The medical museum : modern developments, organisation and technical methods, based on a new system of visual teaching / by S.H. Daukes.

THE MEDICAL MUSEUM

BASED ON

A NEW SYSTEM OF
VISUAL TEACHING

BY

S. H. DAUKES

DIRECTOR

THE WELLCOME MUSEUM OF MEDICAL SCIENCE

THE WELLCOME
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AND AFFILIATED RESEARCH INSTITUTIONS
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THE MEDICAL MUSEUM

MODERN DEVELOPMENTS, ORGANISATION AND TECHNICAL METHODS

BASED ON

A NEW SYSTEM OF VISUAL TEACHING

THE WELLCOME BUREAU OF SCIENTIFIC RESEARCH AND MUSEUM OF MEDICAL SCIENCE
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PREFACE

THE MEDICAL MUSEUM is regarded as a necessary adjunct to any well-equipped school of medicine. Here are stored, in a condition of preservation more or less effective for teaching purposes, specimens which offer unique material for education and research. Around this centre, in the wards, out-patient department and autopsy rooms, revolves a wealth of material illustrating the classic or abnormal manifestations of disease. These manifestations do not necessarily lend themselves to display in a museum jar: indeed, too often such a jar is merely a testimony of failure.

With the passing years we find an increasing number of ways of depicting the manifestations of a morbid process: the radiograph, the electro-cardiograph, the kinematograph, the photograph, the painting, are all available for providing such a record.

More and more are instruments invented which enable the physician and surgeon to peer into the hidden recesses of the human body: the laryngoscope and the ophthalmoscope have been followed by the sigmoidoscope, the cystoscope and many other instruments; and exact pictures can be made of conditions which are rarely seen at the final investigation in the autopsy room or on the shelves of the Hospital Museum.

As a whole, the Medical Museums have not kept pace with these clinical and therapeutic advances, and it is good for us to survey the position and to see if by further development on new lines we may not provide something of real value for present and for future generations.

In such an effort has the system described in this volume been conceived: a system which links up the various branches of medical work as one demonstration, providing a display which may fittingly be termed "synoptical." The system is now in its infancy, but it is hoped that, nourished by the fruit of its labour, it may attain to a useful maturity.

In support of his claims, the writer would quote some words used by Sir Walter Fletcher, Secretary of the Medical Research Council, in his speech at the re-opening of The Wellcome Bureau of Scientific Research and Museum of Medical Science.

> "This museum . . . . succeeds in illustrating in the most vivid and instructive way the present state of knowledge of the causation of human disease. It illustrates, too, so far as possible, the methods of prevention and treatment. No one can doubt the great educational value of this teaching museum. I believe, indeed, that it is making a pioneer experiment that may point the way to wide developments of this mode of teaching in medical education. We still cling far too much to the methods of oral lecturing inherited from days when books were scarce or printing not invented. This Wellcome Museum is both museum and library combined; it is, in effect, a sumptuously illustrated text-book. *In chosen parts of the subject a student may learn more from a quiet hour in one of its divisions than he is likely to gain from any ordinary formal lecture of the schools.*
>
> "May I say, lastly, that I see a large usefulness for this museum, and for what I hope will be a host of its imitators, in the instruction of intelligent laymen who desire to follow and understand the steady conquest of disease by the slow march of discovery?
>
> "A former Minister of the Crown, now in high administrative office overseas, told me that a visit, paid almost by chance, to the museum gave him

his first really vivid impression of what scientific work had done and might still do for the peoples of our Empire. It aroused for the first time his enduring sympathy and interest."

On the same occasion, the Minister of Health, Mr. Neville Chamberlain, said :—

> "I can imagine that all these drawings, paintings, photographs, models and actual specimens, classified as they are, and exhibited in such a manner that they themselves tell their own story to those who examine them, must present a picture of a vividness and impressiveness which perhaps cannot be excelled by any other method of demonstration."

Success in any undertaking is largely dependent upon favourable environment and freedom of action : such conditions have been enjoyed in organising the system described. The writer wishes to trace whatever may be of value to its source in the scientific enthusiasm and educational foresight of Dr. Henry S. Wellcome, Founder of The Museum of Medical Science and of The Wellcome Historical Medical Museum. The fact that The Museum is affiliated to the various Research Institutions of the Foundation has proved of material assistance ; indeed, such an association is especially fitting in view of the fact that research forms an integral part of modern museum work.

The formation of such a museum is essentially a question of effective team work, and the writer acknowledges with gratitude the continual advice and guidance of Dr. C. M. Wenyon, F.R.S., Director-in-Chief of The Wellcome Bureau of Scientific Research, and the loyal co-operation of those members of the staff who have assisted in working out the system which is described. More especially are the writer's thanks due to his secretary and assistant, Miss B. M. Parnell ; to Miss I. M. Bellis, Librarian to The Wellcome Bureau, who has prepared the careful summary of references which is

included; to Dr. A. C. Stevenson, for much practical help and advice; to Mr. A. Michieli, Photographer to The Bureau; and to Mr. H. Bugg, Chief Pathological Assistant.

