanation in the facility with which enormous masses of men, accompanied by abundant material and powerful offensive measures, are placed in action.

(8) A war in the interior of Brazil will never result in such a large number of wounded. Territorial and transportation difficulties, as well as the absence of local resources, prevent the concentration at any point of large fighting masses. As there will be no overloading of material, the front will be very long, discontinuous, and mobile, and so result in a marked diminution of wounded in each sector. The enemy, even when well organized, will find his offensive action greatly diminished, because he will be forced to share the same obstacles and difficulties.

(9) In such campaigns, neither numbers, material strength, nor brute force prevail; the advantage is on that side which, with light material, most rapidly succeeds in adapting itself to existing circumstances, overcomes the obstacles, and carries out its tactical maneuvers, without losing its necessary mobility. The medical corps, as soon as an engagement reaches its maximum movement, should adapt its activities to the methods applicable to cavalry troops.

(10) The question of the means of evacuation must be considered from two viewpoints. The need is not only for the increase and improvement of the medical transportation vehicles, automobiles or others, but also for the increase and improvement of the roads on which these vehicles must travel. This is not an easy problem in a country of the size, and with the topographical and meteorological conditions of Brazil. It is, evidently, not simply a question of the possible passage of the vehicles; the condition of the roads must permit, under any atmospheric conditions, the passing of the vehicles without causing avoidable suffering or damage to the evacuated wounded or sick. Sanitary aviation, when it can be utilized, and in spite of its limited scope, constitutes the ideal measure of evacuation for major casualties, and is destined to play a role of the greatest importance in future wars.

(11) Whenever existing circumstances require rapid evacuation to great distances, through scantily inhabited regions, devoid of local resources, a larger number of medical measures of various kinds must be provided, such as: (a) numerous and rapid means of transportation. Sanitary airplanes will render excellent service when automobiles cannot be utilized; (b) means of treatment: medical stations,

where the wounded who cannot be moved to a great distance can be treated.

(12) That the results may prove efficient, the principles governing the evacuation of the wounded and, consequently, the functioning of the medical corps in the field, must be based on scientific and clinical facts.

GARBOWSKI AND ZAWADOWSKI (Poland)

In their report on "Evacuation in Moving Warfare," Lieutenant Colonel Dr. Garbowski and Medical Commander Zawadowski stated that, under heavy enemy fire, with little or no change in the position of the fighting line, there is an enormous number of wounded, but there is close proximity of the medical services to one another, which facilitates the transportation of these casualties. When, on the contrary, the movement of the troops is the preponderating factor, though losses are generally smaller, transportation becomes more difficult because of the distance between the medical centers, the destruction of the roads of communication, and the danger from the enemy.

The fluctuations of the fighting line and the danger from the enemy along the lines of communication, render it necessary to have light, freely movable medical formations, which can be rapidly installed near the battlefield. But the general rules of organization remain similar to those which apply in a war with a continuous front and even in a war of position. Evacuation consists in guiding the wounded and sick to the establishments where they can secure the care obtained in normal times. Two difficulties confront the action of the medical corps: that due to the large number of wounded and sick, and that caused by the distance of the medical centers from the battlefield.

The losses in modern wars have undergone considerable change. While, due to prophylaxis and improved conditions in the field, the number of sick has progressively and very decidedly diminished, the enemy's fire, war gases, and more powerful means of destruction have taken more and more victims. Thus, the total number of losses increases, while the number of sick diminishes. The statistics of the World War, published in the different countries, are very explicit on this subject. The Polish Medical Corps in 1918-20 on the Eastern front, had to deal with only relatively small losses. The experiences in some respects were suggestive of earlier wars. Bullets caused more deaths than shells in Poland, in the course of the war of 1914-1918

and, in certain periods, the cases of contagious disease, especially typhus fever, were very numerous. For an infantry division of 15,000 men, in four days of fighting, the count was 1,400 to 2,000 disabled, with 30 per cent dead or not accounted for. Such losses require numerous means of transportation. Concerning the time it may take to transport a wounded soldier to the hospital, without danger to the wound and the ultimate course of treatment, the experience of the World War, ably discussed by Duguet at the Rome Congress, shows the following :

(1) The vast majority of war wounds are infected, in spite of correct application of the first dressings and careful disinfection of the wound on the battlefield.

(2) In order to guard against infectious complications, all war wounds are to be operated on during the period preceding the onset of the infection. This period varies, according to the affected tissues, on an average of from twelve to thirty-six hours following the infliction of the injury.

(3) No wounded soldier may be sent to the interior without first being subjected to surgical examination, conducted according to all modern scientific rules.

These general principles still remain obligatory and serve as the basis for the organization of the evacuation system.

In order to fulfill its mission and satisfy the surgical requirements, the medical corps was reorganized during the World War or directly after its termination, in the majority of the allied armies. In its general outlines, the organization of the medical corps is as follows: Behind the lines, at a distance which permits the wounded to reach them in a few hours, there are large hospitals, which, in certain armies, bear the name of evacuation hospitals. Their dependence on the great tactical units is variable in the different armies. They belong, usually, to the army. These hospitals are really filters through which pass nearly all the wounded, gassed, and sick, coming from the front. The men detained here are those whose grave condition does not warrant their being transported to a distant point and those who, for military reasons, must be treated and hospitalized in proximity to the front. Minor casualties and the slightly sick may more rapidly return to the fight, when cared for near the battlefield. In these hospitals, early surgical operations are performed on an important proportion of the wounded.

The part assigned to the evacuation hospitals indicates that their

capacity must be considerable. The percentage of non-occupied beds is important, in preparation for any unforeseen event. These hospitals can be moved only by railway or with the assistance of numerous vehicles. Even in a war of position, the slight changes of the front and the danger of artillery fire, necessitate the location of the evacuation hospitals at a distance of thirty or forty kilometers from the front. Even when good roads and comfortable sanitary autos are available, this distance may be rather long for major casualties, so-



The Local Polish Committee, headed by General Rouppert, through whose untiring efforts the Congress attained its great success.

called urgent cases, whose condition requires immediate surgical care. For these wounded, special hospitals nearer the battlefield must be created and organized in such a way that they can be installed in a few hours. To facilitate the description, these may be designated as field hospitals. They must be small, for a variety of reasons. In the first place, their situation, eight to fifteen kilometers from the front, renders them useful only to a small sector. Secondly, in a battle with great losses, they hospitalize only the non-transportable major casualties. Thirdly, these formations must be provided, especially in a war of movement, with suitable means of transportation of their

supplies. Finally, as they may fall into the enemy's hands, the losses in personnel and matériel must not be very serious. In the different armies, these hospitals bear various names, such as ambulances, light surgical ambulances, or field hospitals, and belong either to the division or to the army corps.

The field hospitals and the evacuation hospitals are united with each other and with the fighting units by a series of medical establishments, whose mission is the transportation of the wounded. The transports are organized in such a way that the wounded can be watched en route. The intervening posts where the wounded are cared for and fed, are known as battalion, regimental, or divisional aid posts. Granting that surgical treatment is possible only in stationary establishments, such as field or evacuation hospitals, the transportation must be only of short duration. Consequently, the medical corps must have means of rapid transportation at its disposal. The quantity of these means must be sufficient so that the wounded will not be compelled to wait at the aid posts.

The foregoing is applicable in its main features to a war of position as well as of movement. It is, moreover, not possible to foresee in advance, if a battle will have the character of the one or the other. A war of position may become a war of movement, and vice versa. The medical organization must be flexible, elastic, and capable of responding to any aspect of the fight. In moving warfare, continuous changes are observed, which, with respect to the territory where the engagement takes place, the distances, the tactical conditions of the fight, and the losses incurred on both sides, furnish a multitude of situations, the details of which cannot possibly be foreseen. The mode of evacuation must always correspond to the existing condition. The quantity and nature of the sanitary formations destined for temporary hospitalization, as well as the nature and quantity of the means of transportation, must be very elastic in order to meet any given situation.

The directors of the medical corps must always take into consideration in moving warfare:

(1) The absolute necessity for the great tactical units to preserve their mobility.

(2) The influence of sudden changes of the tactical situation on the medical corps.

(3) The difficulties resulting from displacements, losses, a long and difficult transportation.

Accordingly, no heavy sanitary formations which involve the overburdening of the convoys are in demand. The rule should be for the minimum of medical formations in the great units. On the other hand, the medical command should have at its disposal numerous reserves, treatment formations, and means of transportation. These must be utilized in a rational manner. Details in this respect can be considered only in relation to the general organization of the transportation service of each army.

In the different phases of the war of movement, medical tactics must be guided by the following principles:

(1) During rapid advance, concentrate towards the front the means of transportation, avoid the scattering of the wounded in small formations, group the wounded abandoned by the divisions, be ready to overcome the numerous difficulties of transportation, place the medical reserve in proximity to the fighting units.

(2) During the retreat, grade the medical formations in depth, rapidly evacuate the slightly wounded and sick, be in a position to replace the medical formations demolished or taken by the enemy.

No matter what the form of the fight, the medical corps must always endeavor to insure scientific treatment to the wounded. Consequently, even in a war of movement, the wounded must reach the surgical hospital in a short time. It is necessary to consider what effect the movement of the divisions will have on the medical service; that is, the displacement of the medical formations to the front, rear, or side. It is also necessary to consider the safety of these formations. The movement of the divisions, namely, the distance which they can travel in a given period of time, is actually affected by various conditions. The intensity of the fire in moving warfare, as in a war of position, evidently plays a considerable part in this connection. While in the war of position, difficulties arise, especially through the number of wounded and the enemy's fire, the chief difficulties in the war of movement, in addition to these, are from the displacements of the fighting units and the maneuvers of the enemy.

The transportation of the wounded between the battlefield and the first line aid posts, varies somewhat in a war of position and a war of movement. In the latter, the transportation often becomes more difficult through greater exposure of the stretcher bearers to the enemy's fire, and increased distances. The battalion aid posts must follow their battalions. A maximum distance must never be exceeded, for it is not permissible to transport a wounded soldier a

long distance without having verified his condition and given him some medical care, which appears possible only at the aid post. In a war of position, the battalion aid posts are more or less sheltered, while in a war of movement, they are rarely protected even by earth bags, against musketry fire. The wounded should be kept at the battalion aid post only the strictly necessary time. After being given the attention immediately called for, and after he is equipped with the evacuation label, the casualty is to be immediately sent to the rear.

The necessity of immobilizing all fractures must be here emphasized, for transportation will be inevitably longer in moving warfare than in a war of position. In view of the fact that a definite immobilization is not to be thought of, the battalion aid posts must be abundantly provided with ready made, lightly constructed, and easily handled fracture apparatus. At the battalion aid post the second stage of transportation begins, and there is a change in the directing authorities as well as in the executive personnel. The battalion (regimental) surgeons, after having bandaged their wounded, have played their part. The special formations of the divisional medical corps have charge of the ultimate transportation. This principle must be observed especially when the battle is sanguinary and the distances are considerable. The divisional departments, charged with the transportation beyond the battalion aid posts, exist in nearly all armies and are called divisional medical groups, medical companies, and so forth.

The duties of the divisional medical group consist in the transportation of the wounded from the battalion or regimental aid posts to the field evacuation hospitals, though the last named objective is practicable only in very rare cases. In the immense majority of the cases, transportation is made to a much nearer point, either by automobile medical sections, by horse-drawn medical columns, or by medical trains. The divisional medical formation is composed of a medical personnel, hospital attendants, stretcher bearers, and motor or horse-drawn vehicles; it must possess the necessary matériel to care for the wounded in the course of transportation, as well as the food needed in transit. The number of vehicles must be limited, in order not to encumber the division with long convoys. The medical personnel directs the first classification of the wounded, gassed, and sick, so as to divide them into two groups: those who are to be sent to the field hospital, as urgent casualties, and those sent directly to the evacuation

hospital as less urgent casualties. This selection takes place at the divisional aid post, organized by the medical company.

The divisional aid post is placed close to the firing line, at the point of convergence of the routes from the front. It is desirable to pick out a place more or less protected against the sight, balls, and shells of the enemy. In a war of movement, this post may be situated six to ten kilometers from the front lines. It should be installed, as far as possible, in pre-existing shelters, farms, villas, workshops, and more rarely, under tents. The possibility of rapid installation in two or three hours must be aimed at. Likewise, in case of danger, the aid post must be capable of a rapid breaking-up. In a war with great displacements, a single divisional aid post will not always prove sufficient. A detached portion of the division may very well have a distinct line of communication and be unable to take advantage of an aid post planned for the entire division, or, in other cases, the divisional aid post may become too distant. Advanced divisional aid posts must then be pushed forward. This will permit lengthening the trunk of the road of evacuation—battalion aid post to divisional aid post—without running the risk of breaking the continuity between these two points. It is, therefore, preferable to give to the medical company such an organization that it may be divided into two or three sections and can, simultaneously, install two or three aid posts.

When the theater of military operations is deficient in a network of roads, the medical company should not be given any automobiles. The vehicles of this formation must reach the battalion aid posts usually by passing through bad roads or even across the fields for ten or fifteen kilometers. When near the enemy, automobiles cannot be lighted up at night. Hence, as a rule, sanitary automobiles should be reserved for transports on roads at a greater distance from the enemy. Much praise has, of late, been given to caterpillar autos and six-wheeled autos; the latter might prove really serviceable, especially in roadless territories.

A few words are in order concerning the medical company and its posts at the time of a retreat. If a post is threatened, an attempt should be made to deviate the flow of wounded to an aid post presenting greater security. At the same time, all the available means of transportation should be directed to the threatened post, so as to remove, at least, the slightly wounded men. Beyond the divisional aid post, the current divides into two: one of its branches, the most

important, turns towards the evacuation hospital, the other, less important from the numerical viewpoint, towards the field hospital.

From the viewpoint of the requirements of treatment, the field hospital must be placed as close as possible to the battle. From the viewpoint of security, it should be as far removed from the firing line as possible. It is generally placed at a short distance from the divisional aid post. Its situation depends upon a number of circumstances. In an offensive which has prospects of success, it is pushed forward. In a retreat, it is removed from the lines. When good roads and comfortable sanitary autos are available, the hospital may be placed farther away. The few kilometers more that the wounded have to make in an auto on a good road, will not unfavorably affect their condition. The maneuvers of the enemy must be taken into consideration. Finally, the question of localities has a great importance. One will not hesitate to move the field hospital backwards or forwards by a few kilometers if this permits giving it a more convenient installation. It is indispensable for the hospital to be capable of rapid installation. And, in a war of movement, it must be in a condition to receive the wounded five to eight hours after its arrival at a given point.

The problem of the capacity of a field hospital finds its solution in statistical data. Given the average proportion of the urgent major casualties as related to the total number of wounded, and keeping in mind that a division is withdrawn from the fight after suffering losses of a certain importance, the theoretical figure of beds necessary corresponds to 0.7 per cent to 1 per cent of the total military strength of a division. It is more difficult to determine the quantity of surgical personnel of a field hospital. During long periods of a war of movement, these hospitals are known to be continually displaced without doing any surgical work, while skilled surgeons are always in insufficient number during a somewhat prolonged and bloody war. During a single day of a great fight, a field hospital may receive from twenty-five to thirty urgent casualties coming from a single division. Among these wounded, there will be 70 per cent who must be operated upon immediately. However, the surgical service in a field hospital can manage only eight or ten wounded daily. The solution may be reached as follows: Usually a field hospital has only one or two surgical services; but in the higher grade army corps or army hospital, there exists a surgical reserve (which usually works in the evacuation hospital), consisting of two services of two surgeons each. Each of these

services possesses its own means of transportation (autos or airplanes) and its own matériel for the installation of an operating room. In case of necessity, one (or several) of these services may be directed to a divisional field hospital and can work there as long as there are wounded to be operated upon.

When it is taken into account that the wounded, in modern warfare, represent the majority of the losses, and that the treatment consists in early operation, it becomes necessary to devote special attention in the field to the rational use of expert operators. Inas-



After the inauguration of the Congress, two thousand carrier pigeons delivered the following message throughout Poland: "Greetings from the Fourth International Congress of Military Medicine, Surgery, and Pharmacy". Enthusiastic telegrams were received in reply.

much as a surgeon usually operates well and rapidly only when assisted by the man with whom he is accustomed to work, established surgical services should be provided. The result of the work of these services depends, a great deal, upon the conditions under which they must function. It is, therefore, not a matter of indifference to concentrate the surgical forces in large, well managed hospitals or to scatter them in small field hospitals, badly installed and close to the front. The rapidity of displacement of the troops, the extent and depth of the fighting zone, as well as the conditions under which transportation is accomplished, must be taken into account. Hence, when transportation is long and tedious, all the wounded cannot be

directed to the large surgical hospitals. The surgical forces will have to be scattered in small field hospitals. In this manner, a more considerable number of wounded will benefit by early operative intervention. As soon as transportation becomes easier, the wounded are concentrated in the evacuation hospitals. Granted that the operated wounded often remain non-transportable for some time, small groups of casualties may be scattered behind the front. They must be regrouped later on and transported towards the rear. Evidently, this results in a more serious situation for the medical corps and constitutes another argument against the scattering of the surgical forces. This scattering, therefore, should not take place unless it is really impossible to do otherwise.

It is noteworthy that operating surgeons have a tendency to employ only surgical methods with which they are familiar and in the habit of using. Often they insist on the performance of definite operations without taking into account the inflow of the wounded and the necessity of attending to everybody. Meanwhile, it is well known that the same results often can be obtained by means of simpler operations. Frequently, surgical treatment can be completed only at the rear, in a better equipped hospital. Thus, the modalities of surgical procedure must vary according to the more or less considerable inflow of wounded and the number of available surgeons. The directors of the medical corps cannot closely watch the surgical procedures adopted by the operating surgeons; this task belongs to the consulting surgeons, namely, to the scientific authorities, the professors of the faculties.

The question arises as to how to displace the field hospitals which hospitalize casualties unable to be transported. If a division advances ten or so kilometers, its field hospital, having become stationary on the first day of the fight, becomes useless for this division, insofar as a hospital for major casualties is concerned. In such cases, the immobilized or stationary hospital passes to the army corps or army hospital. In exchange, the division may receive from the army reserve another hospital, which has no wounded and can, consequently, follow this division in its displacements. It is noteworthy that the question of field hospitals is extremely difficult to solve in moving warfare. In order to carry out the foregoing maneuvers, a very considerable quantity of field hospitals must be always available, ready for service. The only chance of rescue for a great number of wounded, namely immediate surgical attention, must be utilized.

Another solution of this problem might be adopted; the field

hospitals could be organized so as to be divisible into two or three sections. One section might remain in place, and the others follow the division. However, here, also, some inconveniences arise, as, if this plan were followed, the administrative personnel of the hospital would have to be augmented. Furthermore, the separated sections would run the risk of never becoming reunited.

In the future, the question will be solved by means of sanitary airplanes. Requisitioned civilian, commercial airplanes may be concentrated in the army for the purpose of transporting major casualties from the divisional aid posts directly to the hospitals situated sufficiently far from the front. The severely wounded readily tolerate this mode of transportation, and, as their number is not usually excessive, undoubtedly no difficulties will be encountered in the collection of a sufficient number of airplanes to carry out this scheme.

The course of the transportation of the wounded between the divisional aid post and the evacuation hospital is, sometimes, so long, that the railroad must be resorted to as soon as possible. At the railroad station closest to the battlefield, a post may be organized for the loading of the evacuated into the trains. In order to facilitate the description, this post will be designated as "evacuation station." Evidently, the distance which separates this station from the divisional aid post can sometimes become considerable, forty, fifty, sixty kilometers, or even more, in the case of destruction of the railway. The medical corps of the divisions cannot be charged with the evacuation to such a long distance. Here two solutions must be considered:

- (1) The organization of rapid transportation by sanitary autos.
- (2) The creation of surgical centers, not supplied by the railway, these centers to have the rôle of evacuation hospitals.

In the first solution, the transportation is incumbent upon the directors of the medical corps of the higher grades: army corps who can utilize the automobile sections held in reserve. If the distance between the battlefield and the evacuation hospital becomes so considerable that the wounded cannot arrive there in twenty-four hours, in spite of the employment of autos and sanitary trains, recourse must be had to the provisional surgical centers installed away from the railway. These centers can be organized by the army corps by grouping together several field hospitals. This solution has the advantage of permitting the rapid installation of the first hospital,

which can begin to function while the other hospitals successively arrive for the progressive reenforcement of this provisional surgical center.

The evacuation hospital must be placed far from the front in moving warfare with great displacements—eighty to one hundred kilometers from the firing line, on a railroad junction. At the railroad station of the town where this hospital functions, the selection, or *triage* post is organized. The wounded, sick, and gassed coming from the front on the trains, are here taken out, carefully examined with dressings opened, as far as possible, and divided into groups. Those whose condition requires more urgent care, are sent immediately to the hospitalization services of the evacuation hospital; those who can continue the journey are placed, after the first treatment, if possible, in sanitary trains going to the hospitals of the interior. Minor casualties are forwarded to special centers for the slightly wounded, convalescents, and so forth. During a rapid advance, when the evacuation hospital has become too far away, recourse must be had either to the surgical centers just referred to, or to the installation of provisional evacuation hospitals. At an evacuation station, two or three field hospitals must be installed, whose surgical personnel can be reenforced by the movable surgical teams of the evacuation hospital. When the new provisional evacuation hospital, thus organized, begins to function, the evacuation hospital progressively ceases its work and, after evacuating all the wounded and sick under its treatment, it moves forward. When there is a general retreat and the evacuation hospital has become too far away, the current must be directed elsewhere, if necessary, towards a hospital of the interior, which will begin to function as an evacuation hospital. If required, it may be reenforced by some field hospitals or some movable surgical teams. Analogous procedures may be adopted when it is not desired to move the evacuation hospital, it being crowded with wounded and sick. One of the hospitals of the interior, or group of field hospitals may receive the wounded coming directly from the front. When the fight is not animated, and when the evacuation hospital is stationary, wounded, gassed, and sick of all classes may be cared for here, but a large proportion of unoccupied beds must always be kept available.

The organization of hospitalization in the interior of the country presents nothing peculiar with respect to a war of position. It is

desirable for each army to provide two groups of hospitals in the zone of the interior, however. One group should be in proximity to the front, the other in a region distant from the front. The first group, constituting a sort of safety valve in the case of a retreat, should constantly possess a considerable proportion (30 to 40 per cent) of unoccupied beds. The hospitals of these groups should have personnel and matériel in sufficient quantity to be enabled, if necessary, to receive, classify, and care for the wounded and the sick brought in directly from the battlefield.

EVACUATION IN CAVALRY COMMANDS

A few words are in order concerning evacuations in large cavalry units, the more so as not much has been published on this subject in medico-military literature. The data on this point herein presented, is based on the work of a Polish military surgeon, Colonel Dr. Koneczacki. Cavalry masses are employed either as a vanguard or on the flanks of the army, or in the raids into the interior of the enemy's lines. Hence, the great cavalry units will often be penetrated by small enemy detachments. The medical formations will, consequently, be less well protected than in the infantry. The field hospitals can be installed only far from the lines, in the proximity of railroad stations, namely, evacuation stations. The wounded will suffer under this arrangement, but it cannot be helped. The divisional aid posts will be installed in proximity to the reserves of the divisions, who will defend the former, if necessary. The medical company of the cavalry division often must be divided into two or three sections, each section being provisionally attached to a brigade. The medical formations of the cavalry must be very light and movable, so that they can move rapidly. In order to organize the medical service of a cavalry division, it is necessary to know the average losses in the cavalry. According to Colonel Koneczacki, a division of 10,000 men may lose 300 in a day of fighting. This figure corresponds to heavy losses. The proportion of killed and missing is greater here than in the infantry. The sanitary means of transportation may thus, at first sight, seem less ample than those of the infantry. But actually, on account of distances, the contrary is true. Convoys of wounded will often be protected against enemy patrols by cavalry detachments.

During a cavalry raid, the functioning of the medical service proves very difficult. The purpose of the raid is to produce dis-

turbance and confusion in the communications and services in the rear of the enemy's lines. The medical corps must keep in mind:

- (1) That the raid cannot last a long time.
- (2) That it cannot take place unless the enemy is weaker from the physical or morale viewpoint.

In its first phase, the raid endeavors to open the passage by force. The wounded of this first phase will be evacuated in a nearly normal manner. After having penetrated to the rear of the enemy's lines, the cavalry tries to destroy the stores, the intersecting points of communication, and so forth. It avoids grave fighting. Consequently, the number of wounded will not be very high, but the medical service will, nevertheless, be seriously taxed with their evacuation. There is only one solution; that is, to leave in civilian hospitals, under the protection of the Cross of Geneva, the very seriously wounded who are absolutely unfit for transportation. The others can be moved by the medical company or by other sanitary means, or even by requisitioned vehicles, until the day when the cavalry returns. In such cases, more than ever, sanitary airplanes are capable of rendering important services.

In regard to the liaison between the battalion and regimental aid posts and the units, it is noteworthy that even a temporary break in the line of communication is capable of producing very serious disturbances in the transportation of the wounded, and of considerably retarding their arrival in the hospitals. This coordination is greatly assisted by the *esprit de corps* which must unite the surgeons and the officers of the troops of the units where they are employed. Surgeons imbued with these principles are always tempted to follow their units, in spite of a purely medical desire to remain at the rear, in order to give more attention to the wounded. The connection between the aid posts of the firing line and the divisional medical corps and that between the higher grades of the medical corps is established, on the one hand, with the assistance of means of transportation properly belonging to the medical corps, and, on the other, by virtue of the general organization of communications elaborated and carried out by the liaison service. While the first mode of connection has always been much in use, the second seems to be less often employed. It may, however, prove highly serviceable for the wounded, when a good system of communication is available, especially in a war of movement. Hence, the following principles are to be adhered to:

(1) The directors of the medical corps, in all grades, will collaborate with the chiefs of the service of communications.

(2) In the installation of the medical formations, the transmission of information service must be taken into consideration.

(3) It must be seen to, that all departments, and the formations of the medical corps, are kept informed concerning the plan of connection (transmission center, telephone wires, optic signals, radiotelegraphy) and arrangements must be made so that these sanitary organs can take advantage of the foregoing means of transmission.



Czechoslovakian delegation headed by Surgeon General Fisher.

(4) The directors of the medical corps and the commanders of the medical formations and departments must have suitable means of transmission at their disposal, such as telephones, couriers, mounted messengers, cyclists, motor cyclists.

The liaison between the directors of the medical corps and the military staffs, the importance of which has been greatly stressed, must be still closer during a war of movement. Every modification of the aspect of the battle may have an immediate effect upon the placing of the medical formations as well as on their displacements.

In concluding their report, the authors again emphasized the absolute necessity for the directors and the executives of the medical

corps in the field to have military instruction. The directors, as well as the chiefs of the medical formations and departments, are military surgeons. Experience has clearly shown that a medical formation functions well only when its chief is a physician. Consequently, in addition to his medical instruction, the military surgeon must have a knowledge of general tactics, as well as sanitary tactics, be able to orient himself in the territory, be familiar with the reading of maps, be a good administrator and instructor of his unit. It is, therefore, very important to encourage military surgeons to study military science. By organizing maneuvers in the sense of fictitious wars, by setting the military surgeons exercises and tasks of military tactics on the map or in the field, their acquisition of military science will be enormously facilitated, as well as a spirit of initiative and habit of prompt decision, which are indispensable for the military surgeons in the field, especially in the course of a war of movement.

CONCLUSIONS

(1) The medical formation in a war of movement should be placed at some distance from the firing line. This distance must be calculated, however, so as to permit the wounded to arrive in the hospitals in a few hours, and be promptly operated upon when necessary.

(2) Transportation must be rapid, consequently the medical corps must be provided with abundant means of transportation.

(3) It seems reasonable to equip the divisions with a small transportation outfit, and to establish a strong reserve of these means of transportation in the superior units—the army corps and the army. This reserve can reenforce the divisions, which, due to great losses, may be temporarily in need of supplementary means of transportation.

(4) During the march forward, the large units should be equipped only with the necessary sanitary formations. Large reserves should be placed in the rear, ready to be sent to any part of the battlefield.

(5) During a retreat, the medical organizations should be placed in echelons far apart. Provision must be made to replace the medical formations destroyed or taken by the enemy.

(6) Each director of the medical corps and each chief of a medical formation whose duty it is to take care of the transportation of the wounded must limit his activities in proportion to the means at his disposal.

(7) Small field hospitals should be located near the firing line for the severely wounded, who require immediate surgical attention and who cannot be transported to a distance. The capacity of these hospitals should be small with only a small surgical staff, and be re-enforced, if necessary, by mobile surgical units. Every division should have a field hospital of this kind. Although not in favor of dividing the surgical forces by placing them in small hospitals, this division becomes unavoidable in moving warfare, when there are great displacements and resulting difficulties of transportation.

(8) The large evacuation hospitals situated more to the rear than the small field hospitals, during the active portion of the battle receive only those wounded and sick who are unable to stand a more distant transportation. In the case of a rapid advance, temporary evacuation hospitals may be organized by grouping together several field hospitals. These united groups are often called upon to work at a distance from the railroad.

(9) The permanent hospitals, in a zone of communications that can be easily threatened by the enemy, should not have a large bed capacity. In the case of a retreat, some hospitals in this zone may be called upon to replace evacuation hospitals.

(10) In large cavalry units, especially during raids, the medical corps, under some conditions, is able to apply only the old methods of caring for the wounded. Early surgical operation often is impossible.

(11) It is necessary to emphasize the importance of a close liaison between the different medical formations, as well as between the directors of the medical corps, the chiefs of medical organizations, and the command throughout. For this purpose, not only stretcher bearers, drivers of the medical vehicles, chauffeurs of sanitary motor cars, must be utilized, but also the provisions included in the general plan of transmissions established by the liaison service.

(12) Tactical military instruction is indispensable for all surgeons, directors, or medical chiefs of medical organizations at the front.

SPIRE (France)

COMMUNICATIONS

“Territorial Influence on Evacuations in Moving Warfare” was discussed by Médecin Principal de 1^{ère} Classe, Spire, Medical Chief of the War High School, Paris. In the case of military theaters provided with ample means of communication, an army, normally equipped with material for necessary repairs, can overcome most diffi-

culties regarding evacuations. Conditions are altogether different in military theaters where the road system is distinctly deficient, sometimes even absent or reduced to mere footpaths or irregular ground. Also, the extension of the fronts involves a considerable lengthening of the lines of evacuation. In these circumstances, the territory becomes the principal obstacle. No matter how numerous, rapid, and convenient the means of transportation, they are useless because of their impracticability. The solution of the problem lies in three general procedures:

(1) Conquest of the territory by creating means of transportation capable of progression aside from any road system: autocaterpillars or six-wheeled carriages.

(2) Reduction of the number of evacuations by roads by pushing the railroads forward and by creating advanced posts of treatment, at least for emergency cases. This illustrates the mutual influence of evacuation and hospitalization.

(3) Avoidance of the territory. When the utilization of special vehicles meets with difficulties and when the extension of the railroads requires a long time, it becomes imperative to neglect the territory and to resort to the only procedure of comfortable, rapid, and extensive evacuation, in the form of the sanitary airplane. Its services are limited only by the possibilities of landing and taking off.

In moving warfare, the parallelism between the front and the organization of treatment of the wounded, is perpetually broken, due to the greater rapidity of movements at the front as compared to the progress of the provisionally immobilized treatment stations. The first difficulty, arising through the lengthening of the line of evacuation, is easily overcome in favorable territory, but otherwise becomes complicated. While it is true that the losses are less in a war of movement, it must not be overlooked that the *numerical* question is only a part of the entire evacuation problem; the *technical* problem remains the same and, moreover, the momentary eventuality of increased losses always remains possible, and represents a maximal complication of a situation which must be fought with every known measure. The solution of this arduous problem lies in overcoming the naturally or artificially produced territorial obstacles.

SCHICKELE (France)

In his communication on "The Question of the Stretcher in Long Distance Evacuations in Moving Warfare," Médecin Principal de 2^{ème}

Classe, Schickele, of the French Army, stated that it has been almost universally admitted that, in order to guard against unnecessary suffering, a wounded case should be left on the same stretcher from the extreme front to the sanitary treatment station, irrespective of the distance between the two. This involves certain difficulties, as the length of the regulation stretcher seriously interferes with its installation in the evacuation vehicles. Shorter stretchers are necessary for sanitary airplanes and automobiles.

The relative importance in space and time of transportation by stretcher bearers and transportation by vehicles in the course of evacuations, is shown in the following statements: From the front to the regimental aid post the medium distance is two to three kilometers, and transportation of the wounded by stretcher bearers varies from an hour and a half to two hours. Light sanitary autos are utilized at the regimental aid post. From there on, the wounded are only exceptionally transported by man power, and only for the short time required for their passage from one mode of transportation to another. An effort should always be made to reach the treatment station at the greatest distance from the front, because it is there that the most complete and definite care can be given. Evacuations often will have to be considered to distances up to 150 or even 200 kilometers, where the French Military Sanitary Service provides its large sanitary field formations under the name of secondary evacuation hospitals.

It appears that 10 per cent of the total evacuation time, under normal conditions, is assumed by man power transportation and 90 per cent by vehicular transportation (auto or railroad). The statistics of the World War show that, on the French side, of one hundred wounded who come to the regimental aid post, sixty-two can reach the secondary evacuation hospital. About two-thirds of the wounded are, accordingly, capable of supporting a long distance transportation, and evacuation by man power is plainly shown to take a very minor part. Under these conditions, it is difficult to understand why the stretcher for manual transportation has been adopted to serve exclusively for the evacuations, while it serves only for a portion of the same.

It naturally follows from the foregoing considerations that two models of stretchers should be provided. The first, for transportation by carriers, should be simple, solid, rustic, divisible into several pieces, and very easily transportable. It should be reserved for the

zone of the battlefield, where it would be exclusively in charge of the stretcher bearers. The second, to be designated as the evacuation stretcher, should be a couch-stretcher, of a general model, absolutely the same for all vehicles, preferably of metal equipped with an elastic headrest, capable of receiving a light mattress, of becoming transformed into an evacuation bed for gravely wounded casualties, and of permitting eventual immobilization. The immobilization and transportation frame of the French Military Sanitary Service, combines the fundamental characteristics of the desired evacuation couch-stretcher. Every sanitary evacuation vehicle, no matter of what kind, should be permanently provided with couch-stretchers corresponding to the number of recumbent wounded it can normally carry. It is advisable that the dimensions of the couch-stretcher be standardized and internationalized, so as to permit the eventual utilization of any evacuation stretcher in the sanitary evacuation vehicles utilized by the different nations.

CACCIA (Italy)

Colonnello Medico Dr. Professor Filippo Caccia, Director of the Military Hospital in Bologna, discussed "Evacuation in the War of Movement in Mountainous Areas" where the problem involves great difficulties and still remains unsolved. The various solutions which have been proposed are far from meeting the modern technical requirements for rational wound treatment. In the World War, which was chiefly a war of position, the problem was successfully solved in many high mountainous areas by means of railroads, which permitted the transportation of the gravely wounded, within a few hours, to the hospital or surgical ambulance. However, the railroad system worked only when the great units remained in the same positions a long time, as was usual on the Italian front. The rapid evacuation of the wounded in the war of movement is, likewise, in need of an adequate solution, compatible with the high modern requirements.

The recovery of the men is essentially connected with their transportation from the field of battle and the time required for the same. The ideal of surgical therapy is that of preventing wound infections by surgical prophylaxis. Such infection usually begins after ten to twelve hours, but may be delayed for twenty-four hours. The first really rational treatment is, therefore, that of surgical intervention in the foregoing time limits. Two possibilities here enter into

consideration: the placing of surgical stations as closely as practicable to the battle field; or the evacuation of the wounded to the particular surgical sanitary formation. With respect to the former plan, aside from other indisputable considerations, it is not possible to give really useful assistance to the gravely wounded in advanced zones. The rapid transportation of the wounded to the field hospital or surgical ambulance is the important problem which remains to be settled in these progressive days. The great difficulty lies in the means to be adopted. Railroad transportation is a rapid modern measure which can be utilized in mountain warfare. The airplane, at the present state of our knowledge, can only constitute an exceptional measure in the zone of military operations in the mountains. Transportation in sprocket wheelbarrows (*barelle a catena*), handled by a team of orderlies who were changed every ten or fifteen minutes, was much utilized in the Italian army during the World War. These carriers always traversed the same tract, so that it became so well known to them as to be safely traveled by night. This system is excellent and relatively convenient, but is limited to fairly short distances. Wound carrier posts were established, formed of trained sturdy mountaineers, so that in case of a breakdown of the railroads, and for military reasons, the wounded were carried directly to the sanitary units or to the auto-ambulances.

Transportation in barrows, combined with railroad transportation, meets with all requirements for rational evacuation (rapidity and minimum inconvenience) in moving warfare in mountainous areas, and and for the time being solves this important problem in a most efficient manner. A single type of barrow should be selected during peacetime to fill all sanitary transportation measures (railroad cars, auto-ambulances, sanitary trains). The official representatives of the nations who took part in the former International Congresses of Military Medicine, Surgery, and Pharmacy agreed unanimously that a single type of barrow should be adopted by all nations, so as to be mutually exchangeable.

NADOLSKI (Poland)

“Evacuation in Moving Warfare and Territorial Obstacles,” was discussed by Lieutenant Colonel Médecin Dr. Nadolski of the Polish Army. A study of the evacuation problem shows at once that evacuation changes its character in proportion to the distance from the firing line. While at a certain distance from the front, it is merely a ques-

tion of transportation, in the immediate proximity of the front it is so closely connected with the military procedure as to present all the features of a tactical problem. In laying down the plan of evacuation for a large unit, for example, a division of infantry, it is necessary to maintain an intimate contact with the command of this unit; the intentions and ideas of the commander must be well known, and there must be a connection with the directors of the sanitary service of the neighboring sectors, in order to insure mutual assistance. It is, likewise, necessary to foresee the manner of the fight, the losses which will be sustained, the capacity of the means of transportation—which must be provided in sufficient quantity, and, finally, the territory where evacuation will take place must be studied. This knowledge of the territory is of capital importance. Without a careful preliminary investigation it is not possible to outline the routes of evacuation. In the war of position, the question of the territory is of secondary importance; here the distances to be overcome are reduced, the roads are carefully kept in good condition and, furthermore, an entire system of new routes may be established.

In a country, such as Poland, very poor in routes of communication, where the evacuations had to be organized on the Eastern front, in 1919-1920, conditions were altogether different. Use was made of the following: (1) Sanitary trains. (2) Sanitary automobiles. (3) Horsedrawn carriages. (4) Requisitioned vehicles, employed by the population of the country. The same means of locomotion will, presumably, have to be utilized in the future, as the sanitary airplane does not lend itself to mass transportation; moreover, its employment in the war of movement is limited by the fact that the airplane cannot land everywhere. The most reliable measure of evacuation has been, and will remain, the railroad system.

As the military operations, on the Polish Eastern front, developed principally along the railroad tracks, the improvised trains simultaneously played the part of means of communication and of principal division aid posts. Under certain favorable conditions, it was possible to work in the trains while keeping in close touch with the battle field. The railroad permitted the evacuations to be effected with all necessary precision and according to all the rules of evacuation, except in winter, when numerous obstacles arose due to the snow. The mode of communication of next importance was the high-road. While this was maintained in good condition, evacuations occurred normally, with utilization of automobiles or horsedrawn vehi-

cles of various kinds. On the highroads as well as on the railroad, the snow caused serious difficulties. Even sledges are sometimes incapable of forcing a passage through snowdrifts. While on well kept roads, these and other obstacles are connected with the season of the year, various difficulties were encountered during all the seasons on the unkept roads of the Polish Eastern front.

There are many more countries with scanty railroad systems and poor roads, than there are countries with a well developed rail and road system, and the directors of the sanitary services, charged with



PARADE OF RED CROSS AND ATHLETIC SOCIETIES IN HONOR OF THE DELEGATES TO THE CONGRESS

evacuations, are often confronted with obstacles similar to those encountered by the Polish Sanitary Service in 1919 and 1920. In order to overcome these difficulties rapidly, the whole subject must be studied and the medical personnel systematically trained during peacetime.

LOUDARD (France)

“Evacuations by Sea in Moving Warfare,” formed the subject of a Communication by Dr. Loudard, Médecin Chef de 1^{ère} Classe of the French Navy, Professor of Clinical Surgery. The navy may collaborate in evacuations during a war of movement and lend most useful assistance with hospital ships of great displacement. Undoubtedly

superior to the sanitary trains, the ship is actually a genuine hospital with its large, well lighted, and heated wards, where the wounded can rest comfortably and be given the most regular care. It may be expected to receive very rapidly, and to transport with great rapidity, the largest possible number of sick or wounded, to the nearest port prepared for their reception. The sick and wounded in the course of treatment in overcrowded hospitals, and those directly evacuated from the front, with barely dressed wounds, may be entrusted to the hospital ship. As a general rule the surgeons on board do not have to perform any definite surgical procedure, but are expected to improve upon the work of evacuation, with respect to diagnosis, bandaging, immobilizations. However, a surgical staff should be ready to carry out such emergency operations as might become imperative.

In a remote territory, only accessible by way of the sea, where large regional hospital centers have been established, permitting early surgery, the application of apparatus, the classification of the sick, and the isolation of contagious cases, a fleet of hospital ships can evacuate the operated wounded and transportable sick. The physicians on board need give only the ordinary care and see to the dressings. But here again a trained surgical team is necessary to meet unforeseen wound complications.

In the absence of a nearby medical base, when the sanitary stations on land can be only aid posts, the entire burden of the primary early treatment of the wounded devolves upon the hospital ship. Here arises the problem of the stationary floating hospital ship, a veritable first line ambulance, which cares for, operates upon, and discharges its wounded, as soon as they are evacuated, to the hospital transports. This is devoid of practical value in the course of a war of movement. It is moreover, desirable to shorten the stay of the wounded on board as much as possible. Every sanitary ship must be equipped like a floating hospital, but must itself attend the evacuation of its wounded as soon as it is filled. Two types of ships are necessary: large transports reserved for medical cases; and smaller ships especially adapted to the highly complicated modern treatment of the wounded. These same types will answer all the requirements of colonial expeditions.

Summarizing, to comply with all the forms of evacuation by sea in the war of movement, as shown by the experience of the World War, three types of ships must be considered: (1) Large hospital transports of great speed, reserved for evacuations of the sick, convalescents, refugees. (2) Large, mixed, hospital transports, of great

speed, possessing limited surgical resources. (3) Specialized surgical hospital ships, with a restricted number of beds, perfectly equipped, with a numerous and trained surgical personnel. No one will expect a navy to possess in peacetime such a considerable fleet, in preparation for hypothetical war eventualities. But it is very simple to foresee in peacetime those commercial ships which can be transformed immediately into hospital ships, retaining their ordinary navigation personnel, but having their personnel of surgeons and attendants accustomed to the sea, provided by the navy department.

SAINT-SERNIN (France)

“An Improvised Motor Fuel.”—In the form of a letter addressed to the president and the members of the congress, the following was offered by Pharmacien-Chimiste en Chef de 2^{ème} Classe, of the navy, Monsieur Saint-Sernin, member of the French delegation: It may happen that in a war of movement, a sanitary station finds itself momentarily deprived of gasoline at a time when an urgent evacuation is imperative. As a fortunate measure of transportation, there is a “medical carburetant,” so named because it is composed of four products, alcohol, acetone, benzol, and ligroin or petroleum ether, widely utilized in medicine or in the laboratories attached to the sanitary service. The proportions for the mixture are as follows:

Alcohol, 95 per cent, or fuel alcohol, titer 92 per cent, forty parts.

Ordinary acetone, twenty-five parts.

Benzine, twenty-five parts.

Petroleum ether (ligroin), ten parts.

This carburetant, can be substituted for gasolene in all automobile motors, without their requiring any modification, and can also drive the aviation motors.

DISCRY (Belgium)

“The Discry Stretcher.”—Captaine Pharmacien of the Belgian army, Henry Discry, presented the following summary of his “Monograph on the Discry Stretcher”: This stretcher constitutes an essentially military and colonial apparatus, filling the adequate type of a field stretcher. It is simple, strong, relatively light, comfortable, slightly flexible, both folding and closing, and entirely separable in parts, so that it can be divided into two identical and interchangeable semi-stretchers, each of which can be easily transported by a single man, after the manner of a gun brace. It is very rapidly put up and taken down, without groping, even in total darkness. It is provided

with supporting footpieces, which insure perfect stability, as well as with two stuffed headpieces permitting all readjustments from a right angle to the horizontal position. Due to the absolute interchangeability of all its constituent parts, it can be repaired at any time and in any place, without the assistance of a mechanic. The canvas is movable, supple, solid, impermeable, inextensible, and easily disinfected. The dimensions of the Discry stretcher are in conformity with those recommended by the standardization commission of sanitary material, which met in Geneva, through the International Committee of the Red Cross.

DISCUSSION

BARROW (Great Britain)

In his discussion on "Evacuation in Moving Warfare," Major General H. P. W. Barrow, of Great Britain, Director of Hygiene, stated that, during the World War, the British clearing casualty stations grew to such a size, became so immobile and were equipped in almost the same way as the hospitals on the line of communications, so that it is suggested, in the Polish official report, to relegate this unit to the head of the line of communications, without altering its name or functions and that a new unit, the field hospital, take the place of the evacuation hospital. However, the Royal Army Medical Corps thought it a mistake to complicate the situation by altering the tactical use of a unit, whose name and functions are well known to medical military students.

In regard to the transport, while the nature and quantity are cardinal factors, to these should be added control and method of use. In the British organization, for each battalion, with a strength of approximately 800 men, twenty-one regimental stretcher-bearers are included in the war establishment. This is sufficient in static warfare, though it was found necessary to reenforce this number when any local action was contemplated by the unit. Similarly, in major offensives, the bearers of the field ambulance had to be reenforced. In a fairly wide experience of intensive operations, including retirements to advances, the author never found it necessary to ask for more than fifty men, and these were always used on the line of evacuation, in bearer relay posts, nearer the A.D.S., where carrying was easier and attended with less risk.

In moving warfare the difficulty of evacuation, because of the impossibility to obtain men, was solved, to some extent, by the use of motor ambulance cars far in advance of positions considered suitable

in static warfare. It was found that the risk to the cars and drivers was negligible, if the cars were worked singly, through a system of car relay posts.

In closing his remarks General Barrow suggested that, at the next congress, one of the subjects to be considered, be on "Changes in Medical Tactics Necessitated by the Use of Mechanized Formations and by the Increased Use of Air Machines."

TEWFIK (Turkey)

Colonel Professor Dr. Salim Tewfik pointed out that, in the question of evacuations, it is absolutely impossible to adopt routine measures. This is true for the manner and measures of evacuation as well as for the decision to proceed to it. It goes without saying that in a suitable territory, rich in means of transportation, the necessity of evacuation is self-evident. But in entirely opposite circumstances, where evacuation is confronted with enormous difficulties, due to unfavorable conditions of roads and territory or to deficiency of roads or means of transportation, it is sometimes equally urgent to make the grave decision to evacuate the sick and wounded by all possible means. The increasing number of sick at the front only aggravates the situation. The vicious circle must be broken, and the sick must be evacuated to a greater distance. In case transportation is difficult, sanitary stations ought to be strengthened in personnel and in material in order to insure more favorable conditions for the treatment of the wounded and sick. But this procedure also had its disadvantages, as it is often impossible to foresee the outcome of a military movement. In this connection, attention is called to the absolute necessity, in future wars, to take more efficient international measures for the safeguarding of the medical corps. Many physicians and surgeons, while taking care of their non-transportable sick and wounded, fell into the enemy's hands and, in spite of the Geneva Treaty, remained as simple prisoners until the end of the war. A sufficient guarantee for their immediate restitution to their countries would often guard against a hasty and dangerous evacuation or the lack of competent care, precisely at the most critical moments. By expressing a desire in this behalf, the congress would perform a humanitarian task of the first order.

ANASTASIU (Roumania)

Lieutenant Colonel Dr. Victor Anastasiu, Roumania, Chief du Service Sanit. de l'Aeronaut., pleaded in favor of the air route, no

matter if transportation by land is practicable or not. By means of aerial transportation, all gravely wounded or otherwise non-transportable casualties can be moved under favorable conditions. But the airplane, for the time being, has two disadvantages; it is too expensive, and it undergoes very frequent technical modifications, so that an air fleet would be antiquated, for war use, after two to three years. The airplanes of civilian companies may be transferred to the army in wartime, and transformed for aerial bombardment. Therefore, all aerial navigation companies should be familiar with the means of loco-



ROUMANIAN DELEGATION

motion and the geographical situation of the country; should have a number of their airplanes adjusted so as to be transformed into sanitary airplanes in wartime. Every country should have, in peacetime, a medical aviation service, for the instruction of the sanitary personnel and as an aid post for accidents.

MUNRO (Great Britain)

Vice-Marshal D. Munro, Director of the Royal Air Force Medical Service, agreed that a certain number of airplanes, originally otherwise employed, be reserved for ambulance work. At the present time, the British policy is to gain experience of evacuation by air through

the use of ordinary troop-carrying machines, everyone of which is now built with easily convertible arrangements for carrying stretchers.

