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### **MILITARY PLASTIC AND ORAL SURGERY.\***

**A Series of Four Lectures Reviewing Some of the Recent Literature.**

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Lecture 1. The Extent of the Literature; Comparative Value of Books and Current Journals; Groups of Articles on Plastic and Oral Surgery; the Relation of the Medical Library to the Community; Asepsis and Antisepsis in War Surgery; New Studies of the Treatment of Wounds; the Establishment of the Division of Plastic and Oral Surgery an Important Event.

Lecture 2. General Surgical Considerations; Treatment of Wounds; Asepsis and Antisepsis; New Factors in the Treatment of Wounds; Studies of Tissue Injuries by Gunshot Wounds; Irrigating Solutions, Antiseptic Pastes.

**A**T first thought it might seem that the department of surgery included in this course would constitute a rather small division of surgical literature, but the more one looks into the matter the wider the range of subjects becomes to get a comprehensive view

of what the profession is doing, or should do along this line.

To give you some idea of the amount of literature involved in this division, I recently made an estimate of titles from the last two years of surgical current literature. You will be surprised perhaps, to know that almost without effort I secured more than twelve hundred titles on the surgery of face and neck and can-

\*Delivered before the Officers' School of Plastic and Oral Surgery. Established by order of the Surgeon-General of the Army, Northwestern University Dental School, 1918.

not by any means claim to have completely covered all the periodicals. Among the headings may be mentioned anatomical considerations, physical examination, inflammation, infection, abscess formation, infections confined to the mouth, injuries to the mouth and jaws, infections confined to the teeth, the periodontal membrane, the maxillary bones, motor and sensory nerve disturbances from injury, hemorrhage, shock, anesthesia, dislocations, excisions, resections, surgical technic in general, deformities and defects due to injuries. These may be mentioned as some of the subdivisions of the subject. There remain purely technical questions which will be presented by others.

For convenience, I have divided the literature under several heads, each of which has been given a number and the bibliography is arranged in the same order.\*

The divisions:

1. General Surgical Considerations of the War.
2. Military Clinical Organization for Special Surgery.
3. First Aid—Civil and Military.
4. Surgical Technic.
5. Wounds—General Treatment.
6. Infected Wounds.
7. Infected Wounds—Open treatment.
8. Infected Wounds—Antisepsis.
9. Infected Wounds—Pastes; bismuth, iodoform, paraffin.
10. Infected Wounds — Dichloramine T.
11. Infected Wounds—Isotonic sodium hypochlorite solution—Carrel-Dakin-Daufresne.
12. Infected Wounds—Light and air.
13. Infected Wounds—Indications for secondary suture.

14. Shock.
15. Hemorrhage—Blood vessel surgery.
16. Leucocytes — Coagulability—Blood-pressure.
17. Transfusion.
18. Bacteria and Bacteriology.
19. Anthrax, Gas Gangrene, Tetanus and other special infections.
20. Prophylactic Vaccines.
21. Jaws—Injuries.
22. Jaws—Fractures.
23. Plastics.
24. Dental Procedures.
25. Oral Surgery.
26. Removal of Foreign Bodies.
27. X-Ray in Injuries of Face, Jaws and Head.
28. Injuries of Neck, Salivary System, Pharynx and Larynx.
29. Nerve Injuries.
30. The Sinuses.
31. The Nose.
32. Burns.
33. Skin, Fascia, Fat, Muscle and Bone Transplantation.
34. Anesthesia.
35. Post-Operative treatment.

#### COMPARATIVE VALUE OF BOOKS AND CURRENT JOURNALS.

Before taking up the subject in detail, I will say a few words regarding the value of medical literature. The John Crerar Library has very kindly prepared a special list for students in the various courses given in Chicago in connection with the preparation for the work of the war. This list, while very valuable, is confined almost wholly to books. A number of periodicals are named in the list but they are simply references to bound volumes to be found in the library which you can consult for such facts as you may desire to search out. For the most part however, it is a list of references to books, government publications, dictionaries, works on anatomy, works on the practice of medi-

\*Note—The articles under each heading were assigned to members of the class and brief written reports were presented to the class. This consumed one hour each week and the other was taken for lectures.

cine, works on hygiene and public health, hair and skin and teeth, etc. There is also a splendid list of works on military hygiene, and naval hygiene; also a useful list on food analysis, with references to works on first aid which are desirable, as are also those on injuries by gas and electricity. The nursing profession is well taken care of in the list, as is hospital practice. More than half the pamphlet is given up to diseases classified by systems, as for example the circulatory system, the respiratory system, the digestive system, genito urinary system, nervous system, etc. There is a good list on infectious diseases and venereal diseases. Surgery is especially well taken care of.

Some of these books we will refer to in detail. There is a very respectable list of books on surgery of the head, another good list on surgery of the thorax and the neck. As might well be expected, abdominal and pelvic surgery are well covered. There are not so many books on the extremities or the heart and blood vessels, but there are enough. The eye and ear are both well cared for. The list on operative and military surgery, including emergency surgery covering injuries and bandaging, is extensive. Every one is more than welcome at the John Crerar Library to use the books and journals which will be found on file. I trust each one will take advantage of this opportunity.

I wish to refer to the current literature as a part of one's armamentarium. If we analyze the way in which scientific facts are brought to the attention of the profession, we find that it is usually in the following manner: First, there is a period of experimentation in which facts and data are accumulated; perhaps a single case may be observed, or there may be records of a thousand cases of a particular kind. There may be laboratory work of an experimental character and data is kept of the daily

routine; possibly there is animal experimentation, which has proved very valuable in many lines of our work. Take for example the work done many years ago by Nicholas Senn of Chicago on gunshot wounds of the abdomen, in which he used large numbers of dogs in carrying out a systematic series of experiments. The data was kept from day to day and finally when the series was finished, the results were worked into proper shape for presentation to the profession. After accumulating the necessary data, it is usually presented to some medical society or before the college clinic. Here it is discussed for the first time; criticisms are made and new facts are brought out. Perhaps some one else is working along the same lines and another set of facts is developed.

The second step, as a rule, is the publication in a medical journal. Thus the subject appears for the first time in current medical literature, and comes to the attention of the general medical world, to receive free discussion and criticism. If it is an important subject, perhaps several publications are required before the author has made his work plain. Additional criticisms may appear from other authors. There may be several months or years of discussion before societies and in the journals, until finally the more important facts will be crystallized into a book.

I mention these details to show that this process practically always takes place before important matters get into the books. On an average books are five years behind the medical journals in bringing to us the facts of the progress of the profession. Of course they reach us in a much better shape in books than in journals. They have been redigested, so to speak, by the time they get into the books. Usually the first appearance of a subject in a medical journal is purely preliminary, but by the time it gets into medical books the facts are supposed to be well established

and fairly well accepted by the profession. We can place more reliance on what we read in medical books than what we read in medical journals. On the other hand, if we place our sole dependence on what we read in medical books we will be very much behind those who are good readers of current medical literature. For this reason I have always been impressed with the value of current medical literature. It is true that one reads a good deal that is useless and which must be discarded after the subject is worked out more thoroly, but there is a certain inspiration about current medical literature that one cannot get from any other source. It makes him a part of the development of his profession, a member of the family so to speak; the book reader may be only a visitor.

#### THE LIBRARY.

Webster defines a library as "a considerable collection of books kept for use and not as merchandise." According to this definition, emphasis is placed on the usefulness more than on any or all other qualities of a library. That there has been a wonderful awakening in the matter of libraries, both private and public, both secular and scientific, is patent to every one. This awakening has not been sudden nor without long preparation. It has been coincident with more extended and thoro education. The library is a part of our educational system and is now generally so accredited. To the practical physician it is much more. The word "library" is so intimately associated with culture, progress and achievement that it is hard to conceive of one without the other. Bacon says: "Libraries are the shrines where all the relics of the ancient saints, full of true virtue and without delusion or imposture, are preserved and reposed."

Who does not mourn the loss of the great Alexandrian Library, with its priceless treasures, and who can say

how much of the world's progress was impeded thereby? The great and many sided Virchow has truly said: "All scientific research is really literary." Who can read the history of the life and achievements of Virchow, Darwin, Pasteur, Cohn, Broca, Hulings Jackson, Gross, Pepper, Osler, Davis or Senn without realizing the truth of Virchow's assertion. They were scientists, they made experiments, they studied their cases, they were practical everyday practitioners of medicine and surgery, with few exceptions, but above all that and more than all they were students of the literature of their profession. They read the great masters, they followed them, they learned them, and only by their aid were they able to write intelligently, interestingly and profitably. The colleagues we love most and who appeal to us most are those who know the history of their profession best. It is only thru the library, thru the books and periodicals which form our libraries, that we can know the history of our profession and the signs and progress of our times. Books and periodicals grouped together constitute libraries. Osler says: "It is hard for me to speak of the value of a library in terms which would not seem exaggerated. Books have been my delight these thirty years and from them I have received incalculable benefits. To study the phenomena of disease without books is to sail the uncharted sea, while to study books without patients is not to go to sea at all. To be a real value there must be a general and continuous use; the books must be made available and their use attractive. What exsuccous attenuating offsprings books would be but for the pabulum furnished thru the placental circulation of a library."

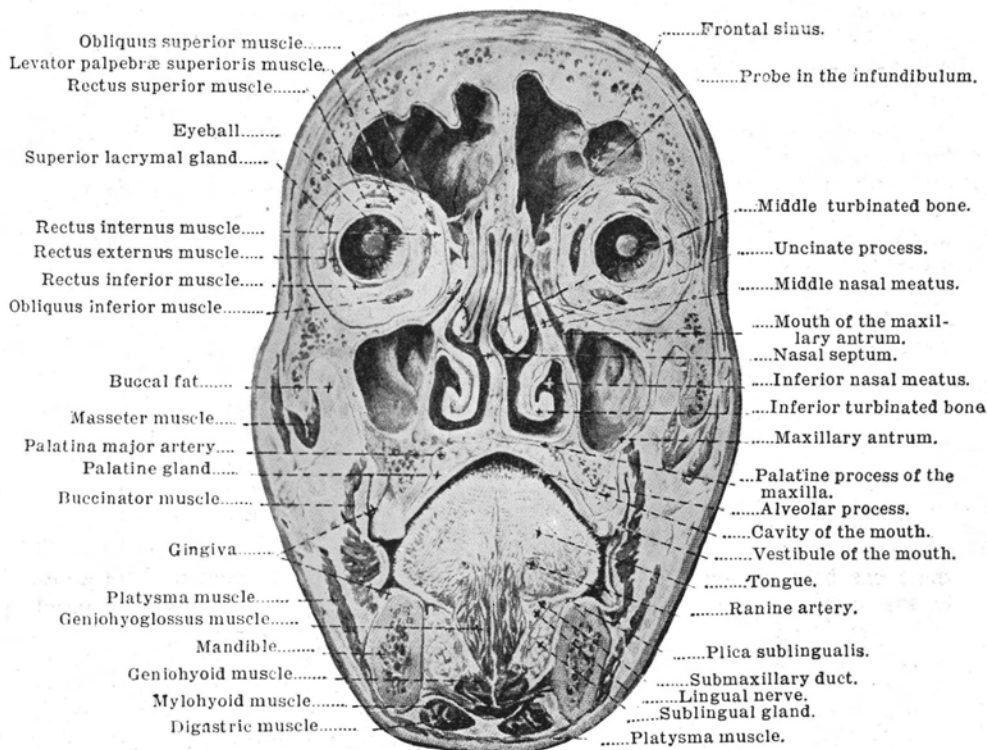
There is little doubt but the "love of study" and the "desire for knowledge" is the power which attracts most men



into medicine. How, then, are we to foster and cultivate this spirit thruout the medical career? Dr. Spivak has pointed out that "the medical school course is merely preparatory for what is to follow. Real knowledge of the

cal societies are valuable means of educating, fostering and encouraging thought, but they have their drawbacks; the stated meeting that one is unable to attend, the subject that one is obliged to listen to, in which he is not in-

Figure 1.



"Coronal section thru the face.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 3.

science and art of medicine is post-graduate. Private practice is the first institution, a teacher grim and morose, but of the highest order if one only knows how to take advantage of its chastising lesson. Hospital practice is an institution wherein instruction is more systematized, the observation more certain and the results better noted. \* \* \* Medi-

terested, the idle and empty discussion from which there is no escape even in the best societies. There is but one grand institution that stands above all, that has all the virtues and none of the defects of those enumerated, and that is the library. On this shelf is my physiologic laboratory, on the other is my biologic institute, here is my anatomic

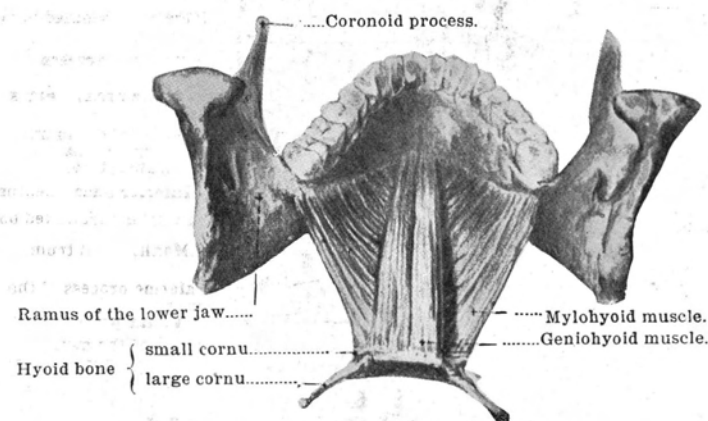
theatre; there my lying-in hospital. The records of medical progress, thousands of clinical reports, the teachings and the research of the best medical minds of all times and all places will be found in the medical library and they are available to every student."

#### RELATION OF THE MEDICAL LIBRARY TO THE COMMUNITY.

Let us consider a moment the relation of the medical library to the com-

taught him to expect these things, and if he has the right to expect them, what shall we say to ourselves when he is disappointed? Have we made every effort available? Have we mastered what the masters have to teach us of the disease we assume to treat? Are we able to say that our diagnosis is as correct and our treatment as appropriate as the great teachers available to us in our literature can teach us to make

Figure 2.



"Muscles that form the floor of the mouth stretching between the concavity of the body of the mandible and the convexity of the hyoid bone.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 4.

munity in which we live. This relation, of course, is entirely enveloped in the medical man himself. The members of the community expect when they call on the doctor for services that they will receive a correct diagnosis of the case, and that the case will receive the most approved treatment known to the medical profession. Thus we see the responsibility which confronts the doctor on assuming charge of any one sick or suffering. How far do we fall short in our duty of furnishing to our patient what he expects? Is he unreasonable in his expectations, in fact, have we not taught him to expect as much, and, if we have

them? Or are we shifting along with a smattering of knowledge which is continually leading us astray and filling the cemeteries with monuments which silently, but truly commemorate our lack of easily available knowledge? The people know something of the medical schools and their facilities and of the medical books and their qualities and of the medical journals and their progress. If we have made full use of all of these agencies for completing and perfecting our knowledge of the profession which we practice, we have no just cause to sorrow should we fail to meet the expectations of a patient. Too often it is



Plate I.

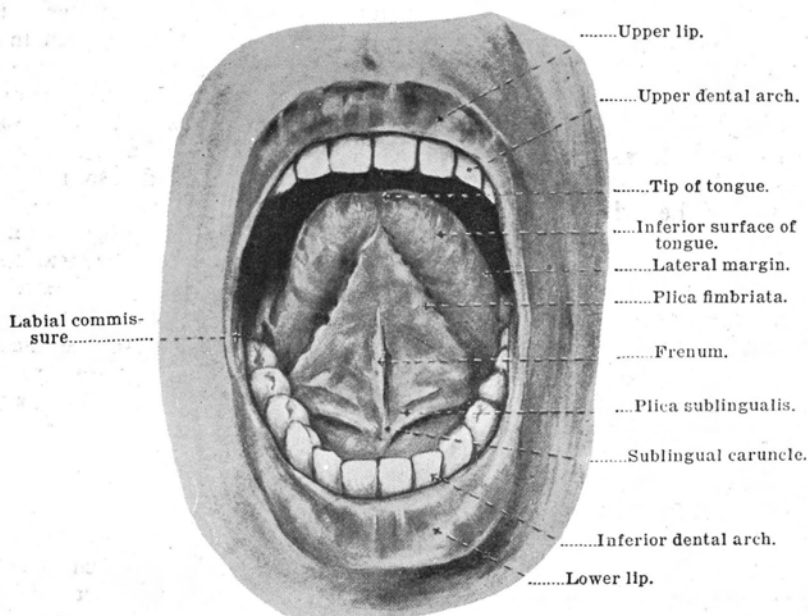
"Drawing of a patient with Haemolytic Jaundice accompanying a fatal general toxemia from an Anaerobic Infection." From, "General Septic Poisoning in a man suffering with 'Gas-gangrene' of the Arm." By Lt. Colonel Butler, R. A. M. C., British Journal of Surgery, July, 1915, 117.

plain that such effort at securing information has not been made. The community is interested to know whether, as medical men, we are making full use of these various agencies for keeping abreast of the times, which will enable us to bring to the sick child or ailing mother the very best in the medical progress. We should not be satisfied

inspiration of the hour, we must keep close to the current medical literature.