Finally, the writer wishes to acknowledge his deep indebtedness to the stimulating influence of Dr. Andrew Balfour, the first Director-in-Chief of The Wellcome Bureau of Scientific Research; also to the many friends, in Hospitals and Institutions throughout the world, who have so generously assisted in the work.

S. H. D.

May, 1929.

CHAPTER I

THE NEED FOR REFORM

Functions of a Medical Museum — A Wider Outlook

THERE has always been a tendency to regard the Medical Museum as a warehouse of classified material, eloquent of the knowledge of a bygone age, with a passing message for the present and small hope for the future. Such an outlook is inevitable under a system which has allowed its reverence for the past to determine its policy for the future, as has been the case in many of the great Medical Museums of the present time. Here may, too often, be seen vast collections of pathological material, preserved in such a manner that the characteristic lesion is no longer obvious, and arranged in such a way that they have lost much of their value for purposes of study and research.

Opportunity

As the years go on, and knowledge grows, the Museum must play an increasingly important part in medical education. Medicine is becoming a mosaic of specialities, and, with the increase of specialised teaching, it becomes essential for the student to have some centre where he can view the subject as a whole and fit the various sections of the puzzle together. Such a centre can be supplied by the Medical Museum provided it is suitably arranged.

Museum study should form a definite part of the medical curriculum, a sequel to the lectures and demonstrations of the wards, out-patient department, laboratories and post-mortem room. To achieve its object, such a museum must depart from traditional methods; it must cease to be a pathological collection and become a compendium of medical knowledge.

Functions

The functions of a medical museum are many. It must collect and preserve specimens illustrating every phase and variation of disease, and thus be available for purposes of

reference and comparison. It must form a centre for research, for investigation into the various manifestations of disease. It must also offer facilities for revision and post-graduate work.

More and more, as years go by, it is being realised that education of the public is essential for the successful prevention of disease. In this health campaign the medical museums of The future will play their part, not only in the education of health visitors, nurses, public health officials and others responsible for such work, but also in bringing home to the more intelligent section of the lay community the essentials of preventive medicine. Such a museum may thus act as a centre for medical propaganda.

The experience obtained in organising and establishing the Wellcome Museum of Medical Science has demonstrated the practicability and value of such a Museum, designed to meet the broader claims of modern medicine—a Museum which treats of medicine as a whole.

Visualisation

In clinical work, the eye is the main avenue for diagnostic information, to which the senses of touch, smell and hearing are supplementary. In medical education, again, the eye must also take first place; it is from the wealth of material stored as visual impressions that the expert draws his comparisons and conclusions. A graphic method of museum demonstration is calculated to sharpen and develop this sense and provide a preliminary foundation upon which subsequent experience can build.

Medical Museums Classified

Medical museums may roughly be divided into national collections, museums of teaching schools, special museums, private collections and public exhibitions. Private collections have formed the nucleus of many of the famous museums; as, for example, those of Athanasius Kircher, William Charleton, Frederick Ruysch, Elias Ashmole, Sir Hans Sloane, John and William Hunter and Sir George Murray Humphry.

A national museum must fulfil all the objects mentioned above, namely:—

(1) Collection and preservation of material.
(2) Reference.

(3) Research.
(4) Education (specific teaching).
(5) Education (general teaching for the public).

The museums of teaching schools are mainly concerned with the teaching of students; it is a mistake to allow the glamour of rare or unusual specimens to create a false impression in their minds. These museums should gradually be modified so as to embrace the system which will be outlined in detail below.

Special museums—for example, those dealing with eye conditions, new growths, etc.—are in a different position; they are largely the concern of the specialist, and should be arranged so as to meet the requirements of those engaged in that speciality.

Personal museums are mainly a record of personal work and tend ultimately to find their way into the public collections.

Functions of a National Museum

It is inevitable that a national museum shall be mainly concerned with the collection, identification and description of material, with subsequent grouping in the method most convenient for reference and research. The arrangement generally adopted is either anatomical or pathological—lesions of the various organs are placed together, or specimens are arranged according to the morbid changes which have occurred.

In such a collection much depends upon the system of labelling adopted—references and cross-references must be so arranged that each specimen is linked not only with its own pathological group, but also with other pathological conditions allied to it either as cause or result.

It is largely upon its value for research and reference that a national collection should be judged, but there is no reason to neglect the educational side. Material is plentiful, and with a wealth of duplicates, it is possible to satisfy the requirements of the student without in any way interfering with more advanced work.

Royal College of Surgeons Museum, England

The hall devoted to general pathology in the Royal College of Surgeons Museum is a good example of what may be

done, and what is most conspicuously left undone in many medical museums.

The record of research work at this Museum during the last few years forms a good illustration of how much may be learned from museum material to advance the knowledge of medicine and surgery. The position is very clearly stated in Sir Arthur Keith's Report, as Conservator of the Museum, of the 16th June, 1925.