SPIRE (France)

Médecin Principal Spire contributed data on the practical utilization of the airship as a means of transportation in the French army. The military operations permitted its utilization on a large scale; as a matter of fact, several thousands of wounded were thus transported, in territories without roads, where the distance between the zone of infliction of the wound and the treatment stations amounted to hundreds of kilometers. This was accomplished without any major accident. The program of evacuation by sanitary planes, carefully regulated by a system of connections, permitted the transportation of the wounded, within a few hours, to treatment centers richly equipped with surgical and hospital facilities and at a sufficient distance away from the vicissitudes of the fight. Two types of sanitary airplanes are utilized, in consideration of the conditions of the territory: (1) A light airplane, type Hanriot, capable of landing on a restricted space and taking off with the same facility, thus permitting its approach to the wounded and reducing the tedious transportation by land. (2) A larger airship, type Breguet, destined for definite transportation. The employment of the sanitary airplane is permanently established in France, in the interior of the territory, for the transportation, in emergency cases, of either the operating surgeon or the wounded.

ETIOLOGY AND PROPHYLAXIS OF INFLUENZA

OFFICIAL REPORTS

JÜRGENS (Denmark)

Médecin Aide-Major Jürgens, of the Danish army, in reporting on the etiology and prophylaxis of influenza, stated that the subject is invested with special interest for military surgeons, for the danger is great in the case of epidemics, and greater, perhaps, where many persons live close together, under conditions and in localities different from those to which they are accustomed.

Since the remotest times, epidemics have been known to be the faithful companions of armies and wars, and often the most dangerous enemies of the troops; even in peacetime the appearance of any disease as an epidemic, presents a special danger for military communities. In a certain sense, this is rather remarkable, as soldiers,

generally, are the healthiest and best of the population, the pick of the men at the most vigorous age. It is observed that influenza most seriously attacks the strong and vigorous, a point which will be discussed more in detail a little later.

It will not be possible to give here even an approximately complete survey of the scientific attitude towards the question of the etiology of influenza, for the contributions, especially of recent years, are too numerous and the opinions too divided. However, it will be possible to point out certain features, which may prove of importance for the future, and to call the attention of those particularly engaged in this work, to the paper by the Danish scientist, Dr. Martin Kristensen, "Investigations into the Occurrence and Classification of the Hemoglobinophilic Bacteria," (Copenhagen, 1922), which combines a survey of the literature on the subject with the most extensive studies in existence, based on the epidemics raging during the years 1918-1922.

When, in 1918, influenza spread over all Europe, probably having its origin in Spain, (*morbus Ibericus*), the question was raised on many sides: Is this influenza? Or is it an entirely new disease? Going backward, even as far as the fourteenth century, there can be traced pandemic invasions, which, at intervals of twenty, thirty, fifty years afflicted large portions of the world. In its entire nature, from the double viewpoint of aspect and malignancy, influenza often varies to such a degree that it is not easy to establish a parallel at once. But apparently the disease can always appear in *pandemic* form, with extensive invasion, at long intervals. This phase can be followed by a period of *epidemic* invasions, the strength and extent of which diminish successively from year to year. Finally, between these periods, isolated cases or small groups of cases, the so-called *sporadics*, may be encountered.

The great epidemics in the years 1889-1892, were the first in the bacteriological era. During these years, very numerous attempts were made and important studies undertaken, to find the specific microbe of the disease. In a certain number of cases, cultures of pneumococci were made (Weichselbaum, Verneuil), others found streptococci, some found still other germs. However, it seemed to be more or less agreed upon that the discovered microbes could not, in any case, be the only cause of influenza, but were rather to be attributed to a secondary infection. At least, all were agreed that the old "miasmatic" theories had to be replaced by the assumption of

a direct infection from one individual to another. In 1892, Pfeiffer submitted his studies on the microbe found by him, showing that he had not only microscopically demonstrated the existence of, but grown in pure culture, a microbe not taking the Gram stain and regularly demonstrable in the expectoration of influenza patients. This microbe could thrive only on culture media containing blood or hemoglobin. The work of Pfeiffer was then and later considered as one of the finest contributions to bacteriology.

During the period following the discovery of this microbe, it was universally considered the specific virus of the disease; the proofs furnished by Pfeiffer fully satisfied the requirements found necessary by his contemporaries. Since that time, some doubt has arisen, insofar as it has been observed that the Pfeiffer cocco-bacillus is often found in diseases which have nothing to do with influenza, while it cannot be discovered in many cases of influenza. All writers without exception, including those who demonstrated the Pfeiffer cocco-bacillus, found other microbes in the expectoration as well as in the lungs, notably streptococci and pneumococci. In the majority of the cases, epidemics of catarrhal fevers of similar character to influenza, which appeared between the great pandemics, the Pfeiffer bacillus was not demonstrated. Subsequently, opinions as to its importance were rather divided. Thus, Secheller says, for example, that a distinction must be made, from the epidemiological, as well as etiological viewpoint, between pandemic influenza which appears suddenly, and rather rapidly disappears again, and ordinary endemic influenza. As the cause of the pandemic, he mentions the cocco-bacillus of Pfeiffer, and for endemic influenza, a series of other microbes (streptococci, pneumococci, etc.) are considered as the etiological factor.

In order to establish the actual importance of the Pfeiffer cocco-bacillus, Martin Kristensen endeavored to ascertain a detailed picture of its appearance at different periods and in different countries, in healthy individuals as well as outside of the human body. His very numerous investigations from all countries may be summarized as follows: the cocco-bacillus of Pfeiffer has been constantly noted since its discovery, in all countries of the world, but its presence has not been regular, nor of the same character. In the interval between two pandemics, there have been localities where, or several years during which, this germ was not encountered at all, or in only slightly numerous cases. It has been found in whooping-cough, measles, influenza, pulmonary tuberculosis, pneumonia, bronchitis, angina, and

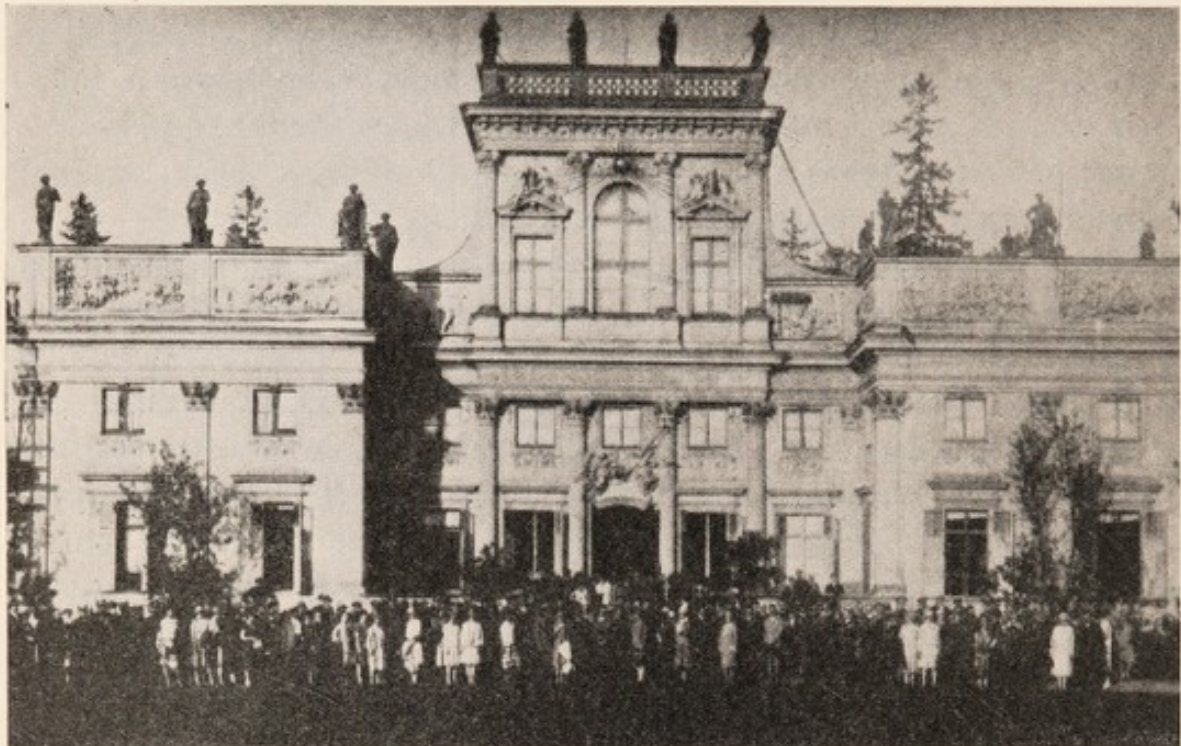
many other diseases. In some influenza epidemics, the microbe has been almost regularly found, in others only from time to time, and in still others not at all, namely, there have been all degrees, from its constant presence to its total absence. This fact is absolutely unrelated to the clinical and epidemiological character of the epidemics. The germ has been principally found in the early stages of influenza, and has disappeared at the end of a few days. The time of its disappearance probably depends, to a large part, on the other existing microbial flora. Perhaps it is encountered somewhat more frequently in uncomplicated influenza than in influenza with pneumonia. It is found in the investigated diseases as well as in healthy individuals, in connection with pandemic or epidemic influenza, as well as without any relation to epidemics similar to influenza. Sometimes, it appears as a harmless saprophyte, in other cases (not only influenza) it has a more or less pathogenic character.

The foregoing variegated picture of the existence of the Pfeiffer cocco-bacillus in influenza gives a clear idea of the difficulty involved in the solution of this problem and indicates how hard it is to answer it definitely. Although the fundamental work of Pfeiffer was, when it appeared, apparently satisfactory and definite, later investigations show that the question is still open and in need of further study. Furthermore, the contributions and new investigations based on the epidemic of 1918 prove that we are actually as far from the solution of the problem as in the years between 1890 and 1900.

Kristensen states that examination of influenza patients during four epidemics from 1918 to 1922, showed that the cocco-bacillus of Pfeiffer, though rarely present in the first epidemic, was more frequent in the second, which was separated from the first by a very short interval. This bacillus was most usually noted during the first two or three days after the outbreak of the disease. In whooping-cough, it was found more frequently than, and in measles, as frequently, as in influenza. In five cases of meningitis, it was found in pure culture in the cerebrospinal fluid. In healthy individuals it was found considerably distributed. Its presence in the different examined groups varied from 8 to 100 per cent. In direct relation with each of the four epidemics, an essential increase was noted in the propagation of the Pfeiffer cocco-bacillus in the population in general, and then, during the following months, a marked decrease. In the military camps and barracks, the Pfeiffer cocco-bacillus was much more widely distributed than in the remainder of the population.

The bacillus was found somewhat more frequently in persons who previously had suffered from influenza, than in those who had not had the disease; however, it was also considerably distributed among the latter. From the fact that the bacillus increased in frequency from the first epidemic to the next, and that its spread in the population was influenced, in a general way, by the epidemic, the conclusion is reached that propagation of the Pfeiffer cocco-bacillus in influenza is probably secondary with relation to its appearance in influenza.

Certain animal experiments with the Pfeiffer cocco-bacillus indi-



Excursion to the ancient Palace of King John Sobieski at Wilanow. Used as a Museum at the present time.

cate that inoculation with the germ causes influenza, but it is always dangerous to conclude from animals as to man. However, in a certain number of cases, the inoculation into human beings of cultures of the Pfeiffer cocco-bacillus, successfully produced a catarrhal infection with symptoms, more or less, resembling those of influenza (Wahl, White, and Lyall, Bloomfield, Rosenau, and others). This observation, and the fact that Pfeiffer bacilli are found in the small bronchioles, and also in the pulmonary tissue itself, of influenza patients, as well as the fact that specific antibodies are formed in the blood of the cases, suggest that the Pfeiffer cocco-bacillus can give rise, to a certain degree, to symptoms and pathological changes; but

these facts by no means prove the etiological importance of the bacillus as the primary factor of the disease.

At the present time, some investigators consider the Pfeiffer cocco-bacillus as the true microbe of influenza; others insist, equally forcibly, that it has nothing at all to do with the disease. Either one of these viewpoints is perhaps rather exclusive. There is a third opinion, midway between these two, based on the results of the foregoing investigations in connection with certain studies of the properties of the Pfeiffer cocco-bacillus and its classification: the Pfeiffer cocco-bacillus is a microbe accustomed to live on the mucous membranes of the human respiratory organs. It is able to exist for some time in healthy individuals, after having been transmitted from other sources, but finds it difficult to persist in the healthy mucosa. Ideal developmental conditions are found by it in mucous membranes in a catarrhal condition, caused by another microbial infection, even if the character of this other infection is less essential. Catarrhal fever, whooping-cough, measles, or tuberculosis may here enter into consideration. A catarrhal condition, attacking large portions of the mucous membranes of the respiratory apparatus, is common to these infections. These diseases, accordingly, offer especially favorable conditions for the growth of the Pfeiffer cocco-bacillus. Its development is likewise, although to a less degree, favored by infections which have spread over a more limited portion of the mucosa, such as ordinary angina, diphtheria, and scarlet fever, as well as catarrhal conditions or the disposition for the same, not produced by microbial causes. The last named fact may account for this germ having been found as the only microbe in bronchitis and similar diseases. The reason why the Pfeiffer cocco-bacillus is almost regularly encountered in whooping-cough and in measles, is due to the wide propagation and endemic character of these diseases, so that the nutrient soil is always present. But how to explain the conditions in the case of an epidemic disease such as influenza, which does not always exist? On considering the epidemic in its first stages, the disease usually attacks a population whose majority are not carriers of the Pfeiffer cocco-bacillus. Examinations show that the microbe is only exceptionally found in the patients but, where it is present, it spreads rapidly and may be transmitted, together with the specific virus of influenza, to healthy individuals, who thus become infected by influenza, as well as by the Pfeiffer cocco-bacillus. Other patients, suffering from influenza, may also, in this way, receive the cocco-bacillus of Pfeiffer as a secondary

infection. Moreover, the germ may be transmitted to healthy individuals without the influenza complication. Perhaps it acquires such a high degree of vitality that it lives not only as a saprophyte in the healthy, but is capable of producing infections itself, similar to influenza. When the influenza becomes extinct, the Pfeiffer bacillus may still live for some months in normal persons, but as it is unable to live during a prolonged period as a saprophyte, it will gradually find itself restricted to occur, as before the appearance of the influenza, only in endemic diseases.

The reason the Pfeiffer cocco-bacillus may have a wide propagation among influenza patients in certain localities, immediately after the appearance of the epidemic, may be attributed, in part, to the invasions of the microbe among the patients from whom the infection is derived, and, in part, to its growth prior to the time the disease became evident. On the other hand, regions may be observed where the Pfeiffer cocco-bacillus is rare, and where influenza is complicated by this microbe only to a minor degree. In small influenza epidemics, which develop in a locality where the Pfeiffer cocco-bacillus is not found or is rare, it may happen that this epidemic becomes extinct before the presence of the microbe is demonstrated in any of the patients.

The foregoing viewpoints would seem to justify the assumption that the Pfeiffer cocco-bacillus is not the primary microbe of influenza. If it must be maintained, from the bacteriological as well as epidemiological viewpoint, that a definite virus forms the basis of the epidemic, it must be presumed that, if a disease like influenza spreads during a short time over a definite district, the same virus is the basis of all the cases. Consequently, when we find that the microbes of influenza, in different patients, present considerable differences among themselves, it must be attributed to another cause. The most natural explanation is that the different types of the Pfeiffer cocco-bacillus which are found, were already present in the population under consideration before the invasion of the influenza. The studies on the Pfeiffer cocco-bacillus have not demonstrated a type which, from the serological or other viewpoint, was found to be uniform and which can be considered as the etiological factor of influenza. In fact, the contrary seems true.

The foregoing confirms the opinion, expressed in 1918 by Thomsen, Kristensen, and Thorborg, and which is summarized as follows:

so-called "Spanish influenza" is of the same nature as the preceding influenza epidemics; pneumococci, streptococci, etc., are often encountered, especially in pneumonia, and are to be regarded as microbial associations. According to present belief, the Pfeiffer cocco-bacillus must be included with these microbial associations. The specific virus is probably of ultraviolet type.

Granting that there are several obscure points and circumstances about the behavior of influenza during epidemics, it must be admitted that the etiology, itself, still remains obscure. Since the Pfeiffer cocco-bacillus has been unable to hold its position, many attempts have been made to find other microbes to replace it. Trawinski and Elli, of the Austrian army, successfully demonstrated, culturally as well as microscopically, in the majority of the examined cases, a diplostreptococcus not taking the Gram stain, derived from the sputum and the pharyngeal secretions, as well as from the blood and the pleural exudates. In some of these cases, pneumococci and microbes resembling the Pfeiffer cocco-bacillus were likewise found. Trawinski concludes from the examined material that the demonstrated diplostreptococci not taking the Gram stain, should be considered the cause of the numerous pneumonias, as well as of the influenza itself. He bases this assumption on the results of agglutination, on the positive demonstration of bacteriological blood, on carefully observed cases of kindred infections, and on the corroboration of some other investigators, who have made similar observations. Considering this, in connection with the established facts concerning the Pfeiffer cocco-bacillus, it must be admitted that the foregoing is based on observations not yet sufficiently worked out to permit even a tentative verdict as to their definite value. It rather seems that the mentioned diplostreptococci in influenza epidemics, may share the fate of the Pfeiffer cocco-bacillus, and act as a secondary infection, but not as the decisive etiological factor.

Among recent studies on this subject, special mention must be made of American investigations carried out in the Rockefeller Institute by Olitsky, Gates, and others, assisted, in part, by the American army. These investigations, which are closely connected with the work on *Bacterium pneumosintes*, are being continued in America on a large scale and, according to already existing facts, seem to contain possibilities for a deep penetration into the problem of the etiology of influenza. Olitsky and Gates state that the results of

their investigations show that in the case of uncomplicated influenza, a specific substance is found in the nasopharyngeal secretions. This substance seems to exist only during the first hours of the disease and is not demonstrable later than thirty-six hours after the onset of the influenza, or in cases of secondary pneumonia, in persons who had not shown any more symptoms of influenza during the epidemic than at other times. With this substance, the American investigators produced in rabbits, a clinical and pathological condition which affected, essentially, the blood and the pulmonary tissue, a condition



THE SPANISH DELEGATION

which could be maintained during the successive transmission through at least fifteen animals. For this reason, and because of the reduction of the period of incubation from rabbit to rabbit, they are inclined to assume the actual transmission of an agent capable of reproducing, instead of a passive transmission of an originally active substance. This agent is filterable and resists the effect of sterile glycerine at 50 per cent, for nine months, but no longer. The manner in which the ordinary microbes, such as the pneumococcus, the Pfeiffer cocco-bacillus, and the streptococcus viridans, etc., appear in the course of the experimental transmission, and during the reproduction of the state

described in the foregoing, confirms the opinion that these microbes are secondary in their effect. The primary effect is produced by an agent having no relation with these microbes. The resemblance between the conditions demonstrated in rabbits and those found in man forms a basis for further investigations on the etiological agent of influenza. Moreover, the American investigators speak of having seen, in cultures, during their experiments, very small, nearly invisible, bodies not taking the Gram stain, derived from the pulmonary tissue of infected rabbits as well as from filtered pharyngeal secretions of influenza cases.

Later, Olitsky and McCartney reported further experiments, where they observed, during the first hours of epidemic uncomplicated influenza, an active agent, pathogenic for microbes. On cultures derived from filtered secretions and from the lungs of rabbits intratracheally inoculated with these secretions, new chains of *bacterium pneumosintes* were isolated. Among ten patients who had recovered from influenza, six possessed immunity against the *bacterium pneumosintes*.

It is an admitted fact that we are here confronted with results which are in conformity with the theories and ideas pointed out in the beginning of this article, and which were expressed before the publication of the American contributions. However, through the American work, it seems that light has been thrown upon this "something," this agent which we divined, but only in negative properties (for it was not in actual relation with the ordinary, so-called, microbes of influenza) and which is probably ultravisible and filterable. This probably ultravisible and filterable agent has been sought by means of exclusion, since it has been impossible to find it either microscopically or culturally.

Judging from the observation made during the epidemics of recent years, it is probable that the disease is followed by an efficient immunity. This was demonstrated by Ammentorp who studies have shown that once affected military posts seem to have become immunized against new attacks. This theory was especially confirmed in the small town of Gjedser, where a company of soldiers was sent in the month of November, who had had the epidemic the preceding June and July, and who were quartered among the inhabitants. The local physician reported that in every house in Gjedser there had been influenza. This naturally, caused some uneasiness, but not a single one of the soldiers sent to Gjedser contracted the disease; they, evidently, had been thoroughly immunized. It goes without saying that

this immunity is relative and may become inefficient, although it resists the natural infection during a long period of time. This possibly explains the phenomenon that, in the last serious epidemics, a relatively large portion of young people, strong and vigorous, were attacked, whereas, for the most part, the aged and weak, nearly all of whom had had the infection during the severe epidemic of about thirty years ago, escaped the disease.

There was still another analogy in the comparison of the influenza agent to an ultraviolet virus, namely, its power of preparing the way for other microbes of secondary inflammations. This applies, especially, to those kinds of virus which are transmitted by fine droplet infection from the mucous membranes of the mouth, pharynx, and upper air passages. An example is represented by variola infection, which is usually attributable, for the majority of cases, to infection through fine droplets, and with which bronchitis, bronchopneumonia, pleurisy, and so forth, are very often associated as complications, with different cocci in the secretions, while the specific efflorescence itself, namely the vesicles, are rather frequently secondarily infected.

It seems logical to believe that an ultraviolet and filterable virus is the actual etiological factor of influenza. This does not permit one to ignore the great importance of the secondary infections, especially when the complications are kept in mind. When the true etiological factor is finally successfully demonstrated, the relative connection between the extent and gravity of the disease, especially during epidemics, will certainly be shown to be of considerable importance. The work of, or at all events, the avenues opened up of recent years by the American investigators, probably will result in the discovery of the causative organism.

The American investigators (Vaughan and others) have demonstrated that the catarrhal and epidemic diseases are dangerous in military life, as the men are often exposed to physical exertions to which they are not accustomed, and are gathered together in very close contact with each other under abnormal conditions. To this is added the fact that men, coming from various regions and provinces, with different conditions of life and climate, present a greater liability to contract disease. Men from a healthy region, who never have acquired a relative immunity by attacks of a disease, come into close contact with the carriers of microbes from regions where the immunity is perhaps relatively superior, but whose men act as disease

carriers. Numerous studies, and not the least, those made by the American Army Corps during recruiting and in preparatory camps, have established these points regarding the spread of contagious diseases, and, more particularly, in relation to the most serious complication of influenza, namely pneumonia.

There has not been any essential advance during the last decades with regard to the prophylaxis of influenza. As in all other contagious diseases, the old rule may be applied, that, in order to heal and control it, one must have knowledge of its cause. Numerous serum and vaccine treatments, based on different bacterial factors, such as the Pfeiffer cocco-bacillus and various other microbes and their mixtures, have been tried. However, no definite results have been attained as yet.

In an epidemic disease, it goes without saying that there will always be a certain connection between its prophylaxis and therapy. The more rapidly and efficiently one succeeds in curing the various cases and in limiting the complications, the more one may hope to prevent a very great spread of the disease. It seems that the violent and serious complications invest the specific microbes with strength for a renewed and increased inroad, while, at the same time, these viruses are responsible for the primary disease. Therefore, efficient means must absolutely be found to prevent its epidemic progress.

With special reference to prophylactic measures against influenza, it is natural to apply, during an epidemic, the strongest possible—that is, the most efficient—therapy. This must be emphasized, because a pandemic, in consequence of its considerable development and extent, often renders such treatment difficult. In military life where, often, a large gathering of men is inevitable, one must prevent all contact with the civilian population or with sections affected by the influenza epidemic. Moreover, strict hygienic measures must be enforced in the barracks and on the boats. Finally, and this is the essential point, persons who seem to be affected must be separated and isolated, in order to guard against the spread of the contagion. Presumably the most efficient prophylactic measure, at our disposal, against a disease as contagious as influenza, especially with respect to military conditions, must be and is an efficient isolation of the affected individuals. This refers particularly to patients with complications, as such cases must always be regarded as the most dangerous to themselves, as well as to others. Even during a mild epidemic, isolation of the patients, especially those suffering with complications, is a

necessary prophylactic measure. The grave cases involve an increased possibility to stimulate the strength and progress of the disease, because of the cooperation and combined efforts apparently at work between the microbes of the secondary infections and the primary specific agents. Isolation must, accordingly, be the principal prophylaxis, to secure better conditions for the cases and thereby to prevent dangerous complications and increased virulence of the disease; and also to prevent, as much as possible, the direct transmission of the contagion from one individual to another. What is done by public notices warning against large gatherings of all sorts, and by the improvement of bad hygienic conditions during an epidemic, will help in precisely the same direction. What should actually be done to secure an active immunization has not as yet been sufficiently ascertained and must form the basis of further studies, in conjunction with the investigations for the discovery of the specific agent of influenza.

CONCLUSIONS

(1) Recent investigations on the etiology of influenza have shown that the cocco-bacillus of Pfeiffer cannot be considered as the specific virus of this disease.

(2) Like pneumococci, streptococci, and so forth, the cocco-bacillus of Pfeiffer, when found in influenza, must be considered as a secondary infection.

(3) The various theories and surmises concerning the nature of the disease were discussed and deliberated upon all over the world following the great influenza pandemic of 1918 to 1922. These considerations resulted in the acceptance of a specific virus of influenza, which is possibly filterable and ultravisible.

(4) American investigators, as a result of their work on the *Bacterium pneumosintes* and the conditions pertaining thereto, have pointed out new roads for the elucidation of the question, and opened up avenues wherein may be found the solution of the problem.

(5) It is assumed that influenza pandemics were of the same nature as the earlier known pandemics. Several investigators claim that the relative immunity of persons of a certain age is due to a previously undergone infection, notably during the epidemic of 1889 to 1890.

(6) Various bacteria, such as pneumococci, streptococci, and several others, some of which have recently been described, possibly in-

cluding the Pfeiffer cocco-bacillus, seem to play an important part in the complications and grave sequelae following influenza.

(7) These complications are dangerous, not only from the prognostic viewpoint in the individual cases, but from the epidemiological viewpoint. Their ability to spread the disease and to increase its virulence is probably referable to a cooperation between the specific virus and the secondary microbes.

(8) From the prophylactic viewpoint, the importance of isolation, particularly of grave cases, is emphasized, in order to prevent direct contagion as well as to protract the epidemic, so that the application of special, careful treatment may not be hindered by an overwhelming number of cases. In this manner an attempt is made to weaken the virulent character of the disease.

(9) Influenza is more easily spread in military camps and barracks than elsewhere, because the soldiers are recruited from different regions and must lead an altered mode of life. For this reason, it is especially necessary to isolate complicated cases.

KARWACKI (Poland)

In discussing the "Etiology and Prophylaxis of Influenza," Colonel Doctor Leon Karwacki, Adjunct Professor in the University of Warsaw, stated that the last pandemic of influenza took its toll of twenty millions of lives. He called attention to the fact that the positive result of numerous etiological studies, is very mediocre. Influenza, as heretofore, is considered from an epidemiological rather than a clinical or bacteriological standpoint. Its great distribution forms the most reliable features for the diagnosis. Sporadic influenza does not afford the same certainty, for its clinical aspect possesses no signs absolutely characteristic of this disease, and its diagnosis often is one of exclusion.

The fundamental question, i.e., if pandemic and sporadic influenza are of the same nature, would be decided, of course, by the discovery of a common specific microbe. In the absence of bacteriological proofs, the relation is variably interpreted by different writers. Some, like Kelsch, consider the seasonal catarrhs as attenuated forms of classical influenza, others deny the common character and, with Bieganski, Szwajcer, Vaughan, distinguish two entirely different pathological conditions in influenzal disease, namely, influenza nostras and influenza epidemica. The opinion also exists that seasonal affections in certain localities and under certain conditions may, sometimes, be the expres-

sion of attenuated influenza and, at other times, of ordinary diseases due to the increased virulence of the normal microbes of the respiratory passages. Meanwhile, a question of the greatest importance is whether the influenza microbe, after its virulent action is over, may act as a saprophyte in the upper air passages, and give rise, under favorable conditions, to sporadic or even epidemic affections of a moderate degree. If this were so, the seasonal catarrhs might be a sign of the persistence of the vitality and virulence of the causative agent. It would then remain to determine the cause or causes of the rapid exaggeration of virulence, transforming a semisaprophyte into an extremely pathogenic and infectious microbe. The importance of the elucidation of this problem seems, to the author, almost equivalent to the discovery of the influenza microbe. Actually, the bacteriological investigations in sporadic influenza do not concern the etiology of pandemic influenza so long as the causative identity of the two has not been demonstrated. As pandemics do not occur every day, it is difficult to furnish the necessary proofs.

The author shares the opinion of Dopter, Jacquet, and Menetrier, that only a portion of the cases of sporadic influenza possesses a common etiology with epidemic influenza. In the absence of bacteriological criteria, the diagnosis must be based exclusively on the clinical analysis of the symptoms.

By virtue of bacteriological investigations in influenza—barren as to etiology—valuable knowledge has been acquired on the pathology and pathogenesis of this disease, particularly, that influenza is very often complicated by the action of various other micro-organisms. The majority of these micro-organisms possess a very definite pathogenic action, sometimes of epidemic character. Their pathogenic action may become mingled with that of the influenza virus in such a way that, sometimes, influenza appears on the basis of another infection, and complicates it, while in other cases, influenza is complicated by another intercurrent infection, or, on the other hand, one may prepare the soil for the other. Under the influence of this combined action, and on account of the virulence of the symbiotic agents, numerous clinical symptoms of influenza arise. Their aspect may vary from one month to another, as a result of the changes of the superadded infection. The secondary infection often decides the course of the influenza, its duration, and even its outcome. The action of this additional factor may so alter the clinical aspect of the disease, that physicians who have witnessed two pandemics, refuse to admit their etiological identity.

The Pfeiffer bacillus was almost regularly encountered at certain times and in certain influenza epidemic foci (Lister, Besancon and Legroux, Netter, Stillmann, Bergmann, Mathews, Young and Griffith, Uhlenhuth, Neisser, Carpano, Tytler, James, Dobbin, Patterson, Little and Williams, McIntosh, Malone). At other times and in other foci, it was only rarely isolated (Dick, Mandelbaum, Gruber and Schadel, Schmorl, Denier, Selter and Lubarsch, Kolle, Schottmüller, Menetrier and Stevenin). The author found it in Poland very abundantly in the fall and winter but rarely in the spring and summer. Modrzewski, in Military Hospital No. 1, observed it in seventy-six of 700 patients—a little over 10 per cent. Apart from epidemics, the bacillus has been encountered in the course of noninfluenzal affections, such as measles, whooping-cough, tuberculosis, diphtheria and scarlet fever, and even in healthy throats (Dible, Jehle, Auerbach, Lewinthal, and especially the Danish scientist Kristensen). In order to secure the specificity of his microbe, Pfeiffer claimed that, aside from the typical influenza bacilli, there exists a family of pseudo-influenza bacilli, and that the latter is found outside of epidemics, but no biological fact pleads in favor of this hypothesis. The presence of the Pfeiffer bacillus in the throats of healthy persons does not fundamentally exclude its etiological rôle, but indicates the possibility of the existence of germ carriers. This theory should be supported by the determination of the definite character of the virulence of the microbe and by the serological reactions of the infected organism. It has been established that the virulence of the Pfeiffer bacillus possesses features closely related to that of the meningococci and, in part, to that of the pneumococci and streptococci.

Locally, the Pfeiffer bacilli give rise to inflammatory processes, of variable severity, in the throat and nose, to sinusitis, otitis, affections of the respiratory passages, the most common form of which is a broncho-pneumonia, to serous and purulent pleurisy, to pyelitis, cystitis, urethritis, orchitis, and epidymitis, to endometritis and perimetritis, to cholecystitis, appendicitis, and peritonitis. The Pfeiffer microbe may become generalized and give rise to bacteriemia and septicemia. It can be isolated from the blood and urine. In general infections, it causes metastatic foci in the spleen, lungs, and pleurae, but its favorite localization is in the meninges and the cerebral tissue. Many cases of metastatic pericarditis and endocarditis resulting from the Pfeiffer bacillus have been described. The lesions of the endocardium may develop in an acute or chronic fashion, thus producing endocar-

ditis with a slow course. Arteritis and phlebitis, caused by this microbe, have been observed, as well as osteomyelitis, periostitis, and metastatic, subcutaneous abscesses. In very rare cases, it may cause puerperal septicemias and pyemias.

It is readily seen that the long pathological list given above has nothing in common with influenza. It might be suggested, that the difference between these pathological processes and influenza depends upon the virulence and the localization of the microbe; as long as the bacilli are lodged on the mucous membranes of the nose, the throat, the air passages, they cause influenza, while on passing into the blood stream, they give rise to septicemias or pyemias. Numerous experiments of human contamination performed on voluntary subjects have proved that this is not the case. Massive infection with cultures, obtained by painting of or by instillation into the throat, the nose, or on the conjunctivae, has yielded doubtful results at the hands of several investigators (Pfeiffer, Uhlenhuth, Schmidt and Jensch, Sellards and Strum, Bloomfield, Whal, White and Lyall, McCoy and Richey, Cecil and Steffen, V. Fenyvessy and Kopp, Yamanouchi, Sakakami, Iwashima). In the rare cases where the infection was successful, the effect of coryza rather than the true influenza was produced. There is no conformity of results of serological investigations in influenza patients. While, in convalescents, certain writers almost regularly found a weak agglutination (Lewinthal, Fromme, Loewenthal, Fleming, Wilson, the English Committee), others always found a deficient agglutination. Laboratory investigations, meanwhile, have established the fact that the family of hemophilic bacteria does not show a uniform behavior from the antigenic viewpoint; bacilli isolated from the throat, blood, and cerebrospinal fluid, of the same patient, may behave differently towards the agglutins.

In view of these various considerations, the author sides with those writers who regard the Pfeiffer bacillus as an ubiquitous germ, commonly encountered in the rhinopharynx of healthy and diseased persons, including influenza patients. Its virulence, outside of an influenza epidemic, is characterized by syndromes in common with streptococcus, pneumococcus, or meningococcus infection, the condition never presenting the picture of classical influenza. It is a microbe of a type that very often complicates influenza. The same statement can be applied to the pharyngococci, enterococci, typical or atypical pneumococci, streptococci—all of which are capable of giving rise to secondary complications of influenza.

As a result of the experiments of Nicolle and Lebailly, the opinion has been reached that the influenza microbes must be grouped under the heading of the filterable viruses. The Chamberland bougie filtrate of the mucous discharge of influenza patients, proved virulent on subcutaneous injection in man, and on conjunctival instillation in monkeys. Fejes injected into monkeys and rabbits the filtered sputum of an influenza patient and obtained syndromes of hemorrhagic septiemia, independent of the variation of the secondary flora. Leschke, Selter, Yamanouchi, Sakakami, Iwashima, proved that these filtrates are virulent for man in instillations on the mucous membranes of the nose and the throat. In the experiments of Leschke, the filtrate of the mucous discharges of influenza patients, and of the pulmonary juice of persons who had died from the disease, on being sprayed by an atomizer into a place in which there were several persons, gave rise, on the same day, to a typical attack of influenza in all these individuals. Dujaric de la Riviere and the three Japanese writers, quoted in the foregoing, demonstrated that the filterable virus existed also in the blood of the patients.

Man may be contaminated through the filtered blood of an influenza patient, by the subcutaneous route as well as by the nasopharynx. The number of these experiments is still rather limited, and their results are not always equally favorable, as shown by the investigations of Moreschi, Friedberger, and Knotzer, who did not succeed in infecting healthy persons



Admiral Chambers, Surgeon General of the British Navy, who headed the British Delegation.

with the filtrates of influenza products, although a large number of volunteers (twenty-six) were subjected to these experiments. From the investigations carried out in this direction by Olitsky and Gates, it appears that the rabbit serves as an excellent agent for the filterable influenza virus, and that the experimental disease of the rabbit has many points in common with human influenza. Olitsky and Gates contaminated rabbits with the products of nasopharyngeal irrigation of influenza patients, obtained in the first hours of the disease. The inoculation was applied by the tracheal route. The animals appeared sick on the first or second day after the infection, but the pathological symptoms were not very marked. Leukopenia was demonstrable. In two or three days, the rabbits recovered their normal appearance. The autopsy of rabbits killed in the course of the first days was very instructive; all the organs appeared normal, except the lungs, which were distended by interalveolar edema and presented areas of emphysema. The pulmonary surface was interspersed with hemorrhagic spots and a profuse serous fluid escaped, on section. The mucosa, locally, presented signs of necrosis and desquamation. According to Olitsky and Gates, the character of these lesions corresponded to the findings of certain writers, in persons who had died from virulent influenza (Sörensen, Lucke, Wright and Kime, Goodpasture, Wolbach, Lecount). The product of crushed pulmonary tissue from infected rabbits, injected into healthy ones, reproduced the same pathological picture. It seems that Olitsky and Gates, through this procedure, proved the existence of a virus capable of multiplying.

The intratracheal inoculation of the Berkefeld bougie filtrate of pulmonary juice, derived from "experimental rabbits' influenza," gives rise to the same affection in a healthy animal, showing that the infectious agent must be exclusively a filterable virus, and not one of the representatives of the ordinary pulmonary flora. The American workers also established that the first infection invests the animal with absolute immunity against a repeated trial. The resistance of the virus towards certain physical and chemical factors approaches that of filterable virus in general.

These investigations have culminated in their logical result, namely, cultures on artificial media. The microbes isolated from the irrigation water of the nasopharyngeal cavity of the patients, in the first thirty-six hours of the influenza and of the experimental rabbits' disease, grow on the Smith-Noguchi culture medium under conditions of anaerobiosis. These bacilli are very small, their dimensions being

0.15-0.3 micromillimeters. They do not readily take the basic stains and are discolored by the Gram method. They pass through the Berkefeld bougie V and N. Their cultures reproduce in rabbits the same disease as the influenza secretions. Olitsky and Gates have named them *bacterium pneumosintes* (bacterium which damages the lungs). There exists a crossed immunity, which proves their identity, between the bacilli of the culture and the virus contained in the expectoration of the patients. The virulence of the bacilli on artificial media is very rapidly attenuated. This germ was again found by these investigators during the three influenza recrudescences, in 1918-19, in 1920, and in 1922. Among twenty-nine persons who had had influenza, the serum in twenty-three contained agglutinins in a rather weak ratio of 1:10 to 1:40. In twenty-two persons without a history of influenza, the serum did not possess this property. At the end of these laborious investigations, Olitsky and Gates tried a preventive vaccination against their microbe, on volunteers, pupils of the Medical School in Washington. They claim to have obtained immunity in 20 per cent of the vaccinated. The Military Medical Committee did not pronounce these investigations as convincing and definite and suggested the continuation of the studies in order to improve the technique. The author has no data in his possession as to the present status of this vaccination.

The experiments of Olitsky and Gates have led to a few control investigations. Lister, Loewe and Zeman, Gordon, Detweiler and Hodge, successfully obtained fifteen cultures of *bacillus pneumosintes* in a large number of experiments. The cultures gave rise, in rabbits, to an experimental disease identical with that described by Olitsky and Gates. Lister mentions that he succeeded in obtaining a typical attack of influenza in a volunteer, in whom an instillation of the culture filtrate was applied in the nose. He also speaks of a febrile condition in two persons who infected themselves in the laboratory while manipulating the cultures. These three observations constitute the entire experimental material concerning the virulence of *bacillus pneumosintes* for man.

Lister quotes separately the investigations of Gibson, Bowman, and Conor. Their results as to the virulence of the influenza secretions for the rabbit, to the passages and filterability of the virus, to the pathologico-anatomical lesions of the lungs of rabbits, to the presence of the virus in the blood of patients, are in conformity with the investigations of the other writers, notably with those of Olitsky and

Gates, but they differ as to the morphology of the virus on artificial media. Their microbe, which passes through the bougie like that of Olitsky and Gates, is a coccus of the dimensions of 0.1-0.2 micromillimeters, and stains by the Gram method. Wilson also speaks of the same coccus as the filterable virus of influenza.

The English Committee for the Study of Influenza found very small cocci taking the Gram stain in filtrates of the discharge from infected mucous membranes and of crushed organs. Prell and Binder saw very fine granules in extracellular collections, in sections of lungs, and glands of influenza cadavers. As the sections were stained by the Giemsa method, nothing can be stated concerning their Gram affinity. Very small cocci, according to Prell, are also found in blood from influenza patients: the *Aenigmoplasma influenza*. On the contrary, the fine cocci found by Leschke, with which he succeeded in contaminating several persons, are discolored by the Gram method.

Considering the foregoing, it must be admitted that the secretions of persons suffering from influenza, contain specific bacilli and cocci. Judging from their behavior towards the Gram method, the cocci must belong to two different species. All these micro-organisms pass through bougies, all grow in cultures under conditions of anaerobiosis on serum media, all give rise in rabbits to very similar, if not identical pulmonary lesions, considered by writers as equivalent to human influenza. If this is the case, the question arises, which of these micro-organisms is the specific agent for influenza. An etiological dualism or trialism of experimental influenza in rabbits rather indicates that none of these micro-organisms is the causative factor in human influenza. The experimental disease of the rabbit is a basis of all the ulterior deductions, as the experimental disease of the guinea pig, contaminated with the blood of a typhus patient, is a basis for etiological investigations in typhus. But can we claim with all certainty that the two experimental diseases are equivalent? It seems to the author that such an assertion would be premature. Moreover, Olitsky and Gates are far from claiming that the *bacillus pneumosintes* sums up the etiology of influenza.

Recently, the opinions of very competent writers, such as Bemelmans de la Haye, have been expressed against the classification of the virus of influenza under the heading of a filterable virus, claiming that the truth of this has not been demonstrated. The etiology of influenza, accordingly, floats on a vague territory of surmises and theories.

No special prophylaxis of influenza can be thought of before the specific microbe has been discovered. Furthermore, it has not been scientifically established if convalescents acquire an immunity, and, if so, the length of its duration. All the data in this domain bear, rather, the mark of personal impressions of the writers, than of accurate facts (Chauffard, Malone, Basset-Smith, Buchanan, Besanzon). Dopter and de Lavergne express the opinion that, if immunity exists, it is of brief duration. In America, England, Australia, and New Zealand a preventive vaccination against the various germs of the secondary complications of influenza, was carried out on a rather large scale. According to the statistics, this preventive vaccination very notably lowered the mortality and, remarkably enough, the morbidity, likewise, underwent an important diminution. The author is rather skeptical as to the efficacy of anti-influenza vaccinations, for neither antistreptococcus nor antipneumococcus vaccination, repeatedly attempted for preventive purposes on a large scale, furnished practical results.

In regard to the prophylaxis of influenza, we have borrowed from the experiences of other infections. By strictly observing all the protective measures, one may not hope to protect a country, a town, or a district, against the epidemic. By rigorous isolation, one can protect a small human community, such as a convent, a sanatorium, a prison, or a family. But such occurrences are so rare as to be quoted in epidemiological manuals. At the expense of interfering with commercial life and incurring economic losses, it is possible to protect islands and harbors against the importation of the epidemic. The efficiency of sanitary cordons, quarantines, and observation wards is imaginary, in the case of countries with terrestrial frontiers, or even with maritime frontiers of very considerable extent. On account of the rapidity of extension of the disease, it is always too late to mobilize prophylactic measures when influenza is announced in a neighboring country, even when excellent means are available.

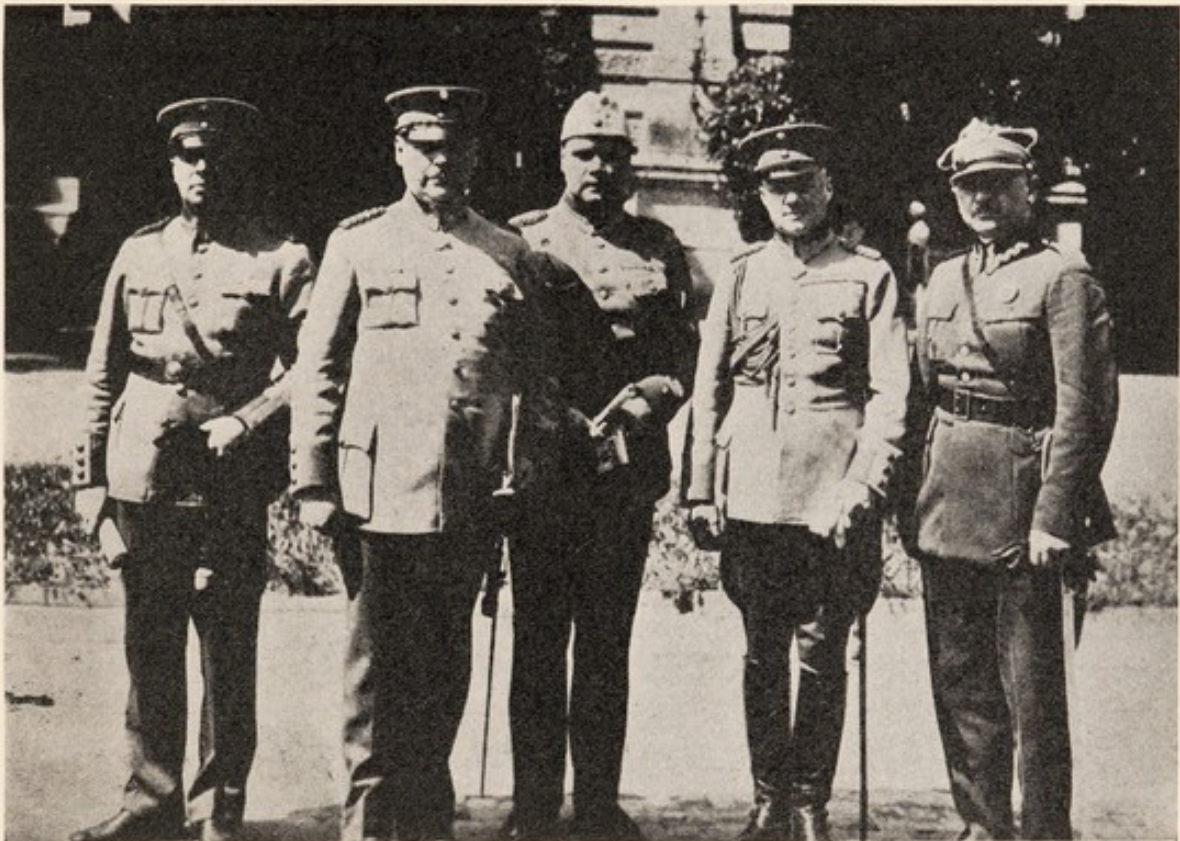
A single efficient prophylactic measure in our possession consists in the isolation of the patients immediately the symptoms appear. The military surgeon must treat all seasonal catarrhs as if he were dealing with declared influenza. The "spotting" of influenza patients in the barracks is of cardinal importance. The efficiency of all the other measures depends on this correct and prompt discovery. Every soldier with a rise of temperature, cough, or prostration, must immediately present himself for medical inspection. Every man on

furlough must, on his return to the corps, present himself before the military surgeon. The same measure must be observed for soldiers arriving on new assignments. Every individual coming from a corps where influenza exists, must be sent to the infirmary for three days' observation. Every man found to be affected with influenza, or merely suspected of having the disease, must be isolated. The isolation can be applied in the barracks, when local conditions permit, and the case is mild. Graver cases must be sent to the infirmary or hospital. Care must be taken that the infirmary does not become a center of contamination for men coming from various units and suffering from affections other than influenza. It goes without saying that influenza patients must be assigned to special wards in the infirmary, though it may be better to reserve the infirmary for cases other than influenza, and to place patients with this disease in special localities, in barracks, or hospitals, depending on the gravity of the cases. The conditions under which the infirmaries usually function do not give a sufficient guarantee against the spread of influenza among another class of patients. In the hospital, simple influenza and complicated influenzas must have separate services. The complicated influenzas, in their turn, are sometimes infected with pneumococci, sometimes with streptococci, or with Pfeiffer bacilli. Each of these germs may acquire an epidemic character and determine special infections, different from those of the congeners. Influenza patients, with different microbial association in the same ward, are exposed to superadded infections. An ideal solution of this problem consists in the individual isolation of each patient in a ward having separate cubicles. It is desirable for the medical personnel of the influenza services, male and female nurses, to be isolated also, in order to prevent the dissemination of the virus to the outside. We do not possess sufficient data concerning the necessary duration of the isolation.

It is almost certain that patients in the convalescent stage of influenza become germ carriers, but this view is not based upon actual facts. In certain cases, the tenacity of the lesions of the mucous membranes, coryza, pharyngitis, pulmonary affections, suggests that the virus still persists in the organism. The situation is more precarious when, in spite of the absence of physical signs, the convalescent complains of fatigue, and asthenia, and when a sporadic subfebrile state is superadded. These signs may equally well be the proof of a terminated infection, or of a latent influenza, which, on the slightest negligence, may cause a relapse.

In the absence of accurate data, the author empirically states the following: individuals attacked by a mild form of influenza must remain in the hospital for a week and more serious cases a fortnight, after all pathological symptoms have subsided. A more prolonged isolation may completely paralyze the functioning of the military service, while a shorter one does not conform with necessity, based on our knowledge of the persistence of germs in the other infections of rhinopharyngeal type.

Experimentations do not confirm the value of the sterilization of



DELEGATION FROM FINLAND

the nose and throat by means of chemical agents. The efficiency of protective masks is strongly contested by Swiss and German writers, and the employment of these masks involves too many serious inconveniences for their use without conviction. Very little is known about the probable rôle of indirect contagion. The vitality of the influenza virus in external media remains entirely unknown, but by analogy with other infections of the same epidemiological type, the author is inclined to believe that the virus dies rapidly in the outside world, the throat of healthy or diseased individuals serving as its place of preservation. As a matter of fact, there are no examples where trans-

mission through contaminated objects have been definitely demonstrated. Accordingly, the author believes that disinfection of dwellings, is not imperative, but the disinfection of linen, especially handkerchiefs and napkins, is of the utmost necessity. The disinfection aims not only at the fragile influenza virus, but, especially, at the associated microbes.