The second reason is, that much will be found in current literature which cannot be found in other places. I mean much which is especially adapted to the needs of the work in hand. Progress has been especially recent and rapid in this field of surgery.

Figure 3.



"Mucous reflections under the anterior of the tongue.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 5.

with less. We all know full well that the best is none too good.

There are then two very good reasons why a great deal of what we consider in this course in the literature of the subject should be taken from the current medical literature. This should be checked up by the use of the books and in many instances the books will be much more helpful than the current literature. But on the whole if we want to keep up with the times and get the real

Our government is using every effort to get this necessary information into the form of manuals for the use of its medical officers but this task is by no means completed and no doubt some of the manuals will be disappointing and will have to be rewritten. Consequently it is desirable to devote considerable attention to the literature which has appeared in the last few years on the subject of war surgery in its several departments.

The evolution of this literature is a

wonderful thing in itself. You all remember full well that it is only one or two years ago, that one could hardly get a hearing before a first-class medical or surgical society for any subject connected with the treatment of wounds. It is a subject which has been much neglected until recently. Every medical society meeting was taken up with subjects connected with the upper abdomen, the mid-abdomen, the lower abdomen, the pelvis, the brain, but there has been little time for the subject of the treatment of gunshot wounds or compound fractures. The day of compound fractures was long ago. That was the class of injuries which gave Lister his inspiration and on which he did his first great work in demonstrating to the world the value of the antiseptic treatment of wounds. Following Lister's announcement in 1867 regarding his method of treating compound fractures and other wounds there was an enormous literature, for that day, on these subjects. Then it was the treatment of wounds above the other subjects which were considered in medical society meetings. It had a wonderful hold and was altogether the most important subject ever taken up by the medical profession. That consideration was thought to be complete, many thought that the last word had been said on the use of antiseptics. We had settled down to treatment by the aseptic method. To a man coming into the world of surgery today even the word "Listerism" means little or nothing unless he takes pains to go back and study the history of the development of antiseptic surgery as begun by Lister, following out the work of Pasteur on the germ theory of disease.

Now it transpires that just at the time when we thought the last word had been said on antiseptic surgery and in fact antiseptic surgery had been given a back seat and asepsis had entirely taken its place even in the treatment of wounds, we are awakened to a realization that

after all antiseptic surgery is the great theme before the world as developed by this mighty war and we are confronted by the fact that even the leading surgeons are not well trained in the care of accidental wounds, gunshot wounds, bullet wounds, etc., and we find it necessary to "right about face" and study the whole problem of surgery over again. In fact many of us were born into the medical profession after the subject of wound surgery had been largely talked out and are finding it necessary to really begin at the bottom and study the whole question anew. Perhaps we have some advantage over the men who were familiar with the old Listerism and who had to rid themselves of that before they could take up asepsis. Many men never succeeded in the practical application of asepsis after they had once come to depend on antiseptics.

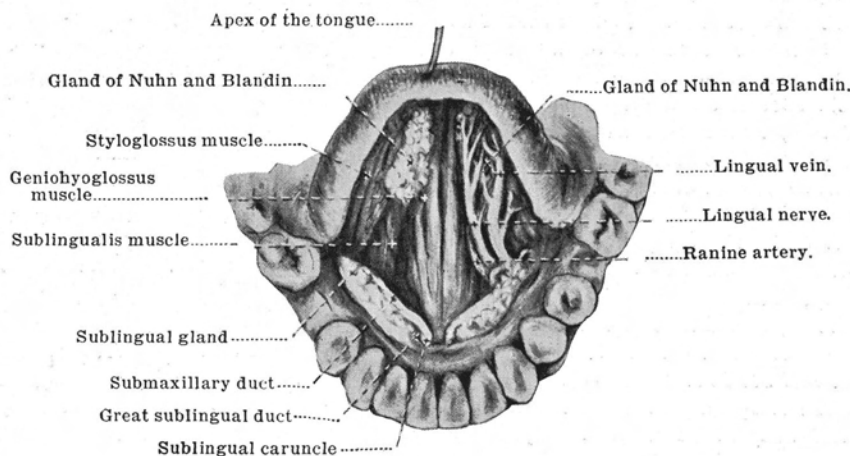
This change in the attitude of the medical profession toward whole questions of treatment of wounds and of compound fractures, of gunshot wounds, etc., is the thing which makes it necessary for us to come together in this way and take up the question anew and study it from its development. And the many failures which have arisen are warnings that the last word has not been said upon the use of antiseptics in spite of the wonderful developments of aseptic surgery.

I trust that in our study of the literature of war surgery we will be able to show how much real advancement has been made. While we have perhaps had only a meagre report of the failure of the early surgical work of the war we have had enough to show us that in the beginning the professional men of the various countries at war were deficient in their understanding of the necessities of the case. It is a mistake to think that these errors were entirely confined to the French and British. Germany and Austria have had to acknowledge their surgical errors. That this is true

is well known because American surgeons went to Germany early in the war and helped them in their work. Many of our men had charge of hospitals in Germany and did everything they could for their sick and wounded. From what we read in our literature it appears that the English were perhaps more deficient in the early days of the war than any others, but this is likely due to a habit which Englishmen have of being more frank in admitting their

It is true, however, that up to this time few men in the profession have devoted special attention to surgery of the mouth and jaws as it is exhibited in the great war. Yet the mass of literature collected shows how rapidly the profession is looking into the subject and how eager they are to obtain information regarding it. In reviewing the literature I would especially ask you to give attention to one fact which stands out more prominently than any others,

Figure 4.



"Structure lying beneath and within the anterior part of the tongue.—Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 6.

errors than almost any other people. We must first see our errors and then correct them.

#### THE PLASTIC AND ORAL SURGERY DIVISION.

While surgery of the face and jaws has many points peculiar to itself it also has more points in common with surgery in general. Surgical principles are just as applicable to the surgery of this region as to that of any other region of the body and for this reason I have included many articles in the bibliography which may appear to be too general, but they cover this general application of the subject.

namely that in the treatment of all wounds, not only those of the mouth and jaws but of every part of the body, the greatest improvement and progress which has been made since the beginning of the war has come from early and thorough treatment.

The establishment by the Surgeon-General of this division of Plastic and Oral Surgery has brought together members of the medical and dental professions, which is to my mind, one of the most important things that has ever happened. It coordinates two branches which have heretofore been somewhat widely separated. Few gen-

eral surgeons have been expert in treating injuries to the jaws and there is much regarding the subject which has been only indifferently taught or not taught at all, by medical schools; on the other hand, few dentists have received sufficient training in surgical principles and technic.

These courses for the first time coordinate these two important branches into one department of medicine and surgery and I predict that they will never again be separated. We will probably have growing out of the war, as we find illustrated in the literature of the day, a class of surgeons who will in the future devote special attention to this subject, and who, like Major Blair and a few others, will be recognized as having mastered it from both points of view.

There are several good American books on the surgery of the face and jaws. Two deserve special mention, namely, that of Major V. P. Blair, of St. Louis, and that of Truman W. Brophy of Chicago. The work of Major Blair has been revised since the war began and everything considered is the best on this subject. The work of John D. Roberts of Philadelphia on the plastic surgery of the face is one of the best on that subject in any language. There are also several good English works on the subject.

Major Blair devotes Chapter I of his book to a careful anatomical and technical consideration of the region involved in this course of study. His illustrations for this chapter are taken from the work of the great Anatomist Spaldeholz. There is probably no better way to refresh our memory of the anatomy of this region than to reproduce on the screen illustrations used in this book.

\*Figure 1 is the "coronal section thru the face" which shows the series of bony cavities covered with soft tissue which

go to make up these parts. These partitions enclose spaces that contain either air or special organs. This section is especially valuable in showing the relation of the various sinuses and also in showing the tongue and the situation of the glands between the tongue and the mandible.

Figure 2 shows the mandible and the "muscles that form the floor of the mouth stretching between the concavity of the body of the mandible and the convexity of the hyoid bone."

Figure 3 shows "mucous reflections on the anterior surface of the tongue" and incidentally the relations of the lip and the teeth.

Figure 4 shows the "structures lying beneath and within the anterior part of the tongue;" especially valuable for the relations of the blood supply and the glands under the tongue.

Figure 5 is a "sagittal section thru the mid-plane of the face."

At the last meeting of the Western Surgical Association I reported the case of a boy four years old with a gunshot wound entering thru the upper lip and lodging in the body of the axis. All of the teeth on the left side of the upper jaw including both those which had erupted and the unerupted teeth were carried away by the ball and the crown of one tooth was carried in front of the ball and lodged in the body of the axis. Operating thru the mouth the opening in the pharynx was enlarged and the ball removed with forceps, with the probe I could then feel that there was still a foreign body in the bone. The wound in the bone was enlarged and with a forceps the crown of the tooth was then removed from the bony cavity. The boy made a good recovery. He still has a little stiffness in moving the head from side to side but otherwise is in perfect health and I think he will overcome his disability in time. He is young and the probabilities are that he

\*The illustrations referred to in the text were shown on the screen by reflectoscope.



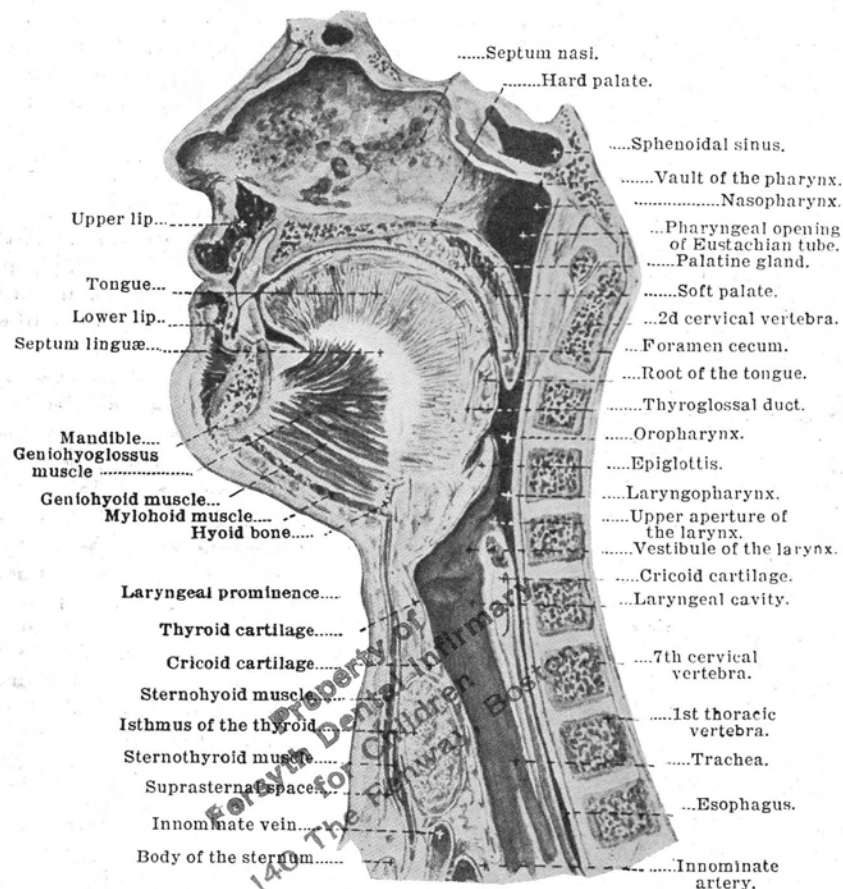
will make still further improvement. Several teeth on the upper left side of the jaw will be missing.

Figure 6 shows the "dorsum of the

#### FIRST YEAR IN WAR SURGERY.

In July, 1915, the great French surgeon Tuffier discussed in the "British Journal of Surgery" (July, 1915, p.

Figure 5.



"Sagittal section thru the midplane of the face.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Villray Papin Blair. Third Edition, p. 8.

tongue" and especially the epiglottis, the tonsils and the lingual tonsil.

Figure 7 shows the "submucous structures of the palate and faucial pillars."

Figure 8 illustrates the "occlusion of the teeth and their position in the jaw bones."

110) the first year's work in war surgery. I quote all that was said in that discussion regarding fractures of the maxillary bones and wounds of the face, as follows:

"Maxillary wounds are treated with great care by dentists who from the very



beginning apply to the fragments or fashion when necessary to replace them, bridges which render very great service."

In the light of the literature of today on this subject this seems a very scanty dismissal. Even then it was beginning to be borne in upon surgeons that the method of treating these wounds must be changed and improved, and under the general heading of war surgery the author gives the following advice regarding injuries:

"The grave infection of nearly all wounds received in warfare, requires the absolute necessity of rapidly transporting the wounded to a well equipped hospital for which numerous motors are absolutely indispensable. As regards the wound itself, the earliest possible extraction of foreign bodies especially those from artillery fire; Chassaignac's drainage; perfect immobilization of bones and of articulations, and the quickest possible disinfection of the wounds are my suggestions for treatment at the front. The great importance of all these points is incontestable. With regard to the question of antiseptics there exists a difference of opinion; every surgeon extols his own method. The usual antiseptics have gone bankrupt; new ones must be found with a more permanent action. Researches in this direction of the highest importance and necessity are being made. For myself I entirely share the opinion of Wright and Watson Cheyne. In all cases, however, we must rely on light, good air, and free evacuation of discharges rather than on any special antiseptic except, perhaps, hypochlorite of magnesia. The same may be said in regard to sero-therapy. No polyvalent serum, no specific serum, can make the patient safe from infection. Only the preventive antitetanic injection is of use. \* \* \* After tetanus the most serious infection is gas or emphysematous gangrene."

This same number of the "British

Journal of Surgery" contains several interesting illustrations of wounds of the head and face. (These were shown on the screen.) Before leaving this number of the British Journal of Surgery I wish to show you a "Drawing of the Trachea of a patient who died 36 hours after being gassed." See Plate II.

"He was deeply cyanosed and lightly delirious. In the actual specimen the most striking feature was the abrupt line of transition from the purple plum-colored mucous membrane of the pharynx to the healthy pinkish white tint of the unaffected oesophagus at the level of the thyroid cartilage. All the surfaces over which the irritant gas played are deeply injected and discolored. There was, however, very little oedema in the trachea and no inflammatory membrane had been formed. Curiously the larynx was in most cases free from oedema and irritation. The voice rarely became hoarse and the dyspnoea at any rate after the first few hours was never caused by laryngeal obstruction. This extreme congestive irritation was evident in almost all the fatal cases before the use of respirators. The protection devised later prevented this injury to the pharynx and trachea even in men who died of inflammatory oedema of the more delicate lung tissues. In these cases if the patient survived the asphyxiation of the first few days his color soon became normal again but the dyspnoea persisted for some time and a cyanotic tint at once returned to the face when any muscular effort was made."

We will not attempt to follow any particular journal or series of articles in chronological order, but will select articles which will fit in with a somewhat orderly subdivision by subjects as already outlined. Naturally we should first consider the tissue involved. I have collected considerable material from the British Journal of Surgery, because it is more voluminously illustrated than any other publication and also because

its editorial committee has been giving special attention to the question of wounds and injuries.