"THE MUSEUM AS AN ENGINE OF RESEARCH.—

"To explain this purpose it is necessary to touch on the objects which such a Museum as ours is intended to serve. In reality it is a vast instrument for the preservation and propagation of all knowledge relating to the processes which take place in living matter, both in health and in disease. All that is in it should reflect, directly or indirectly, upon these processes as seen in the human body. Our Museum has become an immense consulting library where specimens take the place of manuscripts and of books. Nature, however, is a publisher who never produces two imprints exactly alike; no matter whether we study cancer of the stomach, inflammation of the appendix, acute osteomyelitis of the femur, or the cranial form in a given race of mankind, we never find two instances exactly alike. The original aim of the Museum custodian was to select only representative specimens, and to devote the whole space at his disposal for their display. If ours were a purely teaching Museum—one designed for the needs of students preparing for pass examinations—then it would be our business to select only representative specimens of each disease. The needs of medical students are already amply met by museums attached to their schools. The Museum of the College must supplement these teaching museums; it must cater for the special student, for the man who is seeking to increase and improve medical knowledge, by placing at his disposal not only typical specimens but the varieties, for often a study of the less common

> varieties of a disorder will throw more light on its nature than an investigation of a series of typical specimens. Every modern museum has now to distinguish between its 'exhibition' specimens placed in show-cases, and its 'study' specimens—representative or instructive specimens—needed only by special students, and which may be kept in cupboards or any accessible parts of the Museum."

These Annual Reports of the Museum of the Royal College of Surgeons show the lines upon which research may be carried out in such an institution. Here, every specimen may serve to throw fresh light upon the processes of health and disease; even the routine work may serve such a purpose, as is shown by the following quotation:—

> "The preparation of a new descriptive catalogue is essentially a work of research . . . . many new facts have come to light as old specimens were re-examined by modern methods."

Research

Good recent examples of this branch of research are afforded by the work of Lawford Knaggs on the diseases and disorders which affect the skeletal system of the human body; by investigations of Victor E. Negus on the ramifications of the bronchial tree in the natural position within the lungs; by the research into the origin and nature of hernia by Sir Arthur Keith; and on various pathological conditions of the joints by A. G. Timbrell Fisher.

Abnormalities

A national collection is the rightful home for unique or rare specimens; it is a mistaken policy which allows these specimens to remain as conspicuous exhibits in teaching collections. The mind instinctively fixes upon what is bizarre or unusual, often to the exclusion of what is of greater practical value; moreover, there is a manifest advantage in collecting together the various abnormalities and rare variations so that they are readily available for comparison and research.

Wider Use of Hospital Museums

The hospital museums are almost entirely collections of pathological and anatomical specimens, though some have excellent wax models, as, for example, Guy's Hospital, whilst

others show a certain number of clinical photographs or paintings and a few have historical relics included amongst the other material. There can be no doubt that many medical museums need drastic reform: the labels are inaccurate or incomplete, the catalogues out-of-date, and the specimens badly preserved. Revision is inevitable in view of the advance in knowledge and improvements in technique which have taken place during the last few decades. With vigorous pruning, however, much may be done, and already in many of the London museums progress is being made.

The scope of these museums should be considerably extended by the larger use of photographs and paintings: the hospital photographic department is often a mausoleum of valuable clinical material. Teacher after teacher emphasises the importance of a certain facies, posture or gait; in the wards is material illustrating every visible manifestation of disease, available for the camera or the artist's brush: the collection of such material for the hospital museum would be of infinite value to teachers of medicine.

Temperature charts and clinical records can often with advantage be placed in proximity to the pathological specimen. The ideal hospital museum would meet the requirements both of the pathologist and of the clinician; it would provide a pathological collection illustrative of general pathology, and a clinical section where the case was demonstrated as a whole (*see Appendix* A, *pages* 64–71).

Labelling

The question of labelling is very important. It is essential to remember that a student uses the museum for study in his spare moments, and that the spare moments of a student are few, often snatched from his time for recreation or nourishment. Any system which is fatiguing will probably fail to keep his attention. To place a number on a bottle referring to a catalogue of which there is one copy, difficult to find, incomplete or out-of-date, is a sure way of neutralising any value the museum might otherwise possess. The specimen should have a descriptive label sufficiently explicit to enable it to be identified and studied, further information being supplied in the catalogue.

CHAPTER II

The Evolution of the System

School of Army Hygiene, Leeds—The Wellcome Museum of Tropical Medicine and Hygiene—Wembley, 1924—Wembley, 1925—The Wellcome Museum of Medical Science

Before proceeding to a detailed description of methods of administration, arrangement and technique, it will be well to summarise the various progressive steps which have led up to the present position.

School of Army Hygiene, Leeds

The experience has extended over about eleven years, commencing in the winter of 1917–18, when, under the War Office, the writer was responsible for the organisation and administration of the School of Army Hygiene, Leeds.

The primary object of this School was to give a short intensive course on army sanitation to American medical men who had volunteered for service with the British forces on the Western front. The time available for teaching was very short—four or five weeks for each class—and it was obvious that for men going straight to responsible positions in the front line the course must be essentially a practical one.

To meet the situation, a demonstration centre was established which reproduced as nearly as possible the position in the front line in France: trenches were constructed; "dug-outs," field kitchens, incinerators, and all the other paraphernalia which constitute environment under service conditions. The lectures were then delivered in an appropriate setting and under the best conditions for emphasising the various points under consideration. The results were in every way satisfactory as far as it is possible to judge of results under such abnormal conditions.

All problems of water purification, rations, food poisoning, clothing and equipment were demonstrated in the same graphic manner, free use being made of paintings, photographs, and models in wax or plaster.