The insufficiency of all our prophylactic measures in fighting influenza imposes the concentration of all efforts on general hygiene, with the introduction of certain changes and adaptations dictated by necessity. In the first place, it is necessary to overcome the crowding in the barracks by enlarging the buildings, separating the beds as widely as possible, forbidding the collection of a large number of soldiers in common halls during conferences or amusements. Only moist sweeping of the rooms must be employed. They must be well heated and rationally ventilated. A sufficient number of spittoons must be provided, placed high enough to guard against the scattering of the sputum in the surroundings. As fatigue facilitates all infections, the reduction of strenuous exercises is indicated. In cold or damp weather, rest after exercise presents a favorable time for catching cold. It must, therefore, be seen to that the rest does not pass into prolonged immobility in the seated or recumbent position on the ground, but that it consists, rather, in moderate movement in the form of walking. The duration of sentinel duty must, also, be reduced. The supplementary distribution of hot tea after drills in cold weather also seems, to the author, a very useful protective measure.

SUMMARY

Influenza is well defined only from the epidemiological standpoint; clinical diagnosis is not always easy, and the differential diagnosis between influenza and seasonal catarrh is often deficient in accurate data.

The sporadic forms of influenza are interpreted by some as genuine influenza, of an attenuated type, while others regard it as an etiologically different infection. Eclectics accept both opinions as true, under certain conditions and at certain times.

This difference of opinion renders etiological investigations, outside of an epidemic, very difficult, more so than in other infections.

Up to date, the etiological investigations have not emerged out of the domain of theories.

The majority of writers do not admit the etiological scope of the Pfeiffer bacillus in influenza, because of the following considerations:

- (1) The Pfeiffer bacillus is not regularly found in influenza patients, but undergoes the same fluctuations as the other germs constituting the rhinopharyngeal flora, notably the streptococcus, the pneumococcus, the enterococcus, or the pharyngococcus of various types.
- (2) This Pfeiffer bacillus has been observed in several diseases, such as measles, whooping-cough, scarlet fever, diphtheria, or tuberculosis, and even in healthy persons, with the same frequency—showing it to be an ubiquitous micro-organism.
- (3) The pathogenic property of the Pfeiffer bacillus for man, apart from the epidemics, resembles that of the meningococcus, the streptococcus or the pneumococcus, but never produces the symptomatic suggestive influenza.
- (4) Numerous experiments with human infection by the Pfeiffer bacillus have, for the most part, proved unsuccessful. The cases claimed to be positive appear doubtful.
- (5) The serological reactions are in favor of the plurality of the hemoglobinophilic bacilli.

It is very probable that the influenza virus may belong to the family of filterable virus. As to its morphology, the opinions of writers vary; some regard it as a very small bacterium (*bacillus pneumosintes*); others as a coccus of very small dimensions, sometimes Gram positive, sometimes Gram negative.

All three micro-organisms, aside from their filterability, are entitled to be regarded as specific by virtue of the affection of the respiratory passages produced by them in the rabbit. This affection apparently corresponds exactly to the influenza process in man.

The existence of three germs, claiming to be the specific factors, renders their etiological rôle doubtful, as well as the relationship between the human lesions and those of the rabbit.

The rôle of the filterable virus, without specifying its morphology, is still undetermined, for an experimental confirmation on man is still lacking.

The hypothetical character of all investigations on the etiology of influenza does not favor the better knowledge of either its epidemiology or prophylaxis.

Accordingly, we must remove from our therapeutic arsenal all expensive dogmatic measures which have not justified their existence, in the treatment of influenza, and all our efforts must be concentrated

on the early isolation of the patients and on the improvement of the hygienic conditions in military quarters and barracks.

Preventive vaccinations against the microbes complicating influenza belong, in the author's opinion, to the measures mentioned in the foregoing. Their efficiency rests entirely upon data furnished by statistics, leaving the immunological aspect an open question.

COMMUNICATIONS

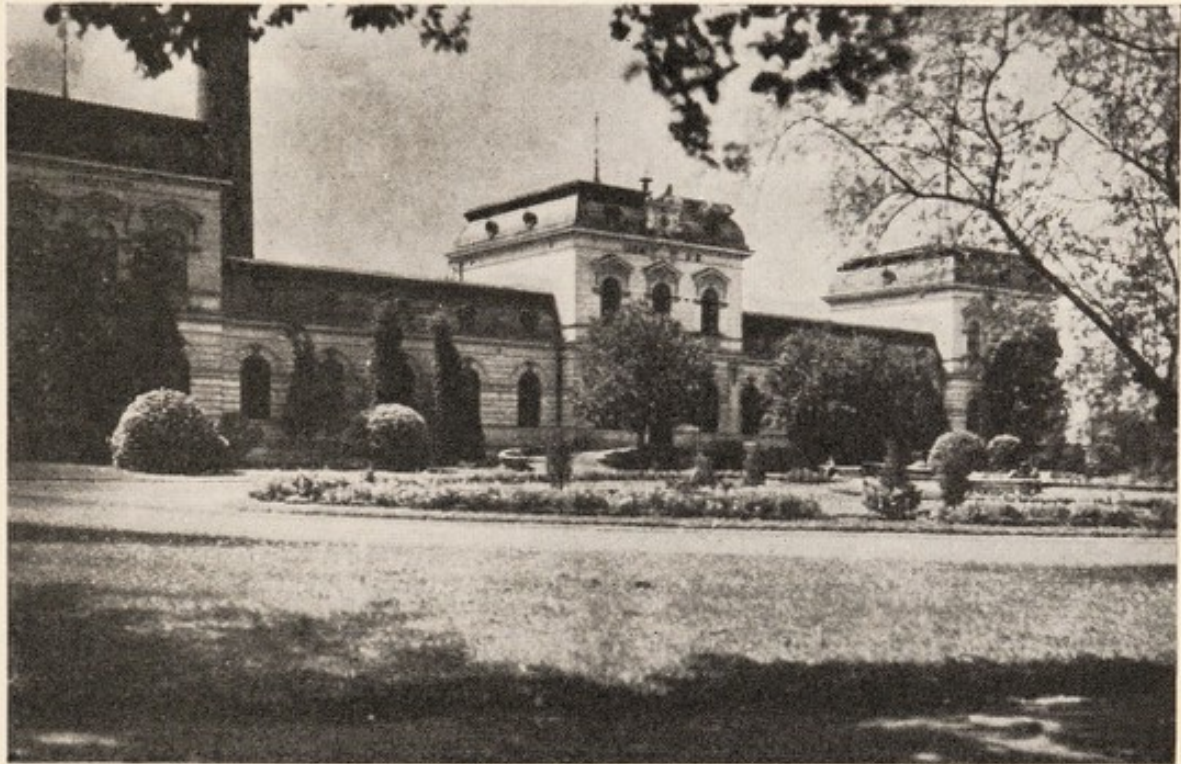
PANAITESCU (Roumania)

Having had occasion to study two epidemics of influenza, that of 1918 and that of the beginning of 1927, Dr. V. Panaitescu, Médecin Colonel of the Roumanian Army, discussed the "Etiology of Influenza," as having formed the special objective of his investigations. In 1918, these investigations were carried out in the Contagious Service and in the Bacteriological Laboratory of the Military Hospital in Bucharest, which was then evacuated to Jassy, because of the events of the war. The epidemic appeared with very malignant features, especially during the months of September, October, and November of 1918. The bacteriological investigations during these three months were made on 186 patients, at least 75 per cent of whom presented pulmonary complications (pneumonias), broncho-pneumonia, or purulent pleurisy, all accompanied by an entirely grave general condition. Some of these patients, moreover, presented cerebral, meningitic, and even psychic symptoms, simulating genuine attacks of acute mania. In nearly all the cases, the onset of the influenza was sudden, and the fever very high the whole time. The mortality reached the figure of 29.4 per cent among those interned in the contagious service. During the entire duration of the 1918 investigations, no positive blood culture was obtained in these patients for any other micro-organisms except the *cocco-bacillus* of Pfeiffer.

The general morbidity of the epidemic in the Roumanian army from January 15 to March 31 of 1927 (date of extinction of the epidemic) amounted to 4,456 cases, with a mortality of 4.67 per cent. In the civilian population, the mortality in the same space of time amounted to 6.44 per cent. Blood cultures all proved negative in twenty-three studied cases, a single exception concerning an influenza patient with pneumonia of the right apex, who died, and whose blood was found to contain the pneumococcus.

The conclusions to be drawn from the results of these investigations seem to be as follows:

- (1) The epidemic of 1918 presented a gravity undeniably greater than that of 1927.
- (2) The epidemic of 1918 was almost entirely dependent on the cocco-bacillus of Pfeiffer, which was found in the blood of the patients in a proportion of 68 per cent, although it is impossible to assert that this bacillus is the true etiological agent of influenza. In the beginning of 1927, the germ was never found in blood cultures.



INSTITUTION AT CIECHOCINEK WHERE MUD BATHS ARE GIVEN

- (3) The last epidemic was rather referable to the pneumococcus, which could be isolated from the patients' blood in a proportion of 4.35 per cent, and which was also isolated from the sputum, the throat and the nose, though not the pathogenic agent of the disease.
- (4) These two epidemics of pandemic behavior must not be confused with the annual seasonal influenzas connected with climatic disturbances.
- (5) The clinical character and the gravity of the cases are generally dependent upon the localization of the lesions, and in the two quoted influenza epidemics, seem to have been due, especially to micro-organisms associated with the filterable

virus, the existence of which is still a matter of controversy. It apparently possesses a preponderating importance in regard to the extension of the epidemic. The very marked asthenia of the patients, noted in both epidemics, even in the most benign cases, was, in all probability, due to a general toxicosis.

- (6) Immunity against influenza (not against ordinary influenzal affections) is undoubted in persons who have had the disease, and therefore, anti-influenzal vaccination, is recommended by means of vaccines prepared from the associated micro-organisms, in addition to the other customary prophylactic measures.

LAKMUNT AND NIEMYSKI (Poland)

“Tuberculous Reaction in Influenza Patients” was the title of the communication by Medical Lieutenant Stanislas Lakmunt and Medical Lieutenant Anatole Niemyski, of the Polish Army. The tendency shown by certain individuals, suffering from influenza, toward secondary infections, and the frequency of complications, especially pulmonary ones, in the course of certain influenza epidemics, led the authors to carry out investigations as to the behavior of the defense mechanisms of an organism attacked by influenza. Some investigators have shown that the influenza toxin possesses the property of producing humoral modifications in the organism. The modifications induce a diminution of the defensive measures for the fight against secondary infections. The absence of the Pirquet reaction has been shown to be common in this class of patients. The fact that this test is positive in a very large number of adults permits the corresponding experimentation on nearly all influenza patients.

The Pirquet test in influenza was applied by the authors in nearly all the patients admitted to the hospital, for influenza, since May, 1926. Ninety patients were examined, with variable results, according to the time of year. The behavior of the disease during the two periods of the epidemic, namely in May and November of 1926, generally presented a very benign aspect. The majority of the patients had no temperature at the time of admission, and there were few pulmonary complications. On the contrary, the patients admitted from December, 1926, up to the time of this report presented frequent complications, such as rather severe broncho-pneumonia and bronchitis. The outcome of the experiments showed that the complications supervening

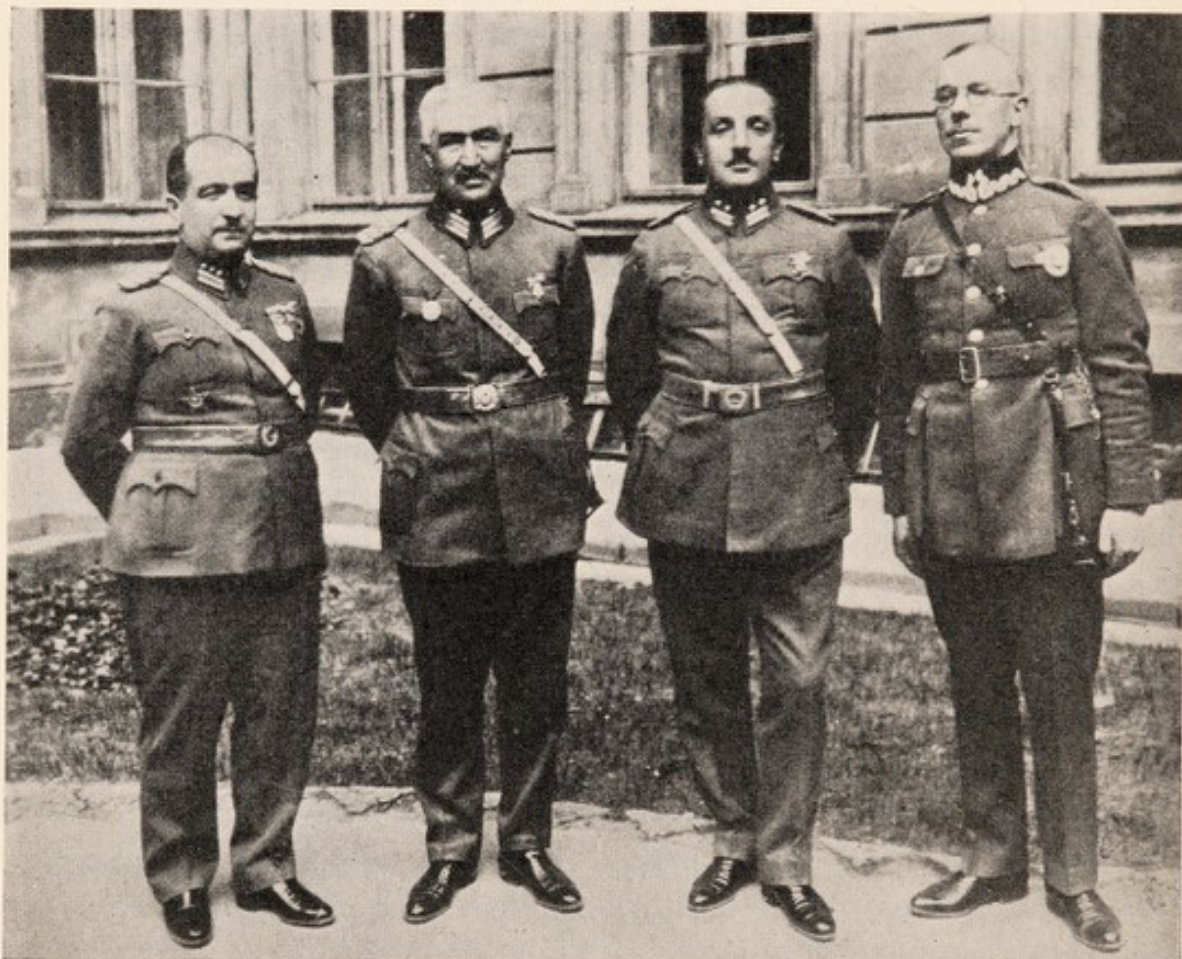
in the course of influenza, coincide with the lowering of the defensive faculties of the organism, manifested by the negative outcome of Pirquet's test. The degree of the arrest of the biological reaction, which expresses the state of energy of the organism, as it were, fluctuated in wide limits, from a complete absence, during a certain length of time, to a considerable retardation in the appearance of the regional inflammatory phenomena. The cases with retarded positive results, as well as those with plainly negative Pirquet tests, constitute 75 per cent of the cases of energy demonstrated in the author's patients. The duration of the state of energy was very variable, but as a rule did not exceed a few days. Only a positive outcome of the experiment, namely a distinct absence of the Pirquet cuti-reaction, is in favor of the influenzal etiology of the affection. A negative outcome of the experiment is devoid of significance.

LAKMUNT AND NIEMYSKI

The same contributors proceeded to the investigation of the "White Blood Corpuscles in Influenza." Opinions of writers are considerably at variance concerning the leukocyte formulas in influenza. These differences may be explained by an entire series of causes, having no relation to the effect of the influenza virus.

The present investigation comprised sporadic cases of affections presenting signs of influenza, as well as massed cases of influenza, occurring in two installments in the course of 1926, in the Warsaw garrison. This permitted a comparison of the leukocyte formulas of the blood in seasonal catarrhs, erroneously interpreted as influenza. In eighty-four blood examinations, in forty-seven patients suffering from an attenuated form of influenza, with mild pharyngeal or bronchial complications, the number of white blood corpuscles did not exceed 10,000 in 80 per cent of the examined cases. There was nothing constant about the behavior of the white corpuscles in the blood. At any rate, judging from the results of these investigations, it is not permissible to speak of a marked leukocytosis, let alone a leukopenia, characteristic of influenza. On the contrary, the authors constantly found in all the cases of influenza complicated by bronchopneumonias or follicular anginas, a leukocytosis attaining 12,000 to 18,000 white corpuscles. After the disappearance of the complications, the number of white corpuscles usually dropped in twenty-four hours to the original level. Thus, the etiological factor of the influenza did not change in any case the leukocyte formula of the blood of the complicating infections.

As regards the leukocyte formula, it must be emphasized that only the number of lymphocytes and neutrophilic leukocytes underwent variations. In 100 per cent of the examined cases, without serious complications on the part of the tonsils or the pulmonary parenchyma, the proportion of neutrophilic leukocytes fluctuated between 38 and 64 per cent. The leukocyte formula differed greatly in the cases of influenza complicated by follicular anginas and broncho-pneumonias.



TURKISH DELEGATION

In these cases, the leukocytosis was always found to be accompanied by a notable increase of the neutrophilic leukocytes. The proportion of neutrophilic leukocytes fluctuated between 74 and 82 per cent. In connection with these figures, the number of lymphocytes varied from 12 to 21 per cent. All the examined cases of uncomplicated influenza showed that the absolute number of neutrophilic leukocytes were maintained at the normal level. In complicated influenza cases, on the contrary, the constant and often considerable increase of the number of white corpuscles, in general, in the blood, corresponded to a con-

stant increase in number of neutrophilic leukocytes, the quantity of lymphocytes being normal or diminished. Very distinct and typical modifications of the leukocyte formula could be observed, when one of the foregoing complications supervened in a patient whose blood had been examined before the onset of the added infection.

The following conclusions may be drawn from the foregoing:

(1) Uncomplicated influenza:

- (a) The total number of white blood corpuscles behaves in a variable manner; as a rule, there is a slight leukocytosis. Sometimes the number of white corpuscles remains normal, rarely it exceeds slightly 10,000 per cubic millimeter.
- (b) Leukopenia is encountered in sporadic cases.
- (c) The absolute or relative lymphocytosis coexisting with a normal or diminished (sometimes considerably so) number of neutrophilic leukocytes, represents a constant characteristic.

(2) Influenza with complications:

- (a) The influenza toxin does not modify the leukocyte formula, that is, it has no effect on the modifications of the composition of the blood due to, and characteristic of, the affection which complicates the influenza.

BUJWID (Poland)

“The Virus of Influenza” was discussed by Professor Dr. O. Bujwid, of Krakow, who pointed out that influenza is a disease with a still undefined virus. Some believe that the Pfeiffer bacterium is its cause. The author, in 1890, was the first to observe this bacterium in the blood of the spleen, obtained by means of a sterilized syringe from the splenic substance. A very fine culture was obtained, composed of small bacilli closely resembling those of hog’s erysipelas. A reinsemination of this culture proved unsuccessful, for, as declared by R. Pfeiffer shortly after this observation, these bacteria can be cultivated only in a medium containing hemoglobin. These bacteria were repeatedly seen by the author in typical cases of influenza. He also observed in many such cases, two species of streptococci, one floccular, the other rather granular. Both are similar under the microscope. He has made no observations on the filterable virus. Concerning prophylaxis, he is of the opinion that infection by droplets, in

coughing, must be the most widely spread, and believes a trial should be made of preventive vaccinations with products of streptococci derived from influenza cases.

OWCZAREWICZ (Poland)

Lieutenant-Colonel Dr. Leon Owczarewicz, Military School of Sanitary Service, in his communication on "The Etiology of Influenza," arrived at the following conclusions:

- (1) Many affections, which are very different from the etiological and epidemiological viewpoint, are classified under the term influenza.
- (2) The affections to which this name is applied, must be divided into:
 - (a) Those which appear in countries with a temperate climate during the cold season. They are often designated in medical literature as "seasonal" catarrhs, and are determined by different germs: the pneumococcus, the streptococcus, the catarrhal diplococcus, the pneumobacillus of Friedlander. These are sporadic, primary infections, without epidemic character. They may appear under a more or less severe form and cause various complications.
 - (b) Genuine or epidemic influenza. At the present time, there is no satisfactory proof of the existence of sporadic cases of influenza supervening in endemic foci.
- (3) The actual state of our knowledge permits the formulation of two types of influenza:
 - (a) The epidemics, which are accompanied by the Pfeiffer bacillus, considered by some writers as the causative germ of influenza, by others as the agent of sensitization of the human organism for the action of the germs of secondary infection. The insufficiency of our knowledge of the biology of the Pfeiffer bacillus prevents the complete elucidation of the etiology of these epidemics. They were observed before, during and since the World War. Sometimes, they manifest themselves in the form of small local epidemics, which raises the question of the existence of endemic foci of influenza.
 - (b) The pandemic of 1918, very different from the preceding epidemics, broke out in Central Europe at the time of the seasonal affections of early spring. According to the ac-

tual data, it was determined by a germ belonging to the group of virulent pneumococcus, which is apt to take a chain form. The outbreak of the disease was favored by the diminished resistance of the population, due to the conditions of a long war. The noted complications, namely, the secondary infections, were determined by the various micro-organisms, such as the catarrhal diplococcus, the diplostreptococcus of Bernhard, the streptococcus hemolyticus, the staphylococcus, the Friedlander bacillus. The pandemic of 1918, blending with the foci where the Pfeiffer bacillus was in existence, enabled the Pfeiffer school to propound the theory that the Pfeiffer bacillus was the specific agent.

- (4) The actual results of investigations on the invisible germs and filterable viruses rule out their consideration as the etiological agents of influenza.
- (5) In order to establish the etiology of influenza, it is indispensable to pursue investigations on:
 - (a) The biology and means of differentiation of the Pfeiffer bacillus; in these procedures, it is imperative to take into account the fact that the bacillus is, perhaps, capable of assuming forms which pass through the filters, and of giving endotoxins on its absorption.
 - (b) The invisible germs and the filterable viruses.
 - (c) The pneumococcus and streptococcus groups from the viewpoint of their biology, their virulence, and their eventual property of determining epidemic affections.
- (6) The extent of these investigations is too considerable for their being carried out in a short time by isolated experimenters. It is desired that the Congress proceed to the organization of a plan of future work on the etiology of influenza.

SACQUEPÉE (France)

Medical Inspector E. Sacquepée, Permanent Inspector of the Hygienic and Epidemiological Services of the French Army, contributed a communication on the "Etiology and Prophylaxis of Influenza." He stated that the disease represents one of the gravest affections of military communities, and one of the most difficult to control. The measures of defence against it are limited, for two essential reasons.

On the one hand, contrary to the majority of other infectious diseases, influenza does not possess specific, differential, clinical characteristics. On the other hand, bacteriology is here less helpful than in many other epidemic diseases; it does not possess decisive means of specific diagnosis, and thus fails to lend the same valuable assistance as in other domains.

From the etiological viewpoint, it is frankly admitted that influenza is an infectious disease. Investigations, carried out in connection with the last pandemic, seem to indicate that the pathogenic



ITALIAN DELEGATION

agent is a filterable virus, primarily situated in the rhinopharyngeal and buccal mucus, and in the expectorated material. But, aside from this specific virus, influenza patients are often infected by other associated germs, pathogenic in themselves, particularly the pneumococcus under its different varieties, the streptococcus, and the Pfeiffer cocco-bacillus. These associated germs are dangerous because they can give rise to a serious complication in the bearers, and because they are capable of being transmitted to healthy persons. In the same epidemic influenza focus, nests of complications may thus be formed, each with its own complication. At the time of the Paris epidemic of 1920, the patients of certain quarters of the city were found to be

contaminated by streptococcus 2, or by pneumococcus 3. Prophylactic caution must be exercised in this eventuality.

Influenza is propagated primarily from man to man. In all likelihood, the contagion may also occur, by an inanimate intermediary, such as a table utensil, when not sterilized after use, or the food, when a cook is affected. It is essential, therefore, that the patient must be traced, and isolated. All prophylactic measures must aim at this objective. Such measures can prove successful only with the intelligent cooperation of the Military Command, in all its grades. Precautions must be taken against the importation of the disease or its complications from the neighboring population or from other military barracks. Medical supervision must be exerted incessantly and with the assistance of the military command; this supervision should be extended to the entire troop, without exception. The above must be complemented by other measures, such as the establishment of sick-rooms for minor cases in the barracks themselves; taking of precautions when visiting the infirmary; spacing of the beds; disinfection of kitchen and table ware. In the hospital, isolation of the patients is in order. The personnel should be protected by wearing masks.

COSTA (France)

Dr. S. Costa, Médecin-Principal of the Reserve, Professor in the Marseilles Medical School, contributed "Considerations on the Epidemiology and Prophylaxis of Influenza," and proposed an explanation for mass contaminations. The author stated that the mechanism of mass contamination, according to the investigations of Tridlat, is as follows: The microbes projected into the air by coughing, speaking, or sneezing, play the part of condensed nuclei of moisture. In this way, microbial droplets are formed, which remain suspended in the atmosphere. The surrounding moisture dissolves the gaseous substances which may serve to nourish the droplets, and in all probability there is a multiplication of them, with eventual formation of a real, invisible cloud, the behavior of which is subject to all the laws of physics and meteorology. These droplets escape the action of gravity and are attracted by cold surfaces. They form the more easily the smaller the nucleus of condensation, namely the germ, these conditions being met to the highest degree by a germ of ultramicroscopical dimensions, such as that of influenza. These considerations, less theoretical than they may seem, are alone capable of explaining the mechanism of mass contaminations, the actuality of which is equally

undeniable. Unfortunately, the above does not furnish the key to prophylaxis. Granting that the gravity of influenza is usually due to secondary infections, every effort should be exerted to prevent their development. The author has an anti-influenzal vaccine which is prepared with the Pfeiffer bacillus, the pneumococcus, pneumobacillus, staphylococcus, and streptococcus, including the enterococcus, the rôle of which is progressively gaining in importance. This vaccine is made with formol (formaldehyde), an excellent bactericide, which takes hold of the living corpuseles, encloses, permanently, all their biological properties in a fine shell, after it attenuates or destroys the toxins. It can be preserved indefinitely, does not give rise to any reactions or pain, and gave favorable results in all the cases where it was employed.

MINET AND BENOIT (France)

The Communication of Professor Jean Minet, Médecin-Major de 1^{ère} Classe of the Reserve, and by Dr. A. Benoit, Médecin Aide Major de 1^{ère} Classe of the Reserve, dealt with the "Vaccine Prophylaxis of Influenza." The recent epidemic of the winter of 1926-1927 permitted them to confirm the preventive action of anti-influenza vaccination, as practised by a large number of civilian physicians. One of the main causes which is helping to retard the application of vaccine therapy of influenza for preventive purposes, is, undoubtedly, the evident absence of specificity, as well as the variety of proposed formulas. But it can hardly be otherwise in an affection with such variable manifestations in the course of one epidemic, and especially, in epidemics supervening at most varied times in the different regions of the globe. There is no imperative formula for paraspecific vaccino-therapy, and only long experience can sanction some formulas. The following has been utilized by the authors since April of 1920:

| | |
|---------------------|--------------|
| Pneumococci | 100 millions |
| Streptococci | 9 millions |
| Pneumobacilli | 150 millions |
| Staphylococci | 200 millions |

Remarkable results have been obtained with this formula in the prophylaxis, as well as in the treatment, of influenza and its complications. Since 1924, the bacillus pyocyaneus has been added to the foregoing formula.

The rapidity of the action of the vaccine in infectious diseases, such as influenza, renders the theory of a vaccination, in the bacteriological sense of the term, absolutely untenable. Because of this, the

very peculiar vaccine action has been attributed to a protein shock. But the distinctly preventive action of such a vaccine seems to invalidate this second reason. In the author's opinion, the therapeutic action is due to the microbe itself, or to its disintegration-products—perhaps through an indirect action on the leucocytes or the fixed defense cells. It is possible that the injection of the vaccine determines, in the organism, the rapid production of non-specific allotrope substances, which nevertheless, are capable of attacking the most various microbes, thus permitting the ultimate elaboration of specific bactericidal substances. For practical purposes, and granting that the treatment involves the same contra-indications as antityphoid vaccination, the authors endorse and recommend a minimum total dose of vaccine of three cubic centimeters, one cubic centimeter daily in subcutaneous injections, preferably in the suprascapular region, for preventive treatment of influenza in an epidemic environment. At the present time no vaccination, in the true sense of the term, is practicable against influenza, but only against the microbial flora capable of aggravating it. This not very various flora is evident by all examinations of the excretions of the respiratory system. Since the day that its proliferation on the surface of the mucous membranes was no longer considered as negligible, the therapy and prophylaxis of bronchopulmonary affections took a great stride forward.

DUJARRIC DE LA RIVIERE (France)

In connection with the prophylaxis of influenza, a "Mobilization Plan against Epidemics" was proposed by R. Dujarric de la Riviere, Laboratory Chief of the Pasteur Institute, Auditor to the Superior Council of Public Hygiene of France, Médecin-Major de 2^{me} Classe of the Reserve. The enormous morbidity and mortality caused by the influenza pandemic of 1918, should have rendered evident to all, the imperative necessity of reenforcing and reorganizing the epidemic services, especially in the sense of a greater flexibility and greater rapidity of adaptation and execution. Certainly the fight against influenza in 1918 was particularly difficult, not only on account of the incessant movements of very large masses of men coming from all parts of the world, but also because it is always difficult to establish the prophylaxis of a disease whose germ is so diffusible and whose onset is so abrupt and extensive. On the other hand, the fight could have been made efficient, because the two best means of prophylaxis against influenza, the early discovery and isolation of the patients, were rendered possible almost everywhere, through the existence of large hospital facilities and a large number of medical and nursing

personnel, mobilized and well handled by a direction of the sanitary service. This experience must serve as a lesson for peacetime.

All hygienists are aware of the fact that epidemics often cause greater ravages than wars. It seems to be an established fact that the influenza of 1918 originated in the interior of China; the epidemic advanced, undoubtedly at a progressive speed, from the Asiatic boundary, across Europe, spreading from east to west. The United States of America was promptly invaded, the cases being first noted on boats, then in land units of the marines, in the troop camps, and finally in the civilian population. This shows that it was possible to foresee the arrival of the epidemic in France. Why not have an immediately applicable plan of mobilization against epidemics? In the first place, there should be a center charged with the organization, direction, connection, and control. The mobilization plan must have a service of information. Organizations like the International Office of Hygiene and the Hygienic Committee of the League of Nations render the most distinguished services in this connection. An epidemic service should be in constant touch with them in every country.

As there can be no rational treatment and efficient prophylaxis without an accurate diagnosis of the nature of the epidemic disease, it is indispensable to possess an organization of laboratories analogous to that which was tried and tested during the World War. There must be a central laboratory, for direction, control, and storehouse of supplies, as well as mobile section laboratories, always ready to function, and adequately equipped. The existence of a similar organization in peacetime is highly desirable, in the interest of the patients, as well as in behalf of scientific research. Until hospital architecture becomes modified, it is advisable to install in the common hospital wards, simple appliances, such as hooks for curtains, clamps for screens, which at the time of an epidemic, permit separation into compartments. The education of the public must not be neglected, and all means of instruction should be utilized—pamphlets, tracts, and cinemas.

DUJARRIC DE LA RIVIERE

The author proceeded to the "Filterability of the Pfeiffer Bacillus," on the basis of personal investigations conducted in the Hygienic Institute in Breslau and continued in Paris. In the course of these experiments, the Pfeiffer bacillus could not be demonstrated in the filtrate of *cultures*; but a certain number of positive results were obtained by filtering the peritoneal fluid of guinea pigs into

whose peritoneum the Pfeiffer bacillus had been previously injected. It is very important that the sum total of the procedures, withdrawal of the peritoneal fluid, filtration, and insemination of the filtrate, be effected in a minimum of time, at most a few minutes. Therefore, the entire material must be prepared in advance. The Pfeiffer bacillus is identified, and aerobic and anaerobic control cultures are made. The author had fourteen positive results among sixty filtrations of peritoneal fluids.

LEREBoullet (France)

“*Influenza and Diphtheria*” was submitted by P. Lereboullet, Adjunct Professor of the Medical Faculty of Paris, Physician to the Children’s Hospital, who discussed the relations between these diseases, pointing out the greater gravity of diphtheria supervening in influenza patients, and the frequency of respiratory complications reported in the various epidemics, particularly that of 1918-1919. His service in the Children’s Hospital, which receives about seven hundred cases of diphtheria yearly, furnished a very useful field of observation in this respect.

Diphtheria was rare and relatively benign in August and September, 1926. It became more frequent towards the end of October, and in November and December, an acute epidemic ensued, in the number of cases as well as their gravity. This epidemic continued in January and February, 1927, and then declined in March and April. It was characterized, on one hand, by the greater and earlier malignancy of certain cases of diphtheria angina and on the other, by the abnormal frequency of associated and secondary infections. An investigation of the causes of the excessive mortality showed that hypertoxic diphtheria was only partly responsible; the majority of the fatal cases were the result of the associated or secondary infections. The frequency of pneumococcus infections, in particular, is very unusual in the history of diphtheria and, certainly, was one of the causes of the gravity of these cases. The part played by influenza in the recrudescence of virulent pneumococcus infections is known, and the frequency of the associated infections in the course of this diphtheria can hardly be interpreted otherwise than as a consequence of the influenza epidemic of the preceding winter. The question even arises if the influenza, just as it aroused the latent pneumococcus infections, did not exert a recrudescent effect on the diphtheria infection itself, rendering the Löffler bacillus more rapidly and more strongly toxigenic. At any rate, there was, in that year, a parallel epidemic of

influenza and of virulent diphtheria. This fact explains a special point that has been much discussed: the lessened efficiency of anti-diphtheritic serotherapy. It is undeniable that the antidiphtheritic serum, even when employed in large doses, had not the same action as usual on the cases of malignant diphtheria; but the relatively



REPRESENTATIVE OF THE LEAGUE OF RED CROSS SOCIETIES AND
OF THE INTERNATIONAL COMMITTEE OF THE RED CROSS

marked proportion of therapeutic failures must be attributed, not to a slighter action of the serum, but to the greater gravity of the disease.

The severity of the diphtheria epidemic of 1926-1927 in Paris, was apparently due to the influenza epidemic of the preceding winter months, which seemed to have induced a considerable recrudescence of virulent pneumococcus and streptococcus infections capable of be-

coming associated with the diphtheria, and probably contributed to the increased virulence of the diphtheritic infection itself. Thus, a twofold obligation results, namely that of multiplying, in times of influenza epidemic, the employment of antidiphtheritic seroprevention and antitoxin vaccination, and of treating all suspicious cases, as promptly as possible, by intensive serotherapy, without waiting for bacteriological confirmation.

DOPTER AND JAUSION (France)

“Influenzal Energy” was discussed by Médecin Inspecteur Ch. Dopter, Director of Val-de-Grâce, and H. Jausion, Médecin Major de 2^{ème} Classe, Adjunct Professor at Val-de-Grâce. Based on the conceptions of energy previously established for measles, pertussis, and small pox, by a number of investigators, the existence of an influenzal energy, demonstrated in the experimental domain by French investigators, and confirmed by epidemiological findings, was pointed out. Influenza may accelerate an incipient tuberculosis and arouse a latent bacillosis. The virus of influenza seems to summon in its train the rhinopharyngeal germs, notably those of the pneumopathies, which have been designated as microbes of secondary association. Pneumococci, streptococci, the Pfeiffer cocco-bacillus, behave, in these circumstances, like micro-organisms of “release.” Emerging from their rhinopharyngeal shelter, these germs are released as a result of the organic weakening caused by the action of the influenza virus. Under the influence of the general tissue energy which limits or even destroys the means of habitual defense of the affected territory, they lose their ordinary character, acquire virulence, and become pathogenic. The same is true for the bacillus of pertussis and the spirochete of Castellani. Also, the meningococcus may invade the organism prostrated by influenza. Epidemic encephalitis so closely followed on influenza in the pandemic of 1918-1919, that it became erroneously considered by some as a simple nervous manifestation of the influenza virus. Pulmonary gangrene is, likewise, sometimes a concomitant of influenza. Staphylococci and gonococci may also be activated by it. However, these entirely rational and explicable sequelae are not of regular occurrence.

It follows from the preceding that the influenzal virus does not restrict itself to the production of specific damage, giving rise to disturbances which properly belong to the clinical picture of influenza; it may equally powerfully intervene by favoring the damage done by already active germs, up to the outbreak of new infections existing

in a latent state in the organism. Once released from the influenzal territory, these infections, according to their nature and existing circumstances, may themselves develop in a sporadic or even epidemic form. The necessity for the prophylaxis of influenza thus becomes more and more imperative.

GUIBERT (France)

Médecin Major 1^{ère} Classe Guibert, Physician to the Military Hospitals, Physician in charge of the Begin Military Hospital, Paris, contributed a communication dealing with the "Prophylactic Treatment of the Complications of Influenza." Towards the end of November, 1926, an epidemic of influenza attacked the garrison of Vincennes, and 186 influenza patients were admitted in thirty-eight days to the contagious ward of the Begin Military Hospital. At the onset of the epidemic, the direction of the sanitary service at the war ministry furnished the mixed anti-influenza lipovaccine of Dr. Le Moignic, for therapeutic use. This vaccine contains, per cubic centimeter, four milligrammes of microbes, as follows:

Five milliards of pneumococci.

Two milliards 300 millions of pyocyanus.

One milliard 300 millions of staphylococci.

One milliard 300 millions of enterococci.

These micro-organisms were in oily suspension. This anti-influenzal lipovaccine was employed in certain of the author's cases, in doses increasing from $\frac{1}{2}$ cm., 1 cm., to $1\frac{1}{2}$ cm., at two or three days' interval, by the subcutaneous route. The lipovaccine was not employed in all cases of influenza, but its use was reserved for cases with a striking symptomatology (severe headache with a high fever, repeated epistaxis, vomiting) or for influenzas of a dragging type. A special endeavor was made to apply a prophylactic treatment for the complications of influenza. The number of patients who received anti-influenzal lipovaccine in the contagious service amounted to twenty-six cases. Sixteen patients were distinctly benefited by the treatment while presenting a high temperature and a distinct influenza syndrome. All these patients required two subcutaneous injections, one of $\frac{1}{2}$ cm., the other of 1 cm., at intervals of two days. In four other patients, who were threatened with a pulmonary complication, the lipovaccination exerted a favorable effect on the course of the disease. The most important result to be mentioned is that no death occurred

among all these patients, and that they were protected against formidable complications, such as bronchopneumonia and purulent pleurisy.

ERHARDT (Sweden)

“Rules for Prophylactic Purposes” were recommended by Richard Erhardt, of Stockholm, Sweden, who emphasized the necessity of a very careful, accurate study of the statistical relations concerning the development of the different epidemics and pandemics.

During a grave epidemic, special rules should be published, with the object of reducing to the strictly necessary minimum the number of recruits summoned to military service. The soldiers of a troop, or a regiment, affected by influenza, must not leave the service until the date of termination of the epidemic. In a troop attacked by an influenza epidemic of grave character, all fatiguing military exercises should be forbidden; the convalescents should be subjected to rigorous supervision with application of the necessary clinical measures, including the Fahraeus reaction of the blood. When the development of the epidemic in a given country is considerable, and the infection assumes a grave character, although the military medium is not yet affected, the necessity arises of discharging the soldiers for a certain length of time, as this measure permits the avoidance of a mass increase of the epidemic and thereby contributes to diminish the danger of very grave infections.

The foregoing rules, including others which might be applied if required, are published in an official bulletin against epidemics in the Swedish Army. The rules are principally empirical in character, but have been tried and tested in practice, and comply with the necessity of employing all possible means in the fight against influenza, basing the fight on scientific principles and making the best of precarious sanitary situations.

OLBRYCHT (Poland)

“Anatomical Changes in Epidemic Influenza” was the subject of a communication by Dr. J. Olbrycht, Professor Pathologist of the Military Hospital in Cracow, who believes that such changes may be of help in elucidating the etiology of the disease as well as suggesting preventive measures against it.

Out of a total of 580 autopsies performed during the period of influenza epidemic of September to December, 1918, it was found that pneumonia was the ultimate cause of death in 254 cases; forty-nine cases were uncertain as far as clinical and bacteriological investi-

gations were concerned. The remaining cases were due to unmistakable influenza.

The autopsies were performed within twenty to forty-eight hours after death. The rigor mortis was normal, the process of putrefaction more rapid than usual. In twenty-three cases there was a jaundice-like discoloration of the skin and mucous membranes. In one case there were a few ecchymoses on the skin, with an acute oedema of the spleen, an opacity and dryness of the muscles of the abdominal wall and chest, tracheitis, bronchitis, and purulent bronchiolitis.

The most important findings, on internal examination of the cadavers, were the changes in the lungs. Only rarely were there alterations in the upper lobes, but the lower lobes showed constant inflammation. Lesions were found in the trachea, particularly in the lower part.

The most frequent form of pneumonia that was found was the disseminated lobular type. Frequently, the foci were confluent and invaded the greater part of one whole lobe. In all forms, lobar, lobular confluent, and disseminated, purulent and hemorrhagic processes prevailed. The lungs underwent a process of hepatization, but, in the midst of the tissue, there were irregular stripes and yellowish foci of soft parenchyma inundated with pus or whole groups of small, pinhead abscesses. The pleura covering them was necrotic.

Alterations in the pleura nearly constantly accompanied the inflammatory changes of the lungs. In 114 cases there was a parenchymatous degeneration of the heart muscle, in seventy-three a fatty degeneration, and in five cases an acute myocarditis. In twenty-two cases there was parenchymatous, and in 114 fatty degeneration of the liver. In fifteen cases parenchymatous and in fifty-one fatty degeneration of the kidney; in seventeen cases acute nephritis. In only two cases were there ecchymoses in the mucous membrane of the renal pelvis. A slight enlargement of the spleen was noted in thirty-nine cases. The intestinal tract always was intact. Zenker's wax necrosis was very frequent in the musculi recti abdominalis and the pectoralis major. No change was noted in the endocrine system.

In his résumé, the author stated that epidemic influenza is characterized by local affections of the lungs, very variable in their anatomic aspect, particularly by hemorrhagic pneumonia and purulent processes. Degeneration of muscles and other organs, jaundice and early putrefaction, indicate severe bacteriaemia.

GARINO (Argentina)

In his communication on "The Etiology and Prophylaxis of Influenza," Julio R. Garino, Director of the Sanitary Service of the Argentine Army, stated that, since 1918, there has been an annual accession of influenza in his country. These epidemics extend over a large portion of the territory and, without reaching the severity, extent, and gravity of a great pandemic, require the attention of the medical authorities, especially of the army, because of the complications produced by the Pfeiffer bacillus, the pneumococcus, and other germs. Influenza presents a well defined symptomatology, with a brief development in three days, and, being an energizing disease, it predisposes the organism by diminution of its resistance, while, at the same time, heightening the virulence of the associated microbes. In the resulting genuine symbiosis, some viruses play a preponderating part in the complications, and the Pfeiffer bacillus must be included among these.

By virtue of the part which was formerly attributed to the Pfeiffer bacillus, an anti-influenzal vaccine was prepared in Argentina, which was utilized whenever influenza acquired an epidemic character. The results were largely negative. The reason for this is obvious as neither the Pfeiffer bacillus nor the associated pneumococci, streptococci, staphylococci, had anything to do with the pathogenesis of the disease. Further investigations in the author's country began in 1918, from which date on the Argentine Biological Institute, under the direction of Dessey, prepared a vaccine with about twenty strains of the diplostreptococcus of influenzal pneumonia, which apparently represents a single and identical species in the entire world. No value was attached to the Pfeiffer bacillus, by Lorentz, former Chief of the Military Sanitary Laboratory in Argentina, and a vaccine was prepared by him from the pneumococcus combined with the staphylococcus and streptococcus. Mazza, Chief of the Sanitary Laboratory of the Argentine Army in 1920, found the Pfeiffer bacillus in 30 per cent of the cases in 1919; but in 1920 the germ was entirely absent, whereas the pneumococcus was extremely frequent and virulent. The modern interpretation of influenza directed investigators towards the preparation of a vaccine which acts in a specific manner against the filterable virus, exclusively; others have a vaccine against the germs which cause complications as well as the filterable virus; finally, there is a vaccination against the germs of complications, exclusively.

Vaccination is undoubtedly indicated in all cases of influenza, sporadic or epidemic, against the germs which give rise to complications.

Summarizing, the author stated that :

- (1) Influenza is an infectious-contagious disease etiologically referable to a filterable virus. This disease predisposes to secondary infections (Pfeiffer bacillus, pneumococcus, streptococcus).
- (2) From the prophylactic viewpoint, the employment of polyvalent vaccines against the secondary infections is imperative. It is advisable that these germs (Pfeiffer bacillus, pneumococcus, streptococcus) be isolated from the same epidemic, in conformity with the work of Lister on pneumococcus vaccine.

TEWFIK (Turkey)

Colonel Professor Dr. Salim Tewfik, of Constantinople, summed up briefly his opinions on the prophylaxis of influenza :

- (1) We are practically powerless in the actual prophylaxis against influenza.
- (2) The great and rapid extent of the disease renders the efficient isolation of the patients nearly always impossible.
- (3) The prophylaxis must limit itself to the prevention of the complications, by early and careful treatment of even the mild cases, which is not easy in the army, especially during wartime.
- (4) Influenza is otherwise important in military medicine, especially during wartime. This disease may stimulate a host of others. It is particularly dangerous to confuse influenza with typhus exanthematicus, recurrent fever, and typhoid fever, as happened almost everywhere during the World War.

VANDREMER (France)

“The Utility of a Permanent Medico-Biological Section for Influenza” was discussed by Colonel Dr. Vandremér, who pointed out that the three pandemics witnessed and studied by him, namely those of 1889, 1918, and 1922, showed a different character. Whereas the 1889 epidemic killed adults and especially the aged in a few hours, that of 1918, and especially, of 1922, attacked, predominantly, youthful individuals. The three influenza pandemics all had a septicemic onset with secondary, usually pulmonary, fixation and tertiary metas-

tases indiscriminately affecting the various systems. However, the 1918 epidemic showed a severely hemorrhagic behavior in the Near East and more particularly in the Ægean Islands and in Albania, where the author had occasion to observe it. In these countries, the infection manifested itself suddenly by a high temperature followed by a chill. At the end of a few hours, hemoptysis and sometimes purpura supervened. These phenomena correspond to the theory of the endohematic virus. The morbidity was enormous, practically total. The mortality was high. The striking feature of this epidemic was that the disease broke out in isolated mountain villages, without any contact with the contaminated regions.

There are three contradictory opinions in regard to the causative agent of influenza: The Pfeiffer bacillus, bacterium pneumosintes, ultravirus. Pathogenic germs are now known to have filterable forms oftener than was formerly believed, and it is entirely possible that the bacterium pneumosintes, if it is the agent of influenza, likewise possesses filterable forms. The prevailing ignorance is due to a bad working method; the bacteriologists do not work in a manner similar to one another; they have neither a common mode of experimentation nor a comparable material; physicians are not in sufficiently close touch with laboratory workers. These errors are in need of correction, and in the interest of millions of lives to be saved, the author requested the Permanent Committee of the Congress to create a permanent Medico-Biological Section for the study of influenza.

HERTZ (Poland)

Dr. Richard Hertz, of Warsaw, stated that, during the recent influenza epidemic (1927), he was particularly struck by two kinds of nervous influenza, a neuralgic and asthenic form. In the cases of the neuralgic type under his observation, the pains were localized particularly in the sciatic nerve, and, from the onset, dominated the entire picture of the disease to such a degree, that the influenzal origin could easily remain entirely unperceived. As a rule, the cases of asthenic influenza develop without fever, or, at least, with trifling temperature fluctuations and without any of the symptoms which accompany simple or catarrhal influenza. Although the onset of the disease may be violent, the patient being often in a state of syncope, the ultimate course is generally benign. Certain cases convey the impression of a masked influenza. Afebrile influenza, like that with slight temperature fluctuations, may be the source of numerous errors of diagnosis.

In prolonged cases of influenza, the process, in all probability, becomes localized in the peribronchial ganglia, as confirmed by radiographical findings. Cases of this kind may sometimes lead to an erroneous diagnosis of a tuberculous process, which is known often to become aggravated under the action of influenza. The same is true for influenza complicated by bronchopneumonia, which, when it lasts a long time, may arouse a suspicion of a tuberculous focus.