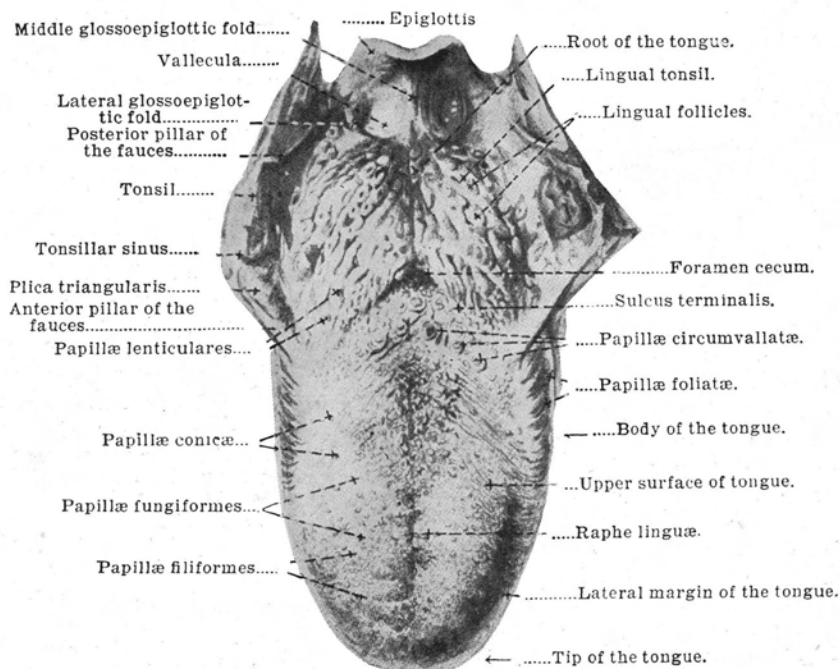
Every member of this course should have a copy of the British Journal of Surgery for July, 1917. It is sort of a text book for wounds and injuries of

4. The Carrell Treatment of Wounds, by Col. G. Barling.

5. Treatment of Hemorrhage from Gunshot Wounds of Face and Jaws, by Maj. V. H. Kazanjian and Capt. Harold Burrows.

6. Report of Oral and Plastic Sur-

Figure 6.



"Dorsum of the tongue.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 9.

the head and face. The following is a list of its titles on these subjects:

1. Inter-relation between Radiography and Surgery of gunshot wounds of the Head, by Capt. H. E. Gamlen and Capt. S. Smith.

2. Repair of skull injuries by Perforated Plates, by A. B. Mitchell.

3. Repair of Cranial Defects by Cartilagenous Grafts, by H. L. Warren Woodruffe.

gery on Prosthetic Appliances, by Maj. A. C. Valadiar and Capt. H. Lawson Whale.

To name the titles does not give the full importance of this issue of the British Journal of Surgery. Each of these articles is beautifully illustrated and contains much of the most recent French and British experience.\*

Two of these articles are of especial

\*The pictures illustrating each article were thrown on the screen by the reflectoscope.

importance. The first on the treatment of hemorrhage caused by gunshot wounds of the face and jaws, which is well illustrated showing a number of types of injuries, calling especial attention to concealed hemorrhage and secondary hemorrhage in this region. The article contains the best of advice on the two subjects which I have found.

It also shows a number of methods of fixing the jaws by wires and controlling hemorrhage by clamps. It has the interesting and instructive radiogram showing numerous fragments of shell and pieces of bone distributed thruout the tissues. It presents a number of original drawings showing the anatomy of the face and jaws (Figures 12, 13 and 14) which are not found in books on anatomy and which are exceedingly useful in understanding the effects of gunshot wounds and the application of the newer methods of treatment. In conclusion it reports thirty-two cases in considerable detail. The article entitled "Report of Oral and Plastic Surgery, and on Prosthetic Appliances" is especially valuable. I have found nothing else in the literature which compares with it for practical instruction in this branch of surgery. The illustrations are numerous and show each case in its several stages from the original injury to the conclusion of the final plastic operation necessary to restore the face. There are twelve full page illustrations following cases from the beginning to the end and some of the groups of pictures contain as many as twelve separate pictures in different stages of the same case. No doubt, sooner or later the author will put this work in book form. Any first-class medical library will supply the journal.

#### GENERAL SURGICAL CONDITIONS.

There are several papers and addresses which every member of the profession should read, not because they are so directly applicable to the immedi-

ate subjects of this course as for the general information and inspiration which they contain. Others should be read because of their direct instruction as to better methods of treating war wounds as well as those of civil life. Notable among the first is the address of Dr. Charles H. Mayo, of Rochester, Minn., as president of the American Medical Association, delivered at the New York meeting in June, 1917. I quote a few sentences:

"The medical profession should feel proud of the position it has taken in the affairs of the world. It has been second to none in its progress, and medicine has become nearly an exact science. The exalted position of medical men thruout the world's war has become accepted and has given them an opportunity to apply wholesale, as it were, the newer methods of prevention and treatment of disease by adopting at once fixed medical standards. The enormous value of this practical application relieves the necessity of a slower advance by discussions with the ignorant and by overcoming obstructionists. Hundreds of our medical men, appreciating the needs of the people as well as the requirements of soldiers, have long since accepted medical service to aid humanity in all the countries of Europe."

"The medical profession was first to mobilize, and has been signally honored by the government in having given to it the first flag to be carried abroad, thus signifying our country's active entrance into the war. No worthier representative of the profession could have been chosen as standard bearer than Dr. George W. Crile, who had done so much to develop the base hospital idea."

Dr. Mayo then proceeds to discuss comparatively America and Germany in the development of the medical and surgical professions and certainly makes out a splendid case in favor of American medicine. He does not fail, however, to give reasonable credit to Germany for the many things which she has accomplished. Many of the great names which have given lustre to American medicine are mentioned and many of the great achievements in medicine and surgery by Americans are brought out

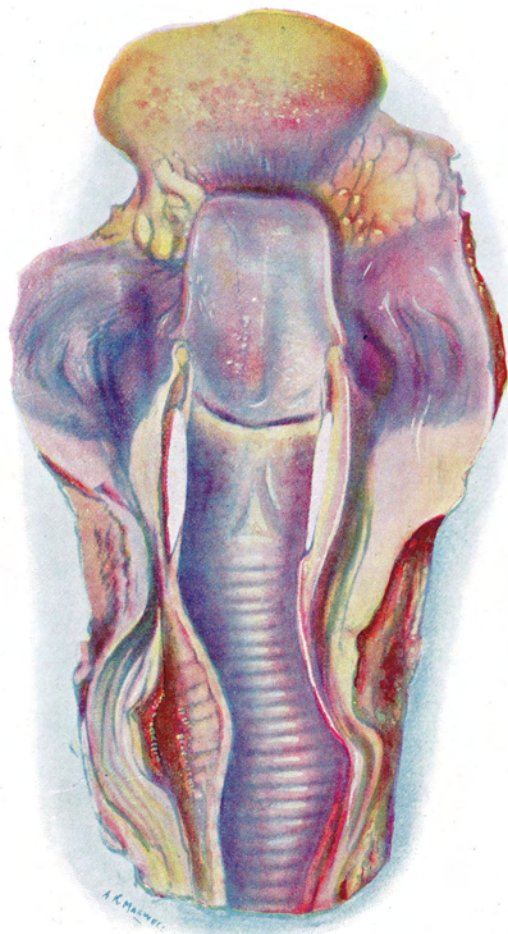


Plate II.

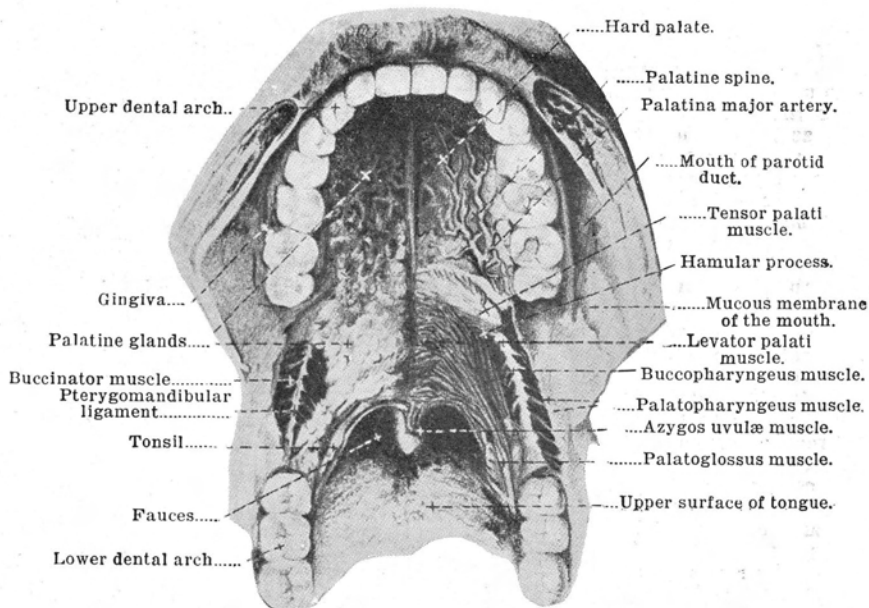
"Drawing of the Trachea of a Patient who died thirty-six hours after being gassed. Note the abrupt line of transition in color from purple to a healthy tint, at the level of the trachea." From, "Cases of Gas Poisoning Among the British Troops in Flanders." By Col. Sir. John Rose Bradford, K. C. M. G., C. B., F. R. S., A. M. S., and Capt. T. R. Elliott, F. R. S., R. A. M. C., British Journal of Surgery, October 1915, 237.

in splendid relief. He does not fail to remember American dentistry and I quote the following paragraph in this connection:

"American dentistry has made a place for itself in the world and America stands at the head of all countries in the care of the teeth. We are all proud of the work of American dentists. We may pay our tribute also to the American nurse who has distinctly elevated the

tary life afforded him, and compares them with those enjoyed by the present generation. "The pathologic anatomy of the lesions produced by gunshot injury to the brain, the spinal cord, the lungs, heart and the abdominal viscera has been worked out to an extent that will leave little to be desired. New facts regarding cerebral localization and the functions of the spinal cord have been noted, while others founded on animal experiment alone have been confined by injuries

Figure 7.



"Submucous structures of the palate and faucial pillars.—From Spaleholz." From, "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair, Third Edition, p. 13.

nursing of the world and the care of the sick. Her experience and training make her the best wife and mother and a leader in support of the best in education and discipline in her community."

If one has any special interest in the history of military surgery he should not fail to read the article:

"The influence exerted by the military experience of John Hunter on himself and on the military surgeon of today," by G. H. Makins (British Journal, Feb. 17, 1917, p. 213). He concludes the Hunterian oration by a consideration of the opportunities of research Hunter's mili-

comparable to the knife of the physiologist. Observations regarding the fevers of the field have been accumulated, an enormous practical experience of the value of the protective inoculation for enteric fevers has been acquired while the prophylactic value of tetanus antitoxin and its influence in modifying the character of a subsequent attack has been placed beyond the region of doubt. It is not perhaps too much to expect that not only the acquisition of this extended knowledge, but also the manner of its acquisition, will exert an enduring influence upon the workers to whom we are indebted for it."

One of the best articles of the year is entitled "The Development of British Military Surgery at the Front," by A. Cowlby and D. Wallate (*British Medical Journal*, 1917, Vol. I, p. 705.)

These authors have been among the most valuable contributors to war surgery during the whole period of the war and this article is somewhat in the nature of a summary of their observations. Regarding wounds they say:

"The impossibility of disinfecting a wound at the front by the use of first-aid dressing is acknowledged and well recognized. A clean dressing is applied and kept in situ until a favorable opportunity for a redressing. The time for the latter is fixed as early as possible, when all the exposed and torn tissues, except in the smallest wounds, are excised. This is especially recommended in the case of tissues ingrained with dirt and portions of clothing. Free drainage is next established. Unless so treated wounds in France and Belgium become heavily infected in two or three days."

"The military surgeon of experience is always solicitous about caring for the wounded on arrival at the hospital or casualty clearing station. Nothing has greater bearing on the chances of subsequent recovery than the efforts to combat the effects of shock, bleeding, exposure to cold and the want of sleep and food. Severe pain must also be combated, and exhaustion bordering on collapse as a result of a hazardous journey over broken roads has to be carefully treated."

I also quote in full what the authors say about head injuries, as that is directly applicable to our particular work:

"Head injuries: In the early part of the present war and in all recent wars, gunshot injuries of the head were operated upon promptly whenever there was hope of recovery. The wounds of entrance and exit were cleansed of loose fragments of bone, foreign metallic fragments and all dirt. The British surgeons in the Anglo-Boer War advocated operation at the earliest time. They operated under fire, and by candle light at night instead of delaying a few hours. Later operations to them meant sepsis and sepsis meant encephalitis, abscess, hernia cerebri and death."

"Colonel Sargent advocates a delay of twenty-four hours or more because after injury the brain is liable to be oedematous and to extrude if operated upon while in the condition. Again, a moderate delay is beneficial in that it allows adhesions to form between the dura and pia mater, thus lessening the chance of a spread of infection over the brain surface."

"Experience in this war has brought out the following significant facts:

1. Cases which arrive at the base hospital unoperated upon did better than those operated on at the front.

2. It has been noted that patients kept quiet at the place of operation do very well, while cases operated upon and apparently doing well are apt to arrive in bad condition if they are evacuated early.

It is not in order to either operate at the front and keep the patient quiet, or to evacuate him as soon as possible to the base before operation. The patient should not be operated on and then evacuated forthwith.

Special hospitals for head cases are erected at the front. On arrival at the casualty dressing station they are examined and dressed. If the pulse is low they are sent to the special hospital; if the pulse is rapid they are put to bed and evacuated later if they improve. The technic is as follows:

1. Wound in the soft parts and soiled fragments of bone should be excised.

2. There should be exploration in a limited way for missiles and bone fragments.

3. Drainage is not strictly necessary. The exposed brain is covered with scalp, also the bone and dura, either by simple suture, pericranial flap, or relieving incisions formed by under-cutting the scalp. A drain introduced under the scalp may be employed. By this method hernia cerebri is not as frequently seen.

4. In cases of depressed fracture over the longitudinal sinus there should be no interference; they should be left alone (Sargent and Gordon Holmes.)

5. Dura should not be opened if it is found intact; true compression of the brain is seldom seen.

6. The use of novocaine and adrenalin locally often takes the place of general anesthetic. If this method is employed it should be preceded by hyocine and morphine or omnopon and scopolamine.

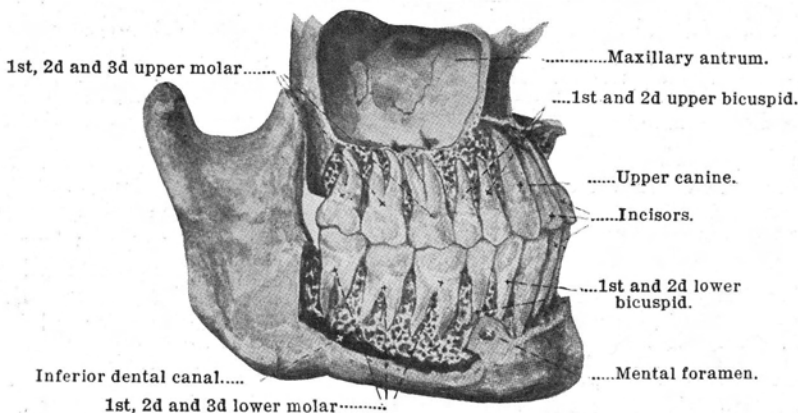
The foregoing plan of treatment may be summarized as follows:

1. Primary cleansing of the wound.
2. Transmission of the patient as soon as possible, to the hospital where he will convalesce.
3. Taking of X-ray pictures.
4. Limited and careful exploration of the wound for foreign bodies.
5. Excision of the scalp and bone wound.
6. Covering the exposed brain.
7. Closure of the wound with super-

heart in our surgical work and should make up our minds to be neither timid nor rash in the prosecution of the treatment of wounds. All true surgery should be conservative surgery. I quote as follows from Dr. Mixer's address:

"Conservatism in surgery means the best use in our power of the means at hand for the saving of life, the relief of pain and deformity, without unnecessary mutilation. The man who is timid and the man who is rash are alike. Far from being conservative—amputation when necessary to save life may be the highest

Figure 8.