Here especially the value of such a method was demonstrated : the subjects were easily taught, the attention was held, and the knowledge acquired was essentially practical. There is no need to elaborate further this experiment, which the writer has described in some detail in the *Official Medical History of the War* (Hygiene, Vol. I, pp. 35–52).

Further Development of the System

It was at this period that Dr. Andrew Balfour, then Director-in-Chief of The Wellcome Bureau of Scientific Research, selected the writer to carry on the work of the affiliated Museum which had been started in 1914 at The Wellcome Bureau in London. On the Continent, the International Hygiene Exhibition at Dresden, in 1911, and the Board of Trade Section on Tropical Medicine at the Ghent Exhibition, 1913, had in a measure paved the way for such developments.

Progress, subsequent to the inevitable hiatus due to the Great War, may be divided into five periods, each of which played an important part in determining the ultimate conclusions arrived at :—

(1) Development of The Wellcome Museum of Tropical Medicine and Hygiene.

(2) Organisation of Tropical Diseases Section, Wembley, 1924.

(3) Organisation of Ministry of Health Section, Wembley, 1925.

(4) Revision of The Wellcome Museum of Tropical Medicine and extension to cover all branches of medicine under the title "The Wellcome Museum of Medical Science"—re-opened December, 1926.

(5) A comparative study of various medical museums in Europe.

With reference to Tropical Medicine, the value of graphic demonstration is obvious. Here we are dealing with a subject

The Wellcome Museum of Tropical Medicine

which, from an ætiological standpoint, lends itself especially to such a method of demonstration. Animal reservoir hosts, insect vectors, prophylactic measures, are all specially susceptible to such a mode of expression. Clinical material is hard to obtain in this country, and, as a result, photographs and paintings become of special importance.

As The Wellcome Museum of Tropical Medicine developed, it was used more and more to supplement the routine teaching of tropical medicine, but always in the background was the feeling that there can be no real division between tropical medicine and that of other parts of the world. A few diseases are essentially tropical, such as yaws, yellow fever, and the sleeping sickness of Central Africa; others which are classed as tropical are more common under such conditions owing to lack of adequate sanitary precautions amongst the crowded native population, *e.g.*, plague, relapsing fever and typhus. On the other hand, many so-called diseases of temperate climates are equally common in the Tropics, and may even assume epidemic proportions of undue severity in races which have not acquired immunity—pulmonary tuberculosis and measles are classic examples. For this reason, it was inevitable that ultimately such a museum should develop into one covering every variety of disease.

The value of the Museum in this early stage of its development was emphasised in a leading article published in the *Indian Medical Gazette*, February, 1923, *pages* 73 *and* 74, where a high tribute was paid to its efficacy as a teaching centre :—

> " Very few medical museums can be described as ' live ' ; most of them would more fittingly be described as ' dead ' in more senses than one. It is probably for this reason that so few people feel inclined to spend time in them.
>
> " It will be a revelation to those who visit The Wellcome Museum in Endsleigh Gardens, London, for they will find it the museum of their dreams . . . . a museum which is not only a great illustrated encyclopædia of tropical diseases, but also a vivid and orderly picture from which the visitor

can obtain a clear conception of the whole subject. Even if he has only a short time at his disposal he will come away with fresh ideas of the whole field of tropical diseases; but if he is more fortunate in having more leisure, he will be able to obtain, in the most attractive form, a clear insight into each and every disease which is specially common in the Tropics.

. . . . . .

"The Museum with which this note deals is a good illustration of the advantages of the orderly and pictorial method of education.

"The arrangement of the Museum is particularly clear. The ground floor is given up to hygiene, and the upper three floors to tropical diseases and special sections, such as entomology and medical zoology in general. By a simple system the visitor to the Museum is kept on the right path, and he is able to distinguish between the essential and the unessential, and also between proved facts and unproved suggestions."

Tropical Diseases, Wembley 1924

In 1924, at the Wembley Exhibition, a demonstration of "Tropical Diseases" was included amongst the sections in the Government Pavilion; the Museum contributed many exhibits, and the writer was Organising Secretary.

This followed the lines of a similar exhibition at Ghent in 1913, which had proved sufficiently popular to justify a repetition of the experiment. A number of diseases of imperial and international importance were selected, and an exhibition was prepared displaying the more interesting features of each disease; in some, stress was laid on the cause and method of transmission, whilst in others, the clinical features or mode of prevention provided the main theme for demonstration.

A great deal of interest was taken in this exhibition by the general public, and also by qualified medical men. It was obvious that a "popular" method of demonstration, designed to interest the layman, also made a considerable appeal to the expert and

to medical students; indeed, classes of students were taken round the section for demonstration purposes.

Health Exhibit, Wembley 1925

The success of this exhibition inspired the Ministry of Health to undertake a similar section in 1925, dealing with home hygiene and disease prevention. This was also organised by the writer, and The Wellcome Museums supplied much material.

Here the hygiene of the past, the present and the future was graphically represented in three large halls; the key-note to the exhibition was progress. Everything was carried out in such a manner as to attract, interest and educate the more intelligent section of the community. Life-sized tableaux illustrated the passage from ignorance to knowledge. Pictures, specimens and models were utilised to illustrate every phase of public health work.