THOMANN (Switzerland)

"The Prophylaxis of Influenza by Active Immunization," with results obtained in the Swiss Army, was discussed by Colonel Thomann, of Berne, Switzerland. The first attempts with active immunization against influenza were made in 1918 and 1919. A polyvalent vaccine was utilized, manufactured in Switzerland, which contained, per cubic centimeter, a definite number of influenza bacilli, pneumococci and strepto-staphylococci, killed by heat. For the first vaccination, a subcutaneous injection was applied, in a dose of 0.5 cm., and, at the end of a few days, another injection of 1 cm. was given. The tests were made in two infantry regiments, which were in active service, at the end of 1918, and at the beginning of 1919, namely at a time when, everywhere in Switzerland, numerous cases of influenza occurred in the civilian population. In one of these two regiments, however, the number of vaccinations was not sufficient to permit conclusive results. In the other, the originally favorable results in the form of fewer cases, less complications and less deaths, among the vaccinated as compared to the unvaccinated soldiers, did not persist, for, as the service continued, just as many men were attacked among those who had been vaccinated as among the others. When, in 1924, an enterovaccine, called "Buccaline," was manufactured by the Swiss Serotherapeutic and Vaccine Institute, it was given a trial. This vaccine contains influenza bacilli, pneumo-strepto- and staphylococci, killed by heat, and is sold commercially in the form of graded tablets, which dissolve in the intestine, passing through the stomach unchanged. In order to sensitize the intestine for their action, these tablets contain a certain quantity of bile. The administration of this product is contra-indicated in all cases of acute disease, especially in cases of evident influenza. At the onset of influenza cases in about thirty schools for recruits in very different localities, in 1925-1926, about 12,000 immunization doses of Buccaline were employed, and, according to the reports, almost without exception, the product was

not injurious. Only four reports mentioned intestinal pains or gastric disturbances of short duration.

With respect to the utility and value of Buccaline as a prophylactic measure, the opinions expressed by the different military surgeons varied enormously. Altogether about forty reports were received, each concerning an average of three hundred cases. In about thirty reports, the result was described as doubtful, if not plainly negative; and in ten reports was considered favorable. Where a favorable result was apparently demonstrable, this usually coincided with improved atmospheric conditions. It had to be concluded that an eventual diminution of influenza cases or analogous affections was, in reality, due to other causes than to the Buccaline treatment.

SEAMAN (United States)

Colonel Gilbert E. Seaman, of the United States, pointed out that there is still a rich field for study by bacteriologists and immunologists, in regard to the etiology of the different epidemics of so-called grippe.

The World War taught that the important prophylactic measures, as they apply to the armies, lie in isolation, segregation, adequate ventilation in barracks and other shelters, and avoidance of overcrowding.

HARVEY (Great Britain)

It was stated by Major General D. Harvey of Great Britain, Director of Pathology, that army medical bacteriologists in his country agree that the Pfeiffer bacillus is not the true and only cause of epidemic influenza. This bacillus was found in many cases of influenza, or only late in the disease. While the streptococcus and pneumococcus cannot be considered as the cause of influenza, they are found, either alone or together with the Pfeiffer bacillus, in pneumonia following true epidemic influenza.

As a result of the work done in many countries, particularly in the United States, considerable evidence is available to show that epidemic influenza may be produced by a filterable organism.

In Great Britain, as thorough a trial as possible was given to a prophylactic vaccine prepared with the Pfeiffer bacillus, streptococcus, and pneumococcus of various types, together with one or another of the catarrhal group of bacteria, but no striking success can be claimed. However, if it is agreed that these microbes are not the true cause of influenza, it cannot logically be expected that such vac-

cines will afford any protection against the disease, at least, not of a specific character. But there is evidence to show that there were fewer grave complications following influenza among those persons who were inoculated, as compared with those who were not; also, inoculations with these vaccines proved of considerable benefit to persons previously subject to frequent attacks of cold with fever.

HUME (United States)

In his communication on "Influenza in the American Army during the World War," Colonel Edgar Erskine Hume, United States Army, stated that from the day the United States entered the war until the end of hostilities, it is estimated that there were inducted into the army proper 4,352,922 men; 1,160,178 cases of respiratory disease, allowance being made for more than one diagnosis in the same patient, were recorded during this time. That many cases never reached the sick report, and that many thousand were recorded under such diagnoses as pharyngitis, tonsillitis, etc., is doubtless true. Indeed, the large proportion of pneumonias, noted as secondary to these latter conditions, suggests strongly that many of them were, in reality, cases of influenza.

Statistics show that one man in each 5.45 suffered from influenza of sufficient severity to bring him on sick report. One in 15.6 had bronchitis; one in 45 had broncho-pneumonia; and one in 57.5 lobar pneumonia. In all, one man in about 3.76 suffered from one of these major respiratory diseases. The group as a whole was responsible for nearly three times as many admissions as its nearest competitor, the venereal diseases. The deaths, almost entirely from primary or secondary pneumonia, totaled 47,435, a number nearly comparable to those from battle casualties, 50,385. Of all deaths from disease, 81.6 per cent were chargeable to this respiratory group of admissions. One man in every ninety-two in the army died of pneumonia during the course of the war. There were 3,001 discharges for disability and 17,042,838 days lost from duty as a result of these diseases.

This experience is all the more remarkable as coming in an army far better cared for and protected against disease than had been the case in America's earlier wars. By contrast, the mortality from diseases that had scourged armies from time immemorial, was insignificant. The explanation of the high pneumonia incidence came in the autumn of 1918 when the great epidemic of influenza made its appearance. It is believed that most, if not all, of the pneumonia mor-

tality from the earliest months was due to the predisposing influence of the virus of influenza.

Two factors served to render the army statistics less exact. First, mild cases of influenza were unavoidably confused with ordinary types of respiratory infection, such as coryza, pharyngitis, tonsillitis, bronchitis. Second, certain medical officers refused to report an outbreak as influenzal in nature unless the bacillus of Pfeiffer was demonstrated in the majority of cases. The effect of these two influences was to make it necessary to draw conclusions as to the prevalence of influenza, at least partly, from indirect evidence. Largely for the same reasons, the mortality of the 1918 epidemic among civilians was estimated by the United States Public Health Service by means of the excess mortality of that year, over an average of previous normal years.

As it is impossible to separate the records of the several diseases of the respiratory group, including influenza, bronchitis, bronchopneumonia, and lobar pneumonia, the group is herein considered one disease, epidemiologically. The pneumonias constitute the serious and fatal complications that determine the mortality. All our statistical data tend to justify the belief that the pneumonias of the war period, those of the first winter and spring of mobilization, as well as more evidently related pneumonias of the autumn epidemic, were the result of the presence and activity of the virus of influenza. Moreover, there was a significant relationship between the influenza epidemic and the pneumonia supposed to result from measles. The percentage of measles cases developing pneumonia varied from month to month in a manner more or less parallel to the variations in the influenza incidence, and somewhat independently of the measles incidence. Hall estimates that about half of the measles-pneumonia cases owed their origin to the presence of the influenza virus. However, they owed their fatality, in large part, to the virus of measles, although the fluctuations in fatality appear related to the prevalence of influenza. There were in the United States Army 172,642 cases of pneumonia unrelated to measles, and only about 2,500 cases of measles itself. It is evident, therefore, considering that about half of the measles pneumonia cases were of influenzal origin, that most of the pneumonia during the war was the result of the presence of influenza. Perhaps even 90 per cent of the cases may be safely attributed to the influence of this infection.

Vaughan states that efforts in the United States Army, as else-

where, against influenza, were of but little avail. Quarantine was ineffective because it could not be applied in a really efficient manner. Even with physical examination of all men entering the guarded training and mobilization camps, the disease could not be excluded. Medical inspection was used apparently to good effect in the camps, to separate the incipient cases from the well. In some camps men were examined twice each day and 50 per cent of the hospital admissions were discovered in this manner. In some camps, intercompany quarantine delayed the progress of the epidemic, but did not prevent its ultimately reaching all units. Of the forty large camps, thirty-four were quarantined; twenty-three had in addition to quarantine, physical examination of all men entering camp; nineteen had quarantine, physical inspection, and also placed the new men in a detention camp. In eight camps, besides the measures mentioned above, each man entering camp was given a prophylactic treatment of the nose and throat. Preventive throat sprays and gargles were generally ineffective. Face masks proved equally valueless. Attempts at immunization were generally unsatisfactory.

Thus, it is thought that the morbidity and mortality from respiratory disease among American soldiers during the late war, were almost entirely the result of the presence of recurring waves of influenza. Should another mobilization become necessary at a time when the influenza virus is not manifesting its periodic activity, no such admission and death rates for respiratory disease would be expected.

SEQUELAE OF TRAUMATISMS OF THE SKULL AND THEIR TREATMENT

OFFICIAL REPORTS

In a preliminary introduction to their official reports, Aissopos and Papastratigakis of the Greek Army, and Weglowski, of the Polish Army, made the following remarks:

The sequelae of craniocerebral traumatism are the sum total of nervous, neurotic, or psychic manifestations, which persist or develop after the healing of the immediate consequences of the injury, without the affected individual having passed through any period of "restitutio ad integrum." These sequelae may be referable either to gross material lesions, easily demonstrable on macroscopic examination, to microscopic lesions, or to a dynamic disturbance, the cause

of which cannot be demonstrated by any of our existing means of investigation. They may result from a combination in different proportions, of these three varieties of lesions. The efficacy of therapeutic interventions in these cases, depends upon the nature of the individual trauma. Treatment is the more efficient, the more localized and palpable are the lesions.



GENERAL SLAWOJ SKLADKOWSKI, MINISTER OF THE
INTERIOR

Former Surgeon General of Poland

For reasons of greater clearness, the reports have been divided as follows:

(1) Nervous, neurotic, and psychic sequelae of craniocerebral traumatism, and their treatment.

(2) Actual surgical sequelae of cranial traumatism and their treatment (loss of substance, brain abscess, epilepsy).

It is understood that only the craniocerebral sequelae proper will be discussed, without considering any lesions of the sense organs.

PAPASTRATIGAKIS AND AISSOPOS (Greece)

Dr. Papastratigakis, Past Chief of the Military Neuropsychiatric Center, in Athens, Physician of the Reserve, and Dr. Aissopos, Médecin-Major of the Army, Chief of the Athens Surgical Center, in discussing "Nervous, Neurotic, and Psychic Sequelae of Craniocerebral Traumatism and Their Treatment," stated that the study of the sequelae of craniocerebral wounds, actually began after the World War. Although prior to it, the eventual consequences of a cranial traumatism in the nervous system and the psyche of an individual were known, not much information was available on the symptomatology of nervous and mental diseases, so that all efforts at clinical classification were extremely difficult. This uncertainty of diagnosis resulted in indecisions as to therapeutic indications, which were essentially restricted, up to the beginning of our century, to the trephining operation.

The study of cranioencephalic sequelae concern three kinds of clinical manifestations:

- (1) Organic nervous manifestations.
- (2) Neurotic manifestations.
- (3) Psychic manifestations.

No matter to which class these sequelae belong, the part actually played by the causative traumatism must be determined, with special reference to the individual himself. As a matter of fact, there are cases in which the traumatism was merely a predisposing cause, either favoring the localization, at the level of the brain, of a latent infectious process, such as tuberculosis or syphilis, or rendering evident an abnormal psychic constitution. The following sequelae of a cranioencephalic traumatism may appear:

- (1) A local tuberculosis as a direct result of a traumatism of the affected region.
- (2) Cerebral syphilis, particularly with general paralysis.
- (3) Any neurosis or degenerative psychosis (becoming evident under the influence of a traumatism) on a soil previously suitable for its development, either as a result of hereditary predisposition or in consequence of individual pathological acquirements, such as alcoholism or permanent arterial hypertension, primary or secondary.

One might even state that the farther we get away from distinctly organic nervous manifestations, the more the individual factor predominates.

Examination of the wounded should include:

(1) The personal condition prior to the traumatism. This is of cardinal importance, as in several cases it will furnish the key to the problem that confronts the military medical corps. It is so much the more necessary as, at the time of a general mobilization, the recruiting councils take pride in incorporating in the army, the largest possible number of individuals, some of whom are already subject to nervous manifestations of many kinds. An attempt must, therefore, be made to obtain information on the specific previous history of the patient, especially regarding syphilis and tuberculosis, his alcoholic habits, and psychic constitution. Furthermore, in tropical countries, tropical diseases enter largely into consideration. These, such as dysentery or malaria, lead to a chronic exhaustion of the body.

(2) The circumstances of the traumatism and its immediate consequences. It must first be learned if the wound is the result of a war projectile, a contusion, or a concussion without any external lesion. One must endeavor to determine the condition of the patient at the instant of the accident. Likewise, any loss of consciousness synchronous with the accident, immediately following it, or slightly delayed, as well as the approximate duration of the period of unconsciousness, must be noted. Importance is attached to the first symptoms presented by the patient on recovering consciousness. It is essential to be able to establish the continuity between the actual sequelae and the phenomena immediately following the receipt of the trauma. An interval of perfect restitution, without subjective and objective signs, between the phenomena immediately following the injury and the existing condition, does not permit the interpretation of the latter as a sequel. It may be a delayed complication, like cerebral abscess, for example, but it cannot be considered a sequel.

(3) The actual condition of the wounded. This must be determined locally and generally. The local examination consists in the study of the cicatrix; the general examination, in that of the nervous system. The examination of the cicatrix possesses great interest. By its localization, assisted by our knowledge of craniocerebral topography, by its extent, etc., it can furnish valuable indications for the

clinical diagnosis and the possibility of a therapeutic intervention. In order to be complete, this examination must always be followed by radiography. As a matter of fact, all soldiers with skull wounds, no matter what the injury may be, should be radiographed. In addition to the usual general examination of the nervous system in men with skull wounds, an ocular test is necessary, including, especially, the determination of the visual field and ophthalmoscopy; a testing of the functions of equilibrium (vestibular and cerebellar tests); and the examination of the cerebrospinal fluid.

It is customary, since the World War, in speaking of the sequelae of craniocerebral traumatism, to distinguish between two groups of symptoms:

(1) Those which do not depend on a definitely localized lesion, and which can, consequently, be designated as atypical symptoms (Grasset).

(2) Those which express the anatomical functional involvement of the different regions of the brain.

Among the atypical symptoms, two varieties of disturbances must be distinguished, i.e., subjective and objective.

The subjective disturbances, pointed out by Pierre Marie, are at the basis of what, in the authors' opinion, has been wrongfully called the common subjective syndrome of craniocerebral traumatism. It has actually been proved that this so-called subjective syndrome always includes a complex of distinctly objective signs, the demonstration of which merely has to be looked for. Among the latter we note: hyperalbuminosis of the cerebrospinal fluid, combined with a rise of intracranial pressure (H. Claude, Siccard), unilateral or bilateral mydriasis (Sollier), the modifications of labyrinthine vertigo (Babinski, Lortat-Jacob), general disturbances of equilibrium (Cestan), tachycardia, which can be increased through pressure on the cicatrix (Briand), symptoms of sympathetic type, as the syndrome of Claude Bernard-Horner and hyperthyroidism (Pitres), increase of venous pressure on the side of the body opposite to the cranial traumatism (Villaret and Jonnesco), changes of the oculo-cardiac reflex (Oppenheim, Mougeot and Duvergier, Sainton, Valotere). The demonstration of these organic tests proves the real existence of the subjective disturbances complained of by the patient, and is a protection against malingering.

True subjective signs of the sequelae of craniocerebral traumatism, consist, essentially, in headache, visual and mental disturbances. The

headache is of moderate severity, continuous, or, usually, paroxysmal (in the morning, at night, or after eating), with a frontal localization, usually independent of the site of the wound and its extent, easily provoked or aggravated by changes in position of the body, on physical or mental fatigue, even on inconsiderable shaking, and change of temperature. In a word, everything which exerts a vasomotor effect is a factor for the provocation or aggravation of the headache. For this very reason, it is not difficult to see certain relations between these headaches and some neuralgias, such as facial neuralgia



VIEW OF THE HIGH TATRA—CARPATHIAN MOUNTAINS

and causalgia, in the production of which the sympathetic element intervenes to a very large extent.

The visual disturbances or pseudovertigos consist either in a simple, instantaneous blurring of sight, or in a fog which spreads before the eyes. These pseudovertigos are not accompanied by any rotatory sensation, such as belongs to the true vertigos. Their frequency varies enormously from one individual to another, and, in the same individual, from day to day. However, this frequency seems to be distinctly greater in persons with an emotional constitution, a soil favorable to the onset of psychasthenic manifestations. The pseudovertigos must be distinguished from the labyrinthine and epileptic vertigos, with which they may alternate. It must be kept in mind that labyrinthine vertigo usually follows temporoparietal wounds, that

it is accompanied by sensations of displacement of objects, Romberg's sign, and changes of the caloric nystagmus. It must also be remembered that the principal characteristic of epileptic vertigo consists in the loss of consciousness.

The mental disturbances of patients with skull wounds are evidenced by an excessive intellectual fatigue which, at times, involves an absolute incapacity for work, and impairment of memory. But these subjective mental conditions are associated, in nearly all of the cases, with other abnormal mental characteristics and can be summarized in two words: bradypsychism and hyperemotionalism. Bradypsychism is characterized by slowness of mental processes, weakening of attention and will, a tendency to immobilization, by a sort of inhibition, in the performance of voluntary acts. It closely approaches the "mental viscosity" of postencephalitic Parkinsonism. As to the state of hyperemotionalism, this sometimes reaches an extraordinary degree, either in the manifestation of anger, or of the tender emotions.

A special analysis must be made of cases of impaired memory. Usually, there is merely a weakening of the fixation memory, related to the disturbances of attention. But, aside from this, there are other conditions which assume more complicated forms; such as retrograde and enterograde amnesia. There is often, also, a lacunar amnesia concerning the accident itself, and the events immediately following it. In reality, this memory gap corresponds only to the period of loss of consciousness. It is, therefore not correct to speak of amnesia, for the patient affected with it has lost nothing of his memories, having fixed nothing during this period. A final traumatic variety, of importance from the medico-legal viewpoint, is so-called delayed amnesia. This appears some time after the accident and concerns it. All these varieties of amnesia may be met with outside of cranial traumatism, notably in the course of hysteria and epilepsy. It might even be stated that amnesia, through traumatic shock, presents all the characteristics of amnesia through moral shock. Post-traumatic amnesia is more frequent in individuals with an emotional constitution. A final form of memory disturbance in a soldier may be represented by the automatic resurrection of certain painful memories of life at the front whether or not related to the traumatic accident. This disturbance usually supervenes during sleep and manifests itself in the form of a nightmare. It seems that the emotional memory is more particularly affected in these cases.

In addition to the objective disturbances mentioned in the foregoing, demonstrable in the majority of patients with skull wounds presenting the subjective syndrome, there exist other classes of objective disturbances which are not referable to a special localization. These are: the group of epileptic manifestations, the group of psychic manifestations assuming the form of a distinct psychosis, the group of neuroses and disturbances of speech. The epileptic manifestations have been studied by Professor Weglowski, and are discussed in his report.

It seems that the development of the majority of traumatic psychoses is subordinate to the concussion factor, to the primary infectious condition, and to the apparent or latent predisposition of the individual. The following distinctions must be made:

(1) Psychoses, which are merely the continuation of a state that began immediately after the traumatism. These are, for the most part, confusional syndromes with hallucinatory delirium, apathy combined with excitement.

(2) Transitory attacks of delirium, suggestive of the delirious "fits" of degenerates. These are, sometimes, merely the psychic equivalents of a post-traumatic epilepsy. In other cases, there are attacks of mania or melancholia, either isolated or combined in the characteristic fashion of manic-depressive psychosis.

(3) Mental disturbances in cases with a cerebral tumor (including abscess), situated, usually, in the frontal lobes, and which develop in consequence of the cranial traumatism. A syndrome of mental puerilism is present in these cases. It may seem surprising that these disturbances are here grouped among the psychic sequelae of cranial traumatisms. The reason for this is that, as a rule, the anatomopathological nature of the existing mental syndrome is not suspected, but discovered only at autopsy.

(4) Traumatic dementia, characterized, especially, by a lacunar amnesia, emotional indifference, weakening of the critical sense and diminution of voluntary activity. The syndromes of maniacal confusion, depression, paranoia, in progressive attacks, may be grafted on this demential background. The authors have also seen the evolution of the catatonia syndrome, as pointed out for the first time in 1900 by Murault, in men with skull wounds. In these latter cases, the clinical picture closely resembles that of dementia precox.

The study of traumatic dementia may be linked with that of post-traumatic general paralysis. Attention was especially directed during

the World War by Mairot and Pieron, I. Lepine, Pitres and Marchand, to a pseudogeneral paralysis. It is distinguished from true general paralysis, first, by the retrogressive evolution of symptoms, and next, by the predominance of the physical phenomena over the mental disturbances. In another group must be included the genuine general paralyzes, which develop insidiously and only become evident as a result of traumatism. Finally, in a third group, the traumatism itself appears as the determining factor. These last two groups deal with syphilitic persons, in whom the condition manifests itself at the first opportunity.

It does not seem that the relation can be established between the nature of the craniocerebral traumatism, the gravity of the wound, its localization, and the subsequent mental disturbances. Meanwhile, it can be stated in a very general way that: (a) mental disturbances are more common following grave traumatisms, which involve a serious and permanent state of organic weakening, (b) lesions of the anterior regions of the brain are more apt to be followed by mental disturbances, (c) concussions preferably induce syndromes of mental confusion, puerilism, and pseudogeneral paralysis, (d) traumatic dementia develops on a basis of chronic meningo-encephalitis. Delirious seizures, when not referable to epilepsy, are connected with mental degeneration.

In the provisional group of the neuroses belong neurasthenic states on the one hand, and hysterical disturbances on the other. The neurasthenic states appear either essentially as such, or secondarily, after a primary attack of mental confusion. They are always connected with a defective organic condition, which results from an intestinal, hepatic, renal, or endocrinic autointoxication. They are usually accompanied by emaciation and modifications of the arterial pressure, mainly by hypotension—hypertension being exclusively reserved for old syphilitics with specific arteritic lesions, and for cases of renal lesion, as well as certain types of alcoholism. From the clinical viewpoint, the neurasthenic states assume various forms, the chief one of which, at least in Greece, is depression with excitement or anxiety neurosis. In a certain number of these cases, the authors observed phenomena of ambulatory automatism, sometimes accompanied by homicidal or suicidal impulses. The condition always follows a dream, connected with an event at the front. Another form is that in which phenomena of the psychasthenic type predominate, such as obsession and doubts, with a feeling of loss of personality and actuality. The

delirious neurasthenic states must be classified in another category. These include men with a pathological psychic constitution, usually paranoiac, who, on the basis of their neurasthenic depression, develop, more or less, vague ideas of persecution, alternating with classical chronic delirium. These conditions were pointed out by Professor J. Lepine, who described them as "elementary forms of persecutory delirium." In the absence of anxiety, psychasthenia or delirium, the simple, classical form of neurasthenia, was very rarely encountered by the authors.

The post-traumatic hysterical attacks which were noted, appeared either isolated or associated with clinical manifestations, depending upon a definitely localized lesion. These attacks did not present any forms peculiar to skull injuries. Hysterical hemiplegia, alone, appeared with more frequency. The attacks assumed forms which closely approached, at least from the viewpoint of the motor disturbance, certain extrapyramidal syndromes, such as progressive lenticular dystonia or torsion spasm, so-called mental torticollis.

It can be here stated that the clinical manifestations of classical hysteria, Charcot's hysteria, are still met with, Babinski to the contrary, notwithstanding. There certainly are cases in which suggestion plays the principal part. But there also are others, which are beyond the imagination of the patient and the physician, such as certain hypertonias localized in a limb, combined or not with tremor and with very marked vasomotor disturbances. Where are these to be classified? Among the hysterical complications noted by the older writers, or in the newly formed group of so-called physiopathic manifestations, destined to receive the disturbances of functional aspect, which resist the suggestions of the adherents of pithiatism (hysteria)? In all these so-called functional disturbances, including hysterical conditions, the authors see only postemotional imbalance, some of which better than others meet with the concepts assigned by Babinski to the hysterical disturbances.

There are cases in which emotional shock is alone responsible, independently of all question of the localization of the injury, for the onset of Basedow's disease following upon cranial traumatisms. These cases deal with individuals in a state of latent hyperthyroidism, previously manifested simply by an emotional constitution. But there are other cases in which the symptomatology of the Basedowian syndrome seems to have a labyrinthine origin. Attention has been called to this by Hellin and Szwarc, of Warsaw.

The group of traumatic neuroses might be extended by the *sinistrosis* syndrome, a peculiar intermediate condition between traumatic hysteria and neurasthenia, characterized by a mental depression with the idea of absolute incapacity for all work, obsession of the accident, and of multiple unpleasant sensations, all based upon the fixed idea of the right to indemnity. This is a sort of fight for existence in which nothing is seriously comprised, but which, nevertheless, appears in the patient's eyes as a legitimate reaction of individual defense against a social deterioration acquired as a result of the discharge of duty. These cases always are those whose military or occupational inaptitude gives them only very restricted claims to a pension. It becomes extremely difficult to return these patients to the armies, the more so as their condition is very imperfectly understood by the laity, as well as by the military authorities, who are always glad to receive them. Refractory against all occupational re-education, seeing no possibility of resuming their work, they demand to draw the maximum benefit possible out of their accident. Thus, they do not hesitate to exaggerate the actually experienced trials, to persist in an original but no longer necessary incapacity, even to simulate what has never actually existed. It is in the differentiation of this *sinistrosis* from the common subjective syndrome of skull wounds, that the positive or negative organic tests, mentioned in the foregoing, will prove most serviceable.

The authors group speech disturbances, resulting from cranial injuries, among the nonlocalizing symptoms. It is certain that aphasia may be seen outside of any involvement of Broca's zone or the sensory regions of the cortex. Besides the cases of postemotional mutism, aphonia, and stammering, which, on the part of the organs of speech, are the equivalents of the motor incapacities of the neurosis group, there are certain postconcussional dysarthrias which closely simulate the speech disturbances of pseudobulbar affections. In all probability central lesions are concerned in these cases.

In ordinary, nontraumatic nervous pathology, a distinction is made between cortical and subcortical syndromes. This is not so in war pathology. As a matter of fact, one cannot conceive a post-traumatic subcortical syndrome unaccompanied by a cortical syndrome. There are only certain cases of concussion which may manifest themselves exclusively by subcortical symptoms. But in all other cases, the appearance of a subcortical syndrome, as a sequel of cranial traumatism, has always been preceded, and, at times persisted in, by a cortical symptomatology.

It is very difficult to describe briefly all the symptoms of focal lesions. The authors, therefore, limit themselves to a description of the essential symptoms of different localization syndromes.

1. *Syndrome of the frontal lobe*—Here the psychic factors predominate, in the form of slowness of ideation and elocution. The latter may coexist with stammering or scanning, when the wound is of the left frontal lobe. In this case, the speech disturbances are merely the sequelæ of initial motor aphasia. These symptoms may become associated with other clinical manifestations (facial paralysis, contractures, cerebellar syndrome), which are not directly referable



VIEW OF THE HIGH TATRA—CARPATHIAN MOUNTAINS

to the region of the frontal cortex. The same is true for optic nerve atrophy and paralysis of the motor nerves of the eye, which are usually referable to irradiation of the skull fracture to the walls of the orbit, as well as for auricular disturbances, which are due either to labyrinthine concussion or to fracture of the petrous bone.

2. *Syndrome of the parietal lobe*—There are wounds of the parietal lobe, which, for unknown reasons, do not manifest themselves by any symptom. When present, however, the syndrome is especially characterized by disturbances of the deep sensibility and the stereognostic sense. In certain cases, there are disturbances of the superficial sensibility, in the form of longitudinal bands. In low lesions of the left parietal lobe, extending to the supramarginal gyrus, Wer-

nicke's aphasia is noted, as well as the different varieties of apraxia, the most important of which are ideation apraxia (analogous to Wernicke's aphasia) and ideomotor apraxia, a disturbance in the performance of movements. This apraxia is bilateral and often more marked on the injured side. Finally, when the wound penetrates deeply, hemiplegia and hemianopsia may supervene, the latter through destruction of the optic radiations of Gratiolet.

3. *Syndrome of the temporal lobe*—There is only a single clinical manifestation referable to superficial wounds of the temporal lobe, namely, Wernicke's, or sensory aphasia. The existence of cortical and pure verbal deafness is more than doubtful. The authors have never observed it. The symptomatology of deep lesions of the temporal lobe is derived from subcortical syndromes, especially through injuries of the optic layer and the lenticular nucleus. In a very rare case of Pierre Marie and Chatelain, there was, in addition, a lesion of the optic band in contact with the cerebral peduncle. There may be complications on the part of the middle and internal ear, with facial paralysis, either through direct involvement of the petrous bone, or through an irradiated fracture. Among all these lesions, those which seem most capable of retrogression, are the labyrinthine ones, which generally improve and disappear entirely.

4. *Syndrome of the occipital lobe*—This is characterized by visual disturbances, which often must be systematically looked for, because they may remain unnoticed by the patient. They consist, essentially, in a variety of lesions of the visual field (blindness, homonymous lateral hemianopsia in the upper or lower quadrant, single or multiple scotomas), and in verbal blindness, which occurs in lesions of the left occipital lobe, when these reach the deep regions contiguous to the speech zone. There may also be disturbances of orientation in space. Labyrinthine complications are the most frequent.

5. *Syndrome of the Rolandian region*—This is the motor syndrome par excellence. The different varieties of paralyzes are here observed (monoplegias, hemiplegias, paraplegias), according to the seat of the lesion. As sequelæ, they generally appear in the spasmodic form. For the most part, they coexist with disturbances of the superficial or deep sensibility, in segmentary or radicular topography; they may be global or dissociated, with preservation of the tactile, algid, thermic, and bony sensibility. The tendon reflexes are exaggerated; Babinski's sign is generally absent. On the other hand, the sign of adduction of the foot is observed. The paralysis may affect all the

segments of the limb, or present the peripheral type. When there is paraplegia, as the result of a tangential injury of the two paracentral lobes, it is generally unequally distributed over the two lower limbs. It may coexist with preservation of the spinal automatism of walking, or with disturbances of coordination of movements, subsequent to disturbances of the deep sensibility. The hemiplegia presents nothing unusual. When it is very attenuated, it can be evidenced through the maneuver of Barre, homologous with the former, for the lower limb. Finally, there is facial paralysis of cortical origin, which must not be confused with facial paralysis through irradiated fracture at the base. This cortical facial paralysis is very attenuated, assuming the form of a simple facial asymmetry, rendered more evident on movement. It is usually localized on the inferior facial site, but Revillot's sign is also regularly encountered in the upper facial region (impossibility of separately closing the eye of the affected side).

6. *Subcortical syndromes*—These syndromes are extremely rare, in view of the gravity of injuries of the central gray nuclei. The thalamic and Parkinsonian syndromes, especially, have been described. One of the authors observed two cases of Parkinsonian syndromes, the first following upon a wound of the left parietal lobe, the other as the result of direct concussion. In these two cases, the Parkinsonian syndrome developed very slowly after the traumatism. Post-traumatic Parkinsonian syndromes, supervening immediately after the traumatic accident, are to be mistrusted. The reported cases of this kind usually concerned syndromes which appeared at the time of the traumatism. The choreiform syndrome has also been noted, following upon the concussion.

7. *Cerebellar syndrome*—Because of the rapidly fatal result of the wounds, observations on the cerebellar syndrome, through direct traumatism of the brain, are extremely rare. Marie and Chatelain, in a total of about 5,000 cases of skull wounds, find only a single wound of the cerebellum. Likewise, Grasset and Villaret do not note any in a total of 1,366 cases. However, Andre-Thomas published three such cases, and Rochard and de Martel another. The symptomatology includes the known constituents of the cerebellar syndrome—disturbances of equilibrium, disproportionate movements, cerebellar asynergism, adiadochokinesis, tremor, disturbance of speech and writing, increased static volitional equilibrium, passivity, peduncular reflexes—associated in variable proportions in each case. It is rare to observe the syndrome as a whole. Likewise, it may be demonstrable

in only one or two limbs. Thus, in a case observed by Leri, the cerebellar signs were localized exclusively in the lower limbs. In the case of one of the authors, the same signs existed in the upper limbs, and were associated with speech disturbances. In those cases where the injury does not directly affect the cerebellum, one may have to settle a question of differential diagnosis from the labyrinthine syndrome. In the authors' opinion, great importance must be attached to Romberg's sign, the presence of which points to a labyrinthine lesion. The symptoms of the cerebellar syndrome usually have a tendency to slow retrogression.

8. *Peduncular syndrome*—This is most frequently a postconcussional syndrome. From the clinical viewpoint, nuclear ophthalmias predominate. The Argyll-Robertson sign has been observed. One of the authors has also seen a Parinaud syndrome. More complicated cerebello-spasmodic syndromes have also been described.

9. *Bulbo-protuberantial syndromes*—There exist a few such cases through concussion, or through indirect traumatism affecting the cervical column. Thus it is common to see a combination of bulbo-protuberantial phenomena with syndromes of medullary type. In a case of Leri and Schaeffer, one year after the traumatism, bilateral bulbo-protuberantial signs were found, involving the nuclei of the trigeminus, facial, acoustic, glosso-pharyngeus, pneumogastric, spinal, and hypoglossus nerves, combined with a syringomyelic dissociation and muscular atrophy of the Aran-Duchenne type.

PATHOLOGICAL ANATOMY

Data, concerning the anatomical study of the sequelæ of cranio-cerebral traumatisms, is relatively scanty, the pathological anatomy of these traumatisms being based, especially, on cases which rapidly died as a consequence of grave direct, or indirect lesions. It is, therefore, on the basis of findings at the time of surgical operations and the results of certain experimental investigations, that a more or less clear idea can be obtained of the lesions that cause the clinical manifestations. Surgical operations furnish material on the, more or less, gross macroscopic lesions, while the experimental investigations, give information based on the study of the finer lesions of the nerve centers, following upon direct concussions. Thus we have the investigations of J. Lepine on the experimental hematomyelias, of Marinesco on the postconcussional or postcontusional lesions of the ganglionic cells of the cord, and the important investigations of Jacob. These investiga-

tions show that cerebral concussions, through the direct application of blows on the skull of rabbits and monkeys, cause changes of the meninges; focal lesions of the nervous substance; hemorrhage and softening of the brain, capillary apoplexy particularly at the level of the medulla oblongata and the upper cervical cord; regular secondary degeneration of the axis cylinders of the projection and coordination fibers, more evident at the level of the protuberance and the bulb; and changes of the ganglion cells of the central gray nuclei.

Experimental lesions are only remotely similar to lesions produced by the traumatism and concussions of war. We do not yet know, for example, the intimate mechanism of production of the concussional lesions, notably those following upon the explosion of a shell of large caliber. We content ourselves with theoretical explanations, such as the transmission of the vibratory movements of the exploding gas to the brain, shock produced by the explosive gas or the greatly compressed air, gaseous embolisms through liberation of the gases contained in the blood and the tissues, in consequence of a sudden atmospheric decompression and congestion of the nerve centers.

It is noteworthy that there is a frequent association of post-traumatic lesions with those of an infectious character, especially meningeal infections, which are sometimes long delayed. Simple concussions may give rise to an acute meningitis, such as the Weichselbaum diplococcus cerebrospinal meningitis demonstrated by the authors. It must, therefore, be understood that certain clinical sequelae rest merely on anatomical sequelae indirectly connected with the traumatism.

Cranio-cerebral injuries can be divided into two great groups: (a) more or less extensive, macroscopic lesions; (b) more restricted, small lesions, demonstrable on microscopic examination.

The above division is in no way related to the clinical symptomatology. As a matter of fact, it is possible to have very slight functional disturbances follow a grave wound with a large loss of cranial and cerebral substance, and a deep cicatrix. On the contrary, grave functional disturbances are found in patients who have an apparently slight injury, sometimes even after a simple concussion. Certain wounds or concussions may produce, as a result of repercussion, hemorrhagic lesions, foci of softening, and other lesions at a distance from the point affected by the shock.

The macroscopic group may be divided into meningeal and cerebral lesions. The former are of two kinds, inflammatory and vascu-

lar; the first is the result of infection superadded to the traumatism, and referable either to direct infection of the membranes through the foreign body, or to the penetration of micro-organisms through the cranial cavity itself, or the adjacent cavities of the ear, orbit, and sinuses. Among the remainder of inflammatory lesions are the following:

(a) Pachymeningitis, which consists in an inflammatory and chronic thickening of the dura mater.

(b) Leptomeningitis, i.e., increase of the cerebrospinal fluid, thickening of the arachnoid and adhesion to the dura mater and the cortex.

(c) Circumscribed serous meningitis around an infectious focus, or a foreign body. This represents the mildest meningeal reaction.

The vascular meningeal lesions include:

(a) The circulatory disturbances resulting from the presence of a cicatrix in a region where there is loss of osseous substance.

(b) The results of a meningeal hemorrhage, an organized hematoma, either above the dura mater or between the dura mater and the arachnoid.

(c) Hemorrhagic pachymeningitis as the result of small hemorrhages from vessels of the dura mater which, itself, presents a hyperplastic reaction.

(d) Cerebral lesions, which consist of the old hemorrhagic foci in different stages of cicatrization and absorption. Sometimes the hemorrhagic focus is surrounded by a connective tissue membrane in the form of a cyst, the walls of which are infiltrated with hematin pigment and which contains a yellow, brown, or clear fluid. The cerebral softening, with or without associated encephalitic processes around the focus, consists in a yellow degeneration or a still more advanced cicatrization process. This focus of softening may, in the course of time, undergo a more complete disintegration, and terminate in a genuine cyst cavity containing a serous fluid, in the formation of which the locally thickened meninges participate. Edema of the brain may result from the disturbances of cerebral circulation, by a hemorrhagic focus, thrombosis of the vessels, or by a cicatrix. Cerebral sclerosis may also intervene.

(e) Traumatic encephalitis, localized or diffuse, which is a combination of phenomena of capillary hemorrhage and lesions of the nervous and neuroglial system, atrophy of the nerve cells and hypertrophy of the neuroglia, terminating in sclerosis. This traumatic en-

cephalitis may supervene in the absence of any loss of cranial substance.

(f) Suppurative encephalitis, brain abscess, with or without the presence of a foreign body.

(g) Cysts forming around foreign bodies, projectiles or splinters. These cysts are surrounded by a fibrous capsule and contain a lemon colored fluid.

There are mixed lesions which result from craniocerebral injuries and these are represented by :

(a) Hemorrhages under the pia mater and organized hematomas.

(b) Meningoencephalic adhesions and cicatrices.

(c) Meningoencephalitis with agglutination of the meninges to the surface of the brain. In this case, the vessels derived from the pia mater penetrate into the cortex, thus establishing close relations.

(d) Venous thrombosis and, in a general way, the disturbances of the venous and lymphatic circulation of the brain and the meninges, producing an increased pressure of the cerebrospinal fluid and modifications of its morphological parts.

As a result of the disturbances produced either directly or indirectly in the meningeal and cerebral circulation, by the majority of the foregoing lesions, there may be an increased pressure of the cerebrospinal fluid, and this affects the symptomatology of the case.

The microscopic lesions are :

(a) Minute vascular ruptures, diffuse bloody exudates and escape of blood into the pericellular spaces. In certain cases of concussion, even a screwlike distention of the vessels has been observed (J. Lepine).

(b) Small miliary intracerebral ruptures.

(c) Cellular lesions, such as displacements of the nerve components, with fragmentation or extension of their protoplasmic processes or axis cylinders.

Aside from the foregoing disturbances, which can be discovered on microscopic examination, there is reason to assume the existence of dynamic cellular lesions, which cause certain mild or grave clinical manifestations, and which, in all probability, possess an anatomical substratum not demonstrable by our present methods of investigation.

From the topographical viewpoint, there are :

(a) Cerebral lesions, localized or diffuse, direct or indirect.

(b) Lesions which are always indirect, but affect intracranial organs, such as the hypophysis and labyrinth; the latter may be directly damaged in cerebral concussions.

(c) Lesions at a distance, among which special mention must be made of the medullary lesions and those of certain glands of internal secretion, particularly the thyroid and suprarenals.



Warsaw. Lazienki Palace of King Stanislas Augustus. Many noted architects and sculptors figured in the construction and decoration of this Palace, which was built about the end of the eighteenth century. On one floor is an apartment for visiting sovereigns.

TREATMENT

In order to treat the sequelæ of craniocerebral lesions, it is necessary to repair the anatomical damage, and this is often impossible. How can one repair a focus of softening or a loss of cerebral substance? However, aside from these lesions against which we are powerless, there are others which may be benefited by appropriate treatment or a surgical intervention.

Symptomatic treatment is directed against the clinical manifestations which have developed as direct or indirect consequences of the wound. These may consist of motor or sensory disturbances, nervous seizures of epileptic or hysterical character, and so forth. The treatment, therefore, varies in each case.

Causative treatment aims at the repair of the lesion itself, or the removal of the producing cause. Such methods are employed as trephining for decompression, the evacuation of an organized hematoma above the dura mater or even under the arachnoid, the excision of an adherent cicatrix, the extraction of a foreign body, the excision, opening or drainage of a serous cyst or brain abscess.

While the above treatment is distinctly surgical, there are others not especially so, such as lumbar puncture, which is indicated in the cases of rather diffuse compression of the cerebral mass, as a result of the increased pressure of the cerebrospinal fluid. No matter what the pathogenesis of this increase, be it the result of a meningeal irritation or a disturbance of the meningoencephalic circulation, or the indirect consequence of the cerebral edema, it is a fact that, by withdrawing 10-20 cc. of fluid by lumbar puncture, a lowering of pressure is obtained. A single puncture has sufficed in some cases, for example, to cause the disappearance of the minor signs of epilepsy. By virtue of its easy and simple performance, the puncture can be repeated, should signs of intracranial hypertension recur. In certain cases of obstructed cerebrospinal circulation, when the increased amount of fluid remains localized in the ventricles, the application of ventricular puncture is justified, and should be performed after a small trephining operation, permitting the passage of the needle or a fine trochar, either in the frontal portion of the lateral ventricle or in its lateral or occipital prolongation, according to the clinical indications. Roentgen and radium therapy are capable of lessening cicatricial processes which cause irritation. Chartier reports very satisfactory results obtained by Roentgen therapy, applied, especially, in cases where the spastic phenomena predominate as a consequence of a cortical lesion. Finally, it is necessary to point out the encouraging results obtained by the Bourguignon method for the treatment of traumatic cerebral hemiplegia. This consists of a very weak galvanic current, with ionization of calcium chloride, through application of the electrodes on the eye and at the nape of the neck, on the side of the lesion.

CONCLUSIONS

(1) Under the heading of "sequelae of craniocerebral traumatism" are included the sum total of nervous, neurotic and psychic manifestations, which persist or develop after the healing of the immediate lesions, without an interval of *restitutio ad integrum* between the original accident and the sequelae.

(2) In the determination of the clinical manifestations, two factors must be taken into account: the causative traumatism on the one hand, and the individual predisposition on the other.

(3) From the symptomatic viewpoint, a distinction must be made between the symptoms which do not depend upon a special localization (atopical symptoms) and those which are connected with the site of the lesion. Among the former can be grouped the subjective features of the common syndrome of skull injuries, epileptic manifestations, neuroses, and psychoses. This group of so-called atopical symptoms must be considered as provisional. Among the latter belong all the organic manifestations referable to a circumscribed lesion.

(4) From the anatomical viewpoint, a distinction is made between direct, associated, and indirect lesions (intracranial or remote). The direct lesions may be meningeal, encephalic, or meningoencephalic. The same is true for the associated lesions, which are of infectious or inflammatory character. The indirect lesions concern organs which can be influenced either by the cranial traumatism itself (labyrinth) or by the emotional shock (endocrine glands).

(5) The clinical manifestations are not always dependent upon the gravity and extent of the wound. Simple concussions may cause focal lesions, as well as very extensive injuries.

(6) The prognosis depends upon the length of time which elapses from the accident to the onset of the sequelæ, and upon the site and character of the lesion. As a rule, the prognosis is more favorable for patients presenting atopical subjective symptoms; more serious for those with signs of focal lesions and for psychopathic conditions, which have developed on a soil of mental degeneration, and in the old syphilitics. Medico-military decisions are based on this data.

(7) The treatment of the sequelæ is sometimes symptomatic, sometimes causative. In the symptomatic treatment, the known therapeutic methods for nervous diseases are utilized. The causative treatment is chiefly surgical, in the form of trephining, cranioplastics, lumbar puncture, excision of adherent scar tissue; and physiotherapeutic, in the form of Roentgen therapy, radium therapy, ionization.

WEGLOWSKI (Poland)

“Actual Surgical Sequelæ of Cranial Traumatisms and Their Treatment,” was the subject of the report of Professor R. Weglowski, *Medecin-Principal Commandant* of the Sixth Regional Hospital in Lwow. It deals with the group of affections that result from cranial

traumatism, which are nearly always treated surgically. The following conditions belong to this group:

- (1) Losses of cranial and cerebral substance.
- (2) Foreign bodies in the brain.
- (3) Post-traumatic brain abscess.
- (4) Post-traumatic epilepsy.

LOSSES OF CRANIAL AND CEREBRAL SUBSTANCE

This group comprises loss of substance not only in the skull itself, but also in the cerebral sheaths and the cerebral substance.

Etiology—All losses of cranial or cerebral substance are caused by wounds of the skull. It is only rarely that lesions, produced by cutting or by sharp-pointed weapons, are observed among these. A few cases are noted of wounds received during a bayonet attack, but the percentage is very small, as the force and rapidity of a blow inflicted by such a weapon are not great, the bayonet usually slipping on the bone. Losses of cranial substance due to wounds received during attacks with the sword (saber) are more frequent. Aside from the deep incision in these cases, complete segmentary cleavage occurs, either of the hairy scalp, or also of the skull, including the cerebral tissue. Such losses of substance may be very extensive, for example, in one of the author's cases, there was nearly total loss of the temporal bone. Undoubtedly, however, as the last wars have shown, the preponderating portion of all losses of cranial and cerebral substance, is due to wounds by fire arms. It is also known, that bullets coming from a short distance, cause the greatest destruction of the cranial bones as well as of the cerebral tissue, and that, at the exit orifice of the projectile, the destruction is much more extensive than at its entrance. Shrapnel wounds, and those by shell splinters, were very numerous during the last wars, but the loss of substance due to the latter was relatively smaller, aside from those produced by a shell splinter of large caliber.

It must be taken into consideration here that all the losses of cranial substance considered in this report, are of somewhat more extensive dimensions than those observed immediately after the infliction of the wound, as in the aid posts or hospitals these areas of loss of substance were regularly enlarged by different surgical interventions (extraction of splinters, trimming of the bone margins).

Pathological anatomy—The lesions of the skull and the cerebral tissue, where there is loss of substance, are very variable and depend

not only on the means by which the wound was inflicted, but also on the mode of treatment. It has been undeniably demonstrated that, in a loss of cranial substance, the bone is not regenerated, for the periosteum of the flat bones and the dura mater do not possess the power of osseous reproduction. When a bone wound heals, it is by virtue of a fibro-connective tissue cicatrix. These cicatrices become hardened and, sometimes, calcium salts become deposited therein. On microscopic examination of these sclerotic portions, a calcification of the cicatrix is shown, but no regeneration of the bony tissue. The margins of the bony wound become rounded off and are thinned rather than thickened. The dura mater and the arachnoid likewise do not regenerate or, at least, have only a very weak tendency toward this process. In the course of numerous operations on the skull, the author never observed signs of regeneration of the meninges. The same is true for the cerebral substance, which heals chiefly by means of scar tissue.

In the cases where there is rational and immediate surgical intervention, and the cranial wound promptly heals without signs of suppuration, a delicate and elastic cicatrix is noted in the brain tissue, without extensive adhesions or signs of cerebral irritation. Microscopic examinations at different intervals show that a proliferation of the neuroglia is especially in evidence in these cases. On the contrary, in the, unfortunately, more numerous cases where the wound is infected and suppuration prolonged, a large, hard, fibro-connective tissue cicatrix is formed. Such cicatrices compress and drag upon the adjacent portions of the cerebral tissue, and cause disturbances in the circulation of the blood, as well as of the function of the brain as a whole.

The most important lesions, primarily, result from the fact that, at the site of the loss of substance, the scar tissue immobilizes the encephalon, by means of strong adhesions between the bone of the skull and the meninges, as well as the brain. These adhesions are the obstacle in the physiological function of the brain and are responsible for the majority of the grave clinical symptoms. Secondly, as a result of the absence of the cranial bone over a certain area, the corresponding portion of the brain is not protected against external influences and changes, as well as eventual traumatisms. But in these cases, the "*vis medicatrix naturae*" helps in such a way that the cicatrix becomes hardened, is impregnated with calcium salts, and sufficiently protects the cerebral tissue. Among 1,150 cases of loss of

cranial substance, examined in the last five years, there were only 466 (hardly 40 per cent) which were soft and pulsating; while in 704 cases (60 per cent), they were hard and nonpulsating.

In passing to the lesions of the portion of the cerebral tissue which directly touches the fibrous cicatrix, more or less marked signs of degeneration are encountered; the cerebral cells are compressed and deformed, with remarkable changes in their microscopic structure. The most constant and curious symptom, is the edema of the cerebral tissue and the neuroglia—an edema extending over the entire region between the brain and the cicatrix. The production of this edema or infrequently, of cysts, aims at the protection of the cerebral substance against direct contact with the hard cicatrix, generally adherent to the bone. It is a sort of hydraulic space, which protects the brain against its injurious neighborhood, something similar to what is observed in a normal brain, which is separated from the skull by means of spaces filled with cerebro-spinal fluid.