"The Occlusion of the teeth and their position in the jawbone.—From Spaleholz." From "Surgery and Diseases of the Mouth and Jaws." By Vilray Papin Blair. Third Edition, p. 15.

ficial drainage and prolonged rest in bed.

"The wound should first be thoroly cleansed of foreign matter, loose fragments of bone, and well drained by free incisions. The early deliberate and efficient cleansing of the wound is the basis of success, no matter what chemicals are used after it is completed."

The presidential address of the American Surgical Association at its meeting in Boston, May, 1917, by Samuel J. Mixer, M. D., of Boston, was entitled "Conservatism in Surgery," and contained many timely warnings and worthy suggestions, I quote two paragraphs which we should all take seriously to

form of conservation, and, if it is best to amputate at or above the knee for gangrene, the foot alone should not be taken off because the shock is less and the immediate mortality lower."

"Timidity in the treatment of malignant disease is a common fault, the highest type of cowardice. True conservatism means going to the 'anatomical jumping-off place,' for no death is more to be dreaded than that from recurrence. Above all, is he a knave as well as a coward who refuses to operate on a desperate case, when life may perhaps be saved, for the sake of his 'statistics'—statistics which have morally damned many an otherwise good surgeon, had better be juggled in some other way or even lied about. The true surgeon is never 'fearless.' He fears for his pa-



tients, he fears for his shortcomings, his own mistakes, but never fears for himself or his professional reputation. His fear makes him a better man."

#### GENERAL TREATMENT OF WOUNDS— ASEPSIS AND ANTISEPSIS.

It would be inexpedient for me to devote any attention to the subject of military clinical organization, first-aid or surgical technic at this time, excepting as they are considered incidentally in the treatment of wounds. We should keep constantly in mind that wounds are of three kinds; first, wounds made by the surgeon—clean wounds, made under the usual aseptic precautions; second, soiled wounds—those which have become soiled from exposure to metal, clothing, dirt, etc., but in which there has not yet been time for the invading microorganisms to get a lodgement in the tissues; third, wounds which are infected—in which the micro-organisms of infection and suppuration have already made lodgement in the tissues and the battle between the bacteria and the tissue cells is fully on.

For ten years or more following the announcements of Joseph Lister in 1867, the great subject for universal professional discussion was the treatment of wounds; with the advent of aseptic method the profession settled down to the attitude that the last word had been said. Antiseptics were more and more considered objectionable and to be avoided, wherever possible. I was one of those strongly of this view and for several years up to the outbreak of the present war employed practically no antiseptics even in wounds which were already infected at the time they came under treatment. I am sure that this plan has given me more satisfactory results than was obtained from the usual antiseptic solutions, such as bichlorid, carbolic acid, boracic acid, lysol, the assential oils, etc. I believe our study of recent literature will show that my experience in civil practice is not inconsistent with the

present advocacy of antiseptics in war wounds. It is a little difficult to understand the great revolution in stamping out infection which Lister brought about by the use of his strong carbolic sprays and solutions. Today if we use these we seem to promote and prolong the suppurative process. We believe that it is a well proved fact that any antiseptic which is strong enough to destroy the disease germ cells is also strong enough to destroy or seriously impair the resistance of the body tissue cells with which it comes in contact.

On account of the destructive effect of most antiseptics; iodoform has been much extolled by its advocates because it was claimed to strengthen the resistance of the tissue cells and thereby bring about a cure of the infection. A study of the literature will show that for twenty years there has been a gradual drawing away from the use of strong antiseptics. The solutions have gradually become weaker and to a large degree replaced by irrigations with physiological salt solution or plain steril water. Antiseptic ointments and plasters have largely disappeared and the aseptic regimen has been more and more in evidence.

Suddenly the profession is confronted with the care of wounds in a great war; wounds filled with fragments of shell, clothing, etc., in patients begrimed with the dirt of the fields and the trenches, who have been denied the civilized privileges of the bath and clean linen. The wounded have had no opportunity for even changing their clothing. Often they must wear it until it is completely impregnated with the germ bearing dirt of the street, the field and the trench. Dirt, dampness and lack of sunlight and water conspire together to produce all of the conditions which are necessary to the development and preservation of the most virulent and destructive of the bacteria of infection.

Our theories and our practices are all

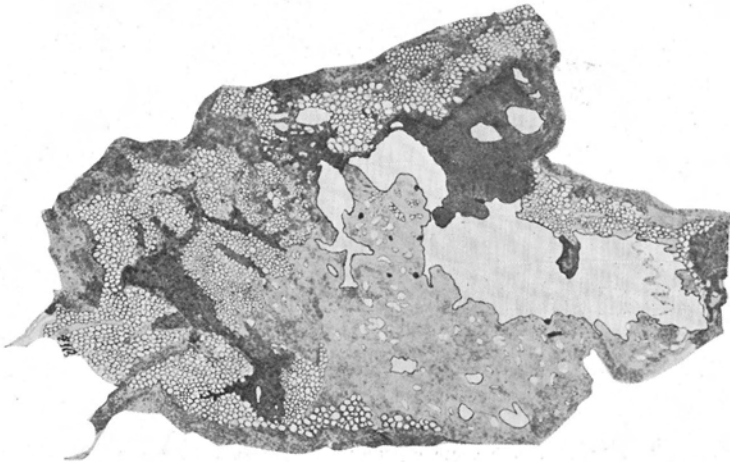


upset and we have the problem of the environment of the patient forced on us in a new light. The methods of handling wounds in civil practice, when applied to the wounded in the war were found ineffective. Tetanus, gas gangrene, streptococcus, staphylococcus and other infections were almost unaffected by the usual methods and were unusually destructive in their virulence and mortality.

It was early apparent that while the

surgeon who expects to take charge of the treatment of war wounds should carefully read. The first, is by Sir Watson Cheyne (British Journal of Surgery, January, 1916). Cheyne was a student of Lister and still is imbued by much of the old Listerism. After all Listerism is the very foundation of our antiseptic regimen and we cannot consider the use of antiseptics without first having as a basis the theory and practice as taught by Lister. Therefore I wish

Figure 9.



"Subcutaneous connective tissue, areolar tissue, and fat, showing track of shrapnel. Dense connective tissue to right and above, which is disorganized and filled with hemorrhage around the track. On the left, and abutting into the track, the capillaries between the fat cells are widely dilated and filled with leucocytes, in places so densely packed as to produce the dark patches seen in the areolar tissue. The intense black spots represent implanted wool fibres (khaki). Entire area removed at operation twenty hours after injury." From, "Investigation of the histology of the tissues, immediate and remote from the point of injury, in gunshot wounds of the Liver, Spleen, Kidney, Intestines, Blood-vessels, Subcutaneous Tissue and Aponeurosis, and Muscles." By Captain E. F. Bashford, R. A. M. C., British Journal of Surgery, January, 1917, p. 449.

cause and course of these infections were perfectly well known that the methods of handling them must be completely reorganized to adapt them to war. Some of the best investigators have been on the field in the several fronts for months and there is some prospect that the labors of Tuffier, Crile, Morrison, Wright, Carrel, Dakin, Taylor, Gosset Dewal and others is bringing practical results.

There are two papers which every

to call your attention to a few paragraphs quoted from Cheyne's paper, a part of which is devoted to Lister's procedure:

"It seems to me that at the present time there are no more important questions for the surgeon at the front to ask himself than these:

1. What was it that Lister did in the treatment of infected wounds which led to the great revolution in surgery which followed his work?

2. Why is it that I am not getting results similar to those which were obtained by Lister as long ago as 1866?

For it must be realized that the military surgery of the present day as regards results, has not advanced as one would have expected.

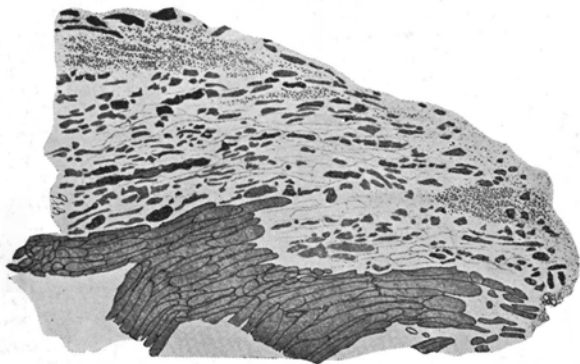
What, then, was it that Lister did which changed the whole aspect of affairs? Here is what he did in the case of a boy whose leg was crushed by the wheels of an omnibus.\*

'When I saw the child,' Lister writes, 'after an unavoidable delay of three hours, he was greatly prostrated by shock as well as hemorrhage, so much so that amputation appeared likely to

ture, and there was also an opening in the skin on the outer side of the leg, implying that the violence had acted with full force upon the whole thickness of the limb. Yet the bone was not comminuted, and the muscles, tho severely contused, were not much lacerated, while the anterior tibial artery was felt beating in the foot; and hopeless as would have been the idea of trying to save the limb by ordinary treatment, I determined to make the attempt by the help of carbolic acid.'

"Now observe," says Cheyne, "what he did in this case, the fifth treated on his new principle, for it is most important in view of the exaggerated ideas promulgated by the number of surgeons at

Figure 10.



"Portion of muscle lying beneath dense connective tissue seen in Figure 9. The muscle fibres at top of figure have been immediately killed by the violence of the missile, and are sharply delimited from the living muscle fibres, some of which show a proliferation of the nuclei of the sarcolemma. At the bottom, limit of surgical incision into healthy muscle. Twenty hours after the injury." From, "Investigation of the histology of the tissues, immediate and remote from the point of injury, in gunshot wounds of the Liver, Spleen, Kidney, Intestines, Blood Vessels, Subcutaneous Tissue and Aponeurosis, and Muscles." By Captain E. F. Bashford, R. A. M. C., British Journal of Surgery, January, 1917, p. 450.

afford but a slender chance of life, altho the state of the injured parts seemed to admit of an alternative. The tibia, which was broken about its middle, lay exposed in a wound occupying almost the entire length and breadth of the inner aspect of the leg, reaching from the inner condyle of the femur to within an inch and a quarter of the tip of the internal malleolus, the skin having been stripped back so as to lay bare the gastrocnemius as well as the bone. The large flap of integument was perforated about two inches from its edge opposite to the seat of frac-

ture, and there was also an opening in the skin on the outer side of the leg, implying that the violence had acted with full force upon the whole thickness of the limb. Yet the bone was not comminuted, and the muscles, tho severely contused, were not much lacerated, while the anterior tibial artery was felt beating in the foot; and hopeless as would have been the idea of trying to save the limb by ordinary treatment, I determined to make the attempt by the help of carbolic acid."

"Chloroform having been administered, the acid full strength was applied with great freedom, the contused mass being repeatedly squeezed to induce the liquid to insinuate itself into all its interstices, including that between the riding fragments of the tibia. The flap of skin was then brought towards its natural position, and the lint soaked in the acid was placed upon the wide raw surface which

\*Note—While this is not a head or face case, the same principles apply.

still remained exposed and over the lint a piece of sheet tin. The other openings in the integument were similarly treated, and the riding of the fragments having been corrected by extension, the limb was laid on its outer side, with the knee bent, upon a pasteboard splint moulded to the leg and foot and strengthened by a temporary wooden splint. A porous cloth was applied over the tin to absorb the blood and serum which must escape from beneath its edges, and the whole apparatus was secured with a roller bandage."

"As regards the further progress of this case, the wound filled up with blood-clot which became firm and adherent to the walls of the wound. This clot remained there day after day becoming organized in its deeper part and no suppuration occurred. The tin plate was removed every day and fresh carbolic acid was painted on the surface of the clot so as to keep up the antiseptic action. After about a fortnight the detached edges of this crust of clot and carbolic acid were clipped away, and a lotion of sulphite of potash was applied over the exposed rim of the crust, to permit cicatrization, which the carbolic acid tended to check."

"Already in his third case Lister had observed organization of blood clot which was quite a new phenomenon to him."

'Speaking of this, he says:'

"Thus, the blood which has been acted on by carbolic acid, tho greatly altered in physical characters, and doubtless chemically also, had not been rendered insuitable for serving as pabulum for the growing elements of new tissue in its vicinity."

'And further, in speaking of healing in connection with this mass of clot, he says:'

"At length, nearly four weeks after the accident, I tore it (the clot) off from the vascular surface beneath which bled as I did so. The crust had preserved the subjacent parts from disturbance as effectually as if it had been a piece of living integument; and it is worthy of remark that the vascular surface below had not the pulpy softness of granulations, but was comparatively firm and substantial. The bit of crust still smelt of carbolic acid, tho none had been applied for five days."

"In the case which I have narrated a very interesting and instructive complication arose. On the fractured leg

there was at one side a small wound which was not treated by carbolic acid. After some days it was observed that this sore, instead of healing, was increasing in size and presently hospital gangrene developed in it and caused a good deal of trouble. Thus we have the very remarkable fact that not only in the same patient but in the same limb, we have a large and very grave wound following an absolutely aseptic course, while in the vicinity a trivial wound became the seat of hospital gangrene. If, as Sir Almroth Wright suggests, the main value of antiseptics is

Figure 11.



"Muscle fibres adjoining those killed by direct violence, to show proliferation of the nuclei of the sarcolemma advanced in one fibre, abortive in another, and irregularly distributed in the rest of the fibres. Marked longitudinal striation and loss of cross-striation. Twenty hours after injury." From, "Investigation of the histology of the tissues, immediate and remote from the point of injury, in gunshot wounds of the Liver, Spleen, Kidneys, Intestines, Blood Vessels, Subcutaneous Tissue and Aponeurosis, and Muscles." By Captain E. F. Bashford, R. A. M. C., British Journal of Surgery, January, 1917, p. 451.

due to their production of a flow of serum, why did that serum prevent hospital gangrene in the large wound and not in the small one. The difference between the two really lay in the presence or absence of the strong carbolic acid."

"Among Lister's early cases of compound fracture two developed abscesses, and in so far were failures; but there was no spreading infective disease, as was previously the case, and as the other cases had been successful

there was sufficient evidence to show that the failure in these two cases was due to some imperfection in the details of the procedure, and not to a faulty principle."

"At the time this paper was written he (Lister) had already progressed from the use of impure carbolic acid to carbolic oil and putty, and he refers to the treatment of psos and other tuberculous abscesses with these preparations. To his delight he found that, when so treated, instead of suppurating freely after they were opened, as was formerly the case, and as I am sorry to say is frequently the case at the present time under the so-called aseptic treatment, suppuration did not occur, and the sinuses healed in course of time."

'Lister says:'

"I have opened numerous abscesses connected with caries of the vertebrae, hip, ankle and elbow and in all cases I have found the discharges become in a few days trifling in amount, and in many it has ceased to be puriform after the first twenty-four hours."

'He says, with regard to this new method of treating abscesses:'

"It is based, like the treatment of compound fracture on the antiseptic principle, and the material employed is essentially the same, viz., carbolic acid, but differently applied in accordance with the difference of the circumstances. In compound fracture there is an irregular wound which has probably been exposed to the air for hours before it is seen by the surgeon, and may therefore contain in its interstices the atmospheric germs which are the causes of decomposition, and these must be destroyed by the energetic application of the antiseptic agent. In an unopened abscess (he is here referring to tuberculous abscesses) on the other hand, as a general rule no septic organisms are present so that it is not necessary to introduce the carbolic acid into the interior. Here the essential object is to guard against the introduction of living particles from without, at the same time that a free exit is afforded for the constant discharge of the contents."

"Thus in this paper he already formulates the guiding principles of treatment in the two great classes of wounds viz., (1) Those inflicted accidentally, in which, therefore infection—which at that time he attributed chiefly to 'atmospheric germs'—had already occur-

red before the patient came under the care of the surgeon; and (2) Those made by the surgeon thru previously unbroken skin."

"It does not concern us here to follow up the subsequent development of Lister's methods; the point is that he began his work with compound fractures and that he did something to these fractures which produced very remarkable improvement in the results, an improvement so self evident that no one could be in any doubt about it (very different in this respect from the results of brine and vaccine therapy), and which completely revolutionized surgical work."