The whole was so arranged as to afford a clear and continuous lesson in preventive medicine. The plan and introduction to the Handbook, drawn up for the use of visitors, clearly indicate the scope of the exhibition (*see Appendix* I, *page* 91).

The Wellcome Museum of Medical Science

Once again the value of such a demonstration, not only for the layman but also for the health official, was apparent. The first step in scientific education is to create interest, to vitalise a subject so that subsequent study and research are the natural outcome of the enthusiasm engendered. The graphic method of demonstration is specially calculated to attain this end in the study of medicine, and the exhibition at Wembley emphasised the need for extending such a system to the specialised training of the medical schools and hospitals.

The various experiences outlined above culminated in the preparation of a detailed scheme for extending The Wellcome Tropical Museum to include diseases of all climates. Limitation of space—for at that stage only 20 small halls were available—determined the immediate programme, but provision was made for ultimate extension, so that eventually the whole of medicine and surgery could be included. This partial scheme has now been carried out.

In such a Museum there can be no finality—progress is the essence of its existence; indeed, in every type of museum it is essential to keep up-to-date. A survey of the present position, however, contains many lessons of practical value.

The various points of importance in the arrangement and management of such a medical museum will now be discussed in detail, with special reference to the methods adopted at The Wellcome Museum of Medical Science.

CHAPTER III

General Arrangement

Classification—Sequence and Grouping

Classification

THE general arrangement of a museum must vary with the type of building (*see Appendix* B, *pages 72 and 73*) and the nature of its teaching—an anatomical museum will have an anatomical arrangement, a pathological collection will have a pathological arrangement, or possibly an anatomical one. A hygiene museum presents greater difficulties, but probably a scheme based upon the mode of transmission possesses a higher teaching value than any other. The method of such a classification is well illustrated in the writer's *Barrier Charts for Health Officers ;* it has a practical value which outweighs any technical or theoretical difficulties which may arise.

The arrangement adopted at The Wellcome Museum is mainly ætiological—diseases caused by metazoa, diseases caused by protozoa, diseases due to spirochætes, diseases caused by bacteria, diseases of doubtful or unknown causation, skin diseases classified according to their mode of production, food deficiency diseases, metabolic diseases, endocrine diseases, blood diseases.

Sequence

Whatever method may be adopted, it should provide a logical sequence of study, and should possess some definite teaching value. The arrangement of the component parts of a museum is of great importance to the student : it may be compared to the sequence of chapters in a text-book.

The course of instruction also must be clearly outlined, so that each exhibit falls into its proper place. This has been accomplished by numbering each hall and sub-numbering with smaller numerals each section in the hall. The student starts at (1) and, by following the numbers, is able to pursue a definite course of study without waste of time or effort.

Groups

Diseases are divided into ætiological groups, and, wherever possible, each group is ushered in by a section dealing with the main factors in causation. Helminthic diseases commence with a general survey of the helminths (Fig. 1, *page* 121), protozoal diseases with

a general survey of the protozoa, and dietetic diseases with a general exhibit dealing with diet. The unit of study is the disease, and each disease is divided into sections representing ætiology, pathology, symptomatology, treatment and prevention (Fig. 2, *page* 122).

The system of grouping adopted enables the centre of the hall to be devoted to exhibits related to all the diseases in the group. For example, in the Food Deficiency Section is a central exhibit illustrating diet in general; here the demonstration deals with Vitamins and Calories. The models are constructed in wax; on the upper shelves they represent the various articles of diet rich in Vitamins A, B, C and D. The two lower shelves have food models, constructed so as to represent the relative calorific value of the more common foodstuffs, each model representing 100 Calories. Such an exhibit is of great value for teaching purposes and forms an admirable introduction to the section of Food Deficiency Diseases.

In the section dealing with Blood Diseases, the central exhibit illustrates various methods of blood examination. Central exhibits also demonstrate recent research work relating to the adjacent diseases.

The main scheme is often neglected in organising a museum, and, owing to this, a valuable teaching factor is lost. The Deutsches Museum of Science and Industry at Munich is an example of how a museum should be arranged (see *Bulletin of Hygiene*, Vol. III, No. 1).

In The Wellcome Museum of Medical Science, on the ground floor, are the diseases due to metazoa; on the first floor, those due to protozoa, spirochætes and the acid-fast bacteria; on the second floor, other diseases due to bacteria, rickettsia diseases, diseases of unknown causation and skin diseases; on the top floor are the food deficiency, metabolic, endocrine and blood diseases, and tumours.

In the original scheme it was intended to commence the consideration of each disease with a summary of the history. Lack of space made it necessary to modify this arrangement, and the historical exhibits included are merely to create interest and draw attention to the importance of the history of medicine, which is demonstrated so fully at The Wellcome Historical Medical Museum.

CHAPTER IV

ÆTIOLOGY

Pictorial Screens—Models—Specimens—Examples

EACH disease is introduced by a pictorial summary of its *ætiology*. The causal organism is demonstrated by photographs, paintings, cultures, and by other means, so as to illustrate its more important features. The mode of transmission lends itself to pictorial representation, more especially in the diseases conveyed by invertebrate hosts. This may be illustrated by the schemes adopted for malaria, ankylostomiasis and bilharziasis.