Clinical symptoms—The clinical symptoms, accompanying the losses of bony and cerebral substance, are variable and depend on the dimensions and character of the cicatrix, amount of loss of substance, and the situation of the wound. Small, superficial cerebral cicatrices, in properly treated cases, do not cause any symptoms or only relatively attenuated ones. On the contrary, extensive and deep cicatrices, which immobilize large encephalic surfaces, give rise to disturbances of the cerebral functions and produce very grave clinical symptoms. One of the most frequent and most persistent symptoms is headache; it is rarely constant, usually coming only in attacks and in certain circumstances; during body work, in stooping, on sudden movements of the head. But in a great number of cases, the patients do not complain of headache or other pains, in spite of extensive losses of substance and large cicatrices. Vertigos are less frequent symptoms, and are usually encountered where there is a loss of bony substance in the cerebellar region.

Psychic disturbances—Relatively rarely, a certain dullness or heaviness of thought and speech is met with in these cases. On the other hand, epileptic attacks or, perhaps, only cortical irritations are observed with some frequency.

In 3,268 cases of cranial traumatism, examined in Poland during the last five years, there were 1,150 losses of cranial substance, 466 pulsating losses, and 704 without pulsation. In 328 patients (32 per cent) no complaints of any kind or other clinical symptoms were

noted. Headache and vertigo were complained of by 822 patients (68 per cent); paralysis of the limbs, or of special muscles, were noted in 541 patients (47 per cent); disturbances of speech in 175 cases (15.2 per cent); post-traumatic epilepsy was observed in 285 cases (8.7 per cent).

The focal symptoms depend exclusively on the seat of the loss of cerebral substance. Even very extensive losses, situated in the frontal lobes, practically do not cause any focal signs. The author often observed stammering, as well as a retardation of speech, following such injuries. These probably were caused by the irritation of Broca's center, as, under appropriate treatment, they gradually diminished to a remarkable degree. Losses of substance in the central lobes, result in either hemiplegias or pareses of special members or muscles. Losses of substance in the region of the speech center cause various disturbances, such as aphasia. Finally, losses of substance with the formation of cicatrices in the posterior portion of the skull, give rise to visual disorders, and those of the cerebellar region to disturbances of equilibrium.

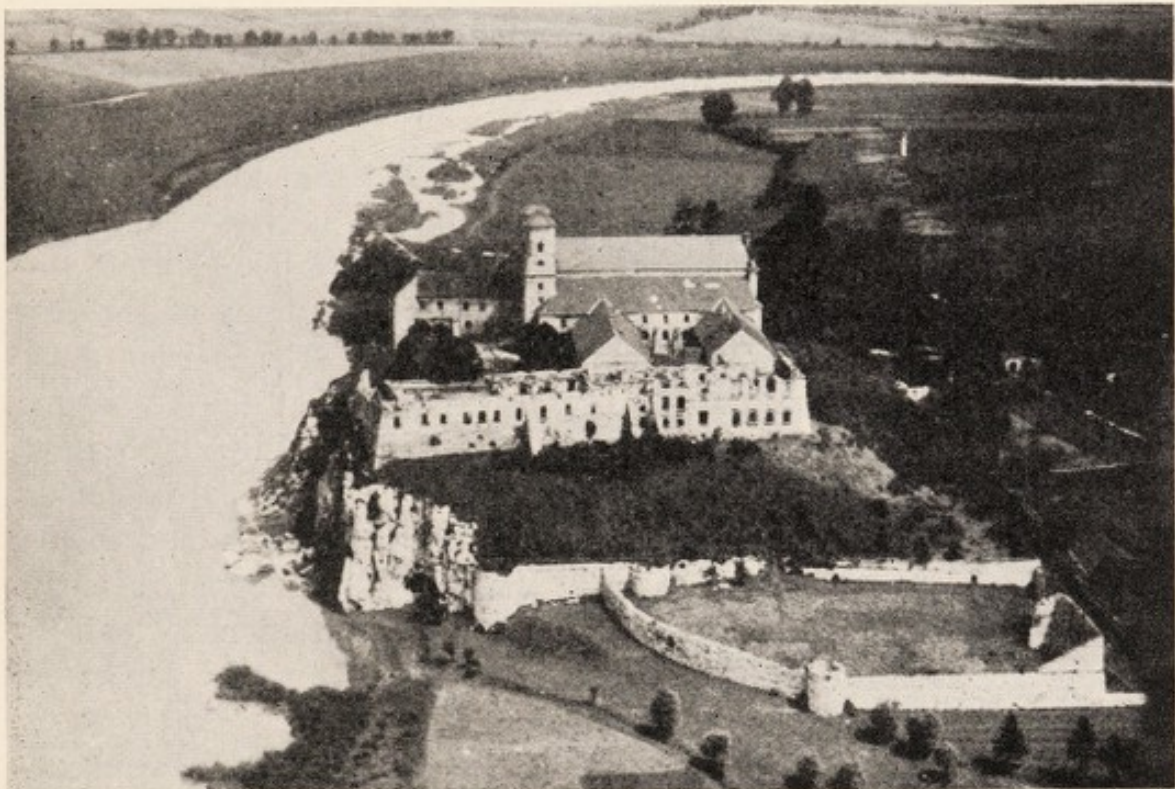
Among the complications, the formation of cerebral abscesses must be watched for during the first years after the injury.

Treatment—As time goes on, the brain adjusts itself to the cicatrix, protects itself against all possible concussions and traumatisms by means of the edema and a layer of liquid found at the boundary of the latter, so that the grave, clinical symptoms gradually become attenuated and even have a tendency to disappear entirely. Due to this fact, the majority of cases of loss of cranial substance do not require operative treatment. This refers especially to the cases where the cicatrix has hardened and fairly well protects the cranial content against external concussions and traumatisms. However, in the cases of more extensive pulsating losses of substance, without any pathological sign, the patients complain of a certain sensitiveness of the uncovered cerebral portion and cover it themselves with pads, pledgets, or other contrivances.

In all those cases where persistent headaches or obstinate vertigo are observed, and especially where the signs of post-traumatic epilepsy appear, the patient must be operated upon. As the principal disturbances do not so much depend on the loss of bony meningeal substance as upon the adhesion of the cerebral substance to the cicatrix, the general rule of operative treatment must consist, in the first place, in the entire and complete removal of this cicatrix, and next, in the

protection of the cerebral substance against a new adhesion to the bone, and this can be accomplished only by a plastic operation on the dura mater and the skull. A simple plastic covering over the region of the loss of bony substance, without a more extensive intervention, fails to relieve the patient, and is useless.

The majority of the patients on whom operation is indicated, originally had a grave suppuration of the cerebral wound, and it must be remembered that the immobilized bacteria in the scar recover their virulence at the time of a new intervention, and again cause an inflammatory process, which may completely destroy the good result of



RUINS OF A CONVENT AT TYNIEC, SHOWING THE VISTULA, THE HISTORIC RIVER OF POLAND

the surgical procedure. Next, an abscess may form in the cerebral substance, and, likewise, ruin a premature plastic operation. Experience teaches that one must not intervene before eight or ten months after complete healing of the primary wound. It is really better to wait at least a year, before operating, and even then, there is uncertainty. The author, himself, has operated upon a patient one year after the primary wound had healed; seven months later another intervention was required for a cerebral abscess.

Routine massage of the cicatrix is indicated two to three months

before the surgical intervention; this procedure mobilizes the scar, facilitates the separation of the cerebral substance and accelerates its organization, hastening the absorption of the latent infection. It is very important to ascertain the disappearance of all inflammatory signs before operation is performed. Concave, movable pulsating cicatrices indicate that the pressure in the cerebral substances is increased, that an inflammatory process persists, and this always becomes exaggerated after a premature operation. In these latter cases, surgical procedure must be delayed. Lumbar puncture possesses a certain diagnostic value, as the demonstration of the inflammatory signs (albumin, lymphocytosis) in the cerebrospinal fluid positively indicates that intervention must be postponed to a later date.

The most rational operative technic, accepted by the majority of operating surgeons, is as follows:

The skin incision must be of such length that the old scar is situated along the flap, passing through its center. The base of the flap, because of its better nutrition, must be broad. In order to avoid necrosis of the cutaneous flap by a cicatrix causing atrophy of the vessels, flaps with transverse scars must be avoided. The incision must be made in the healthy portion of the skin, so that the cutaneous suture does not touch the transplanted bone lamella. Slight irritation from a suture might cause infection in the bone layer and endanger the result of the operation. The incision must always extend to the bone, and the flap must be dissected with the periosteum: this will secure a larger flap, consequently an improved nutrition, as well as a better covering for the grafted bone. The flap must be separated from the borders of the area of bony loss in such a way that most of the cicatricial tissue is removed at the same time. After detachment, the cutaneous periosteal flap is wrapped in a gauze napkin and laid on one side.

Attention is next turned to the interior of the cranium. In the first place, it is necessary to separate the adhesions from the borders of the area of loss of substance, in such a way that the bone does not touch the dura mater or the brain. The margins of the bone are freshened, in order to render the dura mater visible, free, and healthy. After this wide opening, one proceeds to the excision of the cicatrix in the cerebral substance. The dura mater is circumferentially incised to its healthy, non-adherent limit, and, with blunt scissors, the cicatrix is cautiously separated from the cerebral substance. As the intervention is generally made in the edematous layer of the cerebral

substance, the adhesions between it and the cicatrix are always loose. The separation of the cicatrix presents no great difficulties. As far as possible, the bleeding vessels should be cautiously ligated, but when this is impossible, careful hemostasis must be applied with a tampon soaked in adrenalin or warm physiological salt solution.

Though the dura mater may seem to be uninjured, it must, nevertheless, be incised, in order to ascertain if any deep cicatrix is present, if so, it must be removed, and the meninges sutured. After the removal of the cicatrix and destruction of the adhesions, the next step consists in the covering of the defects in the cerebral substance, the meninges, and the cranial bone. It is advisable to fill the defects in the cerebral substance with a layer of adipose tissue taken from the thigh or the abdominal region, preferably the deep layers of fat situated directly on the ligaments, instead of the superficial layers, as the former are softer and better adapted to the purpose for which they are to be utilized. The adipose layer must be neither too large nor too thick, so that it does not compress and irritate the brain after the adaptation of the bone and the cutaneous flap.

In the author's opinion and experience, the losses of substance in the dura mater must be very carefully covered. Certain operators limit themselves to the application of only a single adipose layer. However, in the case of repeated interventions, the fatty tissue is often found to be atrophied or united to the bone and to the cerebral surface, causing irritation. In these cases the author systematically covers the losses of substance in the dura mater with a flap of fascia lata taken from the thigh, and the result is always satisfactory. To replace, simultaneously, the losses of substance in the brain and the dura mater, he generally takes a flap of fascia lata united with the fine adjacent fatty layer, and places this with the fatty surface on the side of the cerebral surface, the fibrous surface on the side of the bone. The ligamentous flap must always be larger than the area of loss substance, and is generally attached with a few stitches to prevent its displacement, or often left perfectly free. The author's own experience is in conformity with the observations of Halstead and Caylor, namely, that the grafted ligament fills its purpose very well, satisfactorily replaces the dura mater, does not irritate the cerebral tissue, and does not unite with the grafted bone.

From a theoretical viewpoint, Krause's suggestion is good, that is, infiltrate the neighboring healthy dura with physiological solution, split it into two layers, excise the upper layer and transplant it on

the site of loss of substance. The practical application is very difficult, however, for in the presence of extensive loss of substance, the healthy dura mater must be exposed over a large surface. Of recent years, it has been suggested to cover the losses of substance in the dura mater by means of a flap taken from the peritoneum or omentum.

The technical means employed until recently for covering the losses of bony substance with grafts of foreign bodies, such as celluloid plates, horn, gold, decalcified bone, now possess only historical interest. These do not adhere to the tissue and always separate from it, like all foreign bodies, by means of a fibrous-connective tissue capsule. A certain quantity of fluid may be found in such a capsule. These foreign bodies often irritate the tissues, cause local inflammatory symptoms, which increase the quantity of fluid in the capsule; this hurts the brain and causes compression symptoms.

The simplest technic, and the one most widely used at the present day, is that of utilizing free bony fragments from the patient himself, for the filling of losses of substance. The statement of Guleke, that these free grafted fragments are absorbed and become atrophic, is not confirmed by facts. For the past twenty-five years, the author has constantly employed for grafting, free bony layers taken from the anterior surface of the tibia, in plastic work on the nose, and has never seen absorption or atrophy of this fragment. Since the outbreak of the World War, he has often performed plastic operations on the skull, and has not observed the absorption of the grafted layers. On six occasions he has had to operate a second time on the same patients, one to three years after the first operation, and has always been able to demonstrate that the grafted layers had united very well with the bone, had become organized and transformed into hard and resistant bony tissue, reliably protecting the brain against all traumatism or external influences. This fact is confirmed by numerous radiographic examinations.

There are many sources from which bone may be taken for filling the osseous loss. It may be secured from the anterior surface of the tibia, from the ribs, the iliac bone, the scapula. The simplest and most convenient procedure is to take the layers from the anterior surface of the tibia, as this lies directly under the skin, is easily accessible, the layer can be readily removed instrumentally, the supply of material is rich for, if necessary, entire surfaces from the two extremities can be utilized. But the most important point is that the removal of the bony layers of the tibia, even along its entire length,

does not cause any complications or diminish the function of the extremities. The removal of layers from the ribs, the scapula, and especially the iliac bone, is technically much more difficult, and involves serious functional complications.

Bony layers are cut from the anterior surface of the tibia by a curved incision, which exposes the periosteum. The periosteum is then incised at the boundary of the layer which is to be taken, and the layer is, then, gradually removed by means of a large drill, so as not to open the medullary canal. Where there is a large loss of cranial bone, some layers are deposited side by side, so as to give a hermetic covering. One layer must never extend beyond another, and must not be slipped under the borders of the cranial bones. The periosteum of the grafts must always be turned towards the dura mater, as the surface is smooth, gives no adhesions with the dura mater, and can even replace it in some manner. It is unnecessary to attach the layers by sutures or any other means. Once they have been placed, they remain immovable until their union has occurred. The next step is to cover the bony layers with a cutaneous flap, being careful that blood and air do not accumulate between the flap and the grafts, as this would complicate the course of postoperative treatment. The cutaneous flap must be regularly attached by some catgut stitches, and afterwards, under constant compression of this flap with the fingers, a continuous catgut suture is applied along its borders. A piece of collodion or masticol gauze is then placed over the skin wound and starch dressings are applied over the entire head. Eight or ten days later, the dressings are removed.

As a rule, the grafted bony layers, even when numerous and small, become completely immobilized in a few weeks, one maintaining the other, and the adhesions between these grafts often become calcified. In this manner, the area of loss of substance is filled with a bony material, suitably protecting the cerebral tissue against all damage.

In a general way the results of the operation are very satisfactory. The clinical symptoms of headache and vertigo disappear very rapidly. In over 60 per cent of the cases, epileptic signs disappear. If they reappear after a certain time, they are always milder, less frequent and readily subside again with the use of luminal or other similar remedies. An improvement of spastic and paretic symptoms is observed. When speech disturbances had been present, improvement in these is, likewise, noted. All of this is explained by the relief of compression of the brain after the removal of the hard cicatricial tissue.

The most important postoperative complications consist in infection of the wound and its suppuration, but this is not of common occurrence. In order to guard against these complications, one must not operate until ten to twelve months after the healing of the primary wound, and then must be careful not to have a collection of blood or air at the site of the operation. If suppuration supervenes, it is best to remove the grafted bony layers altogether, as this will lead to a more rapid healing of the wound. If the grafts are left in place, sequestra are formed and the process may thus be protracted for months. A subsequent cerebral abscess is another complication. The author met with two similar cases. In one instance, he operated eight months and, in the other, twelve months after the healing of the primary wound. The formation of these abscesses indicated that the plastic intervention was performed a little too early.

FOREIGN BODIES IN THE BRAIN

The foreign bodies found most frequently in the cranial cavity or cerebral tissue are free bone fragments, torn away from the skull bone and carried into the interior. The World War, with its highly developed artillery fire, furnished an abundant material of foreign bodies through shell explosions, such as shrapnel, grenade splinters, shells and their fragments. Gunshot bullets, revolver balls, fragments of wood of all kinds, glass, stones, and particles of clothing are also found. The resulting pathological condition must be divided into lesions due to the mechanical action, and those due to infection.

In the infliction of the cranial wound, the skin, the cranial bone, as well as the cerebral tissue are crushed and become necrotic, so that the path taken by the projectile presents the appearance of a canal of necrotic tissue in which may be scattered small bony fragments, particles of the projectile and, finally, other foreign bodies which have been carried along. In time the necrotic tissue is absorbed and an extensive and hard cicatrix remains. A fibrous-connective tissue forms around the foreign body, which usually becomes encapsulated. When the foreign body is aseptic, the fibrous-connective tissue membrane is entirely adherent to it, and immobilizes it to such a degree that it is as if united to the cerebral tissue. In the presence of infection, everything depends upon the strength and virulence of the existing bacteria. When the infection is weak, cysts, filled with an entirely transparent or cloudy fluid, form around the foreign body. The cyst membrane may be fine or thick and fleshy. In more violent infections,

typical abscesses, granulating in the interior and covered on the outside by a fibroconnective tissue membrane, are formed around the foreign body.

Gunshot projectiles are usually aseptic, whereas shrapnel and other portions of cannon projectiles, bony fragments and other foreign bodies, all of which usually carry living bacteria with them, give distinct inflammatory symptoms. Encapsulated foreign bodies may remain in the cerebral tissue for years without causing major pathological lesions; but under favorable conditions, a typical cerebral abscess may form. It is a remarkable fact that the heavy aseptic gunshot or shrapnel projectiles, may occasionally migrate and change their location. This displacement generally consists in a slipping of the projectile towards the dura mater, where it becomes immobilized. Sometimes, however, much more complicated displacements are observed.

Clinical symptoms—These are very variable and depend on the localization of the foreign body and the reaction caused by it in the surrounding tissue. Foreign bodies which produce no clinical symptoms, are often encountered, but the most constant signs are those of irritation, such as headaches, vertigos, convulsions, as well as post-traumatic epileptic attacks. When the epileptic attacks are pronounced, psychic disturbances are invariably observed. The other clinical symptoms depend principally, on local cerebral lesions (pareses, sensory disturbances). The clinical symptoms caused by a cerebral abscess, are the most prominent.

Diagnosis and determination of the localization of a foreign body in the brain—In order to secure this information, it is indispensable to determine the relation of the nearest point on the external surface of the skull, to the foreign body and the depth at which this body is situated. The customary radiographic method is the easiest, and most accurate. It is of assistance, in this method, to mark the sagittal and frontal lines on the skull with two lead wires, and then take the roentgenograms in these positions. Next, at the surmised point of trephining closest to the foreign body, a small lead disk is fastened to the skin by means of adhesive plaster. One thus obtains on the roentgenograms the accurate indication of the depth and direction of the foreign body. Stereoscopic radiography also furnishes very good results.

Among the numerous radiosopic methods, the most practical one is Holzkecht's, which consists in a parallel displacement of the ray

from one point to the other. This is accomplished with an instrument called the "trochoscope," by causing the lamp to slide parallel with the top of the table, while the screen is immovable.

Treatment—Operative extraction of the foreign body from the brain must be performed when indicated. These indications depend on the clinical symptoms and on the localization of the projectile.



THE ARGENTINE DELEGATION WITH POLISH INTERPRETER

Without clinical symptoms, it is not necessary to operate. It is in those cases where obstinate headaches, vertigos, or epileptic manifestations supervene, that the foreign body must be removed. In addition, surgical procedure is indicated in individuals who are in constant fear of the fact that the foreign body is in their brain, in patients in whom migration of the projectile has been observed, as such displacements may give rise to undesirable complications and, of course, in

cases where there are signs of poisoning caused by the metal of the projectile. Finally, operation is imperative when the signs of abscess formation, around the foreign body, make their appearance.

When the projectile is superficially located in the cerebral tissue, operation may be performed without hesitation. On the contrary, when the projectile is deeply imbedded, and in the vicinity of the cerebral ventricles, particularly the third or fourth one, or at the base of the skull, the operative risk must be well considered. In the latter circumstance intervention is so dangerous that it is permissible only in cases with very grave clinical symptoms.

It must be kept in mind that the route of access to the foreign body passes through normal cerebral tissue, which, with the central ganglia, must be saved at any price. Therefore, only those methods must be applied which neither crush nor traumatize the healthy and active cerebral substance. This is possible only in the cases where the localization of the projectile is accurately determined. At any rate, it is not now necessary to open the skull widely and to seek the projectile with the finger in the brain, a procedure which, until recently, was considered the most rational. At the present time, foreign bodies must be removed from the cerebral tissue under the strict control of the X-rays.

After determining the situation of the foreign body, a curved incision is made down to the bone, preferably in the so-called silent area of the brain; a bony fragment of 3-4 cm. in diameter is removed, and a longitudinal incision 2-3 cm. in length is made in the dura mater. In order to discover and more easily grasp the foreign body, heavy, long forceps are utilized, curved at a rectangle and with fine jaws. No sound should be employed for the discovery of the body, for the introduction of a sound for the simple palpation of the foreign body and then of forceps to grasp it, needlessly traumatizes the cerebral substance, as the forceps will not always take the same route as the sound. Under the control of the roentgenoscope the operator cautiously introduces the closed forceps into the cerebral substance and pushes it in the direction of the projectile. The movements of the projectile, when it is touched by the forceps, indicate that the correct direction has been taken. The forceps are then carefully opened and the projectile is grasped on its narrowest side so that, as it is extracted, the cerebral tissue is traumatized as little as possible. In the absence of abscess formation around the foreign body, the incision of the dura mater is sutured, the removed bone fragment is replaced and the skin

is completely closed. When an abscess does exist, its cavity must be drained, as is done in ordinary cerebral abscesses.

The operative results are satisfactory in cases without abscess formation, and the majority of the grave clinical symptoms disappear. On the contrary, in the cases with abscess, the mortality amounts to 40-50 per cent.

Auvray quotes fifty-four cases of delayed secondary extraction of foreign bodies of the brain, with the following results: in fifty cases he obtained good results, in one case the foreign body was not removed, in three cases the patients died from abscesses found around the foreign body. In seven instances, the removed cerebral projectiles were deeply situated at the base of the skull.

POST-TRAUMATIC BRAIN ABSCESSSES

Among abscesses, in general, in peacetime, the post-traumatic abscesses amount to only 6-10 per cent of all cases. During the last wars, in the experience of surgeons who operated near the front, and who dealt with recent injuries, the frequency of cerebral abscess did not exceed 1-2 per cent of all wounds of the skull; on the contrary, in the statistics of surgeons who worked at the rear, and to whom a much older pathological material was referred, the percentage of abscesses reaches 8 per cent or more. Among the post-traumatic brain abscesses, it is necessary to distinguish early abscesses, which supervene in the first weeks after the injury, and secondary abscesses, which appear some months, and even some years, after the complete healing of the original wound.

The cause of post-traumatic abscesses consists, most frequently, in the transportation of the pathogenic agent into the interior of the cerebral substance, in the course of skull wounds caused by exploding projectiles or shrapnel. Gunshot wounds very rarely give rise to abscesses. Foci of softening of brain tissue or posthemorrhagic foci, after traumatism, are also favorable causes for abscess formation. The pathogenic agent may travel either by the blood or the lymphatic route. The cause of early abscesses is principally due to insufficient drainage of the secretion from the wound. Splinters or other foreign bodies often furnish conditions favoring the retention of the secretion. Prolapse of the cerebral substance likewise contributes, in a high degree, to abscess formation. The cerebral hernia becomes edematous, compresses the drainage channel, and causes the retention of the secretions in the canal.

Pathological anatomy—In the localization of brain abscesses, a distinction must be made between those situated between the bone and the cerebral surface, and those situated in the cerebral substance itself. The former appear either as suppurating meningeal hematomas, or as circumscribed meningitis. The latter are true abscesses and are situated at different depths in the cerebral substance.

Early abscesses are generally cortical, for, after the infliction of the wound, the cortex is the first to suppurate. The abscess most frequently becomes concentrated around bone splinters. Such a cortical abscess is generally surrounded by a band of red softening and then by edematous cerebral substance. The pus is of a brownish color; the limits of the abscess are vague, indicating its progressive character.

The most common seat of late abscesses of the brain is the white matter. The lymph vessels probably transport the lymph in the direction of the meninges through the ventricles, and the pathogenic agent is swept along in the same direction. However, the abscesses are not always formed in the corresponding hemisphere. In an entire series of cases, the abscess was shown to form on the opposite side, where it developed from a hematoma, as a result of repercussion.

The more delayed post-traumatic abscesses usually are single, although the literature is not lacking in descriptions of cases with six or eight abscesses longitudinally arranged, like a string of beads. The size of delayed abscesses is generally considerable. In one of the author's cases, 400 gr. of thick pus was extracted from the frontal lobe.

As a rule, in the early abscesses, which develop rapidly in consequence of necrosis of the cerebral tissue, no surrounding membrane is found, whereas in the delayed abscesses, there always exists a well organized capsule, separating the abscess from the healthy cerebral substance. The full development of such a capsule requires from four to five weeks, and is formed, most frequently, by proliferated glia substance with abundant lymphocytic infiltration, as well as a more or less considerable quantity of fibroblasts. In the more chronic abscesses, the fibroblasts form a thick network of fibrous connective tissue. In the cerebral tissue directly adjacent to the membrane, encephalitic signs are generally met with. In proportion to the development of the abscess, the capsule increases in its dimensions, usually progressing in the direction of the lymphatic circulation, that is, toward the ventricles. These abscesses generally penetrate into the ventricles, but only rarely into the submeningeal spaces.

Clinical symptoms—These are not typical and do not appear in an identical manner in different patients. In the course of early brain abscesses, the symptoms of apathy, headache or vertigos, with fever, are pronounced. On the contrary, in the delayed abscesses, clinical symptoms may be entirely missing, or so weak and nontypical that the diagnosis is not suspected. One of the most telling symptoms is headache, which is present in nearly all such cases. The headache is generally constant, with exacerbation on effort. Intermittent attacks are very rare. Vertigo and vomiting are sometimes associated with the headache, indicating that the intracranial pressure is increased. The temperature rises only slightly.

Proportionate to the development of the cerebral abscess, the clinical symptoms become exaggerated and those disturbances appear, that are caused by increased intracranial pressure. Lesions of the ocular fundus, often in the form of neuritis, and, rarely, choked disc, are listed under these disturbances. The ocular fundus remains normal only in cases of rapidly developing early abscesses. Included among the other signs of increased pressure, are bradycardia, excitement, insomnia, psychic unrest, and, finally, epileptic attacks, which sometimes supervene as the only early sign. Localization symptoms appear only in cases where the abscess is situated in the environment of the corresponding centers. On the contrary, when the abscess is localized in the frontal lobe, often no disturbances of any kind can be demonstrated. The author has had occasion to observe some cases with large abscesses of the frontal lobes, without symptoms and functional disturbances on the cerebral side.

In cases of suspected post-traumatic abscess, it is very important to examine the cerebrospinal fluid. If an abscess is present, a greatly increased pressure is almost invariably demonstrable, as well as the presence of albumin and pleocytosis.

Diagnosis—In all cases where a traumatism or cranial injury occurs in the anamnesis, any sign, even the weakest cerebral irritation, should suggest the formation of a cerebral abscess. If, following a long interval after the traumatism, slight elevations of temperature appear, with headache and focal symptoms, corresponding to the site of the traumatism, the diagnosis of a cerebral abscess is almost certain. In order to confirm the diagnosis, the cerebrospinal fluid must be examined and a radiograph taken.

While there are exceptions to the rule, in the majority of cases, the abscess develops in the vicinity of the traumatized region, although

the local signs are less distinct and constant than in cerebral tumors. Radiography is of great importance in determining the localization of the abscess. Encephalography must be combined with radiography when the latter does not accurately indicate the exact position of the abscess. This combined method is very satisfactory.

Treatment—Prompt surgical intervention is the only treatment for cerebral abscesses. Operation—even if only exploratory—should not be postponed. Time is a very valuable factor. Contrary to the opinion of some writers, it is dangerous to wait for the proper formation of the abscess membrane before proceeding.

After novocain anesthesia with $\frac{1}{2}$ -1 per cent adrenalin solution, the patient is placed on the table with the head raised or in a semiseated position. In order to enlarge the abscess, and so facilitate its discovery, some writers recommend a lumbar puncture just prior to the operation, with the withdrawal of as much cerebrospinal fluid as possible.

The skin incision is usually begun at the site of the traumatism, except, of course, in the few cases where the abscess has been localized elsewhere. In the absence of a cicatrix, the bone should be exposed by a flap incision, first carefully suturing the hairy scalp, for packing. The bone is removed and carefully tamponned; then the dura mater is incised, the submeningeal spaces being protected against infection by strips of iodoform gauze, closely placed under the borders of the bone, between it and the dura mater. The best means for determining the localization of the abscess is by puncture. For this purpose, special, rather strong needles with a blunt point and two lateral openings at the end, are utilized. Large needles are necessary, for the pus of cerebral abscesses is always thick. In plunging in the needle, care must always be taken not to puncture a ventricle, which may easily be infected. The needle must not be withdrawn when the pus is reached nor must the abscess be emptied with the syringe, for cases are on record where this was done and it was impossible to find the abscess again. A pair of blunt Pean or Kocher forceps is introduced along the needle, the canal is enlarged, a large drain is inserted, the pus very carefully removed, and the abscess cavity cautiously washed with weak solutions of silver nitrate or with physiological salt solution.

The greatest difficulty in these operations consists in the natural drainage of the pus to the exterior. A cerebral abscess usually has a special membrane which is always under a certain positive pressure

in the brain. As soon as the abscess is empty, its walls are compressed and flattened by the neighboring cerebral parts. This flattening is not always uniform and often a portion of the abscess becomes separated in such a manner that, in spite of an apparently adequate drainage, the separated section develops into a new abscess with all its bad sequelae. In order to avoid this, certain operators drain as widely as possible by means of glass or rubber drainage tubes. Eagleton applies a special encephaloscope with which he may carefully inspect the interior of the abscess. King cuts away the entire anterior wall of the abscess, unites the abscess widely to the exterior, and in this fashion, by inducing a cerebral hernia, brings the floor of the abscess outside. After irrigation of the abscess walls with Dakin's solution, he covers them with a perforated waxed cloth on which gauze, soaked in Dakin's solution, is applied. The neighboring parts are, of course, protected by the application of vaseline.

Wide drainage of the abscesses, by means of simple or iodoform gauze, would be the most convenient, but the gauze irritates the cerebral tissue, which unites with the orifices in the cloth, and every change of dressings gives rise to hemorrhages and rather serious traumatism.

The author's method for the drainage of cerebral abscesses is to make a large opening in the cavity of the abscess, then introduce into this an entire series of so-called "cigaret drains," with a portion of the gauze reaching from the end of the cigaret to the exterior. As the thick pus rapidly obstructs the capillary orifices of the gauze, and thus causes them to lose their capacity of drainage, some fine glass drainage tubes are placed between the "cigarets." The gauze strips, wrapped in fine smooth waxed cloth, do not irritate the cerebral tissue and can easily be replaced.

Postoperative treatment of cerebral abscesses is very difficult, and requires great efforts and careful supervision. It must always be kept in mind that a portion of the abscess may become detached, as a result of cerebral compression, and cause recurrent conditions to which the patients usually succumb. The operator must, therefore, properly study every change in the patient's condition, as well as in the appearance of the wound. If, during the postoperative period, the patient again has headache, vertigo, and rise of temperature, the abscess cavity must be carefully washed out and an examination made, to see if there is retention of pus, with formation of another abscess.

Dressings are changed every eight to ten days; more frequent

changes are not only useless, but rather injurious, as the cerebral tissue is unnecessarily irritated. A rubber or glass drainage tube must not be rapidly removed, for the route of the drain collapses and closes so quickly, that the tube cannot always be replaced by the same path. It has frequently happened that, in changing a drain, it has been incorrectly placed on the side of the abscess in the soft substance of the cerebral tissue. "Cigaret" and small glass drains are changed in the following manner: first the glass drains are removed, washed, cleaned, and replaced, after which the cigarettes are, one after the other, replaced by new ones. The external opening of the wound must remain large as long as possible, and the number of drains or cigarettes must be very gradually diminished.

Among the complications which occur in cases with wide opening of the abscess, prolapse of the brain is often observed. When such a prolapse compresses the opening of the wound, and causes the retention of the discharge from the abscess cavity, the pressure must be lowered by means of lumbar puncture, and when this does not suffice, by puncture of the healthy ventricle. After complete cicatrization of the wound, the patient must remain under the surgeon's observation for a considerable period of time, as it sometimes happens that recurrences of the disease supervene several months after the operation.

The results of treatment are not very encouraging. The statistics furnished by different writers are uniform, but never optimistic. It must be admitted that the postoperative mortality percentage amounts to 75-80 per cent and that only 20-25 per cent of the patients leave the hospital as cured, but even in these latter cases, the function of the brain is altered. Headaches, vertigos, and epileptic symptoms very often recur, depending upon disturbances caused by cicatrization and immobilization of a certain portion of the cerebral tissue.

POST-TRAUMATIC EPILEPSY

The clinical convulsions, with partial or total loss of consciousness, appearing after a traumatism, are grouped under the head of post-traumatic epilepsy. The statistics of the last wars, as to the number of patients suffering from post-traumatic epileptiform convulsions, fluctuates between 0.5 up to 30 per cent of all cranial traumatism. Out of 3,268 cases of cranial traumatism sustained during war and examined in Poland in the last five years, the author found only 285 cases of post-traumatic epilepsy, i.e., 8.7 per cent.

A small traumatism may cause a grave, general epilepsy, whereas a very extensive injury may not result in any such symptoms. Undoubtedly, aside from the traumatism itself, the personal susceptibility of each affected individual plays the dominant part; in other words, it is necessary to take into consideration the neuropathic disposition of the patient, as well as the hereditary, alcoholic, syphilitic, and other factors. The author is convinced, by a comparison of the pathological disturbances in different patients, that the more extensive is the damage of the nervous tissue, the more frequently does epilepsy supervene. Tangential wounds give a greater percentage of epileptic complications than penetrating wounds, for the cerebral cortex is more severely damaged in the former than in the latter. Primary infection and other grave complications, causing the production of a resistant and hard cicatrix, furnish a greater percentage of epilepsy than clean, aseptic wounds. Primary suture of the wound gives the best results.

Anatomo-pathological lesions—These lesions are very variable, for the epilepsy is often only one of numerous morbid symptoms. In certain cases of closed traumatism, neither macroscopic nor microscopic lesions are demonstrable; in others, only microscopic lesions of the glia, vascular sclerosis, structural lesions of the cerebral tissue may be noted. Gross lesions are also found, such as foreign bodies, bone fragments, hematomas, inflammatory foci, abscesses, cicatrices; infiltrations, cysts, vascular dilatation of cysts of the arachnoid, and thickenings of the dura mater.

Leriche arrives at the conclusion, based upon thirty cases of post-traumatic epilepsy, that this condition is always connected with the presence of a cicatrix after a preceding post-traumatic focus in the cerebral cortex. He does not believe that the lesions in the bone and meninges, to which so much importance was attributed in the pathogenesis of epilepsy, play a more important part. But a simple fibroconnective tissue cicatrix is not always sufficient to produce epilepsy. The epileptogenic cicatrices are nearly always due, according to Leriche, to a normal proliferation of the neuroglia, which is dependent upon the reaction and the capacity of proliferation of the connective tissue, in particular individuals. In the case of such a cicatrix of the neuroglial tissue, he surmises that the epileptic attacks result through sudden changes of the cerebral circulation and are always connected with oscillations in the pressure of the cerebrospinal fluid.

Guleke, on the contrary, sees the principal cause of post-traumatic epilepsy not so much in the presence of the cicatrix itself, in the cerebral tissue, as in the immobilization of the brain—in the adhesions between the cerebral tissue and the skull bone, unfavorably affecting the movements and normal functions of the brain.

It is difficult to accept the theories of Leriche and Guleke, for, as previously stated, we find a proliferation of the neuroglia and immobilization of the brain through the cicatrix in all patients with



THE FRENCH DELEGATION HEADED BY GENERAL SAVORNIN, WITH SOME OF THE POLISH OFFICIALS

grave skull wounds, while epileptic signs appear in only 8-10 per cent of the cases. It must, therefore, be assumed that it is not the character of the traumatism or certain lesions of the cerebral tissue which play the dominant part in the development of epilepsy, but the individual soil.

Clinical symptoms—A distinction is made between two fundamental groups of post-traumatic epilepsy: (a) cortical irritations; (b) attacks of general epilepsy.

Jacksonian epilepsy always appears in a typical fashion: it begins by contractions of a muscle or group of muscles. Sometimes it remains restricted to this, but the contractures often spread to the

other muscles and finally over the entire body, the patient loses consciousness and undergoes a more or less typical attack of general epilepsy. These attacks nearly always begin with an "aura." Attacks of post-traumatic epilepsy develop either as *grand mal* or *petit mal*. As time goes on, and the cause of the aggravation remains, the epileptic attacks become more frequent and may lead to so-called status epilepticus; the psychic condition of the patient deteriorates, the attacks gradually lose their local character and terminate in the typical general attacks.

Treatment—This must consist in the suppression of the cause. If the epileptic attacks are due to an abscess, to the presence of a foreign body in the brain, to a defect of the bone or the meninges, these must be properly attended to in the manner described in the preceding portions of this report. It must be emphasized here that epilepsy often follows upon extensive and resistant cicatrices resulting from grave, purulent processes. Therefore, such an extensive and hard cicatrix must be replaced by a delicate, soft cicatrix which forms in the cerebral tissue after aseptic wounds. In other words, favorable results can be furnished only by an operation in which the hard, primary cicatrix is very carefully and entirely removed at the boundary of the healthy cerebral and meningeal tissue, and where the losses of substance in the cerebral tissue and in the dura mater, as well as in the bone, are covered in an appropriate manner.

The results were good in the majority of cases operated upon by the author. In most of the cases where the attacks reappeared, they were weaker and readily disappeared under the influence of luminal and other suitable medications. But in a few cases he had to operate a second time, and, in each instance, showed that the first operation had not been sufficiently radical.

Poor results are obtained in cases of post-traumatic epilepsy, where no important anatomical lesions are found in the cortex. Edema of the soft meninges, opacity and cysts of the arachnoid, thickening of the dura mater, and dilatation and proliferation of the vessels, are observed. In the presence of edema of the soft meninges and the arachnoid, these tissues are cut away with scissors, particularly above the cerebral tears and depressions; when cysts of the arachnoid are found, the upper wall is removed; in the case of thickening of the dura mater, the entire thickened portion is excised and replaced by a large piece of tendon from the thigh; when there is a vascular proliferation and dilatation, all the visible vessels in the damaged space are ligated.

In the complete absence of visible anatomical lesions, Horsley's operation is performed as follows: by means of a weak faradic current the diseased area, which causes the convulsions, is determined; around this region all the vessels of the pia mater are ligated, incision is made, the borders are pushed back, and the superficial layer of the cortex is excised to a depth of 5 mm. Not more than 2-3 square cm. should be removed. After hemostasis, the meninges are sutured, the removed bone plate is replaced, and the cutaneous incision is sutured. Generally, this operation is followed by the onset of paresis of the corresponding muscles, and, when the left hemisphere is operated upon, of speech disturbances. Instead of excising portions of the cortex, Dowman proposes the local injection of a 95 per cent alcohol solution.

Finally, in the cases of post-traumatic epilepsy where there are no signs of local irritation of the cortex and where only general convulsions are observed, favorable results can sometimes be obtained by Kocher's operation ("ventil" operation), especially in those patients where the symptoms of increased intracranial pressure are clearly in evidence.

CONCLUSIONS

I

(1) The cerebral substance, the meninges, the dura mater, the flat bones of the skull and the periosteum do not possess the power of regeneration. Every loss of cranial substance becomes covered with cicatricial tissue. In certain cases, such a cicatrix becomes hard and resistant; microscopic examination may show the existence of calcification of the cicatrix, but not traces of formation of new bone tissue.

(2) Suitable operative treatment, performed as promptly as possible, with careful cleansing of the wound, removal of fragments and necrotic tissues, trimming of the bony margins and complete suture of the wound, results in a soft and delicate cicatrix in the cerebral tissue and does not usually cause any grave, late symptoms. On the contrary, the treatment of cerebral wounds by the open method, causes the formation of a hard, resistant, and extensive cicatrix, which immobilizes the corresponding portion of the brain to the skull, and gives rise to disturbances in the nutrition and normal function of the brain.

(3) A layer of edematous cerebral tissue invariably appears be-

tween the brain tissue and the hard cicatrix; in this layer, cysts of variable sizes, filled with cerebrospinal fluid, are often encountered. This cerebral edema is a favorable sign, for the organism separates the delicate cerebral tissue from the hard cicatrix by means of a hydraulic layer of cerebrospinal fluid, similar to the normal layer of cerebrospinal fluid, by virtue of which the brain is normally separated from the dura mater and the skull.

(4) In one-third of the patients with losses of cranial and cerebral substance, no clinical symptoms are observed. In 25 per cent more serious clinical symptoms are noted, with paresis of special muscles. In 8.7 per cent of the cases epileptic signs supervene.

(5) Operative treatment for the loss of cranial substance must be performed only in those cases where grave clinical symptoms make their appearance. The operation must aim at restoring the normal anatomical relations in the area of loss of substance. This area must be widely opened, the meningeal cicatrix carefully and totally removed, the loss of cerebral substance covered by a layer of fat, the loss in the dura mater restored with fascia lata from the thigh, and the loss of skull bone replaced by bony layers taken from the anterior surface of the tibia.

(6) The results of radical operation are very encouraging: in over 80 per cent of the cases, the partial or complete disappearance of grave, clinical symptoms is obtained, as well as the diminution of paretic disturbances.

II

(1) A fibroconnective tissue membrane usually develops around a foreign body, which remains in the cerebral tissue a long time. Such a membrane may be filled with a certain quantity of fluid (a cyst), and, in the presence of infection, with pus.

(2) The clinical symptoms of a foreign body in the brain depend upon the localization of this body and the irritation of the cerebral tissue.

(3) The accurate localization of a foreign body in the skull is determined:

(a) By the radiographic method, with the radiographs taken in the sagittal and frontal directions;

(b) By the radiosopic method; the most accurate is the stereoscopic method, or that of Holzkecht, which consists of the deflections of the rays to the side of the immovable foreign body and of the immovable narrowed diaphragm.

(4) A large portion of foreign bodies in the skull do not give any clinical symptoms and do not require surgical intervention.

(5) Operation is indicated in the presence of obstinate headaches and vertigos, epilepsy, infection, and psychic fear because of the retention of a foreign body in the skull.

(6) Foreign bodies which are deeply situated at the base of the skull, in the vicinity of important vital centers, may be extracted only in exceptional cases—in the presence of very grave clinical manifestations.

(7) The extraction of a foreign body must be performed in the gentlest manner possible, to guard against damage of the healthy cerebral tissues, and always under control of the Roentgen rays.

III

(1) Post-traumatic abscesses most frequently form around a foreign body, either in the foci of the necrotic or softened cerebral tissue, or in the bloody extravasations in the meninges as well as in the cerebral tissue.

(2) Infection usually comes from outside the traumatized region and progresses in the direction of the ventricles, presumably along the lymphatic current.

(3) Early post-traumatic abscesses are generally cortical; delayed or chronic abscesses are situated in the white substance; around these chronic abscesses, a well developed membrane is invariably found.

(4) In every patient with a traumatic skull injury, where there are headaches and vertigo, agitation without cause, and slight rise of temperature, the possibility of the formation of a cerebral abscess must be taken into consideration.

(5) In determining the diagnosis and localization of the abscess, radiography must be utilized, and may be combined with encephalography.

(6) Operation is the only treatment for abscess and must be performed without delay. The incision is most frequently made at the site of the traumatism. The abscess must be widely opened and freely drained.

(7) The results of operation are not very favorable, as there are frequent recurrences, and because of the formation of large, resistant, fibroconnective tissue cicatrices in healing.

IV

(1) The frequency of post-traumatic epilepsy varies between 8 and 10 per cent of all skull wounds.

(2) In the development of post-traumatic epilepsy, the soil of the affected individual (hereditary, alcoholic, and syphilitic factors) plays the leading part. In individuals suffering from a like type of wound, epilepsy is observed in those with a neuropathic disposition.

(3) The most important anatomo-pathological lesions consist in a proliferation of the cicatricial tissue, or of the neuroglia in the cerebral tissue. The presence of these tissues causes disturbances in the circulation of the blood, as well as of the cerebral functions.

(4) The treatment of post-traumatic epilepsy must primarily consist in the removal of the cause. The opening of abscesses, extraction of foreign bodies from the cicatricial tissue, closing of areas of loss of substance in the dura mater and in the bone, often lead to the cure of the epilepsy. A very radical operation is particularly required in the presence of extensive cicatrices and proliferation of the neuroglia.

COMMUNICATIONS

MAISONNET, (France)

“The Sequelae of Traumatism of the Skull, and their Treatment” formed the subject of the communication of Médecin Major de 1^{ère} Classe, Professor Maissonnet, of Val-de-Grâce. He restricted his discussion to the nervous sequelae, and stated that those casualties, whose dura mater remain intact, must be sharply separated from those in whom this serous membrane is opened by the traumatism or in the course of intervention. In the former case, the wound, generally, is not followed by any infectious complications; the immediate and remote prognosis is favorable. In the latter case, infectious complications are common, the immediate prognosis is grave, the mortality is high, and sequelae are very frequent. In one-third or half of the cases, those wounded with open meninges present, usually before the end of the first year, secondary disturbances in the forms of encysted or generalized meningitis, ventricular lesions, superficial or deep and delayed brain abscesses. These complications are usually fatal, so that the sequelae, namely the late complications, have not enough time to manifest themselves.

Long continued observation of cranial traumatism has modified the older opinions as to the mortality of these cases. Until recent

years, it was assumed that the remote mortality remained high as a consequence of penetrating wounds of the skull. However, investigations carried out since the war prove that, while a large number of the wounded died in the first months after the injury from secondary infectious complications, the mortality in the following years was extremely reduced (1.27-1.34 per cent). The remote vital prognosis of cranioencephalic traumatisms is certainly satisfactory. Brain abscess is the most frequent remote cause of death. These cerebral abscesses may develop at a late date under multiple influences. Super-added infections seem to favor their development. The abscesses, which are of considerable interest from the medico-legal viewpoint, are not easily recognized, their presence being often revealed only by a rapid or sudden death. The purulent gathering is well borne for a long time by the deep cerebral tissue, and symptoms, more or less difficult of demonstration, supervene, only after the abscess has reached the cortical zone in its progressive course. In a general way, these late abscesses develop in cases with a preceding localized infection or brain abscess. Most frequently, they form in the vicinity of bone splinters or projectiles enclosed in the cerebral tissue.

Penetrating wounds of the skull with enclosed projectiles were found to be extremely grave in the course of the war, irrespective of wounds of the soft parts and those of the nervous tissue. It is, therefore, necessary, immediately after the injury, to extract the projectiles and foreign bodies enclosed in the brain, as far as this is possible. According to Bailby, the danger of intracerebral foreign bodies is not proportionate to their depth of situation, but to the course they traverse in the cortical zone.

The most frequent complication of cranial traumatisms consists in traumatic epilepsy, which occurs in simple cerebral concussions, wounds involving only the cranial walls, or penetrating wounds of the brain. The epilepsy manifests itself in the generalized, or in the localized Jacksonian form. Generalized epilepsy is by far the most frequent, except in wounds of the parietal region, which corresponds to the psychomotor zone of the cerebral cortex. While relatively rare after peacetime traumatisms, epilepsy appears in about 15 to 20 per cent of cases of wounds due to war projectiles. Statistics, published in this respect, vary extremely, but the existence of delayed traumatic epilepsy must be conceded. The factors determining the onset of traumatic epilepsy are imperfectly known. The part played by enclosed foreign bodies, such as projectiles and bone

splinters, is undeniable. However, the most important cause of traumatic epilepsy is the existence of one or more foci of cerebral contusion, which lead, in cases of closed fractures or especially in infected lesions, to the production of a connective tissue cicatrix with a progressive course. In the cases of grave localized contusions, the connective tissue repair terminates in the formation of cortico-meningeal pseudo-cysts, and of a cicatricial cone, which is buried more or less deeply in the cerebral cortex.

The results of surgical treatment of epilepsy are mediocre, especially in the cases of generalized epilepsy, and should be resorted to only after a careful examination and in the presence of accurate indications. Cranioplastic procedures are contra-indicated.

The author summarized his opinions as follows: Cranial traumatism, when not fatal, often leave behind various, and often delayed sequelae, of complicated pathogenesis. The mortality, while high in the months immediately following the infliction of the wound, because of infectious complications, becomes almost zero in the course of the following years. Brain abscesses progressively decrease in frequency, and, in the majority of cases, enclosed foreign bodies do not require a late extraction. The late sequelae of cranial traumatism are, for the most part, dependent upon the production of cicatricial fibrous tissue. Surgery is often powerless in the presence of established lesions of this kind. The actual treatment of remote complications of cranial traumatism is essentially prophylactic. These complications are decidedly diminished by a timely, strictly aseptic operation, after removal of all foreign bodies capable of causing infectious complications, and after evacuation of bloody extravasates capable of primarily compressing the brain, or of subsequently giving rise to a generalized or localized epilepsy through fibrous transformation, with avoidance of all needless laceration and the best possible repair of the lesions.