"Now what Lister tried to accomplish was to kill the bacteria which had entered these wounds before they had had time to develop and take root in the body; and the substance which he chose for his first experiments was a fluid, chemically impure, but which contained a large proportion of carbolic acid and cresol. This he applied to the wound undiluted, and he used it in no niggardly manner, for not only was the impure acid applied all over the wound but the contused mass was repeatedly squeezed to induce the liquid to insinuate itself into all its interstices. He did not find that this acid caused sloughing of the surface of the wound, or led to extension of the septic processes, or that the blood clot which formed plugged the wound and permitted the development of the bacteria in the tissues; in fact he found none of the horrible things which we are told by our colleagues in France happened in the infected wounds when strong antiseptics are applied. Had this been the case, had Lister found that his applications made matters worse instead of better, he would have dropped the experiments at once, and the revolution in surgery would not have taken place. Is it conceivable that, if antiseptics were so injurious and ineffective, that most remarkable pilgrimage of surgeons from all the ends of the earth to Glasgow and Edinburg would have occurred and gone on for years? And Lister showed to those visitors all his cases, and among them there were always cases of accidental wounds and compound fractures which were following in an aseptic course."

"It is very remarkable that in the face of these facts some bacteriologists calmly dismiss the subject of disinfection of wounds and state that antisep-



Plate III.

"Wounds of the Face by a Bomb from a Trench Mortar." From No. 10 Casualty Clearing Station.  
Under the care of Lieut. Hilton, British Journal of Surgery, July 1916, 59.

tics are absolutely useless, but that they are not employed in such a manner that useful results could be expected. Sir Almroth Wright suggests that favorable results occasionally (?) manifesting themselves after antiseptic treatment might well be interpreted in the sense here suggested: i. e., as lymphagogues, mechanically clearing out the discharge, causing temporary hyperaemia, keeping the wound moist, and so on. Such a statement which is wrong in its premises, does not need any refutation by me."

"This being the answer to the question as to what it was that Lister did that revolutionized surgery, one would have thought that on the outbreak of war, the first impulse would have been to try to reproduce Lister's results. Unfortunately, of late years a most unaccountable prejudice has arisen against antiseptics, with the result that students have not been educated in their use: indeed they have been taught to decry their value, and to look on them as old fashioned and very objectionable substances. Hence, when the war began, they and also their teachers were unprepared; and when it became evident that their usual methods, sterilized dressings, salt solution, etc., were quite ineffective and that it might be worth while to turn to antiseptics, they had no clear ideas as to what to do, and consequently their efforts were unsuccessful. And the bacteriologists, not having any practical experience, have accepted such results as definite, and it does not seem to have occurred to them that perhaps those who had more experience of antiseptics might have done better."

#### NEW FACTORS IN TREATMENT OF WOUNDS.

Cheyne represents the attitude of those surgeons who would have us return to Listerism in its original form, or in something approaching that form. This attitude I believe to be absolutely wrong, altho I have the greatest respect and admiration for the glorious work done by Lord Lister in revolutionizing the treatment of infected wounds. We certainly have passed to a stage of understanding of infection which should lead us to a much more rational treatment. An exposition of this form of treatment will be found in an article by another

equally prominent Englishman, who recently visited the United States, namely, Sir Berkeley Moynihan, delivered before the (1917) meeting of the Clinical Congress of Surgeons (Surgery, Gynecology and Obstetrics, December, 1917).

Moynihan, like Cheyne and in fact all others who want to thoroly understand the treatment of wounds, begins by a careful restudy of the teaching of Lister. I think that each of us can put it down as a fundamental principle of study that in order to thoroly understand the modern treatment of wounds we must begin by thoroly understanding the bacteriological factors and the antiseptic treatment of Lister. I take the liberty of quoting what Moynihan says about the relation of Listerism to the modern treatment of wounds:

"It is interesting to read again the works of Lister and to see how helpless he felt himself in dealing with putrefactive processes once firmly established in wounds. Lister everywhere distinguishes between the 'prophylactic' uses of antiseptics. All the marvelous achievements of modern surgery are due to the adoption by surgeons the whole world over, of the principle of the prevention of infection in wounds about to be made as distinguished from that of the subduing of an infection already rampant."

"Lister writes: The original idea of the antiseptic system was the exclusion of all microbes from wounds. 'Again, during the operation to avoid the introduction into the wound of material capable of inducing septic changes in it, and secondly to dress the wound in such a manner as to prevent the subsequent entrance of septic mischief!' Again, 'In wounds already septic attempts are made with more or less success to restore the aseptic state. Again, in speaking of the antiseptic system of treatment, I refer to the systematic employment of some antiseptic substance so as entirely to prevent the occurrence of putrefaction in the part concerned, as distinguished from the mere use of such an agent as a dressing.'"

"This distinction between the preventive and the curative use of antiseptics is in many respects that existing on the one hand between the power of a germicide as determined by experiments *in vitro*, and on the other hand, its capacity

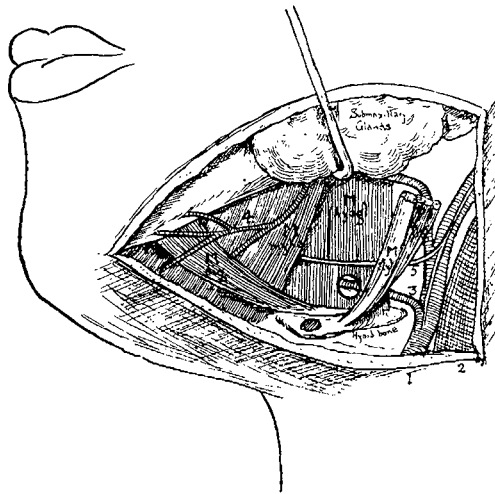
to destroy organisms when it is introduced among the living and the dead tissues of a wound. In the former there is a direct conflict, a clean fight, between the microbe and the chemical agent. Few or none of the many intervening conditions are present which have to be considered when a bactericide is introduced in a wound cavity wherein there are a multitude of actions and reactions which even now seem very obscure and are often conflicting."

Moynihan goes on to explain:

"When after the lapse of many weeks

into the question of the treatment of wounds. France is a very fertile and highly agricultural country in the northern part where the battles have been fought. It is a country which is kept fertile by the use of large amounts of natural fertilizer. This fact coupled with the description of Sir Douglas Haig of the fighting in winter in the war zone, in which he says that the fighting is done in a "wilderness of mud," lays the foundation for the following para-

Figure 12.



"Diagram showing anatomy of the lingual artery. The submaxillary gland has been drawn over the side of the jaw with a hook. (1) External carotid artery; (2) Jugular vein; (3) Lingual artery (shown also in window in hyoglossus); (4) Submental branch of facial artery; (5) Hypoglossal nerve; M. dig. Anterior belly of digastric muscle; M. styl. Stylohyoid muscle; M. Myho, Mylohyoid muscle; M. hyogl. Hyoglossus muscle; P. dig. Posterior belly of digastric muscle." From, "The treatment of hemorrhage caused by gunshot wounds of the face and jaw." By Major V. H. Kazanjian, Harvard Surgical Unit, and Captain Harold Burrows R. A. M. C. (T. F.) British Journal of Surgery, July, 1917, p. 140.

from the outbreak of the war, there came a full appreciation of the several circumstances which had to be allowed on all hands that a new and grave problem had arisen which cried urgently for solution. What then were the several new factors that had to be considered?"

In this connection it is interesting to quote what Moynihan says about the bacteriology of wounds in France. The war has brought an entirely new element

graph from Moynihan's most important and interesting treatment of this subject:

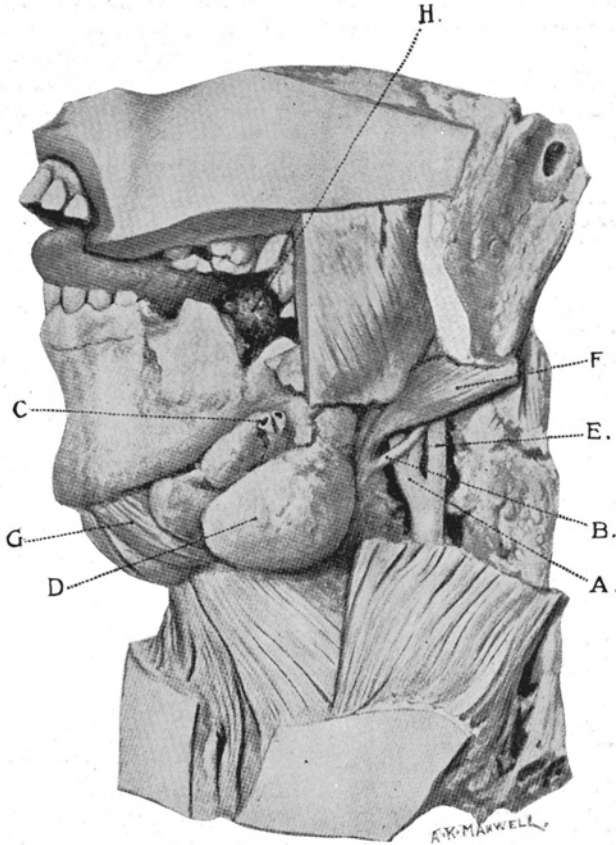
"The bacteria infesting the wounds in France have been studied by Wright, Fleming and others. The general conclusion drawn from their work is that the micro-organisms, as might be expected, are those found in highly manured soil; they are, that is to say, of faecal origin. Wright suggests with his customary fecundity of invention, the new names 'serophytes' for those organisms which



will grow in normal serum, streptococci and staphylococci; and 'serosaprophytes' for those which can only grow in digested albumens. The native albumens of human serum are 'protected' from bacterial development at their expense, and

of tetanus, enterococcus, a streptococcus of intestinal origin described by the French, the bacillus coli, and putrefactive bacilli X and Y which are the cause of the foul odor often met with in wounds. There is often a 'wisp' bacillus

Figure 13.



"Drawing from dissection of a case of bilateral fracture of the mandible due to gunshot wound. The illustration shows the dropping of the anterior portion of the mandible, and the manner in which the glands overlap the submaxillary triangle and render it difficult to expose the second part of the lingual artery. (A) External carotid; (B) Hypoglossal nerve; (C) Facial artery and veins; (D) Submaxillary salivary gland; (E) Internal carotid; (F) Posterior belly of digastric muscle; (G) Anterior belly of digastric; (H) Clot protruding from the exit wound in tongue." From "The treatment of hemorrhage caused by gunshot wounds of the face and jaw." By Major V. H. Kazanjian, Harvard Surgical Unit, and Captain Harold Burrows R. A. M. C. (T. F.) British Journal of Surgery, July, 1917, p. 141.

Wright points out that, if this were not so, human life would have been impossible. Among the serosaprophytes are the larger number of the organisms found in wounds, including all the anaerobes; the bacillus of Welch, the bacillus

and a diphtheroid bacillus appears in later stages of the infection."

"All these micro-organisms find a most fertile medium for their growth in wounds of the character I have described. In every infected wound, where



the recesses are many and intricate, blood or serum may be poured out; tryptic digestion begins as a consequence of the destruction of the leucocytes, peptones are formed and bacteria finding everything to their liking grow apace. From many of the wound surfaces the circulation has been cut off by the powerful stunning effect of the blow given by the projectile and gangrene and sloughing make haste to develop. During the first 4 to 6 or in some cases even 8 hours few organisms or none can be recovered from the wounds, either by smear methods or by cultural methods. The organisms are there nevertheless, and given the prodigal fertility of the soil in which they are sown, will quickly show the evidence of the growth. In this brief early period the wound is said to be 'contaminated,' in all later periods 'infected.'

"Against this attack made upon it by immeasurable millions of organisms, how does the body protect itself? The chief defense is the blood serum and in the leucocytes (phagocytes). The capacity of these two, if only they have an adequate chance, may be said to be almost illimitable against all organisms but the streptococcus. The serum possesses strong bactericidal powers of its own; the phagocytes can devour bacteria greedily. But in exerting their powers, both serum and white cells are apt to undergo degeneration. The leucocyte breaks down and its power of tryptic digestion is then exerted upon the fluids around it, and peptones are produced in quantities which make easy the growth in them of all forms of bacteria. Moreover, the surface of the wound soon becomes 'lymph-bound.' A mesh of fibrin entangles the blood cells and a sort of matting of coagulated lymph spreads over all the surface. No fresh serum can then reach the wound, nor are fresh leucocytes available for the attack. The infective process can then proceed apace, unhindered by those powerful natural defenses which for the moment have quite broken down."

#### PLANS OF TREATMENT OF WOUNDS.

In the main there are two widely divergent theories of the treatment of war wounds. The first may be called the German plan of treatment and has been well described before this class by Dr. Richter, who served for several months, previous to the declaration of

war by the United States, in charge of a base hospital in Germany. In a word this plan is known as the wide open treatment of wounds; that is to say the wounds are left wide open for drainage and made to granulate in the bottom. This is a plan of treatment which we heard a great deal about a few years ago and which has many things to recommend it. In connection with this plan the Germans have made use of the bath treatment of wounds; patients are kept for hours or even for days in a continuous bath of flowing water and the wound freely exposed in all parts. I do not understand that the Germans make a great deal of effort at secondary closure altho secondary closure is used. They depend more on subsequent plastic work.

The literature shows that treatment of wounds falls largely under three heads. (1) The wide open treatment. (2) The primary closure. (3) The secondary closure. Incidentally of course the primary closure of contaminated wounds and the the secondary closure of infected wounds includes a preliminary treatment by antiseptics of some kind.

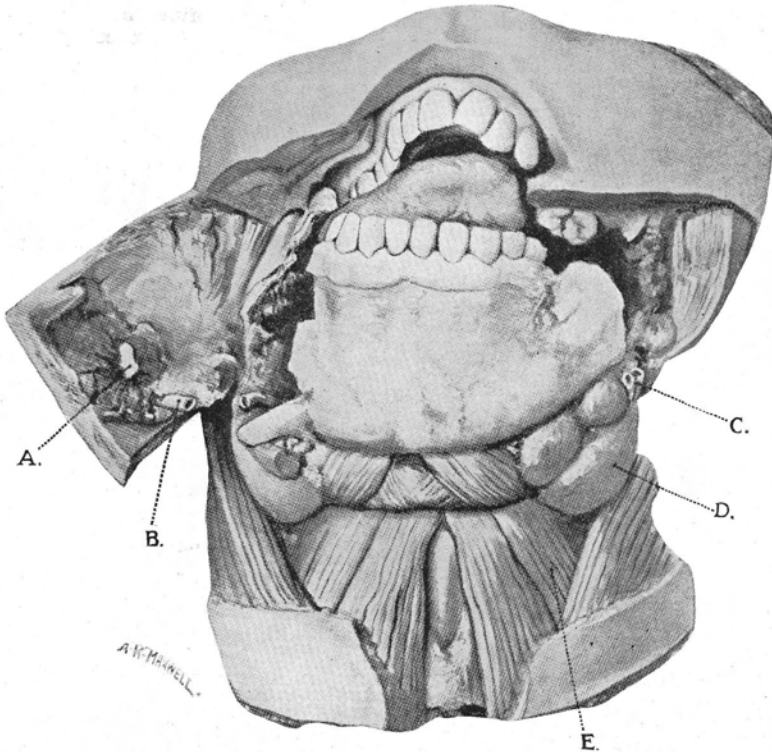
It is impossible to consider each one of the many excellent papers written in all languages on the use of antiseptics in the treatment of war wounds. As we have seen, Listerism underlies all the methods. What are called the physiological methods owe their origin to the work of Sir Almroth Wright; Wright has given especial attention to the bringing into use of all the antiseptic power of the tissue; in other words the ways and means of developing the natural defensive mechanisms of the body fluids and tissues to overcome infection.

Carrel and Dakin have been the leaders in developing the utility of the floating solution and take the first place in all literature when it comes to a consideration of such methods of treatment. They represent the class who are using chlorinated soda, boracic acid, chlorid of lime and other similar ingredients in solution in the treatment of wounds.

The third class among the users and advocates of antiseptics is led by Sir Rutherford Morrison who has done notable work in the use of bismuth, iodoform and paraffin paste in the treatment of wounds.

stantly and Morrison applies a paste over the tissues. All may be called antiseptic methods. With Moynihan we may reasonably ask ourselves, "What is it we expect an antiseptic to do in an infected wound?" The answer cannot be

Figure 14.