Ætiological Screen

The ætiological screen for malaria shows the various forms of parasites in all stages of their life-history; it depicts the passage of the parasite from the sick man to the mosquito, the development of the parasite in the mosquito, and finally the infection of the healthy man. Paintings illustrate certain notorious vectors of the parasite and the various types of mosquito breeding-grounds which act as predisposing factors (Fig. 3, *page* 123; and Fig. 3A, *page* 124).

On the reverse side of the screen the teaching is elaborated so as to demonstrate all the important features for identification of the parasite. In a similar way, the whole problem of breeding-grounds is reviewed in greater detail in subsequent sections.

Wax Models

Wax models of insect carriers are of value for teaching purposes, but strict accuracy is essential. There are very few artists available for the work, and the price is high. Models are made on the Continent at a low cost, but the craftmanship is inferior, and they are not always accurate in detail.

The Graphic Method

The graphic method, thus illustrating the transmission of protozoal diseases, is equally applicable for helminthic infections; indeed, there is special need for the adoption of such a method in this branch of medicine, which, like the protozoal diseases, is inadequately taught to the ordinary medical student at the present time.

Here especially is a subject where prevention is better than cure; here also is a group of diseases where the advance of knowledge has made prevention a matter of practical policy; yet such prevention can only be carried out in the light of an accurate knowledge of the life-cycle of the parasite. By the graphic method, such a cycle, however complicated, is easily taught and remembered.

Good examples are afforded by ankylostomiasis and bilharziasis, two diseases which are of international importance for the tax they levy upon the man-power of the world. The various stages in the life-history of the schistosome—egg in water, miracidium, development in snail, cercaria in water, passage through human skin, final lodgement in intestinal blood vessels, and passage of eggs to bladder or rectum—are easier to understand and remember when demonstrated in this manner.

This applies equally to ankylostomiasis, where the egg passes to the soil, in which the larva develops until it is able to invade the human skin, with subsequent passage *via* the lungs, trachea and œsophagus to the intestines (Fig. 4, *page* 125).

Ætiology and Prevention

Upon such ætiological knowledge has the whole scheme of prevention been based, and, with increasing thoroughness of demonstration, the system becomes a direct stimulus to investigation; indeed, if a museum is kept up-to-date, it will always indicate the starting-point and direction of further research (Fig. 5, *page* 126).

A simple way of demonstrating helminthic life-cycles has been devised and is used in the Museum, which is of value for comparative purposes (Fig. 6, *page* 127).

The ætiology of bacterial diseases is generally not so suitable for demonstration by the graphic method, though predisposing factors and organisms causing disease can be effectively shown.

In the Tuberculosis Section, a whole screen is devoted to paintings illustrating the various factors which determine the incidence of this disease (Fig. 7, *page* 128). It is a simple matter to devise such a screen, and the artistic work is not difficult, provided there is sufficient imagination. The value of such an exhibit is a matter for discussion, but the opinion of those engaged in active preventive work has been unanimous in its favour, and special emphasis has been laid upon the propaganda value of such a method of demonstration. Prevention is daily claiming a larger share of attention from the profession, and any teaching system which emphasises this responsibility becomes an important educational asset.

The type of picture most suitable for illustrating the ætiology of syphilis presented certain difficulties; eventually it was decided to utilise prints from Hogarth's paintings in view of the fact that this artist has provided a very complete ætiological picture (Fig. 8, *page* 129).

Zoological Specimens

Where animals play any part in the process of infection, actual specimens of the species concerned should be exhibited—the various mammals responsible for plague epidemics (Fig. 9, *page* 130), for the spread of Rocky Mountain fever, for tularemia infection, and possibly for sleeping sickness.

In every disease spread by biting Arthropoda there should be a case demonstrating the various species concerned, their classification and life-history. This applies especially to such diseases as malaria, sleeping sickness, relapsing fever and yellow fever (Fig. 10, *page* 131).

Intestinal Infections

In intestinal diseases—typhoid fever, dysentery, cholera, etc.—the various ætiological factors are well taught by this method, and it may be made to subserve an additional function as a record of the actual mode of production of authentic

epidemics. This is well illustrated in the Cholera Section, where, in addition to the conventional pictures illustrating water-borne infection, are others which show less common channels of infection—mulberries taken from an infected pool into which they had fallen, cracked melons infected by flies, a water supply during the Great War infected by cholera corpses, infection through milk, through the wash-tub or the temple bathing tank.

CHAPTER V

PATHOLOGY

Grouping—Collection—Preparation—Illustrations—Colour Photomicrographs—Wax Models

THE *pathological section* of each disease constitutes a new departure in demonstrating this subject, but the system is so obvious and of such practical value that its adoption by medical museums in the future is inevitable. It can never replace the general and special pathological collections, but it must be utilised to amplify the teaching and to complete the picture. Each case of disease is treated as a whole; the primary lesion and all the secondary conditions resulting therefrom are shown together. In this way the pathology is reviewed from the standpoint of the clinician. Grouping of Specimens

The lesion may be a mitral stenosis, but the clinician who confined his examination to the heart would have a very imperfect idea of the morbid condition of his patient. In just the same way, numerous hearts, showing various lesions, preserved and placed in long rows on shelves, are useful for comparison, for research and for classification, but have a limited value to the man whose life will be spent at the bedside. In such work the functional utility of every organ must enter into his consideration, and it is essential that this shall be impressed on the mind of every student of medicine.