ROUVILLOIS (France)

Cranial traumatism, as pointed out by Medical Inspector Rouvillois, Director of the Sanitary Service of the Tenth Army Corps, Past Professor of War Surgery at the Application School, Val-de-Grâce, in his communication on the "Sequelae of Traumatism of the Skull and Their Treatment," may leave behind them a series of sequelae, whose separate or combined manifestations can be grouped under two distinct headings, from the clinical viewpoint:

(1) Manifestations expressed by localized symptoms, such as paralyzes, incoordination, Jacksonian epilepsy, sensory disturbances, trophic disturbances.

(2) Manifestations expressed by less precise symptoms, such as headache, confusion, vertigo, or psychic disturbances.

The sequelae of lesions caused by war projectiles are governed by two factors—the traumatic lesion itself, and its infection. The



THE PERUVIAN DELEGATE

latter is due to the proliferation of germs brought in by the projectile and by the accidental foreign body concomitants, such as bone splinters, hairs, fragments of headgear. Up to a certain degree, the danger of infection of the skull and brain can be remedied by appropriate prophylactic treatment. While this treatment does not differ, in

principle, from the surgical treatment of war wounds in general, the anatomical peculiarities and the physiological importance of a highly differentiated organ, such as the brain, require a series of distinctive precautions and adaptations. Certain rules govern the care to be taken towards the hairy scalp, the bone, the dura mater, the cerebral focus, and the intracranial projectiles. The bony gap must receive special attention. It must be trimmed by carefully removing the irregularities of its circumference and any splinter that may lie between the skull and the dura mater. The latter, when intact, should not be incised, except if it does not pulsate or presents a purplish discoloration, suggestive of the existence of a deep hematoma. Even in such cases, the greatest caution is indicated, and it is usually preferable to omit incision. When the dura mater is open, its margins must be conservatively freshened. If the dural wound is larger than the bony gap, the latter must always be enlarged, in order to guard against the cerebral tissue coming in direct contact with the bone, and to provide a cuff of intact dura mater at the circumference of the bony gap. Neglect of this precaution has been the cause of numerous delayed meningites and cerebral abscesses. Suture of the dura mater gap is not practicable in very extensive cases. This suture has always seemed to the author to possess a theoretical, rather than practical interest. The intracerebral focus must be treated very gently and conservatively, avoiding even digital or instrumental exploration, which is more harmful than useful. Some operators have advocated the employment of antiseptics, such as formol; the author has found ether irrigations of advantage, in an emergency, in the exposure of a cerebral wound. With respect to surgical treatment, when radiography has revealed the retention of an intracranial projectile, opinions are still widely divided.

LERICHE (France)

“The Remote Results of the Treatment of Premature Cerebral Hernias Following Wounds by Shell Splinters” were discussed by Médecin Major de 1^{ère} Classe of the Reserve R. Leriche, Professor of Clinical Surgery of the Medical Faculty of Strasbourg. Cerebral hernias following shell splinter wounds were frequently observed during the first years of the World War. They were generally considered as caused by suppurative or non-suppurative encephalitis. This was undoubtedly true for some of the cases, especially when bony fragments or foreign bodies of various kinds had been left in the wound.

However, in a very large number of cases, premature cerebral hernias were due to a local edema of the contused brain, which subsequently became externalized through an insufficient dural and bony gap, where it was strangulated in some way because of bad circulatory conditions in the insufficient opening. Enlargement of the bony gap and the dural opening, with arrest of the strangulation, lessened the circulatory disturbances and was followed, at the end of a few weeks, by the complete disappearance of the hernia, without elimination of cerebral substance. Healing took place in such a way that, instead of the hernia, a cerebral depression was left, at the level of which a collection of cerebrospinal fluid, at times, produced a false arachnoid cyst or conveyed the impression of a sort of meningocele. Premature cerebral hernias must be treated by enlargement of the trephining orifice, and there is no necessity of lumbar puncture, trimming, or cauterization of the herniated mass.

BILLET (France)

“The Remote Results of Wounds of the Skull,” as pointed out by Médecin-Major of the Reserve H. Billet, Professor of the Free Medical Faculty of Lille, have only begun to become well known during the last few years. The essential condition for the improved prognosis of cranial traumatisms consists in the perfecting of the primary operative intervention.

It must be conceded that the anatomical lesions, caused by the cranial traumatisms, create a state of affairs which exerts an undeniable influence on their ultimate course and, in part, cannot be counteracted. But, aside from this inevitable factor, there are others which can be acted upon, and the distressing effects of which can, at least, be restricted. The most important of these factors are represented by infection, by the cicatrix, and by foreign bodies. While the importance of these three factors, in the production of early or remote complications following upon skull wounds, is generally admitted, it is, perhaps, not yet equally conceded that their effects can be neutralized by the performance of an early operation. In the author's opinion, it is indispensable for cranial wounds to be operated upon as completely and as perfectly as possible, and he is convinced that the patient's future is governed, to a certain degree, by the perfection of the first intervention he undergoes.

Epilepsy constitutes a formidable sequel to war wounds, on account of its tendency to aggravation as well as generalization, and

may supervene a long time after the initial traumatism. Contrary to the opinion of certain neurologists and even operating surgeons, traumatic epilepsy seems essentially amenable to surgical treatment. There is good reason to intervene in epileptic patients, and in all those who present objective signs to account for the attacks, such as motor or sensory localizations, foreign bodies, cicatrices, and thickenings of the cranial wall. However, it seems that traumatic epilepsy is one of those sequelae of cranial wounds which might be avoided in a certain measure. The determining causes of the disease include some which can be controlled or suppressed in the course of the primary treatment. Almost invariably, on repeated intervention on an old trephining focus, the bony gap was found to be of irregular configuration, with, sometimes, enormously roughened outlines. In several cases this alone caused attacks of Jacksonian epilepsy. It is imperative that there be only regular cranial gaps and it is especially recommended that the cranial walls be cut in such a way that the trephining orifice is a little larger on the side of the internal table than on that of the external table, which is contrary to what is usually done. The application of a rigorous technic in all skull wounds will reduce both the primary mortality and the secondary complications, particularly delayed infectious lesions and the formidable epilepsy.

WEITZEL (France)

In "The Surgical Treatment of the Sequelae of Craniocerebral Traumatism," Médecin Principal de 2^{ème} Classe Weitzel, Consulting Surgeon of the French Army on the Rhine, stated that, at the present time, the operating surgeon, in close collaboration with the neuropsychiatrist, endeavors to lessen the sometimes formidable sequelae of cerebral traumatism, instead of limiting the surgical intervention, as formerly, to the simple treatment of the initial lesions and prophylaxis against infection.

Persistent suppurations are often observed in the vicinity of a cranial wound or an operative gap. This, more or less, serious suppuration must always suggest the existence of an osteitic focus, with a sequestrum of the external or internal table. While the sequestra of the external table are usually eliminated spontaneously, such is not the case with sequestra of the internal table, which, through irritation of the subjacent cerebral tissues, may induce reactions, ranging from pachymeningitis to cerebral abscess. Hence, curettage and removal of the sequestra are distinctly indicated.

Surgical intervention is naturally called for, although without much prospect of definite success, in the intradura or extradura mater brain abscesses, which develop in an old focus of cerebral contusion or around an enclosed projectile. These dangerous complications, the diagnosis of which is very precarious, are fortunately not very common. Immediate surgical intervention, following early diagnosis, usually results in transitory improvement, but not in actual cure.

The attention and activity of operating surgeons should be particularly concentrated upon generalized or localized epilepsy of traumatic origin. It is obvious that everything within the limits of the possible must be done to lessen these formidable sequelae of cranio-cerebral traumatisms, which make a veritable wreck of their victims. It is encouraging that the importance of the primary local lesion has long since been recognized. Intervention is indicated in these cases of Jacksonian epilepsy. However, the precise cause of such epilepsies is not yet sufficiently understood to permit an absolutely favorable prognosis of the attempted intervention. No hesitation is permitted in the case of a patient suffering from fulminating crises accompanied by marked cranial hypertension, revealed by lumbar puncture or the existence of ocular disturbances. The Cushing decompression operation is then the procedure of choice; if it does not cure, it sufficiently improves the patient's condition to permit a considerable survival.

The author particularly wishes to emphasize the importance of primary intervention in the sequelae of cranial wounds. Osteitis can be avoided by not denuding the bone of periosteum beyond the necessary limits, and by removing all the detached sequestra from the external or internal table. The important evacuation of intradural or extradural hematomas necessitates a complete exploration, which is easily carried out by means of a simple trephining orifice. While the incision of the dura mater is an operative factor which seriously aggravates the immediate prognosis of skull wounds, according to some writers, other observers point out that it improves the remote prognosis. Preservation of the dura mater, under aseptic precautions, must not be adhered to as an immutable surgical rule. Greater importance should be attached to the reconstruction of the dura mater. Much may be expected from this operative prophylaxis, the efficiency of which can be actually confirmed through the lessons of the World War. Deep radiotherapy will possibly accomplish favorable results, from the viewpoint of retrogression of the cicatricial fibrous-neuroglial process, which is of such importance for the cerebral tissue.

LACAZE (France)

In the summary of his communication on the "Remote Sequelae of Cranial Wounds," Médecin Major de 1^{ère} Classe, Lacaze, Adjunct Professor at Val-de-Grâce, stated that those patients with cranial injuries, who recovered from their wounds without presenting any cerebral disturbance after a lapse of time, are an infinitesimal minority. The usual disturbances consist essentially in the following:

(1) Diffuse symptoms, independent of the site and nature of the lesion: headache, confusion, vertigo, mild psychic disturbances, sometimes marked mental disturbances, and generalized epilepsy.

(2) Localizing symptoms, dependent upon a definite anatomical lesion. These symptoms correspond to destructive lesions (motor, trophic, sensory, speech disturbances) or irritative lesions (Jacksonian epilepsy).

Independently of the above mentioned sequelae, grave delayed complications of infectious type may supervene in cases of old skull wounds, in the form of cerebral abscess, meningoencephalitis, meningitis, cerebral hernia. The prognosis of cranio-encephalic wounds is undoubtedly less gloomy at the present time than prior to the war. Nevertheless, it must always remain guarded, and in a measure, difficult to foresee. As a factor aggravating the remote prognosis of cranio-encephalic wounds, a preceding mental deficiency, and intoxications (syphilis, alcoholism) should be kept in mind.

From the functional viewpoint, cases with cranial lesions are practically always lessened in their individual and social value. From the vital viewpoint, although the mortality statistics of old cranio-cerebral casualties are relatively favorable, the official figures, in the author's estimation, do not entirely correspond with the facts, for many of these wounded are lost sight of on their discharge from the hospitals, or become the victims of accidents, which are never referred to their cerebral deficiency.

COURBOULES (France)

Médecin Major Courboules, Adjunct Professor at the School of Military Sanitary Service, described in his communication, a "Large Intracerebral Cyst Ten Years After a Penetrating Wound of the Brain," followed by fulminating epileptic seizures, hemiplegia, and confusion, cured after surgical intervention. The patient was a man of forty years of age, who received multiple wounds in March, of 1916, including a shell splinter injury of the brain, entrance orifice in the right occipito-parietal region, exit orifice in the left frontal

region. After six months in the hospitals and two trephining operations restricted to the entrance and exit orifices of the projectile, he was discharged and did hard work as a farmer. After a long period, some intermittent headaches supervened, but he kept at work until 1926, ten years after the injury. He began to have epileptiform seizures, paretic disturbances of the lower limbs, and impairment of speech. A sudden aggravation of these symptoms led to his emergency admission to the Desgenettes Hospital in July of 1926. On the day of admission, he had ten seizures, nearly total left hemiplegia, a very pronounced confusional state. On the next day, paralysis of the sphincters supervened and the patient became comatose. Operation was performed under local anesthesia, with extended trephining of the right occipito-parietal region. A large intracerebral cyst the size of an orange was revealed. The fluid which escaped from the cyst had all the characteristics of cerebrospinal fluid. The loss of cerebral substance appeared enormous; the upper and outer wall seemed to be formed by the gray matter of the cerebral convolutions; downwards and inwards, the tissue of the chorioid plexuses could be recognized. The patient made a slow recovery, with progressive diminution of the paretic disturbances and restoration of the cerebral faculties.

GABRIELLE (France)

In his discussion of "Grave Delayed Complications of a Craniocerebral Wound by a Shell Splinter," Dr. H. Gabrielle, Médecin Major de 1^{ère} Classe, Adjunct Professor at Val-de Grâce, Adjunct Professor of the Lyon Faculty, Surgeon to the Military Teaching Hospital of Desgenelles, described the case of an old soldier, under observation for over four years, who presented a series of very grave disturbances following upon a skull and brain wound by a shell splinter. The man was wounded in 1916 in the right parietal region and operated upon twenty-four or thirty-six hours later; wide trephining with ablation of the contused cerebral substance and extraction of the intracerebral fragment, was done. He made a good recovery and it was not until eight years later, in 1924, that very severe and obstinate headaches supervened, as well as progressive paretic disturbances, the condition culminating some weeks later in attacks of Jacksonian epilepsy of increasing frequency. The patient was admitted to the author's service and, at the first operation, a cyst, the size of a large nut and situated in the oval center, behind the Rolandian zone, was emptied. Marked

improvement followed, without further attacks, and the patient left the hospital a fortnight later, apparently cured, but returned forty days after the operation, in bad condition, the epileptic attacks having reappeared two days previously. Another intervention showed that the cyst had formed again, and a more extensive liberation of the dura mater around the bony gap, was performed. Again, improvement followed and the patient left the hospital three weeks later. At the end of five months, he returned the third time, insisting upon an operation for the relief of his headaches. The same cyst, the size of a pigeon's egg, was again encountered and this time the extirpation of its wall, as a whole, proved possible. The large cerebral cavity was filled with fat taken from the patient's thigh, and the wound was completely closed. Improvement this time was less marked than on the two preceding occasions. Very severe epileptic attacks recurred nine days later; the patient entered into a state of complete coma, with cyanosis and asphyxia, stertorous respiration, and greatly retarded pulse. He was immediately operated upon, the cicatrix was opened, and a voluminous bloodclot, which compressed the brain, appeared, the result of a traumatism at the time of an epileptic seizure. The bloodclot was removed, as well as the fat which remained in the cerebral cavity; the wound was loosely packed with a few gauze wicks. At once there was a change for the better and, at the end of twenty minutes, consciousness was fully restored. On further exploration of the wound, the bony skull was found too large for the small brain, and a fourth operation was performed, under local anesthesia, for the removal of the superfluous bone. The patient left the hospital in excellent condition, with a very deep excavation in the right parietal region. For fourteen months he believed himself cured. Suddenly, new disturbances supervened, after a ride of thirty kilometers in a jolting horse-drawn vehicle, and a swelling the size of a large fist protruded from the skull. He was in great pain and his left limbs were paralyzed. A fifth intervention was restricted to a simple incision of the hairy scalp at the level of the old wound. Immediately, under pressure, a considerable quantity (250-300 cc.) of clear, apparently cerebrospinal fluid, escaped, which must have come from the third ventricle through the foramen of Monro, though this orifice remained invisible. The constituents of the floor of the lateral ventricle could be distinctly seen in the depth of the wound. The lateral choroid plexuses were well developed and on them appeared rows of small cysts with clear contents, some of which could be re-

moved. The operative wound was closed as tightly as possible; the prognosis appeared hopeless. Two days later, the headache returned, and the pouch was found to have formed again, as tense and voluminous as before its incision. By means of a syringe, 250 cc. of cerebrospinal fluid was withdrawn; during eight days, these punctures were repeated and fluid was removed, until it seemed useless to continue. The operative wound healed well, the headache gradually subsided, the paralytic phenomena of the limbs improved, the patient was up and about the thirtieth day, and left the hospital soon afterwards. He resumed his work as a farmer. He reported recently that he had only one temporary attack of severe headache, accompanied by minor epileptic seizures, since leaving the hospital. It is impossible to foresee how long this condition will be maintained.

WORMS (France)

“Physiopathic Disturbances Following upon Cranio-Facial Traumatisms” formed the subject of the communication by Médecin Major de 1^{ère} Classe G. Worms, Professor at Val-de-Grâce. The term “physiopathic” disturbances (Babinski and Fromont) is applied to a class of so-called functional nervous disturbances which, on the one hand, cannot be explained by the ordinary lesions of the nerve trunks, with their established symptomatology, and, on the other, differ from the purely hysterical manifestations through certain characteristics now admitted by the majority of neurologists. Disturbances of this kind affecting the limbs, have received almost exclusive attention, perhaps on account of their great frequency. However, the face and various organs belonging to it, may be the seat of the same kind of processes. These functional disturbances may affect the ocular apparatus, the nasal fossae, the auricular apparatus, the soft parts and the bony cranio-facial framework. It is common for a very trifling lesion of the soft parts or of the bony framework, with damage of small nerve strands, to induce a marked loss of organo-vegetative balance, with the associated motor, sensitive, and especially trophic disturbances. In the face, these phenomena acquire special importance, as a result of the complexity of the innervations and the abundance of the organo-vegetative strands. Radiography shows, with rather considerable frequency, a decalcification of the cranio-facial skeleton. These changes are usually encountered on the side of the wound, but widely exceed the affected area, and sometimes are separated from it by segments of apparently normal bone. A certain degree of muscular atrophy

or hypotonia is, likewise, encountered in the regional muscles, especially in those of mastication. This muscular atrophy does not affect only the muscles supplied by the trigeminus; sometimes, a slight atrophy of the muscles innervated by the facial nerve is also demonstrable, in the absence of a direct lesion of the corresponding nerve. Observations on patients show that even a slight traumatism may give rise to a reaction at a distance, either towards the center or roots of the trigeminus, manifested by disturbances of sensory and trophic character. The various modifications noted in the old cases of head traumatism affecting the hairy scalp, the pituitary, the eye, the bones of the skull, the auricular apparatus, should be interpreted as the constituents of an identical complex, referable to lesions of the organo-vegetative nervous system.

In the presence of these persistent physiopathic disturbances, curative attempts are in order in some of the cases. When there is an anatomical cause, this should be removed as promptly as possible. The longer one delays, the more firmly the disturbances become established, requiring time for their retrogression. Perhaps an attempt might be made to inhibit the development of certain grave trouble of physiopathic type by means of a peri-arterial sympathectomy on the carotid system. This method has given encouraging results in the cases of limbs affected by disturbances of the cutaneous nutrition, and might be given a trial in certain dystrophic disturbances of the craniofacial domain.

CANTONNET (France)

The communication on "Fractures of the Skull and Paralysis of the Third Pair," by A. Cantonnet, Médecin Major de 1^{ère} Classe of the Reserve, Ophthalmologist to the Beaujon Hospital in Paris, was based on personal observation of a man who had fallen from the second story of a house, fractured his skull, and, on examination, presented anomalous movements of the eyeball. There was a paralysis of the entire extrinsic muscular apparatus of the right eye, and a total intrinsic paralysis of the third pair, or common motor oculi. The signs of total paralysis of the third pair were completely represented: loss of elevation of the upper eyelid, elevation and lowering of the eyeball, its adduction, paralytic mydriasis with loss of all reflexes, loss of accommodation. Although coma was absent, the existence of cranial fracture, as a result of the fall, was shown by a nasal discharge of serous fluid and blood. The common motor oculi, in this instance,

was damaged at its entrance into the dura mater and the sphenoidal cleft, namely, in the external wall of the cavernous sinus, injuring the nerve trunk itself and causing a total paralysis. The other nerves contained in the wall of the cavernous sinus, such as the patheticus or the ophthalmic nerve, were not damaged, nor were the contents of the sinus, the external motor oculi or the internal carotid. The prognosis of such a case depends upon the degree of involvement of the nerve. In the case of contusion or distention without rupture, function may become progressively restored. But the marked dilatation of the pupil and absence of all pupillary reflexes, in this particular patient point to a deep lesion, with rupture or division, so that the paralysis will prove permanent.

CANTONNET (France)

Another communication by the same author dealt with "Cerebrospinal Hypertension in Contusions of the Skull." A man forty years of age complaining of headache, entered the ophthalmological service on account of an ecchymosis encircling the lower half of the orbit. A few days previously, he had sustained a fall from a motor cycle and, since that time, had headache and transitory visual disturbances. There was no diplopia and the pupil was normal in its dimensions and reflexes. Papillary stasis of a mild degree was found, on examination of the ocular fundus, with blurred papillary margins and a certain tortuosity of the retinal veins terminating in the papilla. This choked disc indicated a disturbance of the return circulation produced by hypertension of the cerebro-spinal fluid.

In the ophthalmological center of the eighth region, the author examined about twenty-eight cases of cranial concussion, and in three-fourths of them found a slight papillary stasis, usually bilateral. These were cases of concussion or simple contusion of the skull, without fracture, but with production of headache; no disturbance of the general condition. Lumbar puncture in these cases of cranial concussion with headache and stasis, showed the evacuated fluid to be under tension, and Claude's manometer showed a figure above the normal standard. The hypertension was usually mild, as indicated by the low degree of papillary stasis. The lumbar puncture caused the subsidence of the headache and papillary disturbances. It is noteworthy that this papillary edema is not accompanied by a lowering of the visual acuity. Although nothing attracts attention to the visual apparatus, the ocular fundus must always be examined in these

wounded, and a material cause will often be found for the headaches and blurred vision. Ophthalmological examination is indispensable in all cases of concussion of the skull.

BERTEIN (France)

“Ocular Sensory Sequelae of Skull Fractures by Projectiles” was the subject of the communication by Médecin-Major Bertein, Adjunct Professor at the Military School of Sanitary Service, France. Visual disturbances, caused by a lesion of the optic fibers, are among the most frequent, most obstinate, and, needless to say, most serious affections now observed in skull fracture casualties of the World War. After the period of spontaneous absorption of the hemorrhages or exudates, which primarily interfere with the nervous function through extrinsic or interstitial compression, these disturbances must now be regarded as permanent. The author emphasized the difference in the character of the optic lesions in cranial war wounds and the cases seen in civilian practice, also the difference in the mechanism of production of the lesions in these two varieties of traumatism.

Nature of the optic sequelae of war fractures: These sequelae, at least, those resulting from lesions of the anterior segment of the optic tract, present two peculiarities: first, the well known considerable proportion of ruptures of the deep membranes through concussion; next, the rarity of lesions of the optic nerve, a fact which is to be emphasized. This rarity establishes a profound difference between the war wounded and those with ordinary skull fractures. Visual disturbances are known to be common in the latter, in fronto-orbital contusions, and have been shown to be connected with the irradiation of the fracture line from the cranial vault to the fragile region of the optic nerve. Lesions of the posterior segment of the sensory tract manifest themselves, as in simple fractures, by homonymous lateral hemianopsia. An exceptional case of vertical hemianopsia came under the author's personal observation.

Mechanism of lesions of the optic tract: Here again, differences are demonstrable between war fractures and simple fractures. The most important consists in the fact that the irradiation of the fracture line, so common in simple fractures, is exceptional in the case of war fracture. As a matter of fact, the conditions of the traumatism are different. In view of the force of penetration of the war agent and its minimum size, the concussion of the skull capsule does not seem sufficient to cause bony damage at a distance from the focus; either

through irradiation or through repercussion; such bony damage is more readily explained by the entirely different conditions of simple traumatism through shock or fall from a high altitude. This irradiation accounts for the optic involvement noted in civilian practice, and explains its rarity in war, where the existing cases are referable rather to another mechanism.

The modes of production of lesions of the optic tract, by projectiles, seem to be as follows:

(1) Direct lesion of the fibers by the vulnerating agent. It is readily understood that the relatively narrow optic nerve may often escape a bullet or a small shell splinter traversing one or even both orbits. Among fifty cases of fracture of both orbits, observed in the clinic of Professor Rollet during the war, the nerve was involved in only two instances. In a case observed by the author, the bullet damaged the four orbital walls, but spared the two nerves. Large projectiles are evidently more likely to reach the nerve, but these are altogether different orbito-ocular or cranial lesions and the entire peripheral visual apparatus undergoes profound and irremediable destruction. In a backward direction, the optic tract, the intermediate nuclei, and the occipital centers offer a larger surface to the action of the vulnerating agents.

(2) Lesions through concussion of the ocular case have been extensively studied.

(3) Optic meningitis. This mechanism must be emphasized and belongs almost exclusively to war fractures. Aside from the acute or subacute generalized meningeal inflammations following fracture and causing death, there are less common cases of chronic meningitis, passing through a progressive localization of the infection to a relative cure, associated with nervous sequelae, one of the most characteristic being optic atrophy. As a matter of fact, one of the subarachnoid areas, where the infection tends to become localized, is the zone of the great anterior confluence at the base of the brain, at the origin of the optic nerves, which, at this point, become surrounded by a meningeal sheath that accompanies them to the eye. Optic atrophy results from the propagation of the infection to this nervous menix, constituting a genuine optic meningitis. This is conceded as being at the origin of the optic atrophies of syphilis or parasymphilis, and likewise explains, in war pathology, the majority of the rare cases of optic atrophy in cranial fractures.

CACCIA (Italy)

This communication, by Colonnello Medico Professor Filippo Caccia, Director of the Military Hospital in Bologna, Italy, dealt with the "Results of Cranial Traumatism and their Treatment." His considerations are based on 107 cranioencephalic casualties, treated in the first aid posts; 118 cases treated in the field hospitals during the World War; and eleven cases treated in the Rome and Aquila territorial hospitals during 1920-1921. There were about one hundred surgical cases, with accurately known lesions, mode of treatment, proximal and remote results.

The author drew the following conclusions in regard to the surgical cases:

(1) The aseptic healing of cranio-encephalic wounds is an important factor for the anatomical reconstruction of the bony gap, when this is not very extensive, and also, for the functional restoration of the nerve centers.

(2) Cranio-encephalic suppurations inhibit the repair of even small bone gaps and contribute to the establishment of, more or less, grave conditions of encephalic origin.

(3) Cranioplastic procedures constitute useful intervention for the protection and defence of the brain.

(4) The treatment of post-traumatic epilepsy is principally surgical and, at the present state of our knowledge, surgery is the only means for obtaining either a cure or a distinct improvement.

(5) The procedure of Leriche, for the correction of disturbances of the cerebrospinal fluid, in the sense of hypopressure or hyperpressure, represents, at the present status of traumatic epilepsy, the most promising palliative treatment and supplement of unsuccessful intervention. In order to guard against recurrences, it is necessary, according to Leriche, to aim at the maintenance of a state of equilibrium of the cerebrospinal fluid, by means of intravenous injections of a hypertonic solution, or by an evacuating lumbar puncture in the presence of hypertension, and by injections of distilled water in the presence of hypotension. Very satisfactory results have been obtained by this treatment, with subsidence of the headache and vertigo, as well as disappearance of the epileptic seizures.

GIARRUSSO (Italy)

"Clinical and Medico-Legal Comments on the Delayed Syndromes of Cranio-encephalic War Lesions" were presented in the communica-

tion by Tenente Colonnello Medico Professor G. Giarrusso, Italy, Clinical Instructor in Nervous and Mental Diseases. On the basis of extensive experience since the war and annual visits to military pension centers, for examination of a large number of wounded or otherwise damaged ex-soldiers, the author discussed briefly the cranio-encephalic lesions in their late course, with special reference to those cases where the lesions have reached a stationary condition. The clinical cases, on which this contribution is based, are not very numerous as compared to the enormous war statistics possessed by the neurological centers, but may be regarded as typical examples of cranio-encephalic lesions. In order to give an idea of the number of ex-soldiers who visit the military neurological centers every year, it may be mentioned that during 1926, about 1,600 neurological war casualties passed through the center in Bologna.

Post-traumatic epilepsy was only rarely encountered in cranial war casualties in a late stage. The vertiginous form was more frequently met with. From the viewpoint of cerebral localizations, the anatomical and morphological teachings of the motor and sensitive-sensory cortical localizations were confirmed by the great experiment of war traumatology, with respect to the starting points of the voluntary impulses destined for the contraction of muscles, and in part, to the points of reception and primary elaboration of impressions from the external world. With regard to the latter, aside from the specific seat on a circumscribed anatomo-pathological basis, war experience plainly demonstrated and controlled, by way of the repair syndromes, the functional synergy of the brain, up to physiological substitution. Conditions differ as to the psychic-intellectual segment of cerebral activity. It was demonstrated, by the psychic-intellectual condition of patients with frontal traumatism, that the so-called intellectual centers are not localized either here or in a circumscribed cortical area, but receive life and strength from all the zones, in which meet, by way of the so-called association fibers, the currents which pass from the sensory centers. Focal frontal lesions did not damage the intellectual activity of the wounded any more than did the lesions of other cortical areas. In no neuropsychic function, more than the intellectual, does the nervous process represent the inauguration of a complex and diverse chain of neuron groups which constitute the functional paths of reasoning thought.

It was shown that the evolution of the cranio-encephalic post-traumatic syndromes has, when possible, a predominant tendency to repa-

ration and restoration. The constitutional factor greatly and invariably influenced the outcome of the syndromes. The subjective syndromes, such as headaches and vertigos, which were found to be obstinate, like the syndromes on a destructive anatomical basis, made careful examination and differential diagnosis necessary, with medico-legal control investigations, in order to determine the multiple and different etiopathogenetic elements in similar conditions, and to make decisions with regard to pension claims.

BUTOIANU AND STOIAN (Roumania)

In discussing the "Sequelae of Cranial Traumatism and Their Treatment," Médecin Général M. Butoianu, Professor of the Jassy Medical Faculty, Chief of the Military Hospital "Regina Elizabeta," and Médecin Major C. Stoian, attached to the First Surgical Service, pointed out that the most important sequelae of such war injuries are cerebral abscesses and traumatic epilepsy, which profoundly affect the individual in his physical and moral standards. The onset, as well as the correlation with the date of the traumatism, are very variable, the statistics compiled by writers at different periods presenting the greatest discrepancies. Jacksonian epilepsy is said to be the most common of the nervous sequelae. Certain writers believe that hereditary or acquired stigmata exert an influence on the development of the epileptic phenomena. One of the most important factors in the genesis of traumatic epilepsy, consists in the mode of treatment immediately after the infliction of the craniocerebral lesion. The causes of the epileptic phenomena are multiple: splinters, foreign bodies, depressions, adhesions, as well as encephalic cysts and cerebral abscesses, which may appear several years after the traumatism.

Extensive craniectomy, which is the treatment of choice for wounds of the skull, must always be accompanied by careful disinfection of the focus, and drainage. In Roumania, decompression—craniectomy with a bony flap according to the technic of Professor Toma Jonesco—has been employed, the flap being held in place by small tacks inserted into the diploë. The authors believe that the sequelae of cranial or craniocerebral traumatism, with successive phenomena of traumatic epilepsy, are the more amenable to treatment, the more complete and aseptic has been the primary operative treatment of the wound or fracture. There must be close collaboration between the surgeon, the neurologist, and the radiologist. Extensive craniaplastic procedures, either cartilaginous (Morestin) or osteo-periosteal (Delageniere) and

even prosthetic appliances have not, so far, yielded the hoped-for results.

FRIBOURG-BLANC (France)

“The Medico-Legal Interest of Delayed Sequelae of Cranial Wounds” was the title of the communication by Médecin-Major de 1^{ère} Classe, Fribourg-Blanc, Adjunct Professor at Val-de-Grâce. Although much has been said and written on the important question of the future of cranial casualties, attention has not been sufficiently directed to the medico-legal consequences of the delayed aggravations. As a matter of fact, it might seem that the cranial war casualties over eight, and up to twelve years after the infliction of the wound, are beyond all grave danger and that their cranio-encephalic lesions are definitely settled in the medico-legal sense. But the contrary is often demonstrated by existing facts, even at the present day. From the clinical viewpoint, these facts aggravate the problem of the future of trephined patients and interest the finances of the Governments regarding the medico-legal consequences.

Trephined war casualties sent, for expert opinions, to the neuro-psychiatric service of Val-de-Grâce, represent a large proportion of the sum total of patients subjected to these examinations, and this proportion is far from diminishing. Thus in 1925, a total of 265 expert verdicts included twenty-three cranial casualties, i.e., 8.7 per cent, and in 1926, a total of 418 cases included fifty-three skull wounds, or a proportion of 12.7 per cent. The disturbances observed in these men, since their first presentation before a discharge commission, seemed, on the whole, to show only a slight tendency to improvement, and the author was struck by the onset of very delayed complications. The prognosis as to the future of trephined patients must be guarded.

BEHAGUE (France)

The communication by P. Behague, former Adjunct Chief of Clinic of Diseases of the Nervous System in the Medical Faculty of Paris, Médecin Aide-Major de 1^{ère} Classe of the Reserve, was on a “Study of the Causes and Pathogenesis of Traumatic Epilepsy.” Prior to 1919, the author examined 3,623 head casualties in the neurological center of the Salpêtrière, and was struck by the frequency of lesions situated to the left of the middle line. These were found in 57 per cent of the wounded, whereas 43 per cent were injured on the right side. A reasonable explanation of this fact remains to be offered.

Statistics show that about one-third the injuries concerned the parietal region, one-fourth the frontal, one-fourth the occipital, and one-sixth the temporal regions.

The osseous portions of the skull correspond only very vaguely to the synonymous cerebral regions, except, perhaps, with respect to the occipital bone and lobe. This observation is far from useless in view of the remote consequences of cranial wounds, notably, persistent epilepsy. As to the situation of the epileptogenic wound, on classification of epileptics in two groups, according to the head wound being situated on one or the other side of the sagittal middle line, a slight difference is found in favor of the left side: 53 per cent. However, since cranial wounds in general were more frequently found on the left side than on the right, it must not be inferred that the left hemisphere has a greater epileptogenic power than the right.

Combined statistical compilations show that of 100 epileptics, fifty-six were injured in the parietal region; twenty-five, in the frontal region; twelve, in the occipital domain; and only seven, in the temporal zone. Undoubtedly, certain encephalic regions are more epileptogenic than others. Cerebellar wounds do not figure in any statistics as a cause of epilepsy. Personal observations on numerous cases of cerebellar injury never showed epileptic phenomena. As to the frequency of epilepsy, available statistics show that there are 11.8 epileptics in one hundred skull injuries. These figures comprise not only the cases of general and partial epilepsy, but also the equivalents whose course leaves no doubt as to their character (auras, etc.). All causes favoring the volume and number of cerebral cicatrices seem, proportionately, to favor the production of generalized epilepsy.

The onset of partial epilepsy is facilitated by localized lesions, which irritate the cortex or the deep parts of a projection zone of the brain. Small meningeal cicatrices or limited lesions of the cerebral cortex, provided they occurred without severe concussion, are apt to induce Jacksonian epilepsy. On the other hand, even deep wounds of the so-called projection zones of the brain much more frequently induce partial epilepsy than those of the other cerebral lobes. Thus, in one hundred cases of epilepsy from wounds of the parietal and occipital regions, there were about 40 per cent of partial forms, while in one hundred cases subsequent to a wound of the frontal and temporal regions, only 21 per cent of localized convulsive attacks were encountered. These statistics refer to the wounded *osseous* regions. In all probability, statistics referring only to wounds of the ascending

frontals and parietals and those of the occipital lobe, would give a much more considerable proportion of partial epileptics. The function of the temporal lobe is still too imperfectly known to serve as the basis of accurate statistics. As a general rule, in a lobe whose incomplete lesion manifests itself by a partial disturbance (monoplegia, scotoma), the epileptic phenomena are more often partial. On the contrary, in the lobes with imperfectly established functions, whose partial injuries always induce the same essential syndrome to a more or less marked degree, the epileptic phenomena are usually generalized. Certain general causes may favor the onset of this condition and render evident a pre-existing but undiscovered epilepsy. The convulsions have nothing to do with the traumatism which brings them to the front, but are governed by the preceding causative factors—unless a very severe traumatic lesion gives rise to new developments. It is very difficult to ascertain in what measure a preceding epilepsy is aggravated by a cranial traumatism.

Alcoholism and syphilis may play a certain, but secondary part in the aggravation and multiplication, but not the genesis, of the epileptic attacks. Contrary to the opinion of some writers, the author believes that alcoholism never constitutes the essential foundation for the traumatic sequelae. A cranial wound which induces epilepsy in an abuser of alcohol, would have done so in a teetotaler, although in the intoxicated, the crises are certainly closer together and the complication, therefore, more serious, than in others. Syphilis has no greater importance than alcohol in the etiology of epilepsy. Individuals with syphilitic meningitis have become epileptics after a traumatism, but it remains to be shown if they would not have become epileptic had they not been syphilitic. It would seem that, aside from the situation of the cranial wound, and the nature of the traumatism, the soil on which epilepsy develops can have only a very slight influence, with the sole exception of old epileptics.

A sharp distinction must be made between partial epilepsy and Jacksonian epilepsy, the latter constituting only a small portion of the former. Jacksonian epilepsy has a precise anatomical cause, being symptomatic of a localized cortical irritation. There exist very numerous cases of partial epilepsy whose clinical symptomatology is the same as that of Bravais-Jacksonian epilepsy, but whose cause is not a cortical irritation. Deep wounds, which have undoubtedly traversed the cortex, but have induced a deep cicatrix of a projection zone of the brain, are causative factors. Traumatic epilepsy is undoubtedly

due to cerebral cicatrices, which seem to act only after a long period of latency.

The old classical therapy of epilepsy (bromides) tends to diminish the cerebral irritability and is fairly successful. Modern surgical procedures on the sympathetic, in the form of arterial denudations, seem to reach the problem by preventing exaggerated and unbalanced movements of expansion or retraction of the brain, as well as by modifying the circulatory output and the nutritional exchanges. The results are very encouraging. A reliable treatment can be accomplished only when the causes of epilepsy have been completely ascertained.

GUILLAIN AND BERTRAND (France)

“Some Anatomico-Clinical Considerations on the Remote Results of Cranial Wounds” were presented in the communication by G. Guillain, Médecin-Major de 1^{ère} Classe of the Reserve, Professor of Nervous Diseases in the Medical Faculty of Paris, and Y. Bertrand, Médecin Aide-Major de 1^{ère} Classe, Laboratory Chief of Nervous Diseases in the Medical Faculty of Paris. The anatomico-clinical considerations offered were collected in the neurological clinic of the Salpêtrière. It is noteworthy that only a few rare cases of brain abscess were observed in old cranial war casualties, these cases being much less numerous than would have been expected. The abscesses usually developed around foreign bodies encased in a fibrous sheath and which, during long years, had been the seat of latent microbism.

The classical signs were frequently absent in the symptomatology of these cerebral abscesses, such as fever, hyperleukocytosis of the blood, hyperalbuminosis or hypercytosis of the cerebrospinal fluid. The pathological reactions of the cerebrospinal fluid may be absent, even in voluminous abscesses, and are often observed only at a late date, in the presence of meningeal infection. The most characteristic clinical signs of cerebral abscesses are those of intracranial hypertension, with headache, somnolence, confusion, choked disc, eventual onset of renewed signs of paralysis. The majority of men with old cranial wounds, who came to the Salpêtrière, complained either of persistent headache, difficulty in doing intellectual work, or epileptic seizures. There are very few trephined old war casualties who do not complain of continuous or intermittent headache, aggravated by fatigue, emotions, or work. These headaches are often accompanied by vertigos and labyrinthine phenomena. Many of these patients present changes of character, a certain irritability, a certain asthenia. All, or nearly

all, are reduced in their efficiency, be it as intellectual or as manual workers.

It is claimed by some writers that the aforementioned symptoms diminish in proportion to the distance from the date of the wound and the operation. This impression is not shared by the authors. According to information secured from the patients themselves and those in their environment, there are very few whose social value, prior to the wound, has been restored. Those old cranial casualties who presented paralytic symptoms, hemiplegias, hemianopsias, aphasias, were very slightly improved. Only the sensory disturbances seemed to have subsided, as is also the rule in nontraumatic vascular lesions.

Among the remote results of cranial wounds, the epileptic attacks are undeniably the most frequent complication. These attacks occur in individuals with penetrating or non-penetrating lesions, also in those who apparently had a mere concussion; they are observed as the sequel of lesions situated in all the zones of the encephalon. Generalized epilepsy is much more frequent than Jacksonian epilepsy. The epileptic crises are equally common among persons who retain intracranial foreign bodies, visible on radiography, as in those free from such bodies. These men with old skull wounds and epileptic attacks, invariably raise the question as to the desirability of another surgical intervention. In the authors' opinion, surgical intervention is hardly ever advisable, except in certain very particular cases of superficial foreign bodies or cortical irritation through bone splinters. Histological examination of various brains with war traumatism confirmed the frequency of diffuse lesions complicating the principal lesion. These diffuse microtraumatism generally consist in small hemorrhages with a grave lesion of the axis cylinders. They may complicate any wound of the skull, even though the dura mater was not opened, and possess great importance in the pathogenesis of traumatic epilepsy. It must also be taken into consideration, in the genesis of epilepsy, that a traumatic cerebral lesion does not become definitely organized, in a few weeks, into an inalterable cicatrix. Slow disintegration processes, often of extensive progressive character, develop in the thickness of a focal lesion, especially as foreign bodies (hairs, shreds of wool, bone splinters) may have been carried within. In addition, the possibility of latent microbism must, likewise, be considered in cranial traumatism.

CRUZON (France)

In discussing the "Remote Nervous Sequelae of Cranial Traumatism," O. Cruzon, Médecin-Principal de 2^{ème} Classe of the Reserve, Physician to the Salpêtrière, Paris, referred to the cranial traumatism observed by him of recent years, in civilian practice, as well as in a considerable number of industrial accidents. Such experience enabled him to make a comparison between cranial war traumatism and those occurring in peacetime.

The subjective syndrome common to all skull wounds can be summarized as follows:

- (1) Headache, permanent or intermittent.
- (2) Visual disturbances of irregular occurrence, in the form of floating specks, and vertigo.
- (3) Impairment of the intellectual faculties, affecting especially the memory, the power of concentration, and the speed of association of ideas. The reasoning power remains intact; there is neither delirium nor hallucination. There is often an exaggerated emotionalism, with irritability, a state of depression with a tendency to melancholia, insomnia, and nightmares.

The course of these syndromes, during the war and soon afterwards, seemed very variable. The degree of the disturbances was not, apparently, related to the extent of the bony gap or the severity of the wound. In a general way, the symptoms seemed to undergo only a very slow modification. The prognosis of the disturbances appeared favorable, but their persistence seemed to be prolonged, in spite of treatment. The working capacity of such wounded, after the consolidation of their wound, has formed the subject of numerous discussions. The physicians and experts who were called upon to examine the men, found that these disturbances induced permanent disablement and invalidism generally estimated at from 5-30 per cent.

Traumatic epilepsy attacks, especially, those whose cicatricial encephalic lesions are the most pronounced. The latent period varies on an average of from three to five months after the infliction of the wound, and in two-thirds of the cases, the epilepsy is generalized. In a general way, the period of latency does not exceed a year and a half. Personally, the author never observed epilepsy supervening several years after the traumatism.

Aside from epilepsy, focal lesions of the Rolandian region give rise to cortical monoplegias, hemiplegias, sometimes paraplegias, and more rarely, to facial paralysis. Parietal or temporal lesions are as-

sociated with the different forms of aphasia. As a rule, after a temporary improvement, as in motor disturbances, the symptoms persist unchanged and the majority of the wounded remain invalids. Likewise, with respect to wounds of the occipital region, hemianopsia, when once established, usually persists. As a sequel of skull wounds, there persist ocular paralyses and ocular lesions, either from injury of the optic nerve as a result of wounds of the frontal region, or of the oculomotor nerves, as a result of injuries of the orbit or base. Among other conditions of the cranial nerves, special mention must be made of auditory disturbances, deafness, in fracture of the petrous bone, or very marked labyrinthine troubles.

On the whole, the foregoing disturbances do not possess great interest with respect to remote results, being similar to the manifestations noted in the first months after the infection of the wound. Post-traumatic mental disturbances may have very serious results, ranging from very mild sequelae up to dementia. The degree of invalidism resulting from such mental conditions is extremely variable. The estimate of the sequelae of the confusional psychoses are 20 per cent, at least, but may reach 100 per cent in cases of chronic mental confusion of the pseudodementia type. The estimate is more difficult in regard to the periodic psychoses, which have been modified or revealed by the traumatism, the invalidism ranging from 30 to 100 per cent, on the basis of the gravity of the mental condition in the interval between attacks.

LERI (France)

Dr. André Leri, Adjunct Professor of the Medical Faculty, Physician to Saint Louis Hospital, Paris, in his communication, discussed the "Syndromes of Cerebral Concussion, Contusion, and Emotion in War Pathology." At the beginning of the World War, cerebral concussion was regarded as a sort of vibration, transmitted directly through the skull when the shock concerned the head, or indirectly through the skeleton, if the person fell on the buttocks, the knees, or the feet. Cerebral concussion gave rise to a complex of nervous disturbances, characterized by the sudden and, more or less, complete arrest of the functions of the brain. But because the vibration was "transmitted," it was usually considered mild, transitory, and curable. It was not credited with macroscopical lesions, which were reserved for the cerebral or medullary "contusions." It is readily understood that under these conditions, the postconcussional compli-

cations were regarded, sometimes, as of organic character, and at other times simply of neuropathic origin.

The term "concussion," at the onset of the war, seemed to have no accurate meaning, and, probably for this reason, was not mentioned in most textbooks. The war taught the lesson of a hitherto unknown variety of concussion, namely, that which resulted from the explosion of shells close by, without any direct or indirect shock against a solid body, the violent compression of the air playing the part of an interposed solid body. These pure concussions were often accompanied by gross macroscopical lesions, notably by focal, cerebral, or medullary hemorrhages. Meanwhile, concussions, as a whole, did not necessarily give rise to focal lesions, and curable concussions occurred, without marked objective signs. It was also shown that violent and repeated emotions could cause some disturbances of distinctly objective character. However, whereas there evidently existed abnormal emotions without concussion, there was no concussion without violent emotion, either immediate or, at least, retrospective.

The distinction between genuine concussions and simple emotional upsets (shell shock) was not easy, neither at the extreme front, in the crowded and inconvenient aid posts, nor at the rear, where the most essential data was lacking as to the actual circumstances of the injury itself. In fact, some observers denied the possibility of making such a differentiation. The term "concussion," particularly convenient on account of its vagueness and indefiniteness, came to include genuine concussion disturbances, pure, mixed, simple emotional upsets, and purely hysterical reactions. This confusion was deplorable in its results, for it led to autosuggestion, on the part of the men, against therapeutic endeavors, and to other abuses. As a matter of fact, the distinction is undeniable when observation is carefully made as soon as possible after the accident, with knowledge of place and circumstances. Soldiers suffering from concussion and those suffering from emotional upset (shell shock) behave like different individuals, and in "mixed" disturbances, the concussion can be separated from the emotion. Casualties with cerebral contusion also show a different behavior from those with concussion or shell shock. When these clinical pictures have been grasped at the source, as it were, they can be easily followed in the course of their successive stages.

The concussion syndrome is simply one of physical and mental inertia. On the battlefield or at the aid post, concussion may cause:

(1) Sudden or almost sudden death.

(2) Loss of consciousness, followed either by complete coma, more or less prolonged, curable or fatal; or by subcoma, simple confusion, and atony. These different states represent various degrees of physical and mental inertia, cerebral and medullary inhibition. They can only be the successive phases of the same clinical picture. Mydriasis and bradycardia seem to be among the most common physical signs.

(3) Focal, cerebral, and medullary lesions, either isolated as in simple contusions, or accompanied by loss of consciousness and disturbances of diffuse inhibition.

Even prolonged concussions have, nearly always, a favorable prognosis, but the symptoms are liable to recur. With or without recurrences, the postconcussional inertia often lasts several months, sometimes a year or longer, but the patients finally emerge from their torpor.

The contusional differs from the concussional syndrome by the existence of localized signs of deficiency or cerebral irritation (unequally inert members, partial shaking or trembling, aphasia, or dysphasia), and by a state of motor agitation and mental excitement.

The emotional or shell-shock syndrome consists in a state of anxiety, entirely concentrated on the thought of the accident and obsessed by it. Shell-shock cases are infinitely more frequent than concussions.

Genuine concussion can occur only in close proximity to the explosion, two or three meters for a small caliber shell, five or six meters for a medium caliber shell, eight or ten meters, at most, for a large shell; the nearness being a much more important factor than the mass of the explosion. Since one must be in the zone of explosion to be subjected to a concussion, it almost invariably occurs in the open air, unless a shell falls directly into the trench, as was the case with aërial torpedoes, which dropped vertically through their own weight. The slightest obstacle (roof, door, or simple covering) deadens the shock and renders the danger practically nonexistent. In order to sustain a concussion, the skull must be intact, so that it can vibrate as a whole. The production of a state of diffuse postconcussional inhibition requires the transmission of the jar to the total of the two hemispheres. A soldier with a penetrating cranial wound does not experience any concussion, unless the lesion is very considerable. This observation was often made and wondered at in the course of the war.

It is noteworthy that when a focal lesion results after a concussion, the symptoms do not always appear immediately after the injury, but sometimes several hours, days, or even weeks later. In a general way, the prognosis of these retarded lesions seems to be infinitely better than that of the immediate or early lesions.

KRYNSKI (Poland)

“Plastic Operations in Lesions of the Skull” formed the subject of the communication by Professor Dr. Leon Krynski (Warsaw). The different operative technics, hitherto employed to fill the loss of substance of the skull, are very numerous and can be classified in several groups, as follows:

(1) Cranioplastic procedures with periosteal, osteoperiosteal, and cutaneo-osteoperiosteal flaps. The osseous portion of the flap is furnished by the external table and the diploë of the skull bone.