"Anterior view of the dissection shown in Figure 13. Shows the characteristic jaw drop which follows bilateral fracture of the mandible. (A) Entry wound as seen from inner surface of reflected flap; (B) Facial artery completely divided in wound without causing secondary hemorrhage; (C) Left facial vessels; (D) Submaxillary gland; (E) Omohyoid." From "The treatment of Hemorrhage caused by gunshot wounds of the face and jaw." By Major V. H. Kazanjian, Harvard Surgical Unit, and Captain Harold Burrows R. A. M. C. (T. F.) British Journal of Surgery, July, 1917, p. 142.

These three general groups of workers base their claims for success on the same general principles. Wright uses a method to increase the antiseptic power of the tissues themselves, Carrel-Dakin use a solution put into the tissues by which the wound is kept bathed con-

simply that we expect the antiseptic to discharge the bacteria which have found their lodgement in the wound. There are a great many other questions which must be taken into consideration:

"The problem of the action of an antiseptic in an infected wound is far too complex for a simple and ready answer."

Moynihan shows the complexity of the answer when he says:

"It may have an affinity for the tissues forming the wall of the wound, for the serum or for the leucocytes or for the raw track into the cavity of the wound or with the dressings applied to the surface. It may have a closing effect on different parts of the wound; it may for example, increase proteolytic digestion in

cells. Therefore their effect is confined chiefly to the bacteria which are lying on the surfaces in the open wound. These facts must be taken seriously into consideration in judging the antiseptic power of any antiseptic or any group of antiseptics suggested for the treatment of wounds. And in fact all of the advocates of the different methods, do take these conditions into consideration."

Figure 15.



"Arterio-venous Aneurism of the External Carotid Artery." From "On the Vascular Lesions Produced by Gunshot Injuries and their Results." By Surgeon-General Sir George H. Makins, K. C. M. G., C. B., Consulting Surgeon to the Forces. *British Journal of Surgery*, January, 1916, p. 383.

its action upon sloughs and it may inhibit or prevent this process by its effect upon leucocytes and their immigration. The fact is that the action of antiseptics on bacteria as shown in laboratory tests, may be quite different in all the tissues. All of the conditions found in living tissues cannot be duplicated in the laboratory. The great difficulty with all antiseptics has been found to be their penetrative power. Few antiseptics, if any, have sufficient penetrative power to be of extended value without the power of destroying or at least injuring tissue

#### TISSUE INJURY, IMMEDIATE AND REMOTE, BY GUNSHOT WOUNDS.

"In studying the literature of the modern treatment of wounds, we will refer again to the article entitled "Investigation of the histology of the tissues immediate and remote from the point of injury in gunshot wounds of the liver, spleen, kidney, intestines, blood vessels, subcutaneous tissues, and aponeuroses," by Capt. E. F. Bashford, R. A. M. C.

(British Journal of Surgery, January, 1917). The author opens his article by declaring:

"It appears that the time has come when some generalization on the special characteristics of gunshot wounds should be considered in the light of the more extensive experience now available. For this purpose wounds complicated by the super-addition of inflicative processes must be discarded but a direct knowledge of the extent and nature of the injuries produced by the passage of the missiles is an essential preliminary to the investigation of bacterial invasion."

In considering the direct effect which the bullet or other missile has in travelling thru the tissues the author makes the following observation:

"It still remains to be proved, however, how far the actual velocity with which the bullet traverses the body effects the tissues beyond the actual area of the wound track; and clinical observation does not support the view that extensive injury, of the explosive-exit form occurs independently of the bullet meeting with such resistance as is offered by the bone—when the separated fragments, themselves endowed with motion, are responsible for the extensive laceration or of an irregular impact of the bullet with the surface, and consequent rotation. In support of this view, evidence may be adduced from the large cavities produced in the interior of the limbs by fragments of shells which in traversing the limb, have made but small aperture of entry and exit, or may even have been retained. Here a mechanism comparable to the spin of a cricket or golf ball explains the extent of the tissue damage more really than any theory of expansion in the limb or air compressed by the passage of the missile."

We will only devote attention to what the author says about injuries to blood vessels, subcutaneous tissues and aponeuroses. Regarding injuries to blood vessels the author says:

"The injuries of vessels have been studied in a number of cases, more particularly by following the disturbance of the elastic lamina. They may be illustrated by a case which was not investigated in the first place for this purpose, but to elucidate the way in which an open passage was made and were there-

fore not studied with a view to ascertaining whether there was only one injury, and preoccupation with other aspects led to the tacit assumption that there appeared to be also injury at a distance in accordance with a widely held view. A bullet had passed between the femoral artery and femoral vein, injuring their contiguous walls, so that a true aneurismal varix had formed, without an intervening sac. When the injured portions of the vessels were removed five days later, by Capt. Fraser, the torn walls of the two vessels were so united as to adhere on one-half of the circumference of the passage between them. This union was effected in part by the displaced adventitia of the artery. The attention given to the nature of this intervening piece led to the tacit track of the missile from a remote second injury to the vein wall. Re-examination of the sections mounted in series has shown that this appearance is due merely to the irregularities of a single transverse wound in the vein wall, from which there extended an irregular fissure for about three quarters of an inch in its long axis.

The limited nature of the disturbance is sufficiently shown by the arrangement of the elastic membranes and fibres in the accompanying diagram."

What the author says about the subcutaneous tissue and the aponeurosis in wounds and especially in those made by missiles of high velocity is as interesting and important in injuries of the face and jaws as of any other part of the body.

"The effects of injury on the elastic fibres has been studied in the subcutaneous tissue, and here also the disturbance is limited to an area immediately surrounding the track of the missiles. The capillaries in such an area are found, as in the accompanying figure (9) to be perfectly capable of well-known congestion so essential to and characteristic of early inflammatory change. In the case illustrated in Figure 9 they were not only dilated but were crowded with leucocytes, showing that far from being greatly injured, they were capable of supplying the requirements of inflammation right down to the injured surfaces."

"Five days after wounding, an examination was made of the aponeurosis covering the origin of the deltoid muscle, thru which a bullet had passed so as to destroy the head of the humerus and pass out behind. The great cellularity of the dense connective tissue around

the track, and the occurrence of columns of cells, were most striking, as was also the proliferation of new capillaries and of the sarcolemma nuclei of the muscle insertions. There could be no question of a zone of dead tissue surrounding the track of this missile of high velocity."

The effect of the passage of a metal on muscular tissue is still more striking and is illustrated by the author in several pictures. Regarding muscles the author says:

imbedded. A narrow zone of muscle fibres lining the track is dead and disintegrated. The sarcolemma nuclei are nowhere stained by haematoxylin. The dead are sharply defined from the living muscle fibres, the latter presenting only an unusual appearance in places where excessive numbers of sarcolemma nuclei are apparent in the fibres nearest the track. The sharp distinction seen under the microscope was not evident to the naked eye of either the surgeon or the pathologist; but the surgeon had succeeded in his effort to remove the injured

Figure 16.

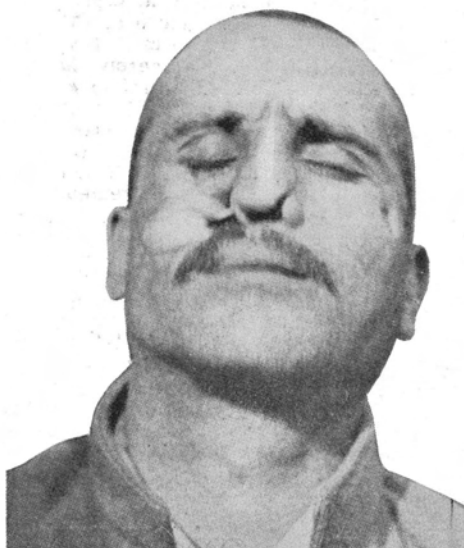


Figure 17.



"Wound of the Face by a Rifle Bullet." From "Illustrations of War Surgery," by the Editorial Staff, British Journal of Surgery, January, 1916, p. 505.

"The examination of injured muscle has been a daily occupation for eight months but it is only proposed to consider here whether the injury is localized to the track of the missile, or has also remote and important consequence. The conditions found have been so constant, that they are sufficiently illustrated by two examples representing the early and the late changes respectively. Figure 10 illustrates the appearance of a piece of muscle which lay immediately subjacent to the dense connective tissue seen in Figure 9, thru which shrapnel has passed and fractured the tibia, in which it was

part by cutting into sound muscle, even if the margin appears slight as the subsequent course of the wound showed."

In Figure 11 the appearances in the muscle fibres adjacent to those killed by the missile, are shown under higher magnification. Two fibres are shown in which the proliferation of the nuclei of the sarcolemma has preceded the formation of almost solid tubes of cells.

Another illustration in this article shows the track of a missile thru the muscles of the lumbar region; which might almost have been made by a trocar. Another shows a section from the

same case under higher magnification "from which it is seen that only a narrow marginal zone of the muscle fibres has been called upon to take part in the processes of repair; the injury might be no less had it been produced by a sharp knife."

"Long muscles have been cut in continuous sections from the wound track to their insertion of origin, at distances of six inches and ten inches in two extreme cases; but no remote primary consequences have been discovered, nor have any late effects such as necrotic changes, fractures of muscle bundles, or hemorrhages at a distance been observed. The extent of the injury to long muscle is to be measured not by a line vertical to the axis of the track of the missile, but by the extensive surface area comprised in it or produced by the loss of tissue."

"In the case of some injuries to the muscles hemorrhage has been observed in the septa, but it only occurred in those nearest the wound; not more than half to three-quarters of an inch away."

"The secondary consequences of anaemia of muscles, due to the severance of vessels or thrombosis, have commonly been observed but they do not come into the category of the special characteristics of gunshot wounds; they will be referred to in a paper on the bacterial invasion of gunshot injuries of muscles."

"Altho the obvious local effects of gunshot wounds may sometimes be surprisingly extensive in their ragged ramifications, the foregoing observations show that remote and other far reaching effects are by no means universal. Indeed during eight months of close attention to so important a subject I have failed to find any evidence that they occur at all in the organs or tissues examined. If vibration be set up by the projectile in the tissues of the body it does not result in capillary hemorrhages, except in situations where they would be expected; for example, under the capsule of the kidney and remarkable disintegrations of cells or even injury of any sort at a considerable distance from the obvious site of the injury have not been met with. The heavy infection of tissues by bacteria, effected by the passage of projectiles, would of itself serve to shake any belief in vibration being an efficient cause of cell death, apart from the influence of direct violence. The bacterial invasion of injured tissues will be considered in another paper; here it suffices to

point out that the facts set out above are all in favor of conservative surgery in gunshot injuries. By a too extended removal of tissues adjacent to the injury, the gap which has to be filled may often be made needlessly great, and the duration of the period of recovery needlessly increased, leaving out of all consideration other possible contingencies."

These statements are illustrated by figures 9, 10 and 11, in which the effect of the passage of the missiles on the adjacent tissues is clearly shown.

#### TISSUE FRAGMENTS IN RELATION TO WOUND INFECTION.

That the problem of the treatment of gunshot wounds is not entirely one of the choice of antiseptics is further shown by the experiments of Kenneth Taylor, director of the Robert Walton Roilet Research Fund and pathologist to the Hospital Complementary V. R. 76, Ris-Prambges (S. & O.) France. His article which is one of several on similar lines of investigation is entitled "Tissue Fragments and Wound Infection." I consider his work of fundamental importance. (*Annals of Surgery*, Dec., 1916). He states the proposition of the wounds of war as follows:

"In the course of injury by the missile utilized in the present war, a wound may be left containing several kinds of foreign bodies. There may remain, first, the missile itself; second, fragments of clothing; thirdly, detached or severely traumatized tissue fragments. Such danger as there may be from the presence of the missile itself depends on its position, its shape and size and especially its sharp edges, for on this depends the local tissue erosion which may result in serious hemorrhage or other damage to the structures in the immediate neighborhood of the missile. On its size and irregularities depends also to a large extent the number of bacteria with which it is charged and from which a focus of infection may arise. The danger from the shreds and fragments of clothing distributed along the track of the missile depends only on the load of bacteria which they contain. The danger from the fragments of detached tissue in the wound lies in the ready made medium of bacterial growth which they constitute.

Thus the injury has usually supplied two factors favoring infection; the supply of devitalized tissue for culture medium and the inoculation with bacteria."

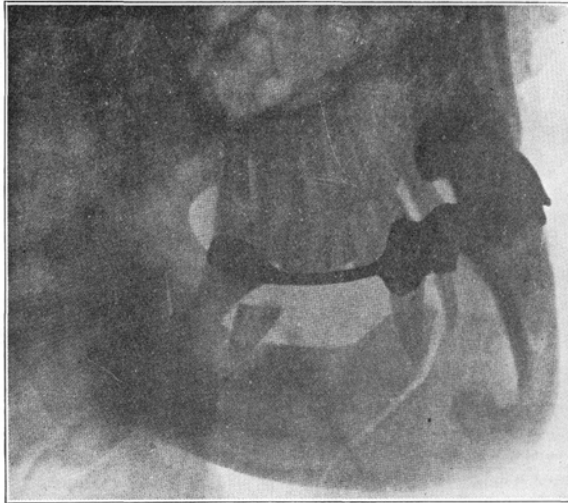
This investigator gives in detail the experiments on animals by which he shows conclusively that while the necessity of removing foreign bodies from wounds and establishing free drainage has long been recognized, little attention has been given to the devitalized frag-

ments of soft tissue. I quote Dr. Taylor's summary and conclusion as follows:

1. "The implantation of a sterile foreign body or a small piece of sterile dead muscle alone produced no microscopic lesions."

2. "The implantation of a foreign body infected with tetanus bacilli, staphylococcus aureus, B. Aerogenes capsulatus, or streptococci produced usually a localized abscess formation without invading the surrounding normal tissue."

Figure 18.



"From a skiagram Showing Cap Splint in Place." From "The Prevention Deformity Following Fracture and Resection of the Jaw." By W. H. Dolamore, London, British Journal of Surgery, January, 1916, p. 532.

ments of soft tissue "which is a hot bed for the unlimited incubation and multiplication of the bacteria." To prove this he produced in animals identical conditions to those found in the wounds of war and in some he allowed the devitalized fragments of soft tissue to remain in contact with a definite quantity of infecting germs while in control animals similar wounds were made and the same quantity of infecting germs were used but all fragments of devitalized tissue were carefully removed. The difference in the reaction of infection in

3. "The addition of a small portion of dead muscle tissue in the region of the infection produced a more rapid and diffuse inflammatory process with earlier and more extensive abscess formation than the wounds containing bacteria or those containing infected cloth."

4. "The implantation of infected cloth together with muscle tissue produced a more active and destructive lesion than the implantation of either alone. When infected with tetanus bacilli the presence of dead muscle fragments determined a high mortality."

5. "Of the two substances, cloth and devitalized muscle in the presence of infection, the muscle produced the more acute infective process."



"Conclusion—The result of these experiments suggests that in the cleaning of fresh wounds at least as much care should be exercised to remove separated and devitalized fragments of soft tissue as is taken to remove other foreign bodies."

"In all operative procedures where blunt dissection is practiced it should be remembered that torn fragments of devitalized tissue may remain to become a ready soil for the incubation of any bac-

#### IRRIGATING SOLUTIONS.

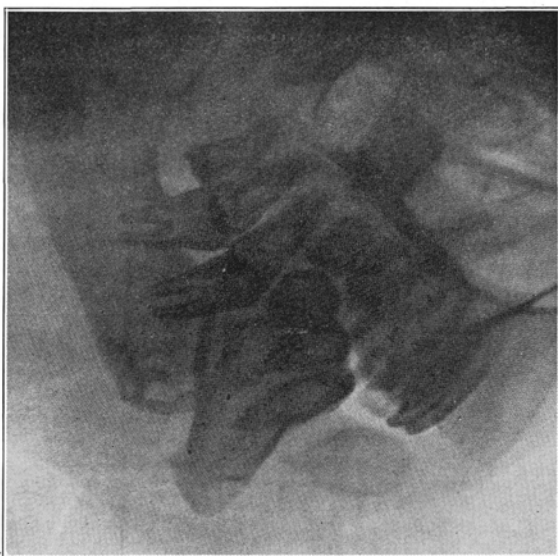
Several solutions have been suggested for this purpose; all are similar and it may be that the ideal one has not yet been developed but all have several points in common.