A series of specimens, illustrating a case of osteomyelitis in a boy seven years of age, emphasises the value of this method. Here was a case of osteomyelitis of the upper end of the tibia, treated with salicylates for 14 days on the assumption that it was a case of "rheumatism." Then with the advent of rigors . . . alarm and rapid dispatch to hospital. Finally, death with the classic signs and symptoms of a septic endocarditis. Side by side are the diseased tibia, the heart with vegetations, the spleen

with infarcts, the kidney with infarcts, and the intestine with small abscesses (Fig. 11, *page* 132). A dramatic lesson with regard to a common medical error. Next to this series is another, showing chronic osteomyelitis of many years' duration with resulting lardaceous disease. Wherever possible this system has been utilised, and pathologists have approved of it and have wondered why a method so obvious has been so little adopted.

Collection of Material

The question of pathological demonstration gives rise to another consideration, applicable to this as to many other types of museum, namely, the haphazard method of collecting material. In many museums material is received without any effort to control the supply at its source, or to fill gaps by definite requests or by seeking material.

In some hospital museums a surgeon is in charge and surgical specimens are received in large numbers, whilst medical material is scarce ; in other hospitals an overworked member of the staff is responsible for the museum, and inevitably the work is confined to the reception and mounting of any chance specimens which may arrive.

For success, a museum must have a definite scheme ; there must be an organised system of collecting material, and very close co-operation between the pathological department, the clinical staff and the museum administration.

It is essential that there shall be one controlling mind over the actual museum, no matter how many departments—pathological, surgical, medical, entomological, helminthological, etc.—are represented. Naturally each department will be consulted as to its own speciality, but over the whole must be a man of sufficiently wide experience and knowledge to co-ordinate the complete exhibition, and with sufficient time to devote to the work.

Methods of Preparation

Great importance attaches to the method of preparation of pathological material ; indeed, much of the success of a museum depends upon careful selection and supervision of the methods employed for preservation. The specimen must be carefully

dissected by a skilled pathologist so that the salient features can be seen at a glance; it must be suitably preserved so that, as far as possible, the natural colours are retained; the colour preservation must stand the test of time.

Much experimental work has been carried out at The Wellcome Museum in order to decide between the many methods which have been recommended, and the L. Pick method, Judah's modification of the Kaiserling method, and Delépine's arsenic gelatine method, are those which have been found to give the best results (*see Appendix* G, *page* 81).

Whatever method is adopted, attention to detail is the secret of success; materials employed must be pure, and solutions must be consistent in composition. The tissue must be placed in the fixative as soon as possible after removal from the body. A teaching school is at a great disadvantage with regard to preservation of specimens, owing to the fact that teaching involves exposure, mutilation and handling of organs, so that much excellent material is lost to the museum.

Evaluation of Methods

The L. Pick method is probably the most satisfactory: it gives perfect colour preservation and great stability; in Pick's Museum in Berlin may be seen many specimens which have been preserved for over 20 years and look as though they have just been removed from the body. Judah's modification of the Kaiserling method (*see Appendix* G, *page* 82) has yielded excellent results, but too few years have elapsed to give any definite judgment.

Specimens occasionally keep their colour excellently for three or four years and then suddenly start to fade. The exact cause is difficult to determine, but probably light, temperature and the reaction of the fluid all play a part.

It is essential to eliminate as far as possible this danger of ultimate failure, and, for this reason, a method which has stood the test of time—as, for example, L. Pick's—should be employed. Delépine's gelatine method has proved of special value for soft tissues—brain, etc.—also for cysts and other specimens where it is important to retain the shape.

The question of storage has an important bearing upon the ultimate success of the specimen. Exposure to direct light is harmful, and certain museums—notably the Army Medical Museum, Washington—adopt stringent precautions to protect their specimens. In the new pathological museum of the Czecho-Slovakian University at Prague, all cases for pathological specimens are provided with spring blinds for shielding the specimens from light.

Small objects, such as worms, fly larvæ and larvivorous fish, may be fixed to glass with celloidin or gelatine and mounted in spirit. This is an excellent method of demonstration, and enables the specimens to be arranged on a definite teaching system as, for instance, in exhibits illustrating the life-history of flies, where egg, larva, pupa and imago are shown in proper sequence (Fig. 12, *page* 133).

Special Methods

Special methods must be used to bring out special features. The ferrocyanide and hydrochloric acid method of demonstrating iron in the tissues is an example. Occasionally, colour preservation is less important than the preservation of shape. As an example may be mentioned changes in the shape and size of the heart, due to various morbid conditions. Professor Schmorl, of Dresden, hardens such hearts before dissecting them. When they are sufficiently hardened he slices them along various planes so as to demonstrate the valves, and dilatation or hypertrophy of the various parts. So rigid is the preparation that the heart can be joined up or separated like the various parts of an anatomical model (Fig. 13, *page* 134).