(2) Cranial osseous grafts, which may be:

- (a) autoplasmic
- (b) homoplasmic
- (c) heteroplasmic

Of these three types of osseous grafts, the autoplasmic operations have been most widely adopted in modern surgery and seem to be the most successful. The cranial grafts can be taken from the vicinity of the bony gap or at a distance from it.

(3) Cartilaginous grafts through transplantation of costal cartilages; claimed by their advocates to be more easily applied than osseous grafts.

(4) Transplantations of decalcified, carbonized, calcined, macerated, dead bone; these grafts seem to serve simply as a stimulus of ossification for the neighboring bone and play only a temporary part.

(5) Cranial prosthesis with plates of rubber, gold, lead, platinum, aluminum, and even ivory are inferior as compared to cranioplastics with living tissue, as a bony or cartilaginous graft.

(6) As a supplement of the cranioplastic procedures, in order to improve the repair, fatty, serous, and fibrous grafts are applied, by introducing them between the brain and the layer of the bony graft, to protect the surface against adhesions and their dangerous sequelae.

While all these methods of obliteration have given good operative results, it can be stated, in a general way, that cranioplastic procedures with osseous and cartilaginous grafts furnish the best re-

sults and are preferable to prostheses by metal or other plates. As to the choice of the osseous material for cranioplastics, the author favors the employment of a graft from the scapula, which provides good material, especially for the closure of large cranial gaps. Concerning the functional outcome, the operating surgeon does not aim at the improvement of the encephalic functional disturbances caused by the change of the brain; his only objective is to protect the brain against external injuries. The psychic effects are good, for the patients feel that their brain is covered and protected. The cosmetic result, likewise, is very satisfactory. The cerebral functional result is open to discussion, being very often beyond operative procedures and outside the domain of surgical intervention.

A cranioplastic operation must not be performed prematurely. It is necessary to wait until the wound, left by the traumatism and the primary trephining operation, is not only entirely cicatrized, but has been cicatrized for a long time. The patient must be kept under careful observation to make sure that there remains no splinter to be eliminated, no small focus of latent infection, no foreign body to be extracted, and that the general condition does not contra-indicate operation. It is only under these conditions that the cranioplastic procedures can yield truly satisfactory and encouraging results.

OSTROWSKI (Poland)

“*Sequelae of Traumatic Lesions of the Skull*” was the title of the communication by Thaddeus Ostrowski, Professor of the Lwow Faculty. On considering the relations from cause to effect, which exist between the cranial traumatism and its direct consequences, it is easily recognized that complications, such as the escape of cerebral substance, or cerebral hernia, are primarily dependent upon the extent of the lesions of the skull and the dura mater. They are, likewise, dependent upon the facility of infection which, in an extensive lesion, plays a part of the greatest importance in the determination of complications, such as meningitis and encephalitis. It is noteworthy, however, that in certain cases of these affections, a disproportion is observed between the extent of the traumatic lesion and the resulting complications. Aseptic serous meningitis has been known to supervene in the presence of a very trifling traumatic lesion, even in the absence of a solution of continuity in the soft parts, where, at first, there probably was only an extravasation due to an injury to the subdural vessels. This extravasation constituted a point of lessened

resistance and subsequently became the starting point of the infectious complications.

The causative relations between cranial traumatism and brain abscess is undeniable. But here again, a disproportion is observed between the traumatism and the resulting brain abscess. Cerebral abscesses may supervene on very minimum lesions of the skull. The abscess often manifests itself at a point which does not correspond to the traumatism, even at a distance from the latter. Infection then occurs by the lymphatic route, when a focus of suppuration is simultaneously present in the integument or in the bones of the skull. Accordingly, the traumatism itself is capable of determining these affections, but more frequently, the immediate or slightly more distant complications are due to the infection which accompanies the injury. In the course of the secondary period, following the successful control of these complications, the patient's life is exposed to no immediate danger. It is not permissible to consider him as cured, however, in view of the fact that the brain has only a very weak tendency to regeneration.

The affections mentioned in the foregoing leave behind them certain lesions which tend to persist: permanent losses of cerebral substance, proliferation of cicatricial tissue, formation of cysts and edemas, which have a tendency to diminish the capacity of the cranial cavity, adhesions between the meninges, which give rise to circulatory disturbances. As a result of the cicatricial adhesions between the brain substance and the rigid walls of the skull, a lacunar and porencephalic condition, visible on macroscopical examination, is produced. All these lesions do not, at times, reveal themselves by any clinical signs until very late. The clinical manifestations are variable, and the anatomical lesions noted immediately after the traumatism, are in no way related to the remote complications. This disproportion between the anatomical lesions and the immediate or delayed complications is undeniable, and appears much more marked in the presence of functional disturbances.

The analysis of the anatomo-pathological lesions observed as a sequel of traumatisms of the brain, does not always reveal the cause of the existing functional disturbances. In this respect, the epileptic syndrome is the most characteristic. The frequency and severity of the epileptic attacks do not depend upon the extent and the depth of the effect produced by the traumatism. Very grave and obstinate cases of epilepsy were observed, where the skull was not damaged

at all or only very slightly so. On the contrary, according to some observers, epilepsy is less common in the cases of extensive traumatism with considerable loss of substance of the cranial wall and the meninges. Infection, as a decisive factor in the clinical course of the complications of cranial traumatism, plays no part at all in epilepsy, as shown by observations by Leriche, Delageniere, and other writers. The bony lesions, following upon cranial traumatism, in the form of exostoses, depressions, as well as splinters, foreign bodies, fragments of projectiles which have penetrated into the brain, evidently play a certain part in the etiology of epilepsy; but clinical observation shows that this part can only be entirely secondary. The study of the anatomico-pathological lesions of the brain and the meninges furnishes no solid basis with regard to the etiology or the treatment. The extent of the lesions is not proportionate to the existing symptoms and, on the other hand, the same clinical symptoms do not always indicate the same anatomical lesions. Inversely, analogous anatomical lesions give different clinical pictures. Aside from the cases where the epilepsy presents distinct anatomical lesions, there exist other cases, in a proportion of about 15 per cent, where absolutely nothing is found on macroscopical examination. Recent investigations occasionally revealed microscopical lesions, such as proliferation of the neuroglia, chromatolysis of the pyramidal cells, bloody extravasations, as well as chemical modifications of the cerebrospinal fluid.

With respect to the sequelae of cranial traumatism, the brain evidently occupies a place by itself in the domain of pathology. There can, accordingly, be no routine treatment.

HIGIER (Poland)

Henri Higier, of Warsaw, pointed out in the "Remote Results of Cranial and Cerebral Traumatism" that these sequelae are of *psycho-traumatic* and *organo-traumatic* character. The delayed results of cranial traumatism are exclusively those which appear weeks, and sometimes years, after the spontaneous or operative healing of the principal process. The most common are: (1) cerebral hernia or prolapse; (2) latent or delayed abscess; (3) chronic encephalitis; (4) circumscribed and generalized meningitis; and (5), epilepsy. Traumatic postoperative cerebral hernia or prolapse is generally caused by an occult inflammatory process in the cerebral substance, often or usually purulent and dangerous (circumscribed purulent en-

cephalitis). Abscess, as a late complication, is generally more rare than purulent meningitis and its symptoms do not appear until some months after the operative treatment of a traumatism taking a relatively benign course.

A grave complication of cranial traumatisms in the form of epilepsy, supervenes in two, six, or, rarely, twelve months after the injury in the form of classic epilepsy, unilateral Jacksonian epilepsy, or a psychic epileptic equivalent. According to some observers, the frequency of this complication fluctuates between 2 per cent and 5 per cent; according to other writers, between 30 per cent and 35 per cent, and even beyond 50 per cent. The statistical data is widely divergent, but a causative connection between the cranial traumatism and the epilepsy is probable.

A less common result of cranial traumatisms, and of great importance from the practical viewpoint, is represented by emotional disturbances, especially in the form of hypersensibility, hyperirritability, excitement, and violence. Some patients show excessive excitement, up to the commission of acts of violence, whereas others present depression, loss of energy and initiative, fear, anxiety, profound apathy; still others present the syndromes of amnesia, hallucinations, and the picture of pseudologia fantastica; finally, in some cases, there supervene alterations of personality, pseudodementia and moral insanity. This is especially the case in injuries of the frontal region. Persistent and chronic psychoses are hardly ever seen in traumatic cases, without a psychopathic and changed territory. Minor disturbances of this kind, although frequent, are revealed only by psycho-experimental examination with accurate and delicate tests, and by close, prolonged, and systematic observation of the patients while at work, when disturbances of will power and attention, perception and memory, and other higher intellectual functions are noted. There is also a psychic incapacity of observation, of vision, distinction of colors, dependent upon disturbances of the visual attention and optic memory, sometimes up to the point of complete alexia, agraphia, apraxia, and psychical or cortical blindness, especially in the course of traumatisms of the occipital region of the brain. Identical or analogous disturbances are encountered in the other sense spheres, dependent upon the change of some cortical center or other. Anomalies of association, and modification of intelligence, are, in a general way, particularly marked in the course of lesions of the left cerebral hemisphere. It has been found that one-third of the skull wounded

are obliged to change their occupation, in spite of systematic treatment. There is a group of post-traumatic disturbances, on the boundary line between functional and organic, which, while long known, was more thoroughly investigated in the postwar years. This is the group of functional, as well as anatomical, cerebral disturbances caused by cerebral contusion, concussion, and compression.

The most important modern methods of examination of the brain are: (a) measuring of the pressure of the cerebrospinal fluid; (b) radiological encephalography of the ventricles and the subarachnoid spaces of the cortex; (c) examination of the system of intracerebral canalization; (d) determination of the rapidity of absorption of substances which have been artificially introduced into the spinal or ventricular fluid.

By means of the foregoing methods, it has proved possible to demonstrate in the lifetime of traumatized patients, who were considered hysterical, neurasthenic, or malingerers, the changes of hypertrophic pachymeningitis, cystic leptoarachnitis, adhesive arachnitis, diffuse serous meningitis, internal hydrocephalus, meningocysts, hypersecretory occlusive hydrocephalus, submeningeal hematoma. The vague clinical syndrome generally depends as much on the superficial diffuse bloody extravasations or miliary microscopical apoplexies as on the traumatico-inflammatory lesions of the meninges and the ventricles, as well as the circulatory disturbances of the cerebrospinal fluid. The clinical symptom complex may exist only exceptionally, without the presence of distinct anatomical lesions, and inversely, these lesions may not manifest themselves clinically by any remarkable phenomenon.

ROSENHAUCH (Poland)

“Wounds of the Head, with Respect to the Eye,” were discussed by Dr. Edmund Rosenhauch, on the basis of cases observed and collected by him during the World War. Although war wounds are often similar to peacetime injuries, there are, nevertheless, some differences which invest these cases with the stamp of battle. There are, also, some injuries which are never seen in peacetime. Wounds of the head are continually on the increase in modern warfare. They were not only more numerous with respect to the number of fighting soldiers in recent wars, but also relatively to the same wounds in the older wars.

It is of interest that the surface of the eye where a bullet can

strike, is equal to the proportion of 1:750 as compared to the entire human body. The surface of the eye, according to Oguchi, comprises 0.15 per cent of the surface of the human body. Nevertheless, injuries of the eye are very frequent, and, in the World War, were assumed to have reached 5-8 per cent. In the Russo-Japanese War (1904) they amounted to 2.22 per cent and in the Chino-Japanese War (1894) to 1.18 per cent. The causes of this increased number of eye injuries must be sought in the new methods of warfare as well as in the newly invented measures of war. Furthermore, any wound of the eye, even the most trifling, causes much more serious disturbances than the same wound, or even a more serious wound, of another portion of the body. During battles fought in trenches, where the entire body is protected by the walls, while the head is covered with a helmet, the eyes are exposed to the bullets.

Wounds of the head may cause lesions of the eye in three different fashions: either the eye is wounded directly; or it is wounded indirectly, by lesion of the tissues adjacent to the eyeball; or, finally, disturbances occur as the result of wounds at a distance from the eye, in any portion of the skull. There exists a certain analogy between wounds of the skull and wounds of the orbit. The brain, like the eyeball, is filled with incompressible fluids, enclosed as if in a bony capsule. For this reason, the modern projectiles which injure the body in a relatively "humane" manner, act in an entirely destructive fashion on the eyeball, with its delicate sheath.

Special importance is attached to changes of the eye caused by glancing or tangential blows, which have not touched the envelope of the eye itself. These usually give rise to changes in the interior of the eye, which differ essentially, according to whether the blow is from the front or rear. The most frequent changes undergone by the eye from wounds caused by tangential blows, include hemorrhages and ruptures of the retina and the vascular tissue. These lesions produce characteristic cicatrices, colored by the pigment, as well as holes and retrogressive changes in the yellow spot, detachment of the retina, changes in the position of the crystalline lens, and even cataracts. These changes are undoubtedly the consequences of direct lesion of the eyeball. Wounds of this kind are caused by a projectile striking directly from the front, or which, in passing through the orbit, acts upon the eyeball from the side or from behind. When the eyeball is struck directly by a bullet or shrapnel, it undergoes complete destruction (perforating injury) and must be enucleated. Likewise, an eye

wounded by a sharp weapon (bayonet) is usually completely destroyed, although in exceptional cases the eyeball can be saved, with more or less preservation of the visual capacity. The author personally observed very interesting cases of this kind, which were followed by a temporary change of refraction (myopia or astigmatism). When a case is promptly recognized and treated by a specialist, the sight can often be saved.

A projectile discovered in the orbit must be unconditionally removed. The removal of magnetic foreign bodies is accomplished by



SALT CONCENTRATION ESTABLISHMENT AT CIECHOCINEK

means of an electric magnet. Non-magnetic bodies, such as copper, must be removed by an operation, with the assistance of the Roentgen rays. Minute metallic foreign bodies in the orbit, not causing any irritation, may be left alone; but if the same bodies are situated in the eyeball, they must be removed, in order to guard against an eventual sympathetic inflammation of the other eye. However, cases are on record where a foreign body remained in the eye for several years, without causing any damage to the patient.

Even when situated at a considerable distance from the eye, any wound of the head may cause disturbances of the organ of sight, when the cicatrization is accompanied by some complications. Inflammation of the optic nerve and choked disc are important symptoms of complication in cranial injuries. When such conditions are not immediately treated or are improperly treated, they lead, in the major-

ity of cases, to total or partial blindness, due to atrophy of the optic nerve. This can be prevented, as a number of operative procedures are known by means of which sight can be saved. Perhaps still more serious affections are represented by the metastatic inflammations of the eye. These can be caused by wounds of any portion of the body. Fortunately they are relatively rare, although the majority of wounds caused by fire-arms are infected.

DE BERNARDINIS (Italy)

Dr. Virginio de Bernardinis, Maggiore Medico, of the Rome Military Hospital, described "Some Aspects of the Symptomatology of the Outcome of Cranio-Cerebral Wounds." While admitting that the most common subjective disturbances, resulting from cranio-cerebral wounds, usually present special features, the author does not believe that such disturbances can constitute clinical pictures of a general description, nor does he agree with some writers in the existence of relations between the cranial gap and the extent and gravity of the cerebral lesions.

While accepting, in a general way, the new teachings of Pierre Marie, with respect to problems concerning the speech zone, De Bernardinis believes that Broca's lobule must not be excluded from the zone of anarthria. In this connection, attention must be paid to the intimate and untraceable physiological relations existing between the various points of the speech zone. The author emphasized the importance of the investigations, which led to the identification, with the retinal projections of Munk and Henchen, of the visual sphere, restricted in man to the cortex of the calcarean fissure.

DISCUSSION

MAISONNET (France)

The need of close collaboration of operating surgeons and neurologists was emphasized by Médecin Major Maisonet. The delayed sequelae of cranial traumatism, especially epilepsy, only exceptionally permit surgical treatment, and the precise indications for operative intervention can be rendered only by experienced neurologists.

PAPASTRATIGAKIS (Greece)

Médecin Major Constantin Papastratigakis likewise stated, in connection with traumatic epilepsy, that one must not be very optimistic as to the results of its surgical treatment. There are cases which become aggravated as the result of such intervention. It must be kept

in mind that the prognosis of post-traumatic epilepsy is dominated by the presence or absence of a cicatricial process, directly involving the cerebral substance. The number of cases of post-traumatic epilepsy in which surgical intervention is beneficial is very restricted.

KOELICHEN

Among the causes of post-traumatic epileptic seizures, Dr. Koelichen called attention to meningeal cysts, which develop as a sequel of adhesive arachnoiditis, are liable to increase in consequence of excessive production of cerebrospinal fluid in their interior and act on the brain like foreign bodies, even without infection and suppuration of their contents. These cysts, which radiology fails to reveal, can be recognized on the basis of a "cracked pot" sound, distinctly heard on percussion of the bones of the skull, in the vicinity of the lesion. The part played by these meningeal cysts in the etiology of post-traumatic epileptic attacks can be proved by the fact that in the cases of extensive bony lesions of the skull, epileptic attacks are less common than in those of circumscribed lesions.

FAZIL HALID (Turkey)

The case of a man, forty-three years of age, who for a year, had suffered from typical, frequently repeated attacks of Jacksonian epilepsy, beginning in the face, was described by Lieutenant Colonel Fazil Halid, Chief Surgeon of the Military Hospital, Turkey. Consciousness was preserved during the attack; there was neither contracture, nor postepileptic paralysis. The patient died from an attack of acute appendicitis, in spite of immediate operation. The autopsy showed a glioma of the first frontal convolution, six centimeters in front of the Rolandian fissure, about the size of a walnut. The case was one of Jacksonian epilepsy, supervening, without direct involvement of the Rolandian region, in the absence of paralytic phenomena.

THE ARSENOBENZOLS: METHODS OF ANALYSIS AND CHEMICAL DETERMINATION

OFFICIAL REPORTS

BLUMENTALS (Latvia)

In his report to the congress, Colonel-Pharmacien D. Blumentals, Inspector of the Military Pharmacy, of Latvia, pointed out that salvarsan is a yellow powder, which gradually dissolves in water. It is less soluble in methyl alcohol, ethylen glycol, and in glycerine, still

less so in ethyl alcohol, and very slightly soluble in concentrated acetic acid, acetone, ether, and in concentrated hydrochloric acid. When water is poured on salvarsan, it forms an agglutinuous mass that can be separated only with difficulty. For laboratory purposes, it is advisable to moisten salvarsan with a little methyl alcohol, in order to render it more soluble in water. Such salvarsan solution gives an acid reaction. On adding a solution of sodium hydroxide to the watery solution, a molecule of hydrochloric acid will be fixed, while the monochlorhydrate of the salvarsan base will remain in solution. Upon add-



MEDICAL ESTABLISHMENT AT KRYNICA, VISITED BY THE DELEGATES

ing more alkali, the second molecule of hydrochloric acid will likewise be fixed, and the not very soluble salvarsan base will give a precipitate composed of yellow flakes, while the liquid will have a neutral reaction. On adding still more of the sodium hydroxide solution, the precipitate becomes redissolved, that is, the disodium phenolate is formed, the hydrogen of the phenol group being replaced by sodium. The solution now contains sodium salvarsan and presents an alkaline reaction. Thus, the dioxidiaminoarsenobenzol, like aminophenol, possesses acid and basic properties, although only weakly marked.

The carbonic acid of the air may decompose the phenolate. A solution of the sodium salt of salvarsan, therefore, becomes turbid on

contact with the air, thus facilitating the separation of dioxido-aminoarsenobenzol, which is not readily soluble in the soda solution. Salvarsan, even in the solid state, is, therefore, oxidized by the oxygen of the air and transformed into arsinoxide. If the oxidation continues, poxymaminophenylarsenious acid is formed. The reaction of decomposition advances gradually, it is hardly perceptible at the beginning. Biologically, however, an increased toxicity can be demonstrated. The oxygen acts more rapidly on the alkaline salvarsan solution than on the acid solution. The arsinoxide thus formed can be measured by titration. Salvarsan solutions preserved in a vacuum are gradually decomposed; they assume a red coloration and finally become precipitated in a brown deposit. The characteristic feature of the dioxido-aminoarsenobenzol is the sulfate, which dissolves, with great difficulty, in water. Sulfuretted hydrogen does not separate the arsenic sulfide from a salvarsan solution acidulated with hydrochloric acid. Bettendorf's reagent, likewise, produces only an amorphous yellow deposit, but no separation of arsenic. When salvarsan is heated with hydrochloric acid and a little potassium chlorate, until clear as water, the resulting solution gives, with sulfuretted hydrogen and Bettendorf's reagent, an arsenical reaction.

The addition of iron chloride, to a salvarsan solution, even in a dilution of 1:15000, changes the color from green to red. On dissolving 0.08 g. salvarsan in 1 cc. methyl alcohol, and then adding 1 cc. water and 5 cc. of a decinormal silver nitrate solution, a transparent dark red liquid is obtained, in which, on the addition of 5 cc. of 25 per cent nitric acid, a yellowish brown deposit appears. This mixture is heated in water until the deposit becomes white and the liquid yellow. After removing the caseous deposit of soluble silver chloride, the remaining liquid is separated by means of a few drops of dilute hydrochloric acid from the excess of silver nitrate, and then filtered. The combined filtrate, with an excess of ammonia, gives, with the same volume of magnesium mixture, a crystallized white deposit of arseniate, ammonium, and magnesium. This deposit, when washed and dissolved in concentrated hydrochloric acid, and with the addition of a solution of zinc chloride acidulated with hydrochloric acid, produces a brown color due to arsenic; on heating this deposit, after a solution of sodium hypophosphite is added, a brown deposit is formed. The lemon yellow color of a solution of 0.02 salvarsan in 5 cc. water changes to light yellow on adding a drop of hydrochloric acid, then to reddish yellow with a drop of sodium nitrate solution, and, finally, into dark red,

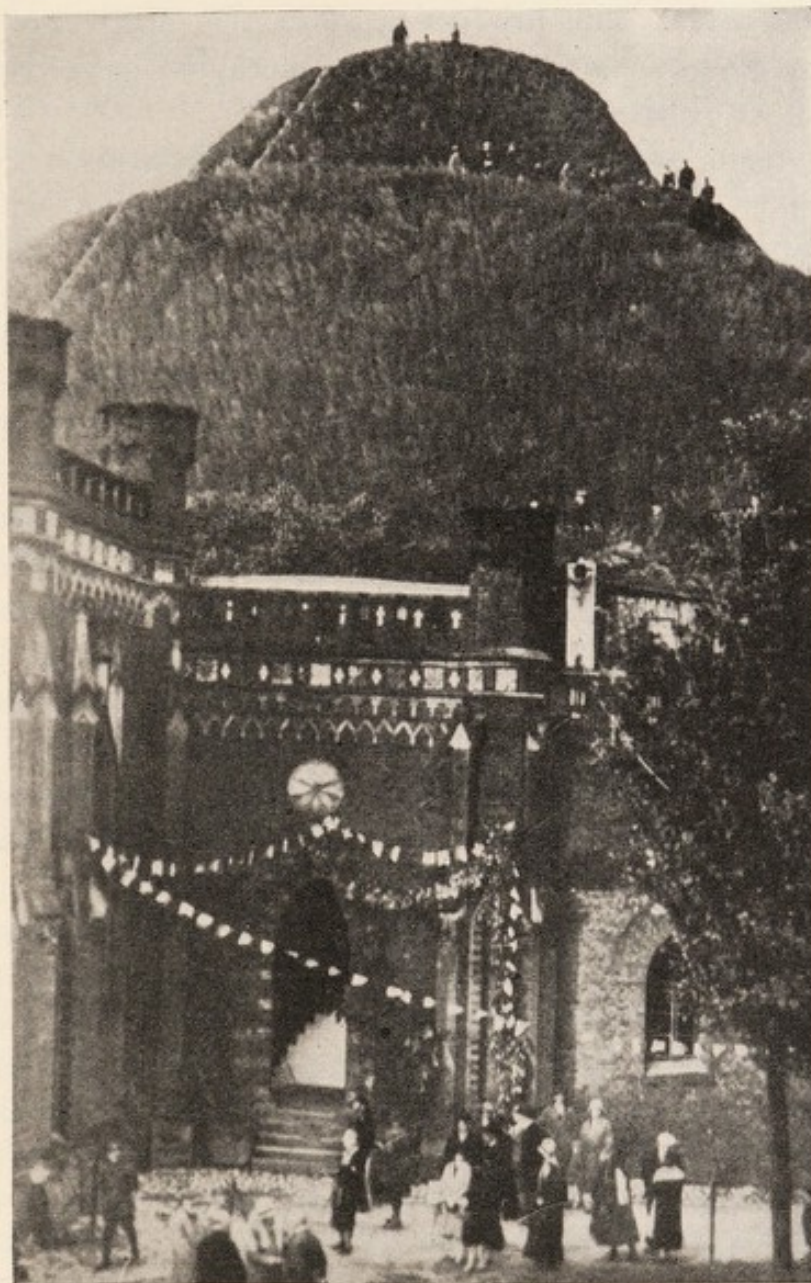
with ten drops of a 4 per cent hydrolytic solution. With alpha naphthylamine, salvarsan produces the diazo reaction, but not with beta naphthylamine. To accomplish this reaction, the salvarsan solution, with the addition of a few drops of hydrochloric acid, is chilled to zero degree, and a weak excess of 0.5 per cent sodium solution is added to it; the nitrous acid is then made to disappear by adding small quantities of urea. When a saturated solution of alpha naphthylamine with hydrochloric acid is added to this, a beautiful ruby red to purplish red color appears, which gradually becomes more and more intense. The production of the coloring substance is distinctly accelerated by heating. In the dilution of 1:15000, when the reaction is made in the cold, the red coloration appears only at the end of a few hours. This reaction, however, demonstrates only the presence of an amine action of a derivative; it is conclusive for salvarsan only when the simultaneous presence of arsenic is demonstrated in the solution, or, better still, in the resulting coloring substance. For this purpose, when heating does not render the coloration more intense, the red colored fluid is saturated with sodium chloride. Some hours later, the coloring substance is collected on a filter, washed with a saturated solution of sodium chloride, dissolved in very hot dilute hydrochloric acid and arsenic is looked for by the Reinsch and Gutgeit method. The discovery of the amino group is conducted as follows: dissolve in 5 cc. water and diazotize, by adding 0.1 cc. hydrochloric acid with three drops of a solution of sodium nitrite. The yellow color of this liquid changes into bright red when an alkaline solution of resorcin is added.

Colloido-chemical analyses of salvarsan solutions and analogous compounds have been carried out by Bauer. The results of the ultra-microscopical findings (ultrafiltration as well as diffusion in gelatine) may be summarized in the statement that salvarsan and its analogs are semicolloidal.

In the human organism the elimination of the arsenic by the urinary route occurs a short time after the administration of the salvarsan. According to Abelin, five to ten minutes after its intravenous injection, salvarsan can be demonstrated in the urine by means of the diazo reaction and the addition of resorcin. This reaction is still demonstrable five to six hours and, in some cases, even eight to eleven hours later. However, all the salvarsan is eliminated only at the end of some weeks. But even then, there remains, for some time, a considerable quantity of the arsenic, especially in the liver, which is the

neutralizing organ of the first rank, for poisons in the kidneys and the spleen, and, in the case of intramuscular injection, in the injected muscle.

The salvarsan reaction is, of course, of great value for the *forensic*



Kosciuszko's Mound. Built by people of Poland. Earth brought in sacks, boxes, barrows, and even bare hands from battlefields on which Poles fought. Some earth brought from Saratoga and West Point where Kosciuszko laid the foundation of the military school.

demonstration of arsenic. Sieburg has found that there is no excretion of salvarsan in the pure state in the urine. There is, rather, a dissociation of arsenic groups with the formation, by oxidation, of less

poisonous and more easily excreted arsenic acids. One-quarter of the arsenic eliminated with the urine, is found in the ionized inorganic form. The liver is the principal site of its deposit.

It is necessary to emphasize the special importance of a condensation product of salvarsan and sodium formaldehyde-sulfoxylate (hydraldite, rongalite). This product possesses the constitution of an acid sodium dioxidiaminoarsenobenzole-mono-methylen sulfoxylate. Commercially, it is called "Neosalvarsan."

Neosalvorsan, also known as Ehrlich's preparation No. 914, is easily dissolved in water, and gives a neutral solution, which can be immediately injected. It is insoluble in pure alcohol and in ether. It comes in the form of a light yellow powder, containing 19-21 per cent of arsenic. This product contains an excess of hydraldite, and a little sodium chloride and carbonate, so that its content in arsenic is less than is theoretically required (32.18 per cent). It owes its preferred employment to its absolutely neutral reaction. Neosalvarsan solutions are more rapidly oxidized than salvarsan solutions.

Other experimental investigations on salvarsan treatment, conducted by Ehrlich and his collaborators, aimed at the removal of certain disadvantages due to the instability of the salvarsan solutions, and at the more extensive improvement of the chemico-therapeutic index of the dioxidiaminoarsenobenzol by chemical modification, especially by the establishment of new substitutions, and by the combination with other efficient substances. As a result of these considerations, numerous derivatives of salvarsan have originated.

Of recent years, the heavy metals of salvarsan have acquired very particular importance. Based on the biological consideration that the pathogenic agent must be attacked at several points, if possible, and with several kinds of poisons, Ehrlich proceeded to mix solutions of metallic salts with other arsenical compounds, and, in doing so, observed the formation of strongly colored substances. The extent of this reaction was found to be very great, in the associated work of Ehrlich and Karres, extending, on the one hand, to all arsenical compounds, on the other, to the salts of copper, silver, gold, mercury, palladium, platinum, iridium, ruthenium and osmium. By means of the metallic combinations of diaminodioxyarsenobenzol they prepared the copper salt, the silver salt, and others. On combining a solution of diaminodioxyarsenobenzol in water or methyl alcohol, with a few drops of silver nitrate solution, an intensive brownish red color was produced, but there was no precipitate of silver chloride, nor was the

presence of silver ions demonstrated. The silver, therefore, disappeared for analytical demonstration; that is, it formed complex combinations. By the addition of the yellowish red solution obtained by adding salvarsan dichlorhydrate to the solution of silver nitrate and caustic soda, a dark brown flaky precipitate of the free base of the silver salvarsan is formed.

Binz and Ludwig isolated the base of silver salvarsan under two forms which they regard as isomers. One, apparently, contains the silver combined with the arsenic, the other with the amino group. By the further addition of a solution of caustic soda, the precipitate becomes a very dark brown liquid, containing sodium silver salvarsan. Commercial silver salvarsan is a sodium salt, easily dissolved in water, producing a dark brown color and containing 20-21 per cent arsenic and 13-14 per cent silver. It is recognized as an anti-syphilitic agent with an energetic action.

Colloido-chemical examination (Bauer) shows that silver salvarsan is not a mixture of colloidal silver or silver oxide with the sodium salvarsan, but a united substance, which passes through the ultrafilter without leaving a residue. Silver salvarsan does not belong to the crystalloids, and must be considered as a semicolloidal substance; kept in flasks free from air and hermetically sealed, silver salvarsan can be indefinitely preserved. It decomposes in the air following which it does not clearly dissolve in water.

Kolle, with his collaborators, Binz, Bauer, and other chemists, succeeded in the preparation of silver neosalvarsan. In the solid state, it presents a blackish brown powder, easily soluble in water, with a weakly alkaline reaction. Its content in arsenic is about 20 per cent, in silver about 6 per cent. Incipient decomposition is indicated by an opalescence of the solution. On microscopic examination, pure products show only minute particles, while the decomposed silver neosalvarsan shows lumps and masses of variable size. The product can, accordingly, be controlled by microscopic examination.

Aside from the preparation of salvarsan already mentioned, a certain number of investigators have prepared and described numerous arsenobenzol derivatives, but these have not been utilized in practice.

The difficulty in the synthesis of salvarsan and its derivatives, which are not crystalline substances, consists in the prevention and separation of the accessory products, to which some writers attribute a greater toxicity, and which increase the equilibrium of the preparation itself. It has been shown, particularly by Meyer, that in the com-

mercial products of salvarsan and its derivatives, the chemically determined additions and the decomposition substances are so minute that they cannot explain the toxic effects of numerous applications. It has also been established that several preparations, in spite of their irreproachable chemical composition, are found to be extremely toxic, on biological examination; whereas, on the contrary, other specimens of salvarsan, in spite of considerable additions and oxidation products, shown no high toxicity.

At the present state of our knowledge, the value of arsenobenzol products is determined by means of biological procedures, comparing the series of the product under examination with standard preparation of a certain arsenic content and therapeutic value. As the biological examination is rather inconvenient and does not possess the accuracy of chemical examination, efforts have been made to improve the chemical methods capable of determining the value of arsenobenzol, a purely chemical product. In this direction, the promising work of A. Douglas Macallum has stimulated further investigations, which have been improved by Dr. de Myttenaere. According to these methods, it is possible not only to identify the preparations of arsenobenzol as such, but also to determine the character of the preparation. These chemical verification methods are based principally on the determination of the nitrogen, arsenic and sulfur, and on the mutual relations of the resulting figures. Thus, for example, according to the formula of arsenobenzol, the proportions between arsenic and sodium atoms are the same as between their molecular weights: viz., 75 to 14. Thus $\frac{\text{As}}{\text{N}} = \frac{75}{14} = 5.357$. In good preparations, the proportion of $\frac{\text{As}}{\text{N}}$ varies between 5.5 and 6, which may be regarded as normal.

Certain substances of which arsenobenzol is composed, are strongly reduced, and, according to the examination of de Myttenaere, they absorb, in oxidizing, the following quantities of iodine:

| | In an acid medium | In an alkali medium |
|---|-------------------|---------------------|
| Base of Ehrlich's salvarsan (592)..... | 8 iodine atoms | 16 iodine atoms |
| Salvarsan methylene sulfoxylate of sodium | 4 iodine atoms | 6 iodine atoms |
| Salvarsan methylene bisulfite of sodium | | 4 iodine atoms |

The figures obtained by chemical analysis and the different mutual relations, permit Dr. de Myttenaere to eliminate the preparations which cannot be utilized. Only the products meeting with the requirements of chemical examination should be examined by the biological procedures.

At a conference in Brussels, in 1925, after the report of Dr. de Myttenaere on the chemical control of the arsenobenzols, a resolution was passed that it is necessary to unify the biological control of the arsenobenzols with a standardized chemical control.

SUMMARY

Of all the chemical methods of control of the arsenobenzol preparations, those of Dr. de Myttenaere furnish the best results and are utilized in some countries.

Attempts were made to examine some arsenobenzol preparations by colorimetric methods, but were not completed because of limited time, so that no positive results were obtained.

Of all the methods for the determination of arsenic, the procedure outlined in the last edition of the *Russian Pharmacopeia*, is the most suitable for easily and rapidly giving fairly accurate results.

WEIL AND POPLAWSKI, (Poland)

Among the different derivatives and preparations of arsenobenzol, as stated by Dr. S. Weil, Director of the Pharmaceutical Institute of the Polish State, and Dr. W. Poplawski, Lieutenant-Colonel, Pharmacist-Chemist, the one most utilized in many countries is the sulfoxylate of dioxidiaminoarsenobenzol. This product is used in commerce, not as a well defined chemical body, but in a mixture of different bodies, and in various proportions. This makes its analysis difficult. It is especially employed by the armies of the different countries. Commercially, it is known under various names: neoarsenobenzol, neosalutan, neoarsphenamin, neomesarca, and others. All these products are put up in the form of a light, or, more or less, dark, yellowish powder, whose active constituent is the sulfoxylate of dioxidiaminoarsenobenzol. Besides this active agent, the powder contains some indifferent, often accidental substances, depending upon the technic of manufacture, and sometimes dangerous impurities and decomposition products.

It is evident, therefore, that the chemical estimation of such a mixture cannot be made in as simple a fashion as the estimation of

pure chemical substances. In order to learn if one is dealing with a blameless preparation, it must be subjected to a triple examination:

(1) It must be ascertained that the examined product is truly a derivative of arsenobenzol, and not an absolutely false product, for example, common salt, colored yellow.

(2) Its therapeutic efficacy must be verified. As the active constituent of neoarsenobenzol is the derivative of the dioxidiaminoarsenobenzol, namely, an arsenic derivative, it is possible, by determining the quantity of arsenic in the examined product, to deduce the quantity



AEROPLANE VIEW OF KOSCIUSZKO'S MOUND

of sulfoxylate of dioxidiaminoarsenobenzol contained in the preparation.

(3) Finally, in order to insure the value of the examined product, it must be studied from the viewpoint of its relative harmlessness.

Any chemist can easily, by simple reactions, distinguish a false product from a true neoarsenobenzol. The reactions, which permit the establishment of the identity of the product, are described in the new editions of the pharmacopeias.

The dosage of the arsenic presents greater difficulties. The examined product may give all the reactions of purity and identity of the true neoarsenobenzol, but, nevertheless, may present a problem, because it may contain too much, or, rather, too little of the active ele-

ment. In order to grade the active element of the neoarsenobenzol, one generally determines the quantity of arsenic contained in it. The quantity of arsenic contained in a neoarsenobenzol is generally fixed at 19-21 per cent. In some countries, these limits are between 17 and 21 per cent. Several methods are known for determining the percentage. All require the preliminary destruction of the organic matter; then the arsenic is measured directly in the liquid, or the arsenic chloride is distilled in arsenated hydrogen. Generally speaking, a distinction can be made between four types of methods:

- (1) Iodometric measurement, in an acid medium.
- (2) Iodometric measurement, in an alkaline medium.
- (3) Bromometric measurement.
- (4) Gravimetric measurement.

Ordinarily, the iodometric or bromometric method in the acid medium, or the iodometric method in an alkaline medium, is utilized. The iodometric method in alkaline medium gives uniform and certain results, and does not present the inconveniences of the iodometric method in acid medium.

The determination of the harmlessness of the examined product is of greater importance, perhaps, than the measurement of the arsenic. The active element of neosalvarsan, the dioxidiaminoarsenobenzol, is known to be a body which decays easily, its decomposition products being much more toxic than the dioxidiaminoarsenobenzol, itself. Moreover, the different methods of manufacture of the neoarsenobenzol may give rise to small changes in the structure of an even minimum quantity of the active element of the product; and this change may increase its toxicity. In order to ascertain that the examined product is not toxic, the physiological method is resorted to at present; injections of a watery solution of neosalvarsan are injected into rabbits, mice, or rats, and the condition of the animals is watched. A committee, charged by the League of Nations with the more accurate determination of this biological method, decided on the injection of arsenobenzene derivatives into rats. This method is rather complicated, expensive, requires much time, and is not convenient. A rapid and easy method, permitting the testing of the content of each flask, before applying the injection, would be of great importance. Of course, the examination of a sample of the product taken from a certain quantity of flasks does not guarantee the harmlessness of the content of the other flasks of the same series.

Several chemists have made investigations on the possibility of establishing the toxicity of the arsenobenzene derivatives, by a chemical method. Ehrlich attributed the toxicity to the formation of oxyaminophenylarsenoxide. But it was soon demonstrated that other factors may considerably increase the toxicity of the product. The different attempts to determine this question by the chemical route have, so far, been unsatisfactory. Neither the direct measurement of the oxyaminophenylarsenoxide, nor the direct measurement of the arsenobenzol by iodometric titration, has established definite conclusions.

Among the different attempts to estimate the toxicity of the arsenobenzene derivatives, the determination of an index, called the DM¹ index, has attracted considerable attention. The index shows the quantity of arsenic that can be precipitated by sulfuretted hydrogen, measured by cubic centimeters of a centinormal iodine solution. Based upon a large number of analyses, De Myttenaere asserts that the DM¹ index, higher than figure 16, indicates a toxic product, while this index for the nontoxic products does not exceed the figure 12. This claim has been questioned by Valeur and Launoy, Moreau and Pontoizeau, Professor Patta, and others, who noted that, among the distinctly toxic samples, there were some for which they found a minimum DM¹ index and, vice versa, they were enabled to determine a DM¹ index above sixteen for products which were not at all toxic. This non-conformity was attributed by De Myttenaere to the fact that each of his opponents proceeded in a different manner for the determination of the DM¹ index. His opinion is shared by Kahl, Tomczynski, and Weil of the State Pharmaceutic Institute in Warsaw. These writers succeeded in showing that if it is desired to obtain uniform results by the determination of the DM¹ index, according to De Myttenaere, all the details of the method must be strictly followed. The value of this index differs widely, for example, when, after precipitation through acetic acid, the filtrate is left to cool off for one or several hours.

Although the majority of fatal cases, as shown by the investigation carried out in Switzerland in 1922, are due to ignorance in the employment of the arsenobenzenes (errors in technic, ignorance of contraindications, bad dosage) and sometimes to idiosyncrasy, nevertheless, such cases or serious disturbances caused by altered or toxic products, have been observed and, for this reason, preliminary control of the commercial product is strongly indicated. In Poland, the State Pharmaceutic Institute has the official control of the arsenobenzene

derivatives. Being in possession of abundant material for experimentation, the tests of De Myttenaere for the determination of the toxicity of the neoarsenobenzol by means of the DM^1 index, were repeated in the Institute. In a general way, the results obtained agree very well with the statements of de Myttenaere. Signs were actually noted which seemed to show the existence of a relation between the height of the DM^1 index and the toxicity of the examined product. Although the method is complicated, it requires less time than the biological method and may prove very useful in the factory or laboratory.

It has already been emphasized that neosalvarsan and analogous products are not uniform and definite chemical bodies, but mixtures of different products, whose composition may vary according to the procedure of manufacture. Under these conditions, it seems natural that the DM^1 index does not represent a figure resting on a strictly scientific basis, but appears, rather, as a conventional figure. It was established on the basis of about one hundred analyses, and permits certain deductions as to the properties of the examined products. Consequently, in conformity with the composition of the mixture which constitutes the neoarsenobenzol, the figure of the DM^1 index may vary in one way or another, for products of different origin, or even for products of the same factory, but of an accidentally or purposely different composition. Moreover, as this index seems to express the degree of oxidation, the figure increases when the examined product has been subjected to oxidation. At any rate, the conformity of results between one hundred samples tested by De Myttenaere and the same number tested by the chemists of the State Pharmaceutic Institute in Warsaw, with the DM^1 index, is rather striking.

Observations closely related to the foregoing have been made by a Polish manufacturer of neoarsenobenzol, Dr. S. Kielbasinski. In a personal communication, he stated that anything above 1 per cent of arsenic, deduced from an index which he determines and designates as SK^2 , indicates toxic products. This index corresponds to the DM^2 index of De Myttenaere. Among sixty-six samples, those whose quantity of arsenic, calculated according to the SK^2 index, exceeded 1 per cent, or approached this figure, was generally toxic or suspicious. The DM^1 index, determined for the same products, generally gave high figures for nontoxic products, and more or less insignificant figures for nontoxic products. In spite of some exceptions, which detract from the value of the findings, the accomplished results are remarkable. In the authors' opinion, it is not necessary to ascertain if these

indexes are based upon purely scientific calculations. For the desired objective, namely, for purely practical purposes, this point appears more or less irrelevant. By considering the DM^1 and SK^2 indexes as conventional figures, they may serve very well as guides for the estimation of certain types of products. At all events, we are still far from the solution of the problem of the toxicological estimation of the arsenobenzene derivatives by a chemical procedure.

The State Pharmaceutical Institute in Warsaw has tried various methods for the determination of the toxic properties of the neoarseno-



A GROUP OF DELEGATES WITH TWO VETERANS OF THE POLISH INSURRECTION
OF 1863

benzols. Attempts have been made to determine the superficial tension of the neoarsenobenzol solutions and the concentration of their hydrogen ions; colorimetric, spectroscopic, and capillary analyses have also been unsuccessfully resorted to. All these methods, for the time being, have not sufficiently characteristic features to permit the deduction of the degree of toxicity of the examined product. More encouraging results have been obtained by the determination of the refraction index of the 10 per cent neoarsenobenzol solutions. The difference between a good product and a toxic product is especially distinct when making the observations of the same solution of the product, as shown by Kahl, of the Warsaw Pharmaceutic Institute,

during a given time, and at the same intervals. In order to obtain the refraction under these conditions, a watery solution of 10 per cent neoarsenobenzol is prepared and, after having determined the refraction index, the solution is left in a test tube. After some hours, by removing a few drops from the upper layer of the fluid with a capillary tube, the refraction of the solution is again determined. This is repeated every few hours. Curves, closely resembling each other for products of the same factory, are obtained. The curves of the refraction index of products of different manufac-



AT THE KOSCIUSZKO AGRICULTURAL SCHOOL NEAR WARSAW

ture give a different picture. It is still more noteworthy that refraction curves of toxic products differ from the refraction curves of nontoxic products. It is obvious that, theoretically, the refraction of a mixture, such as neoarsenobenzol, may present a more or less accidental aspect. But the conformity between the products of different origin on the one hand, and the contrary showing of the refraction indexes of the good and toxic products, on the other, give hope that the determination of the refraction index may prove of assistance in the search for a physico-chemical estimation of the arsenobenzene derivatives.

In view of the encouraging results obtained, some years ago, with the determination of the refraction index on a considerable number of arsenobenzol derivatives in the State Pharmaceutic Institute, the reporters recently resumed this determination on other samples. The work was begun in the laboratory of the military medical service, in an atmosphere of nitrogen; but later, was carried out exclusively in the air, when it was observed that this index is absolutely the same, whether the work is done in an atmosphere of nitrogen or in the air. In order to determine the refraction index, about 0.6 g. of the studied product is accurately weighed (analytical scales) and dissolved in a known quantity of distilled and boiled water, so as to obtain exactly a 10 per cent solution. This solution is equally distributed in several test tubes of the same dimensions (1.5 cm. in diameter, 10 cm. in height). Without stirring the contents of the test tubes, the refraction index is determined, from time to time, with the Abbe-Zeiss apparatus, at a temperature of 20 degrees. Having noted the refraction index immediately after the product is dissolved, some drops of the liquid are withdrawn from the tubes, after a given time, by means of a capillary tube, and the refraction is again determined and registered. This procedure is repeated at equal intervals. These indexes furnish very characteristic curves. At the beginning of the observation, nearly all the examined products presented a, more or less, rapid diminution of the refraction index. This diminution reached its minimum, at most, forty-eight hours later, but generally much more rapidly, often in two to four hours. Then the index gently rose again and, after six to seven hours, attained its original level. The curves for the products of the same factory were similar, the picture of the refraction being rather regular.

In order to ascertain the relation between the diminution of the refraction index and the toxicity of the examined products, the authors determined the refraction indexes of different products, and compared these with the results of the biological observations. Dr. Przesmycki, of the Hygienic Institute, injected into rats the solution of products whose refraction indexes had been determined, and it was shown that the toxicity increased with the diminution of the refraction index, and became very marked at the instant when the refraction began to rise. A solution of a product first recognized as good, when injected into rats at the instant of renewed rise of the refraction index, caused the rapid, almost immediate death of the animals. The satisfactory products from two factories were exposed, for a few days,

to dry air deprived of its carbon dioxide, and this was followed by the determination of their refraction index and control of their toxicity, by injecting their solutions into rats. The resulting curves closely resembled those of the same products which had been exposed to ordinary air. The only difference was that, after rapid diminution of the refraction index in the two samples, this index rose more slowly for the products that had been exposed to dry air without carbon dioxide, than for those altered by the action of moist air. But all these products became toxic, as proved by the biological test.

In the course of their work, the authors endeavored to determine the refraction index of 10 per cent solutions of salvarsan, sodium-salvarsan, sulfoxyl-salvarsan, and neosilver-salvarsan of Meister Lucius in Hoechst; of the neotreparsan of the Clin Laboratories in Paris; and of Eparseno. The solutions of sodium-salvarsan and neosilver-salvarsan were found to form precipitates in the course of time, or to give liquids too dark for the determination of the refraction index. The authors determined the index of about sixty samples of neoarsenobenzol of the same series of the product. They repeated the experiment by determining the index of the same product, but under different conditions. The material on which their work is based, is not sufficient to permit valuable conclusions, especially since the product is dependent on conditions of manufacture and other irregularities. However, if the data of these recent experiments is considered as conventional data, and is compared with the results previously obtained by the collaborators of the State Pharmaceutic Institute, it will be observed that the results are similar.

The authors regard their observations merely as the first steps taken in the search for the correct route for the estimation, by chemical or physico-chemical analysis, of the toxicological properties of the arsenobenzene derivatives. They emphasize, however, that the facts so far obtained by the determination of the refraction index, or of the DM^1 or SK^2 index (DM^2) are rather encouraging, and that it seems highly important to continue investigations in this direction. At any rate, among the various attempts which have been made to find a mode of determining the toxicity of arsenobenzene derivatives by a chemical or physico-chemical route, the DM^1 and SK^2 indexes and the refraction index are the only ones which seem to furnish characteristic findings, and permit a conclusion as to the investigated properties. The authors, therefore, believe that the foregoing observations justify them in summarizing as follows, the results of the investigations on the chemical estimation of the arsenobenzene derivatives.

SUMMARY

(1) The DM^1 index of an arsenobenzol derivative, of neosalvarsan type, is apparently related to the toxicity of the examined product.

(2) This index differs according to the origin of the examined product.

(3) The refraction index of the upper layer of 10 per cent solutions of nontoxic products of neosalvarsan type, from the same factory, exposed to the action of the air for a like period of time, gives curves similar to each other.

(4) While, as stated, this refraction index varies according to the origin of the examined product, there are different factories whose products give similar refractions. In a general way the determination of the refraction enables one to recognize the origin of the examined product.

(5) The curves obtained by the determination of the refraction indexes of the upper layer of 10 per cent solutions of toxic products, generally differ from the curves of the nontoxic products manufactured by the same factory.