The solution originally proposed by Dakin was as follows:

Rx.—

Sodium Carbonate, 140 grams.

Figure 19.



"Skiagram showing a badly united Fracture which should have been treated by a cap splint. The union was fibrous." From "The Prevention of Deformity Following Fracture or Resection of the Jaw." By W. H. Dolamore, London, British Journal of Surgery, January, 1916, p. 534.

teria which may gain access to the wound."

These experiments and their results furnish the pathological and bacteriological explanation of the good results achieved by the Wright, Dakin, Carrel method of thoroly opening up the wound, removing all foreign material including devitalized soft tissue and establishing continuous, multiple deep irrigation with an alkaline antiseptic solution until it is sterile and then closing it and securing union by first intention.

Tap water, 10 liters.

Mix until dissolved and add Chloride of lime, 200 grams.

Boracic acid, 40 grams.

Mix. Sig. use Ad. lib. in wounds for cleansing irrigation or compresses.

Dakins solution as now prepared is as follows:

Rx.—Chlorid of lime (Bleaching powder) (20% active chlorin), 200 grams.

Tap water, 5 liters.

Mix and shake vigorously for a few minutes and leave in contact for 6 to 12 hours (over night for example) (shake until dissolved. Not all the pieces will



dissolve, large pieces float, notice only floating pieces.)

Rx.—

Sodium Carbonate, dry (soda of Sol-way), 100 grams.

Sodium Bicarbonate, 80 grams.

Ordinary cold water, 5 liters.

Mix and leave for 6 to 12 hours and then pour into the flask containing the chloride of lime solution and shake vigorously for a few minutes and leave for half an hour to allow the calcium carbonate to be precipitated. Then siphon off the liquid and filter it thru a double paper to obtain a clear liquid. (The liquid should be kept in a dark place.) Never heat the solution.

This solution is similar to Labarraque's solution and to Eau de Javel and a large number of combinations have been developed by different investigators in an effort to overcome several objections to Dakin's solution. Some of these difficulties are that it does not keep well especially if exposed to the light and is likely to become caustic. If it is over 50% hypochlorite it will be too caustic and if below 46% it will be too weak. Another serious objection is the complicated formula by which it is made. Prof. J. Lorrain Smith and his associates have developed a solution called Eusol which is much simpler to make and keeps quite as well, and some think is fully as efficient as the solution of Dakin.

Eusol is made as follows:

Rx.—

Boracic acid.

Chlorid of lime, aa gms. XII ss.

Water, Liter I.

Mix and shake until dissolved and it is ready for use.

While Dakin has devoted himself to the developing of various solutions, Carrel has been occupied with the examination of all solutions suggested and especially in devising methods for their application.

Thus the Dakin-Carrel technic in the treatment of wounds means the use of Dakin's or some similar solution by the Carrel method. This method consists of

multiple rubber tubes introduced into the deepest part of the wound and a continuous irrigation with the solution until it is rendered sterile and can be closed by suture and will heal by first intention as tho there had been no infection. This work marks a remarkable advance in the handling of wounds which none of us can afford to overlook. My own use of it has been confined to only a few cases (probably about 25) but the results have been all that is claimed. A 1 to 2,000 sodium hypochlorite solution is quite as efficient an antiseptic as 1 to 100 solution of carbolic acid. This is the test of efficiency used for all these new solutions.

"Tuffier states that 80% of all amputations are due to infection (or the fear of infection) and only 20% are due to destruction of tissue by the injury. If Dakin's solution used by the Carrel method will prevent or cure the infection in this 20%, just so many limbs will be saved from amputation (and the same proportionate improvement will follow in other parts of the body.) We all know the ravages of infection and can appreciate the boon to humanity from a method which will readily and completely overcome infection or prevent it. The vast majority of deaths, amputations, disabilities and complications are due to infection; therefore we must control infection."

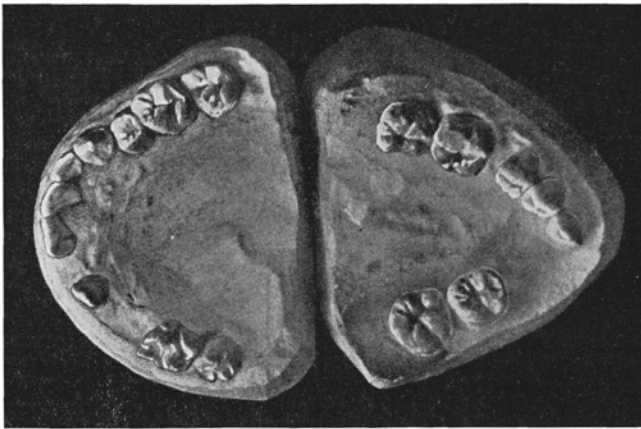
The antiseptics used in the past have been either too weak and feeble in germicidal action or have been too irritating and either actually destroyed tissue or at least so reduced resistance as to actually favor infection rather than overcome it. While there has been much opposition in some quarters I am glad to read a statement by Joseph Rilus Eastman, in Surgery, Gynecology and Obstetrics, January, 1917, that the method was employed with modification in the Base Hospital in Vienna in which he served. The time is at hand when the medical profession may be held responsible for their failure to accept a scientific advance that means the saving of an enormous number of cripples and of lives. It is

claimed that of the wounds treated at Compiègne by the Carrel method 99% have united by first intention, with practically no reaction either along the line of incision or at the stitches.

In considering the literature of war wounds a few words should be said recommending two recent books; one by W. W. Keene, of Philadelphia, entitled "Treatment of War Wounds," and the other by Carrel and Dehelly entitled "Infected Wounds."

study and so much development of technique of wound treatment. For this reason we are justified in devoting considerable time to its literature. I wish to call your attention to certain chapters in Carrel's book. He illustrates all of the apparatus used and perhaps proves to the satisfaction of the critics at least, that the greatest objection to his method is the amount of apparatus which is necessary for its successful application. The apparatus consists of rubber instil-

Figure 20.



"The same case as Figure 19, showing the Deformity where the bones fell together." From "The Prevention of Deformity Following Fracture or Resection of the Jaw." By W. H. Dolamore, London, British Journal of Surgery, January, 1916, p. 535.

Both of these are handy volumes and can be easily carried. They contain the jist of the most recent knowledge on the subject. Of course the books by Carrel is directly in line with the present study. While we may not agree with all which Carrel says about the treatment of wounds and may even disagree with the results claimed, or believe that the same or better results can be obtained by other methods, we must give Carrel and his associates credit for the highly scientific way in which they have studied the subject. Certainly no other investigator has brought into it so much orderly

lation tubes with many small perforations in them and of glass distributing tubes of various sizes and having from one to four branches and numerous Ys and Ts. There must be ampoules or flasks for holding the solution and pinch cocks for regulating the flow. In some instances the solution is instilled into the instillation tubes by a glass syringe with a rubber bulb. He illustrates the application of the tubes to the various conditions of the wound. He shows how the method is applied to a wound with horizontal recesses and demonstrates by a picture that the proper

method is to have the tubes next to the wound and the gauze on the outside of the tubes and not to have the gauze next to the wound and the tubes on the outside. He shows that it is an advantage to have a quantity of the solution in the wound which is cup like and to keep the wound filled with the solution. By many carefully selected illustrations he shows just how to make application to almost any kind of a wound whether it be deep or superficial; whether it has a single sinus or many sinuses and whether it requires one tube or many tubes. One of his pictures shows as many as eight instillation tubes in place in one wound in the extremity. All the solutions and tubes used are ingenious and interesting and should be thoroly understood by all those who wish to treat their wounds by this method. The most important part of the book consists of several charts which show, by careful bacteriological examination, that the number of bacteria are increased from day to day during the injury. He also shows copies of these microscopical fields and illustrates the rapid disappearance of the microorganisms from the field under the treatment. This of course is a fairly scientific method of demonstrating the value of a method of treatment. While none of the illustrations in this book are taken from the mouth or jaw I cannot see but in the main it would be as applicable at this region as at any other, excepting perhaps in those cases in which the wound is actually in the mouth, and a part of the solution would be swallowed. While the solution is not actually poisonous it would be very disagreeable to the patient and it would be undesirable to have very much of it swallowed. I could not do better than to urge each member to read this book carefully as an object lesson in the thoro scientific study of wounds even tho you do not care to adopt Carrel's method in detail.

#### ANTISEPTIC PASTES.

As radically opposed to the Dakin-Carrel method we have the method proposed by Morrison, which has many points in common with Beck's treatment. Rutherford Morrison, of England, who is associated with Sir Berkeley Moynihan, has published several interesting articles on this subject. The last article appears in the April, 1917, number of the British Journal of Surgery. He is connected with a hospital where only suppurating wounds are received for treatment. Soldiers injured in France are sent to England and entered in this hospital and begin treatment from five to seven days after the injury is received. Morrison has developed a plan which is a modification of the Beck Paste. He calls it Bip. The word "Bip," if it can be called a word, represents the first letter of Bismuth, Iodoform and Paraffin and is made as follows:

Bismuth subnitrate or carbonate, one (1) part.

Iodoform, two (2) parts.

Paraffin g. s. to make a soft paste.

This is applied to the wound with a swab. I quote his plan as follows:

Under an anesthetic, usually open ether, cover the wound with gauze wrung out of 1-30 carbolic acid, and clean the skin and the surrounding areas with the same lotion."

2. "Open the wound freely and if possible sufficiently to permit of inspection of its cavity. In doing this special regard must be paid to nerve trunks and muscular branches of nerves, since the division of blood vessels, excepting the largest, and of muscles themselves does little harm as compared with that of the disability following nerve damage. Cleanse the cavity with dry sterile gauze mops, \* \* \* and remove all foreign bodies."

3. "Mop the surrounding skin and the wound cavity with methylated spirit. Cotton wool mops conveying the spirit are used for this purpose, and are introduced on forceps."

4. "Fill up the whole wound with the paste described in the foot note. (Foot note—Bismuth iodoform paste 'Bip' is

made by Sergt. Hunter as follows: Iodoform, 16 oz.; Bismuth subnitrate, 8 oz.; liquid paraffin, 8 fl. oz.; or a sufficient quantity. The powders are mixed together in a mortar, and the liquid paraffin incorporated. The quantity of liquid paraffin required varies according to the bulk of the powders, the bismuth in particular being liable to a considerable variation in bulk. A sufficient quantity should be added to form a paste. It is then advisable to rub down the paste, in small quantities at a time, on a slab with a spatula, to ensure freedom from grit and dry particles of powder.)"

"Dress the wound with sterile gauze, and cover all with an absorbent pad which is held in position by sticking plaster and bandage. This dressing requires no change for days or weeks if the patient is free from pain and constitutional disturbance. Should, however, discharge come thru the stained part must be soaked in spirit, and a gauze dressing wrung out of the same applied as a further covering. Redressing is very simply done. After removal of the old dressing the wound is covered with a dossil of wool soaked in spirit, and the sticky dirty looking discharge is wiped off the surrounding skin until it is clean. This is done with dossils of cotton-wool soaked in spirit and applied by forceps."

This plan has many advantages over that of Carrel-Dakin. First, it requires no redressing or needs redressing at very long intervals. Second, there are no solutions to keep the bed soiled or the patient in a wet pool. Third, it is especially applicable where there are fractures and splints are necessary. Morrison seems to have taken great care with his observations. His cases have been studied and his conclusions drawn, under the following heads: 1. Temperature. 2. Pulse-rate. 3. Emaciation. 4. Bronzing of the skin. 5. Diarrhoea. 6. Stomatitis; blue patches on the gums and on the mouth. 7. Nervous symptoms. 8. Urinary symptoms. 9. Excessive discharge from the wound.

#### GENERAL TREATMENT OF WOUNDS— RECAPITULATION.

To recapitulate for a moment regarding the treatment of wounds we have in the main two general propositions; First,

aseptic wounds, those which are neither soiled nor infected. These we close by primary suture with the full assurance that union will take place by first intention. The laws for handling such wounds are so thoroly understood that they do not need discussion.

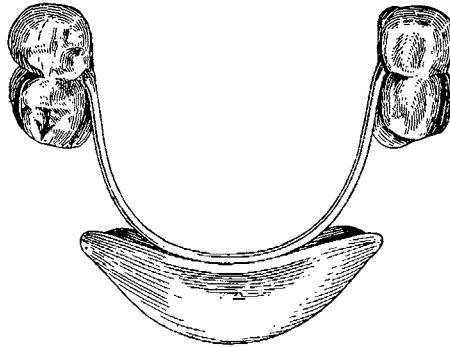
War wounds are those which have become soiled or infected. Cleansing of soiled wounds by some solution or paste or by some method which immediately removes the soiling micro-organisms enables the surgeon to close them by primary suture. Here the great care of the surgeon is the selection of wounds suitable for this treatment. In war at least, only a small number of wounds fall in this category, because of the time which necessarily elapses before they receive even first aid and the inherent difficulties of applying a first aid dressing which will overcome the microbic soiling. Therefore our main consideration must be for wounds which are first treated with some antiseptic and then closed by secondary suture.

My own opinion is that the ultimate method adopted in the treatment of wounds will not be either the Carrel-Dakin method or the Rutherford Morrison method but will be a method which will grow out of the careful treatment and bacteriological study made by these men and their co-workers. We have already referred, in one quotation, to the fact that when a missile enters, a certain area of tissue is devitalized. If that wound is treated by the antiseptic method or by the wide open method or by any other method it will be necessary for this devitalized tissue to be disposed of. Some of it will be disposed of by the active living tissues adjoining but the most of it will be disposed of by sloughing out of the wound. This is what we call having a wound "clean up." We frequently hear it said "the wound is cleaning up nicely." By this is meant this devitalized tissue is sloughing out. It has been shown that certain staining

agents can be used which will show at the time of the first dressing the limit of this devitalized tissue. In other words the active, living, healthy, normal tissue will not take up this stain but the injured and dead tissue will take up the stain. This marks the limit of such an injury to the tissue. There is still another and probably better method of marking the limit of such tissue and that is by direct examination by the surgeon. A little experience will show the eye and the sense of touch whether the tissues are

of his right foot. There was also a compound fracture of the metatarsal of the great toe and the metatarsal of the fourth toe and the phalanges of the second and third toes were left without any bony connection to the body of the foot. In other words he had a hole blown thru the foot. He entered the hospital perhaps six hours after the injury. He was given an anesthetic and all of the injured tissues were carefully cut away, including the second and third toes and every shred of injured tissue so far as could

Figure 21.



"Splint designed to Restore the Contour of a Destroyed Chin."  
From "The Prevention of Deformity Following Fracture or Resection  
of the Jaw." By W. H. Dolamore, London, British Journal of Sur-  
gery, Jan., 1916, p. 544.