(6) The determination of the DM^1 , SK^2 (DM^2) indexes, as well as of the refraction index, can, to a certain extent, help decide the identity and toxicity of the examined products. This determination can, likewise, guide the chemical estimation in a relatively rapid and easy manner.

(7) Thus, in order to facilitate the determination of the identity and harmlessness of the arsenobenzols, typically represented by neosalvarsan, the manufacturers should furnish, on request, the following information: (a), the quantity of arsenic contained in the product; (b), the approximate DM^1 and SK^2 indexes; (c), the approximate index of initial refraction possessed by a 10 per cent solution of the product.

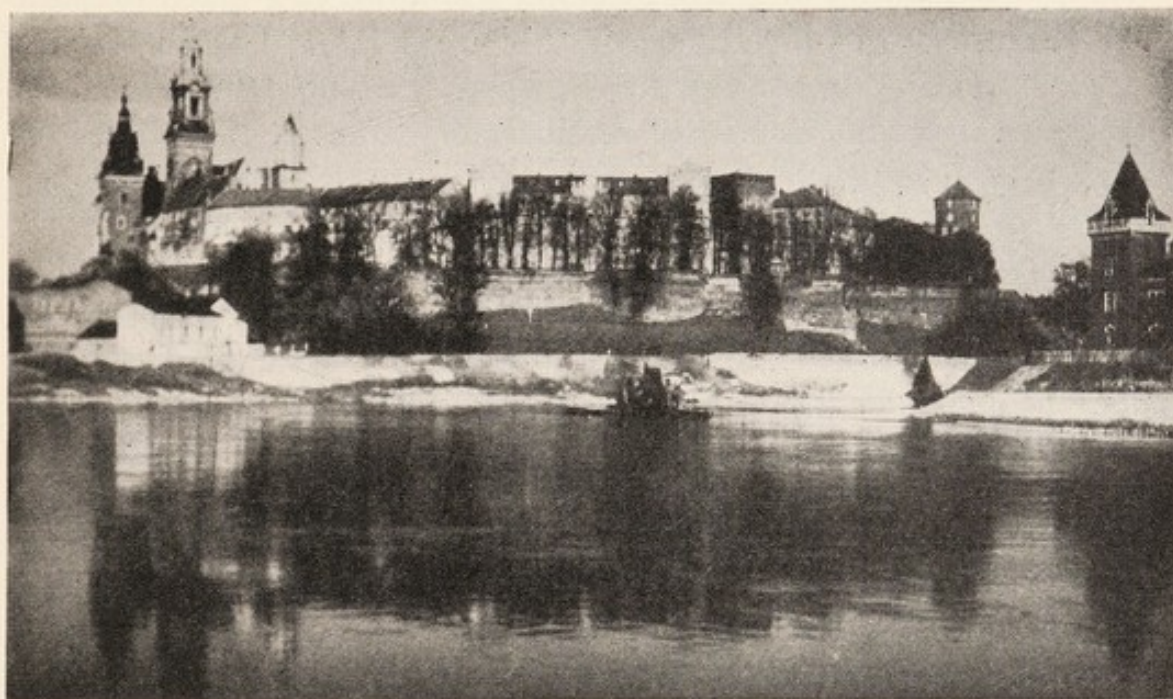
COMMUNICATIONS

MOUNEYRAT (France).

The communication by Dr. A. Mouneyrat, Adjunct Professor of the Medical Faculties, Docteur-es-Sciences, dealt with "The Control of the Purity, the Toxicity and the Therapeutic Activity of the Arsenobenzenes." Endeavors have been made since 1924 to arrive at an international agreement on this subject. A very large number of these controls have been carried out by the author since 1915, but his discussion was restricted to the most commonly employed soluble

arsenobenzene, known as 914. All the soluble arsenobenzenes in use are derivatives of dioxidiaminoarsenobenzene. The last named substance, combined with formolsulfoxylate of sodium, gives the so-called 914, the commercial names of which vary in different countries: Neosalvarsan in Germany, novarsenobenzol in France, neokarsivan in England, neoarsphenamine in America. Combined with sodium formolsulfite, it furnishes the compounds named sulfarsenol, sulfotreparsenan, sulfarsenamine, and others. Combined with sodium phosphite, it furnishes the derivative known as galyl.

The 914 employed in the different countries is not a pure body,



CHURCH IN WHICH MANY ANCIENT KINGS ARE BURIED. WAWEL, CRACOW.

but a mixture, containing about two-thirds of its weight in arsenic and one-third in foreign salts, which include sodium chloride, sodium formolsulfoxylate, sodium sulfite, and small quantities of other metallic salts. The active element in this mixture is the sodium dioxidiaminoarsenobenzene-methylenesulfoxylate, and it is of therapeutic importance to know how much of the active principle is contained in a definite dose. In order to accomplish this object, it is required, in those countries where a control is made, that the examined product contains from 19-20 per cent of arsenic, and any preparation which possesses this arsenical content, besides the physical characteristics, is considered as satisfactory. Such a control is devoid of value, or nearly so, for the arsenic which is determined in bulk may very well

be present in another state than that of 914; for example, in the form of mineral arsenic, arsenite or arseniate, in the form of cacodylate or methylarsenate or the sodium salt of arsenical acids of the aromatic series, these acids being purposely added to raise the arsenical contents of a product too poor in active "arseno." In order for the determination of the arsenic content to be of value, this determination must concern exclusively the arseno separated from the salts which accompany it, by means of a special procedure of chemical analysis.

With respect to toxicity, chemical analysis alone is incapable of furnishing complete information; for while it is necessary to determine the quantity of active principle contained in a given preparation, it must also be ascertained if this preparation does not contain toxic substances. In most countries, where the control of the toxicity is made, white rats are utilized as laboratory animals. This selection does not seem judicious, as these animals are too small and, therefore, do not readily lend themselves to the exact determination of the toxicity and to the observation of the abnormal reactions, which may occur during and after the injection. As the toxicity must be referred to a man of a medium weight of 60 kilos, the smaller the animal experimented upon, the greater is the error committed. It is, therefore, of advantage to take as large a laboratory animal as possible, and the author, for this reason, accords the preference to adult rabbits of a medium weight of two kilos to two and a half kilos; this animal has the further advantage of being more easily handled than mice or rats, and of being more suitable for intravenous injections. The rabbit, moreover, permits the easy demonstration of immediate or delayed reactions. These reactions cannot be readily determined in the case of very small animals. For the investigation of the toxicity, four rabbits are taken, two of which receive an intravenous injection of 20 cg. 914 per kilo, and two others 27 cg. per kilo, the injections being applied into the marginal vein of the ear. The manifestations observed, according to the utilized preparations, may occur in the course of the injection, immediately afterwards, or during the following days. Those animals which have received the smaller dose of 20 cg. show no marked immediate reaction; with a dose of 27 cg., the animal usually remains stretched out flat for a quarter of an hour to half an hour. Any substance which causes the prostration of the animal exceeding three-quarters of an hour to one hour, even at a dose of 27 cg., is a doubtful substance. The injected rabbits are weighed every day, in order to determine their variations in weight during the twenty-five days follow-

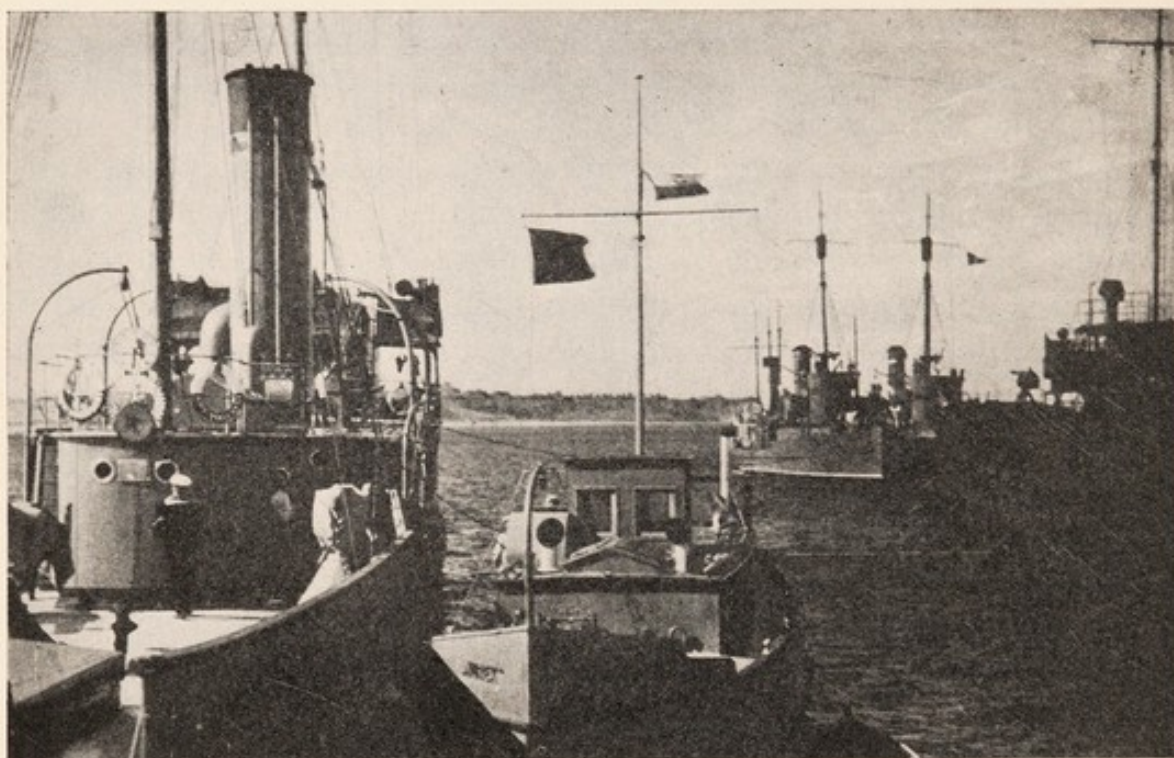
ing the injection; these variations are of great interest, as an attribute of the injected dose. At a dose of 20 cg. per kilo, the rabbit must experience no abnormal reaction; must not lose in weight, or very little; it must put on flesh; and have no diarrhea. Any animal which does not regain its weight and continues to lose flesh, with or without diarrhea, has received a dangerous substance, which must not be employed. Any substance that causes several days' diarrhea, even without marked loss of flesh of the animal, must be rejected. The rabbits are followed for a month and a half after the injection, and no matter what the administered dose, they must remain alive. If one of the rabbits dies during this time, the substance should be rejected.

The control of the therapeutic activity of a medicinal agent must be made on the animal infected by the same microbe as that which is to be destroyed in man. In other words, the control of the anti-syphilitic action of any chemical agent, must be carried out on a rabbit infected by the *treponema pallidum* (*virus Truffi*) or by a related spirochete, for example the spirocheta cuniculi, the pathogenic agent of the spontaneous spirillosis of rabbits. For the therapeutic control of 914, two rabbits inoculated with the virus Truffi are utilized; when the chancre is well developed and the treponemas are present in large numbers in the lesion, 3 cg. per kilo of 914 dissolved in a little distilled water is injected through the marginal vein of the ear. On the next day, the rapidity of disappearance of the treponemas and the course of the lesion are studied under the ultramicroscope. A product which does not induce the disappearance of the treponemas in three days and fails to cause the rapid desiccation of the chancre, is of inferior activity and should be rejected. Moreover, a product which meets with the required conditions of activity, must not permit a recurrence, in the cured rabbits, during a period of observation of one-and-a-half months.

LAUNOY (France)

The investigations of L. Launoy, Adjunct Professor of the Faculty of Pharmacy of Paris, Pharmacien-Major de 1^{ère} Classe of the Reserve, on the "Difference of Resistance of some Strains of Trypanosomes against Arsenical Compounds," showed that the trypanocidal activity of the arsenical compounds, of different manufacture, varies according to the strain of the trypanosome. The *trypanosoma equiperdum* and the *trypanosoma Evansi* are less sensitive and less constant than the *trypanosoma Brucei*. With the latter, very constant results are

obtained with an arsenical compound of definite manufacture. This difference in resistance is not referable to the, more or less, marked trypanocidal activity of the arsenical compound, which manifests itself as well with strongly trypanocidal compounds as with moderately trypanocidal compounds. These facts attract attention to the trypanocidal reaction, which some writers emphasize as a biological characteristic of the neoarsenobenzenes. The trypanocidal activity of a neoarsenobenzene is good for the test with which it has been determined, but it is not applicable to other tests of the same kind.



PART OF THE POLISH NAVY AT GDYNIA

BRETEAU (France)

“The Arsenobenzols; Methods of Analysis and Chemical Appreciation,” were discussed in the highly technical communication of Pierre Breteau, Pharmacien Principal de 1^{ère} Classe, Professor in the School of Applied Sanitary Service of the French Army. A summary of his findings is to the effect that the arsenobenzols are more or less complex preparations derived from more or less pure products. The arsenobenzols are based upon dioxidiaminoarsenobenzene, and contain more or less arsenotetramines, arsenosulfamines, or sulfonates and asymmetrical arsenic. The novarsenobenzols are dilutions of dioxidiaminoarsenobenzene-methylene-sulfoxylate of sodium, containing more

or less disulfoxylate, irrespective of all eventual impurities. The chemical control alone does not permit a conclusion as to the more or less marked toxicity of the preparation. The physiological control is imperative.

THOMANN (Switzerland)

Colonel Thomann, Pharmacien en Chef of the Swiss Army, discussed "The Dosage of Arsenic in the Arsenobenzols." The chemical examination of the arsenobenzols must consist in the establishment of its physicochemical properties and must extend, especially, to the determination of the solubility as well as the identity reactions. This is not sufficient, however, for quantitative determinations must likewise be carried out, aiming at the establishment of the content in arsenic, sulfur, and sulfoxylates. With respect to the determination of the arsenic in Neosalvarsan Hoechst and in other analogous compounds, such as Novarsenobenzol Billon, Novarsol Burmann or Neo-Mesarea 914 "Roche," the author recommends the simple and useful method of Stolle and Fechtig, in Germany (1923). This method is based on the destruction of the organic substances by sulfuric acid and potassium nitrate, and on the oxidation of the arsenic to the state of arsenical acid. The arsenical acid is then titrated iodometrically. This method insures a sufficient destruction of the organic matter. It guards against the loss of arsenic in the form of arsenious acid; this loss being inevitable when the organic matter is destroyed with sulfuric acid without an oxidizing agent.

CERBULESCU (Roumania)

In his communication entitled "Investigations on Neosalvarsan," Pharmacien Lieutenant Colonel Dr. C. Cerbulescu, Chief of the Central Chemical Laboratory of the Roumanian Army, stated that after fatal accidents, which supervened in the Roumanian Army in 1925, following intravenous injections of neosalvarsan (ampullas series *B*), the toxicity of the product, still remaining on deposit in the medical stores of the army, was examined. Careful investigations showed that many neosalvarsan ampullas presented an external appearance distinguishing them from the neosalvarsan series *H*, which at this time was on the market, as well as from a certain neosalvarsan ampullas remaining in the medical store of the army. Some ampullas were found in which the color of the substance had a reddish-yellow tinge difficult to define, and others which presented the identity of neosalvarsan. The author found that the neosalvarsan contained on an average

19.50 per cent of arsenic. On exposing the opened ampullas of neosalvarsan series *B* to the air and diffuse light for two days, he observed that the substance changed slightly in color, but complied with the requirements of the *German* and the *United States Pharmacopeias*. Practically the same findings were noted on exposure of the open neosalvarsan flasks to the air and sun for five days.

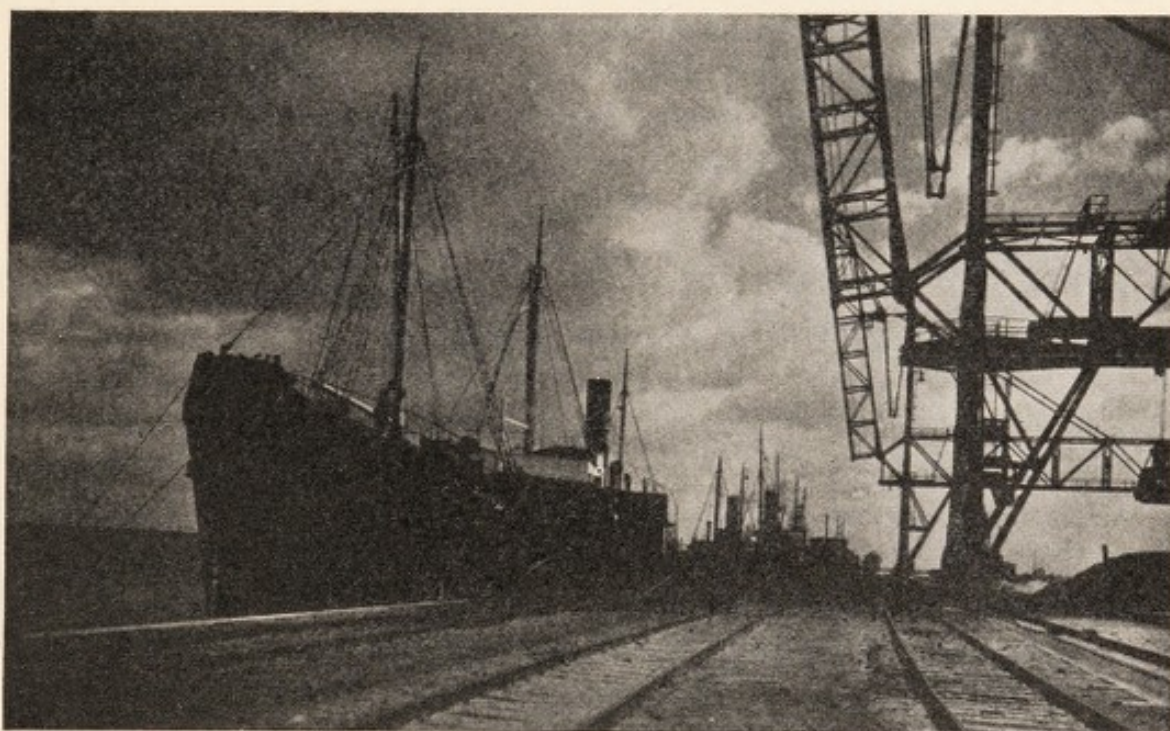
On investigation of the completely altered neosalvarsan of the cracked ampullas, the author noted that, in several, the substance had the appearance of a soft extract, of a blackish-brown color, entirely soluble in water; in others, it had the consistency of a dry extract, incompletely soluble in water, leaving a small yellow deposit. In all cases the watery solution of a reddish-brown color had an acid reaction; with hydrochloric acid it gave a reddish-yellow precipitate; the solution, on addition of iron perchloride, assumed a darker carmine red color, with purplish shades. The other reactions were those required by the two pharmacopeias. The content in arsenic was 19.40 per cent. Neosalvarsan is in an advanced state of change, practically entirely so; that is, it has an acid reaction, a spotted brown or nearly brown color, and even the consistency of an extract, before it fails to comply with the conditions required by the pharmacopeias. A weakly suggested alteration of the neosalvarsan, which may, nevertheless, give rise to symptoms of intoxication, cannot be discovered by the reactions prescribed by the two pharmacopeias, which are rather concerned with the identification of neosalvarsan.

Until such time when reliable chemical reactions are established for the determination of the absolute harmlessness of the product, it is indispensable to resort to the biological control of neoarsenobenzene or analogous products. The International Conference on Standardization of Medicinal Agents, Geneva, 1925, decided on the biological control of medicinal agents of the arsenobenzene group. It would be extremely desirable, however, to be enabled to establish, by a simple microchemical reaction, the perfect state of preservation of the product enclosed in an ampulla, at the precise instant of dissolving it for the injection.

DELIMA (Brazil)

The conclusions arrived by J. Benevenuto DeLima, Capitaine-Pharmacien of the Brazilian Army, in his communication on "The Arsenobenzols, Methods of Analysis, and Chemical Determination," are as follows: The value of the arsenobenzols as medicinal agents and

as one of the triumphs of chemical synthesis is undeniable, but work still remains to be done in order to stabilize their molecule and guarantee their perfect preservation. Neosalvarsan represents a progress over salvarsan, but it is not sufficient; perfection must still be aimed at, in the form of complete intrinsic stability, zero or infinitesimal toxicity. Hence, granting that the arsenobenzols are actually products of wide application, in military as well as civilian medical practice; granting that it is not advisable for a product which is so easily altered and whose alterations are extremely toxic, to be supplied to



THE COMMERCIAL HARBOR AT GDYNIA—POLAND'S PORT ON THE BALTIC

the public without a guarantee; granting that all the pharmacopeias define the general characteristics and the methods for the control of the purity of the medicinal agents, while, nevertheless, the arsenobenzols are not subjected to any official control: It is suggested that the congress arrive, if possible, at an agreement with the different governments, for the official adoption of methods, tests, and dosage of the arsenobenzols.

DENTAL COMMUNICATIONS

HELLIWELL (Great Britain)

“Organization of Dental Service in the British Army,” was described by Colonel Helliwell, Director of Dental Services. The pro-

cedure for the treatment of dental diseases in peace-time is as follows:

(1) Recruits must comply, on enlistment, with a fixed dental standard.

(2) All recruits must have conservative treatment by dental officers during the six months' training period.

(3) Annual inspection and necessary dental treatment of all trained soldiers.

In the British Army in the field, there is but one dental officer to approximately 5,000 men. Each casualty clearing station has one dental officer, one dental mechanic, and some orderlies. The general hospitals of 600 beds have a dental officer and some orderlies; and in those of 1,200 beds, a dental officer, four dental mechanics, some orderlies. At convalescent depots are one dental officer, one mechanic, and one orderly. On the staff of each army there is one inspecting dental officer.

FILDERMAN, WINTERGERST, AND VIAU (France)

Professor J. Filderman, of the Odonto Technical School of Paris, Military Dentist de 1^{ère} Classe of the Reserve, in collaboration with Military Dentist de 1^{ère} Classe of the Reserve Ch. Wintergerst and Military Dentist de 2^{ème} Classe of the Reserve, L. Viau, Chiefs of Clinic in the Dental School of Paris, contributed a communication on "The Organization of the Dental Service in the War of Movement and Position." In the course of the World War, the existing dental training schools in different towns were militarized and charged with the providing of appliances for the toothless and the maxillo-facial casualties. These schools rendered excellent service, notably the Dental School of Paris and Odonto-Technical School of Paris, which were always interested in military affairs and, even at the present day, continue to equip with apparatus, and treat gratuitously, soldiers with facial mutilations, the wards of the nation, and the war orphans of the profession.

WILGA (Poland)

"The Dental Service in the War of Movement and Position," and "The Treatment of Maxillary Injuries in Battle," were the subjects discussed by Professor Dr. H. Wilga, of Poland. The World War furnished many cases of maxillary injuries, which were previously very uncommon; these wounds were very grave, involving physical and psychic distress. The anatomical and physiological peculiarities of the masticating apparatus gave rise to a new specialty:

treatment of injuries of the jaws. The results of this treatment are good and rapid, when carried out as promptly as possible. Men with maxillary injuries must be evacuated directly into the interior of the country. The principal post where first aid is rendered, must be equipped with facilities for surgical procedures and the application of metal wire splints.

GOLDBERG-GORSKI (Poland)

In his communication on the "Organization of Specialized Hospitals for the Treatment of Facial and Maxillary Casualties," Dentist Dr. Goldberg-Gorski pointed out that the number of wounded with traumatic lesions of the jaws during the World War and the Polish War of 1919, and the special mode of treatment of the injuries confronted one with the importance of special hospitals for these wounded. He arrived at the following conclusions:

(1) A specialized hospital is necessary for the rational treatment of injuries of the face and jaws.

(2) The plan of organization of a hospital of this kind must be established during peacetime.

(3) Special training courses, theoretical and practical, must be organized for medical dentists.

BENO (Poland)

Commandant Dentist Stanislas Beno of Poland, discussed "The Organization of the Dental Service in the Field in a War of Movement," and summarized his presentation of the subject as follows: The dental service in the field must aim to be organized in such a way as to insure the necessary attention for the troops through the best possible utilization of the trained personnel and the sanitary material, without incurring exaggerated expense.

MISCELLANEOUS COMMUNICATIONS

GRIMANI (Italy)

A communication was offered by Professor Dr. E. Grimani, of the Reserve Italian Army, entitled "Considerations on the Physiological Alimentary Requirements of Man, Notably of Soldiers." The fighting troops of the army and navy should receive a daily alimentation per man, furnishing 3,900 calories in various foods, including 100 grams of fat. The troops at the rear should receive 3,300 calories supplied by a ration containing seventy-five grams

of fat. In addition, 200 calories should be conceded to soldiers fighting in high mountainous territory, and to young recruits. In the navy, the requirements are the same, with respect to the number of calories as well as the quantity of fat, according to the sailors being afloat or in dock.

BLUMENTALS (Latvia)

The Inspector of Military Pharmacy in the Latvian Army, Pharmaciaen Colonel D. Blumentals, discussed the "Rules Needed for the Examination of Thermometers, Pharmaceutical Glass, and Rubber Articles." The attention of the congress was invited by him to the corresponding indications for the standardization and control of the foregoing articles. He asked the congress to institute the changes recognized as necessary, in order to reach an agreement as to the accuracy of, and conditions to be met by these articles. The accepted indications should be published on an international scale or at least be brought to the knowledge of the armies whose representatives have participated in the congress. In this way, a scientific basis might be created for the manufacture and determination of the good quality of these articles.

CASARINI (Italy)

"Poland and Italy" is the appropriate title given by Tenente Colonnello A. Casarini to the final communication addressed to the congress. He pointed out that the University of Cracow was founded in 1364 by Casimir the Great, on the basis of the age-old Bologna model. A learned Italian magister from Pavia, Giovanni de Sakis, doctor of medicine, here acquired great fame for his compilation of the first statutes of the Polish medical faculty. Later on, the Italian wife of King Sigismund the First, called to Cracow many well known artists and scientists. The Latin tongue became the national language in Poland and was fluently spoken by all classes. The University of Cracow became a wonderful center of learning and attracted students from all parts of Europe. Numerous Italian physicians lived at this time at the Court of Bona Sforza, Queen of Poland and daughter of Gian Galeazzo, Duke of Milan. From the first half of the sixteenth century to the present day, Italian medical men are found in distinguished positions in Poland. Mention must be made among Italian military surgeons, of Michele Bergonzoni (1748-1819), who installed the Polish Military Sanitary Corps and whose work has been

worthily described by Colonel Lodovico Zembrzuski, director of the studies of the Warsaw School of Military Sanitation.

CONCLUSIONS OF THE CONGRESS

After the various reports and communications were read and discussed, subcommittees were formed to draw up the conclusions, which were submitted to the Permanent Committee. The following conclusions were agreed upon by the entire congress, after debate and necessary modifications:



THE PERMANENT COMMITTEE VOTING ON THE CONCLUSIONS OF THE QUESTIONS DISCUSSED AT THE MEETINGS

I

EVACUATION IN MOVING WARFARE

(1) In moving warfare, the influence of tactical conditions, the nature of the territory, and meteorological factors, are of such importance that it is impossible, and would be detrimental, to select a special form of procedure of evacuation of the wounded.

(2) The ideal objective for the treatment of the wounded is the adaptation of all available measures. As regards means of transportation, it is necessary that they be mobile and light. All types, regular or improvised, may be utilized: stretchers, auto-caterpillars, horse-drawn vehicles, railroad cars, and airplanes.

(3) Sanitary tactics should aim at having a minimum of treat-

ment and transportation stations in the large fighting units, maintaining important reserves at the army base.

(4) Sanitary aviation must assume a more and more important part in evacuation in moving warfare, and will, sometimes, remain the indispensable method. The organization of sanitary aviation, beyond the experimental stage, should be investigated in peacetime by studying the adaptation of civilian aërial transportation to medical purposes. The organization of railroad transportation should be studied in peacetime, for its improved adaptation to war.

(5) It is important for the directors of the sanitary service and their special staff officers to be able to settle the variable problems imposed by moving warfare. Only a thorough knowledge, in connection with the military command and the general staff service, will enable them to arrive promptly at a rational and practicable solution of the different eventualities.

II

ETIOLOGY AND PROPHYLACTIC TREATMENT OF INFLUENZA

(1) The actual absence of decisive elements of specific bacteriological diagnosis in influenza, together with the frequent uncertainty of the clinical diagnosis, renders prophylactic measures particularly difficult, especially at the first manifestations of an epidemic. It is desirable that there be an exchange of opinion on this question on every suitable occasion.

(2) Influenza apparently is due to a filterable virus, contained especially in the rhino-pharyngeal mucus and in the expectorated material. Undoubtedly due to the mechanism of energy, this virus permits the attack of very numerous germs, particularly those which cause complications.

(3) The almost exclusive mode of dissemination of the disease is its direct transmission through coughing patients. It is probable, however, that there may be indirect, accidental contagion.

(4) In the army, prompt detection of the disease and isolation of the patients are at the basis of prophylaxis. Early detection is impossible without a close and intelligent collaboration of the command of every grade. The formation of isolation rooms is extremely necessary. Among the numerous complementary measures adapted to existing circumstances, those most to be recommended are the rational organization of medical inspection of the infirmary, the very rapid assigning of his destination to each patient, the spacing of beds in the

wards, the providing of more space for the men, and lightening of their daily duties.

(5) In the hospital, individual isolation should be indefatigably aimed at, either strictly carried out, or by improvised isolation of all patients presenting infectious complications. The utilization of vaccines for the fight against the infectious complications of influenza, should continue to claim attention. The medical and nursing personnel of influenza patients should have their mouths, nostrils, and eyes, protected by masks.

III

SEQUELAE OF CRANIAL TRAUMATISMS AND THEIR TREATMENT

(1) The experience of the World War has shown that, among the sequelae of cranial traumatism, epilepsy, neuropsychoses, neuroses, psychopathic disturbances, and so forth, develop in predisposed individuals.

(2) This category of persons must be eliminated, as harmful elements, from the army, not only in peacetime, but even during war.

(3) Experience having shown that the most favorable results of treatment of cranial traumatism were encountered in those who escaped infection, while the graver cases were observed among those who underwent a prolonged suppuration, methods of treatment are in order, during wartime, which permit the healing of the wounds by first intention.

(4) Among the sequelae of cranial traumatism, epilepsy occupies a preponderating place from the viewpoint of frequency and gravity. It is an imperative necessity to conduct investigations on the pathogenesis of this syndrome.

IV

THE ARSENOBENZOLS. CHEMICAL METHODS OF ANALYSIS AND ESTIMATION

(1) As there is no chemical method which permits a sufficiently reliable and accurate appreciation of the relative toxicity of arsenobenzenes and novarsenobenzenes, further investigations on this point are recommended. The determination of the indexes DM^1 and DM^2 should not be considered as a sufficient measure of the toxicity. It is the desire of the congress that the different governments arrive at an agreement for the adoption of chemical methods of arsenobenzene tests and dosings.

(2) All novarsenobenzenes proposed for medical use should contain not less than 19 per cent and not more than 20 per cent of arsenic.

(3) It is advisable to investigate the possibility of estimating the relative toxicity of the products through the employment of physical methods.

(4) The toxicological experimentation on animals (rabbits, mice, rats) is considered as necessary. The methods elaborated by the hygienic commission of the League of Nations might serve as a model.

(5) Chemical examination remains a control of identity and manufacture.

(6) When the action of an arsenobenzene on an experimental trypanosome affection is under investigation, the action should be designated as "*experimental trypanocidal activity*," but not as a therapeutic activity. This designation should be followed by the name of the flagellate species utilized. The employment of *Trypanosome Brucei* is recommended.

CONCLUSIONS OF THE DENTAL SECTION

(1) In view of the close relations existing between dental pathology and general pathology, the organization of dental services is imperative in peacetime as well as wartime.

(2) A specialized and trained personnel must render the first assistance to the wounded with maxillo-facial lesions.

(3) After the first dressing, the maxillo-facial casualties must be sent directly to the specialized hospitals, without being stopped at intermediate posts.

(4) It is indispensable to establish, in wartime, special hospitals, situated in the interior, for the treatment of wounds of the face and jaws.

(5) The plans for the organization of a hospital for maxillo-facial injuries must be prepared in peacetime.

(6) Special courses, for the training of the personnel destined for the treatment of facial injuries, must be organized in peacetime.

(7) Every infantry regiment must be provided in wartime with a dentist. The same applies to every sanitary station, such as field hospitals, divisional ambulances, and convalescent departments.

SUPPLEMENTARY NOTES

INTERNATIONAL EXPOSITION OF HYGIENE

In conjunction with the Fourth International Congress of Military Medicine and Pharmacy, a most interesting and instructive International Exposition of Hygiene was organized and was visited by over 300,000 persons. This exhibition, which covered a surface of about 40,000 square meters, was composed of the following sections:

- (1) Section of Field Hygiene.
- (2) Scientific and Hospital Section.



A CORNER OF THE EXHIBITION GROUNDS. MEDICAL EXHIBIT.

- (3) Section of Sanitary and Hygienic Installations.
- (4) Section of Pharmaceutic Chemistry and Pharmacies.
- (5) Section of Medical and Dental Instruments.
- (6) Section of Hospital Installations.

A normal medical aid post for emergency cases, with physicians and nurses in attendance and provided with an automobile for any nearby accidents, was organized. A course of popular lectures on hygiene, for the public, was given and scientific films were shown. General interest was aroused by the exhibition of the *Old Polish Medical Book*, organized by the high school of the sanitary service.

Unique, as well as very rare specimens of old medical books could here be seen.

Among the exhibited articles, special mention must be made of those possessing particular military importance, as follows:

(1) Field stretcher, model of General Rouppert, made by Commandant Pharmicien Zlotogorski. This stretcher was exhibited by the Central Department of the Polish Sanitary Service.

(2) Stretcher of Dr. Reverdin of Geneva; very ingenious with respect to its supports, foot-pieces, and extensions.

(3) Belgian field stretcher.

(4) Bacteriological field laboratory, medical case, and field sterilization apparatus, (firm: Charles Krtil, of Prague); exhibited by the Czechoslovakian Ministry of National Defence.

(5) Apparatus for the transportation of the wounded and sick, by Dr. F. Tintner, of Vienna; can be installed in any carriage, wagon, or automobile.

(6) Four-wheeled carriages for the wounded, model of Colonel Pracki and Colonel Dobrowolski. Can be utilized in the sanitary field formations.

(7) Two-wheeled carriages for the wounded, Swedish model; can be utilized even where the roads are bad or lacking.

(8) Carriage structure, model of Colonel Dr. Gilewicz.

(9) Skis and hand sleighs, model of Colonel Chlewinski; permit the transportation of the wounded in winter time, and where roads are poor.

(10) Model of a sanitary wagon, as well as suspension appliances for stretchers in cars, exhibited by the Polish State Railroads.

(11) Rolling disinfecting tank, with douche-baths, by the firm of Grodzisk.

(12) Steam-heated kettles, by Makarewicz, in Warsaw.

(13) Transportable field filter, exhibited by the Sleitzwerke, Kreuznach.

(14) Douching apparatus, transported in an ordinary carriage and easily manipulated, exhibited by the Czechoslovakian Ministry of National Defense.

(15) Radiological apparatus of Gaiffe, Galot, and Pilon, of Paris.

(16) Radiological field apparatus, Victor X-ray Corporation, of Chicago.

(17) Convenient syringe containers for physicians' cases exhibited by the firm Jodlowski, of Warsaw.

(18) Oxygen inhalation apparatus, serving for several patients at the same time, from the firm Perun, of Warsaw.

(19) Improved apparatus for subcutaneous injection of oxygen, from the firm Perun, in Warsaw.

(20) Quartz lamps from the firm Blachowicz, in Czestochowa.

(21) Hemostatic bandage, invented by Singer and Rozwadowski.

(22) Individual dressings package, from the Dutch Dressings Works, in Utermohlen.

(23) Statistical curves and radiographs from the Military School of Sanitary Service.

(24) Anthropological charts.

(25) Roentgenograms from the District Hospital No. 1, named for Marshal Pilsudski.

(26) Roentgenograms and surgical atlas from Val-de-Grâce Application School, exhibited by the General Directorate of the French Sanitary Service.

EXPOSITION OF THE FINE ARTS

There was a very interesting exhibit of paintings and sculptures depicting scenes of battle and the cure of the wounded on the field. The foreign delegates were enabled to gain an idea of the development of the fine arts in Poland, through these excellent works.

POSEN EXHIBITION

In celebration of the tenth anniversary of the rebirth of Poland as an independent nation, an exhibition, destined to visualize the achievements of the country in the single decade of its renewed existence, will be held in Posen from June 1 to October 1, 1929. Over \$30,000 have been contributed by American Poles for the erection, decoration, and installation of a special pavilion, which will be used for the display of certain exhibits and, later, will be turned over to the government to be used as a museum.

TOURS

At the completion of the work of the congress, and after the delegates had visited all sections of Warsaw, including the very modern and well organized military medical establishments, various tours were arranged to centers of interest, and guides were provided. Visits were made to Posen, Wilanow, Lwow, Wilno, Gdansk.

Some of the delegates, under the guidance of General Horodynski, visited the Kosciuszko Agricultural School in Lowicz, and were very much interested in the work being done there.

A trip was taken to Cracow, where the Lord Mayor received the delegates, who visited the military hospital and found it had a number of features of special interest. The John Piltz Hospital for Mental Diseases is very well equipped and organized.

A most unusual tribute to a great man is Kosciuszko's Mound in Cracow. This was formed from earth brought from the various battlefields on which Kosciuszko fought, some coming from the United States. The American delegation placed a wreath on the top of the mound.

A very interesting inspection of the salt mines at Wieliczka, the oldest and largest in the world, was made by some of the delegates who were received by the Town Council. The yearly production amounts to about 75,000 tons of salt. Deep in the mine are the ancient Chapel of St. Anthony (1691), a church, and a large assembly room, all formed from excavations in the salt.

The Red Cross Sanitorium at Zakopane, a famous health resort, was visited, as was the Mineral Waters' Establishment at Szczwnica, and the Thermal Springs Health Establishment at Krynica.

At Gdynia, Poland's commercial and naval port, on the Baltic, there were signs of great activity. There are long piers and the beginning of a basin to accommodate a very large fleet inside the breakwater. Many vessels are in the process of construction, and a new railroad is being built, running from this port directly to Warsaw and other parts of Poland, without passing through the Free City of Danzig.

At all of these places the delegates were graciously received by local committees previously organized, and by the town officials, and banquets and receptions were given in their honor. Speeches were made by many of the representatives including Colonel Van Baumberghen, Major Voneken, Colonel Gilbert Seaman, Commander Bainbridge, General Suleiman Emin Pasha, General Losman, and particularly by Colonel Fronczak who, by virtue of his knowledge of Polish national life and language, was able to interpret clearly, the depth of gratitude and cordial sentiments of the foreign guests.

MISCELLANEOUS

President Moscicka, of Poland, received the foreign delegates officially in the Royal Palace. He conversed with nearly all the chiefs of delegations and showed a lively interest in the work of the congress.

A reception was given to the members of the congress by Marshal Pilsudski, at which were present the President of the Republic, the Diplomatic Corps, members of the Government, representatives of science, literature, and art.

An official reception was given by the Municipal Council of Warsaw in the City Hall; a concert of Polish music was held in the Philharmonic Hall; and a gala operatic performance was given in the ancient theater of the Lazienki Park, after which General and Mrs. Rouppert held a reception in the Lazienki Castle.

Many receptions were held in Cracow, and a wonderful concert was given, in which musicians from all over Poland, participated.

A ladies' committee was arranged for the entertainment of the wives and daughters of the delegates, and most pleasant and interesting plans were carried out.

All the delegates who wished to travel through other parts of Poland, not covered by the special trips of the Congress, were furnished railroad tickets at reduced rates.

The work of the different local Polish committees cannot be adequately praised. Everywhere there was complete cooperation. The meetings of the Congress could not have proceeded with their systematic precision, had it not been for the excellent organization previously arranged and the effective interest of the former Surgeon General of Poland, now Minister of the Interior, General Skladkowski, and Surgeon General Rouppert, president of the congress. The cordial hospitality and the kindly spirit of the Polish nation, were in evidence at all times, in the large cities as well as in the small towns, which were visited. Nothing that was possible to be done for the interest, comfort, and good cheer of the delegates, was left undone.

At the end of each congress there is a closer tie and feeling of kinship among the members than at the preceding one. As the delegates learn to know one another better and obtain a clearer understanding of national opinions, manners, and customs, differences are gradually obliterated, and a broader outlook is obtained. It is this viewpoint, this intelligent understanding of the unusual in each country, that develops mutual confidence and respect and helps forge an international bond of good will, so necessary if the evil of war is to

be stamped from the face of the earth. In addition, there is no nobler ideal towards which man can strive than to help his fellow man in time of suffering—be it physical or mental—in peace or in war. And this is the great aim of the congress.



ALPHABETICAL LIST OF CONTRIBUTORS

- Aissopos, Doctor, Médecin-Major of the Army, Chief of the Athens Surgical Center (Greece).
- Anastasiu, Victor, Lieutenant (Roumania).
- Barrow, H. P. W., Major General, Director of Hygiene (Great Britain).
- Behague, P., Médecin Aide-Major de 1^{ère} Classe of the Reserve, former Adjunct Chief of Clinic of Diseases of the Nervous System in the Medical Faculty of Paris (France).
- Benoid, A., Doctor (France).
- Beno, Stanislas, Commandant Dentist (Poland).
- Bertein, Médecin-Major, Adjunct Professor at the Military School of Sanitary Service (France).
- Bertrand, Y., Médecin Aide-Major de 1^{ère} Classe, Laboratory Chief of Nervous Diseases in the Medical Faculty of Paris (France).
- Billet, H., Médecin-Major of the Reserve, Professor of the Free Medical Faculty of Lille (France).
- Blumentals, D., Colonel-Pharmacien, Inspector of the Military Pharmacy of Latvia (Latvia).
- Breteau, Pierre, Pharmacien Principal de 1^{ère} Classe, Professor in the School of Applied Sanitary Service of the French Army (France).
- Bujwig, O., Doctor, Professor (Poland).
- Butoianu, M., Médecin-General, Professor of the Jassy Medical Faculty, Chief of the Military Hospital "Regina Elizabeta" (Roumania).
- Caccia, Filippo, Colonnello Medico, Doctor, Professor, Director of the Military Hospital in Bologna (Italy).
- Cantonnet, A., Médecin-Major de 1^{ère} Classe of the Reserve, Ophthalmologist to the Beaujon Hospital in Paris (France).
- Casarini, A., Tenente Colonnello (Italy).
- Cerbulescu, C., Doctor, Pharmacien Lieutenant Colonel, Chief of the Central Chemical Laboratory of the Roumanian Army (Roumanian).
- Costa, S., Médecin-Principal of the Reserve, Doctor, Professor in the Marseilles Medical School (France).
- Courboules, Médecin-Major, Adjunct Professor at the School of Military Sanitary Service (France).
- Cruzon, O., Médecin-Principal 2^{ème} Classe of the Reserve, Physician to the Salpêtrière, Paris (France).
- De Bernardinis, Virginio, Doctor, Maggiore Medico of the Rome Military Hospital (Italy).
- De Lima, Benevenuto J., Capitaine-Pharmacien of the Brazilian Army (Brazil).
- De la Rivière, R. Dujarric, Médecin-Major de 2^{ème} Classe of the Reserve, Laboratory Chief of the Pasteur Institute, Auditor to the Superior Council of Public Hygiene of France (France).

- Disery, Henry, Capitaine Pharmacien of the Belgian Army (Belgium).
- Dopter, Ch., Médecin Inspecteur, Director of Val-de-Grâce (France).
- Erhardt, Richard, Médecin-Colonel, (Sweden).
- Filderman, J., Professor of the Odonto-Technical School of Paris, Military Dentist de 1^{ère} Classe of the Reserve.
- Fribourg-Blanc, Médecin-Major de 1^{ère} Classe, Adjunct Professor at Val-de-Grâce (France).
- Gabrielle, H., Doctor, Médecin-Major de 1^{ère} Classe, Adjunct Professor of the Lyon Faculty, Surgeon to the Military Teaching Hospital of Desgenelles (France).
- Garbowski, Doctor, Lieutenant-Colonel (Poland).
- Garino, Julio R., Director of the Sanitary Service of the Argentine Army (Argentina).
- Giarrusso, G., Tenente Colonnello Medico Professor, Clinical Instructor in Nervous and Mental Diseases (Italy).
- Goldberg-Gorski, Dentist, Doctor (Poland).
- Grimani, E., Professor, Doctor, Reserve, Italian Army (Italy).
- Guibert, Médecin-Major de 1^{ère} Classe, Physician to the Military Hospitals, Physician in charge of the Begin Military Hospital, Paris (France).
- Guillain, G., Médecin-Major de 1^{ère} Classe of the Reserve, Professor of Nervous Diseases in the Medical Faculty of Paris (France).
- Guimaraes, Carlos Eugenio, Médecin-Major (Brazil).
- Harvey, D., Major General, Director of Pathology (Great Britain).
- Halid, Fazil, Lieutenant Colonel, Chief Surgeon of the Military Hospital (Turkey).
- Helliwell, Colonel, Director of Dental Services (Great Britain).
- Hertz, Richard, Doctor of Warsaw (Poland).
- Higier, Henri, (Poland).
- Hume, Edgar Erskine, Colonel, United States Army (United States of America).
- Jausion, H., Médecin-Major de 2^{ème} Classe, Adjunct Professor at Val-de-Grâce (France).
- Jurgens, Médecin-Aide Major (Denmark).
- Karwacki, Leon, Doctor, Colonel, Adjunct Professor in the University of Warsaw (Poland).
- Koelichen, Doctor
- Krynski, Leon, Doctor, Professor (Poland).
- Lacaze, Médecin-Major de 1^{ère} Classe, Adjunct Professor at Val-de-Grâce (France).
- Lakmunt, Stanislas, Medical Lieutenant (Poland).
- Launoy, L., Pharmacien-Major de 1^{ère} Classe of the Reserve, Adjunct Professor of the Faculty of Pharmacy of Paris (France).
- Lereboullet, P., Adjunct Professor of the Medical Faculty of Paris, Physician to the Children's Hospital (France).
- Leri, André, Doctor, Adjunct Professor of the Medical Faculty, Physician to Saint Louis Hospital, Paris (France).

- Leriche, R., Médecin-Major de 1^{ère} Classe of the Reserve, Professor of Clinical Surgery of the Medical Faculty of Strasbourg (France).
- Maisonnet, Médecin-Major de 1^{ère} Classe, Professor at Val-de-Grâce (France).
- Minet, Jean, Professor, Médecin-Major de 1^{ère} Classe of the Reserve (France).
- Mouneyrat, A., Doctor, Adjunct Professor of the Medical Faculties, Docteur-es-Sciences (France).
- Munro, D., Air Vice-Marshal, Director of the Royal Air Force Medical Service (Great Britain).
- Nadolski, Doctor, Medical Lieutenant-Colonel of the Polish Army (Poland).
- Niemyski, Anatole, Medical Lieutenant of the Polish Army (Poland).
- Olbrycht, J., Doctor, Pathologist of the Military Hospital in Cracow (Poland).
- Ostrowski, Thaddeus, Professor of the Lwow Faculty (Poland).
- Oudard, Doctor, Médecin Chef de 1^{ère} Classe of the French Navy, Professor of Clinical Surgery (France).
- Owezarewicz, Leon, Doctor, Lieutenant-Colonel Military School of Sanitary Service (Poland).
- Panaiteescu, V., Doctor, Médecin Colonel of the Roumanian Army (Roumania).
- Papastratigakis, Doctor, Past Chief of the Military Neuro-psychiatric Center, Athens; Physician of the Reserve (Greece).
- Poplawski, W., Doctor, Lieutenant-Colonel, Pharmacist-Chemist (Poland).
- Rosenhauch, Edmund, Doctor (Poland).
- Rouvillois, Henri, Medical Inspector, Director of the Sanitary Service of the Tenth Army Corps, Past Professor of War Surgery at the Application School Val-de-Grâce (France).
- Sacquée, E., Medical Inspector, Permanent Inspector of Hygienic and Epidemiological Services of the French Army (France).
- Saint-Sernin, Pharmacien-Chimiste en Chef de 2^{ème} Classe, of the Navy (France).
- Schickele, Médecin Principal de 2^{ème} Classe, of the French Army (France).
- Seaman, Gilbert E., Colonel, (United States of America).
- Spire, Doctor, Médecin Principal de 1^{ère} Classe, Medical Chief of the War College, Paris (France).
- Stoian, C., Médecin-Major, attached to the First Surgical Service (Roumania).
- Tewfik, Salim, Colonel Professor (Turkey).
- Thomann, Colonel, Pharmacien en Chef of the Swiss Army (Switzerland).
- Vandremer, Doctor, Colonel (France).
- Viau, L., Military Dentist de 2^{ème} Classe, Chief of Clinic in the Dental School of Paris (France).

Weglowski, R., Professor, Médecin-Principal Commandant of the Sixth Regional Hospital in Lwow (Poland).

Weil, Doctor, Lieutenant, Director of the Pharmaceutical Institute of the Polish State (Poland).

Weitzel, Médecin Principal de 2^{ème} Classe, Consulting Surgeon of the French Army on the Rhine (France).

Wilga, H., Doctor, Professor (Poland).

Wintergerst, Ch., Military Dentist de 1^{ère} Classe Chief of Clinic in the Dental School, (France).

Worms, G., Médecin-Major de 1^{ère} Classe, Professor at Val-de-Grâce (France).

Zawadowski, Medical Commander (Poland).