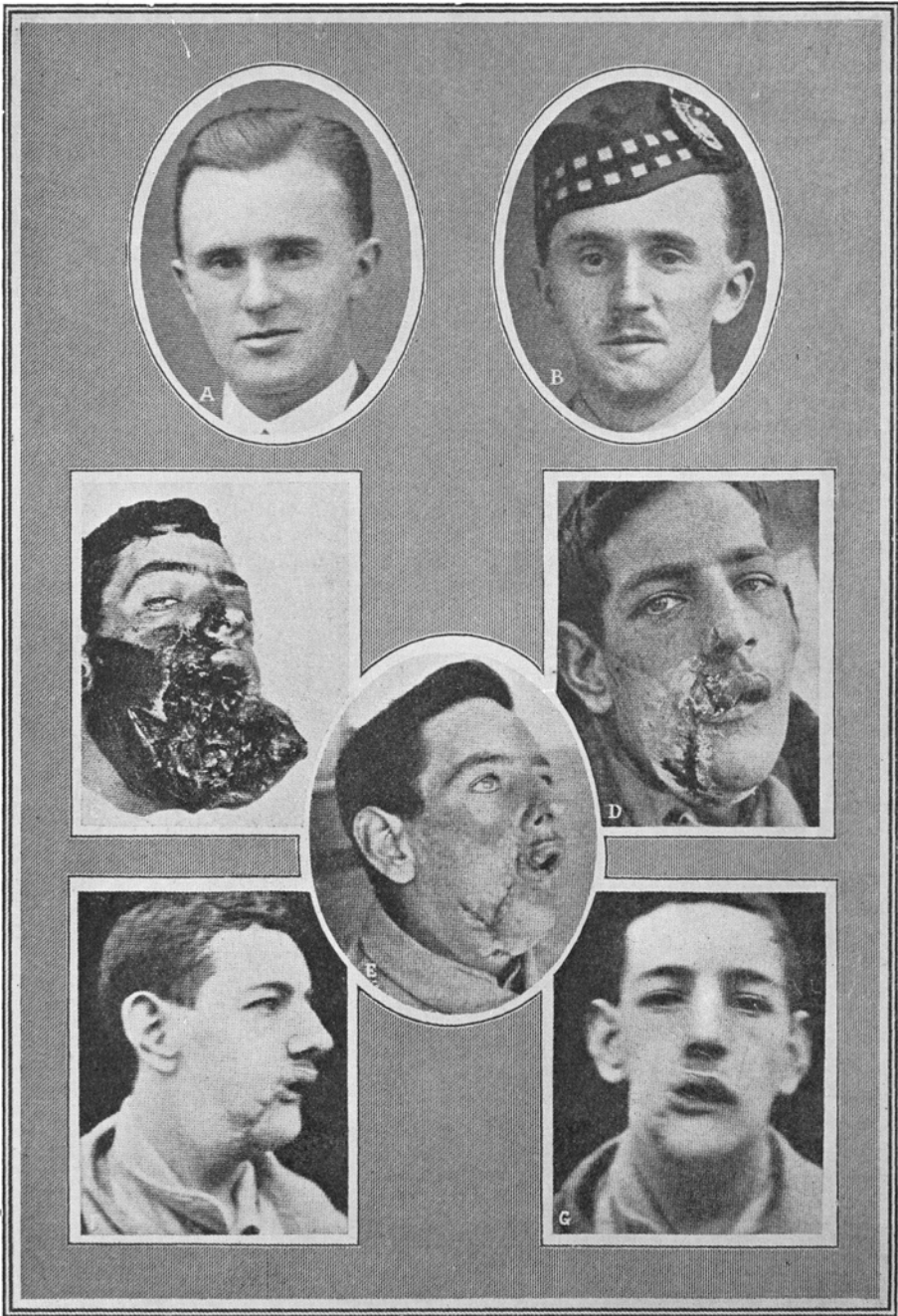
healthy and strong and alive or whether they have been killed by the injury. We need not hesitate to carefully cut away all the tissue which has been injured and bring the tissues which are healthy together by suture. Thus we will get an immediate healing of our wound. I want to illustrate this by two very recent cases which for all practical purposes are war wounds. Both occurred in farmers, both were filled with the dirt of the field, both were soiled in a way that might lead to any kind of infection.

The first was a young man 25 years old who accidentally shot away the meta-tarsal bone of the second and third toes

be searched out, whether it was bony tissue, muscle or tendon. This done, the two raw surfaces were brought snugly together by thru and thru sutures and the skin on both sides sutured with only small drains at the corners to guard against any possible error in the technic. This wound made a prompt primary union and the man has a useful and fairly shapely foot.

The second case is that of a young man who sustained a gunshot wound of the elbow joint by which all of the articulating surfaces were comminuted or carried away. The wound was very large and ragged. However, the princi-

Figure 22.



"A. represents Lieut. C. before the war; notice the protruding lower lip, and that having lost over an inch of lip and chin when wounded, this has not much interfered with his present appearance. B. shows Lieut. C. as he is today. (Figures 23 to 26). C. shows Private H. as when first seen by me; D. was taken three weeks after his first operation, (performed five or six days after being wounded); E. Pte. H. eight weeks after; F, G, are two photographs taken four months after." From "A few Suggestions for the Treatment of Fractured Jaws." By Major A. C. Valadier, R. A. M. C. (T. H. C.) British Journal of Surgery, July, 1916, p. 66.

pal bloody supply was intact and the radial artery was in good condition. Therefore I decided to pursue the same method as was used in the previous case. All injured tissue was carefully cut away, all frag-

placed in one corner to cover any error which might have been made in technic. This wound, like the other, healed promptly and thruout in the most kindly manner. There was surprisingly little reaction and this man has a very good

Figure 23.

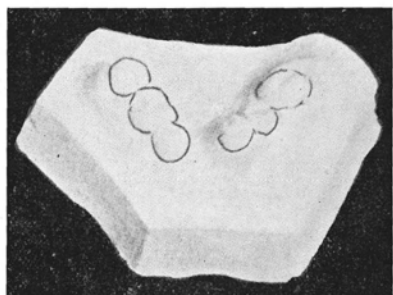


Figure 25.

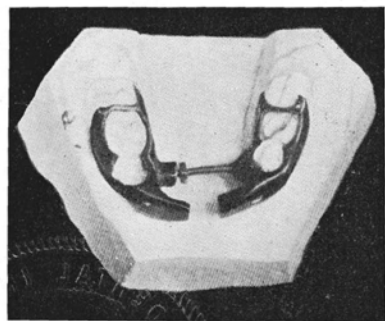


Figure 24.

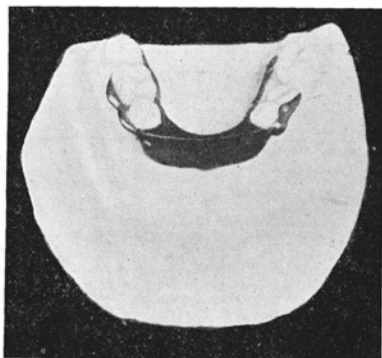
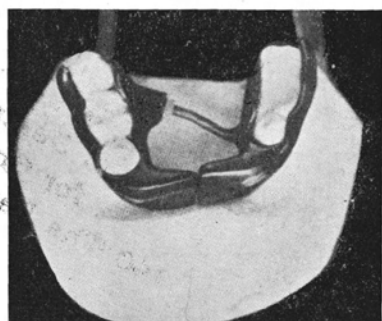


Figure 26.



Illustrate Lieut. C's treatment in detail. "two ends of the mandible were allowed to come together by wiring, and an impression was taken; an X-ray examination having shown that callus was forming. (Figure 23). A jack-screw was used to push apart slowly the fractured ends, and after four weeks a retention appliance was inserted. (Figure 24). Three weeks later a larger jack-screw (Figure 25) was inserted, and this was followed by another, with pressure on a different point, (Figure 26), until I had obtained the result as shown. A retention appliance was then inserted to allow for strengthening of callus, which finally formed new bone. From "A few Suggestions for the Treatment of Fractured Jaws," by Major A. C. Valadier, R. A. M. C., (T. H. C.) British Journal of Surgery, July, 1916, pp. 67 and 68.

ments of clothing, wading, etc., were removed. I extended the cleaning up process far enough to get every bit of tissue that did not look or feel like normal tissue. After this was done the wound was brought together and sutured, only a very small drainage tube being

useful arm with a flail joint. I saw him a few days ago (about three months since his injury) and you would hardly recognize that he had had an injury until his coat was removed and attention was called to the arm. Of course the arm is somewhat shorter than the other,



but is a useful arm with a very fair range of motion in its flail elbow joint. (Blackboard drawings were made by the author to illustrate the two cases.)

In summarizing the treatment of wounds, I cannot do better than quote what Sir Berkeley Moynihan said in his address on this subject as published in the December (1917) number of *Surgery, Gynecology, and Obstetrics*:

"Perfect mechanical cleansing—that is, the excision of all contaminated, infected, or dead parts—the removal of all fragments of cloth (by far the most important of all causes of confining infection in a wound) and of all projectiles, is the supreme necessity in all cases."

"In early cases this may allow of immediate closure of the wound which will be followed by healing in the great majority of cases, say in 80 per cent, or perhaps even 90 per cent, of those in which there is no loss of tissue."

"In infected early cases the mechanical exposure and cleansing may be followed by a treatment directed to the removal of the remaining infection. Physiological and antiseptic methods have each their advocates. The aim of both is to permit of the earliest prudent secondary closure of the wound. In 'infected late' cases, a thoro mechanical exposure and cleansing of the wound and the parts around will allow of secondary closure forthwith if certain antiseptic pastes are used. Experience shows that similar results have followed upon this mechanical treatment of the wound without the introduction of antiseptics. A further trial in this class of cases may show that the natural defenses of the tissues are ample to deal with the infections then remaining."

"It is the natural defensive powers of the body fluids and tissues, of serum and leucocytes, that are the chief agents in finally subduing the bacterial infection in the wound. Sufficient reliance does not appear to be placed upon the stupendous power of the body tissues for controlling infection."

"Finally full emphasis must be laid on the paramount necessity for the complete immobility of wound parts at all times and on all occasions. So will one of the most powerful agencies making for reinfection and auto-inoculation to be kept in check."

The recent literature of the treatment of wounds is so voluminous that it is impossible to do more than refer to a few of the leading articles. We have not exhausted even the best, but I hope enough has been presented to encourage further research.

#### LIST OF ARTICLES ON SURGERY OF THE FACE AND MOUTH.

Prepared by

Dr. Carl E. Black, Jacksonville, Illinois.

The list of articles, part of which will appear in the next issue of *The Journal*, is divided into thirty-five groups, each under a separate heading. These are all recent articles which have appeared in medical and dental journals. Many articles in French Journals, and a considerable number in Italian, Spanish, German, Norwegian and Russian, have been reviewed, but they are not included in this bibliography.

Each group of articles was assigned to a committee of the class, and brief extracts of the more interesting papers, were presented before the class.

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The Physician in War. G. M. Blech, *Am. J. Clin. Med.*, 1917, XXIV, 415.

Some of the Lessons of the War. The New Way of National Life. J. Barr, *Am. Med.*, 1917, 12, 433.

A Few Remarks on European War Surgery, A. O. Fasser, *Internat. J. Surg.*, 1917, XXX, 187.

Behind the Lines of Verdun. Alonzo Milton Nodine. P 298, *Dental Record*, London, Eng., 1917.

War's Influence on Medicine (1917) C. H. Mayo, *J. A. M. A.*, June 9, 1917, 1673.

Prognosis. P. H. Ringer. *Virg. M. Semi-Month*, 1917, XXII, 105.

Six Weeks' Study at the Val-de-Grace Military Hospital, Paris. E. Comte. P 424, 2 illus. P. 492, 2 illus. *Dental Record*, London, Eng., 1917.

The Replacement of Morphine in Surgical Practice; report of 110 cases. J. H. Schall, Long Island, M. J., 1917, XI, 187.

Preparedness. W. A. Chapman, *Internat. J. Surg.*, 1917, XXX, 174.

Report on the Work done by the British Red Cross Dental Surgeons. Field Robinson. P 137. *Brit. Den. Jnl.*, 1917.

The Wounded as We See Them at Home. W. C. Allardice, West M. News, 1917, IX, 73.

Files and Field Surgery. E. O. Kane. Internat. J. Surg., 1917, XXX, 146.

A Short Account of the First Dental Operating Vans for Army Service at the Front. Parker-Cater. P. 41. Brit. Den. Jnl., 1917.

War Surgery at the Front. C. MacLaurin. Med. J. Austral., 1917, I, 503.

Hospital Francais de New York, Hospital No. 32 Bis Passey par Veron (Yonne) France. Alonzo Milton Nodine. P. 105, 2 illus. Dominion Dental Journal, Toronto, 1917.

Gradual Development of Surgery. M. D. Delaney. Virg. M. Semi-Month, 1917, XXII, 59.

Factors which Contribute to Safety and Success in Surgical Procedures. J. C. Fleming, Indiana St. M. Ass., 1917, X, 263.

Medical Preparedness as a Factor in Great Drive for Democracy. J. C. Bloodgood. South M. J., 1917, X, 746.

War Surgery. T. H. Goodwin, Mil. Surg. 1917, XLI, 279. (62).

Surgery Next Door to the Front. T. B. Layton, Lancet, Lond., 1917, CXCH, 483. (61).

Progress in Surgical Therapeutics. A. Vanderveer, Med. Rec., 1917, XCII, 495.

Surgery Before or After Constitutional Treatment in Tubercular Conditions. E. Bonime, Long Island, M. J., 1917, XI, 349.

Conservatism in Surgery. S. J. Mixer, Ann. Surg., Phila., 1917, LXVI, 257.

A Miracle of Surgery. Harold Begbie. P. 84. Selected. Dental Post-Elevator Mandibular Fractures. Georges Villain. P. 122, 16 illus. Translated. Dental Record, London, Eng., 1918.

Observations in Military Surgery. W. A. Clark, Surg. Gynec. and Obst., 1917, XXV, 463.

What the European War Has Taught in the Treatment of Wounds. W. L. Brown, South M. J., 1917, X, 809. (III).

The Influence of the Present War on the Treatment of Infected Wounds. K. W. New, N. Orl. M. & S. J., 1917, LXX, 20.

The Department of Oral Surgery of the Harvard Surgical Unit. Maj. V. H. Kasanjian. P. 454 Brit. Jnl. of Dental Science, 1917.

The Influence of War on Medical Science. J. Ewing, J. Am. M. Ass., 1917, LXIX, 249, 1917.

The Function of the Military Orthopedic Hospital. F. H. Albee. N. Y. M. J., 1917, CVI, 2.

A Summary of Medico-military Facts Developed by Experiences on European Battle Fronts. H. K. Loew, N. Y. M. J., 1917, CVI, 5.

## NO. 2—MILITARY CLINICAL ORGANIZATION.

The Work of British Pathology in Relation to the War. F. W. Andrews. Brit. M. J., 1917, 1,829.

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The Development of British Surgery at the Front. A. Bowlby and C. Wallace. Brit. M. J., 1917, 1, 705.

Experience in a British Military Hospital. J. B. Dawson. Med. J. Austral., 1917, I, 479.

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A Day's Work. A. MacPhail. Lancet Lond., 1917, CXCI, 979.

Medical Units in the Field. O. L. Pothier. N. Orl. M. and S. J., 1917, LXIX, 825.

The Most Practical Plan for the Organization, Training and Utilization of the Medical Reserve Officers of the Reserves, in Peace and War. Med. Rec., 1917, XCI, 857.

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Clinical Organization of Medical Profession. C. O. Hawthorne. Brit. M. G., 1917, 169.

Problem of Unnecessary Operations and of Incompetent Surgeons. A. D. Bevan, J. Am. M. Ass., 1917, LXIX, 161.

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Emergency Suggestions. J. A. Hofheimer. Internat. J. Surg., 1917, XXX, 157.

First Aid to the Injured as it Applies to the Railroads. R. W. Knox. South. M. J., 1917, X, 581.

First Aid to the Injured with Reference to American Red Cross. O. M. Marchmaun, South. M. J., 1917, X, 680.

First Aid and Dressing Stations in Battle in Austro-Hungarian Army. J. H. Ford, Mil. Surg., 1917, XLI, 179.

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The Treatment of the Wounded in the Present War. H. J. Paterson. Internat. J. Surg., 1917, XXX, 178.

Some Inconsistencies in Surgical Technique. J. S. Horsley. South. M. J., 1917, X, 423. (213).

A Portable Operating Table Attachment. T. Stellwagen, Jr., N. Y. M. J., 1917, CVI, 694.

The Suction Apparatus in Surgical Operations. W. M. Brickner, Am. J. Surg., 1917, XXXI, 117.

A Simple Aspirating Device. A. L. Benedict. N. Y. M. J., 1917, CVI, 156.

Aspiration or Vacuum Suction Apparatus. R. C. Myles. N. Y. M. J., 1917, CVI, 629.

Absorbable Metal Clips as Substitutes for Ligatures and Deep Sutures in Wound Closure. E. W. Andrews. J. A. M. A., 69:278, July 28, '17.

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Absorbable Metal Clips as Substitutes for Ligatures and Deep Sutures in Wound Closure. E. W. Andrews. J. Am. M. Ass., 1917, LXIX 278, 1917.

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Cicatriztion of wounds; Mathematical study of the extra polation formula and of the curve of cicatrization. P. L. DuNouy, J. Exp. Med. 1917, XXV, 721.

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The Re-inoculation of Antiseptics. G. L. Ser-voss, Med. Summary, 1917, XXXIX, 242.

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