The Spalteholtz transparent method has been chiefly used for anatomical work, but suggests the possibility of demonstrating pathological lesions by this beautiful process of injection and clearing.

Hochstetter's method of preservation with paraffin is very successful for zoological specimens (Fig. 14, *page* 135), and has been used for anatomical demonstration purposes. Here also is a process which might be utilised in certain carefully-selected pathological conditions.

Selection of Methods

For pathological demonstration, it is necessary to make careful selection of the mode of preparation. Many processes are available and there is too great a tendency to become tied to a rigid routine. This is possibly due to the fact that museum preparation work is inevitably in the hands of assistants, who become skilled in one method. There is, however, a real danger in such familiarity, as a lazy assistant may become careless in the details of a routine technique, or a keen assistant may try experiments without an adequate knowledge of the fundamental principles. In pathological preparation work, such experiments must be absolutely forbidden except with spare material. In any case, much time must elapse before any conclusions can be drawn from a new method.

Normal Specimens for Comparison

The question of the exhibition of normal organs for purposes of comparison is one which is constantly under discussion. It is certainly of value to post-graduates who may have forgotten their anatomy and physiology, and probably is universally applicable. The great difficulty is that the specimens are multiplied and the system is expensive. Possibly the difficulty might be overcome by having one set of normal organs—whole and in sections—for each floor, perhaps on a movable stand or trolley. These would be prepared by the method of preservation usually adopted, so that comparison could readily be made.

Backgrounds

Many preparations are improved by a suitable background, coloured so as to contrast with the specimen. Several different methods and materials have been tried, with the result that paraffin has been found to be the most suitable; it is easily worked and can be coloured in any way desired (*see Appendix* F, *pages* 79 *and* 80). A black back-ground is excellent: the specimen is well shown and, should the fluid or gelatine become discoloured, the defect is not apparent.

Plate Methods

Flat sections of pathological material can conveniently be mounted in made-up glass cells, using one of the gelatine methods. There are many advantages—they are easy to store, can be readily transported to class rooms and lecture halls, and do not suffer from being handed round the class. At the University Pathological Institute, Vienna, this system has been brought to a high state

of perfection, and specimens are stored so as to look like books on a library shelf. It is very easy to find any required specimens, the process is economical and the preparations are not exposed to light. On the other hand, such a collection is more for reference or teaching than for museum demonstration purposes, and is, of course, only suitable for specimens cut into flat sections. The glass cell is very simple to construct, as it is composed of an ordinary flat wooden box, with a glass lid.* A similar method is adopted by the Tuberculosis Hospital in Berlin, and very effective preparations of tuberculous lungs can be made in this way.

Bone Specimens

With regard to the preparation of dry bone specimens, very little work has been done in The Wellcome Museum. An investigation of results obtained in various museums seems to indicate that there is no method which gives better results than those obtained by the L. Pick method, which has been published in detail (*Anleitung zur Konservierung und Aufstellung des Sektionsmaterials*, included in Nauwerck's *Sektionstechnik*, 6th edition, 1921); indeed, it is no exaggeration to say that Professor L. Pick's collection of bone specimens sets a standard of perfection which leaves little room for improvement.

Anatomical Specimens

The preparation of specimens for anatomical demonstration is not included in the work of The Wellcome Museum, but most hospital museums show a certain number of anatomical preparations. Any who are interested in this work should visit the Anatomical Institute in Vienna, where the museum contains a unique collection of material demonstrating methods of injection and dry preservation available for anatomical purposes.

Pathological Illustrations

Pathological specimens may be supplemented by illustrations of characteristic macroscopic and microscopic changes. Much use has been made of this method of demonstration, for there is a wealth of material available, more especially in the store-rooms of the vendors of second-hand medical books.

No pathological museum should be without the wonderful series of illustrations published in the Atlas of Kast and Rumpel;

* The usual method is to build up a glass cell with sheets and strips of glass

for teaching purposes they are invaluable and set a standard for this type of work.

Illustrations from text-books or periodicals can also be utilised to amplify the story or complete the teaching. It is useful in suitable cases to have with the macroscopic specimen a coloured illustration showing the microscopic features. Many illustrations are buried away in the literature which possess a very high teaching value quite apart from the context ; with careful labelling such illustrations can be made to fall into their place in the scheme of teaching.

Original paintings—macroscopic or microscopic—are of great value, more especially the latter, which can demonstrate to large numbers of students material which otherwise would not be available. Changes in the bladder or rectum, as seen with the aid of the cystoscope or rectoscope, can be well shown by means of paintings. These are especially valuable, as no pathological specimen, however well preserved, can supply an exact picture of the condition.

Photo-micro-graphy

One of the problems in museum work is *the demonstration of microscopic changes*. The indiscriminate provision of microscopes is impossible ; many medical visitors rarely use an oil immersion lens and, in any case, valuable microscopic preparations are easily destroyed by a clumsy worker.

After much consideration the writer decided to try *colour photography* as a method of overcoming this difficulty. With the assistance of the pathological and photographic departments, a definite scheme was initiated ; certain subjects were selected and material collected. After many months of experimental work a process was standardised, which gives excellent results, and a special viewing-box designed, in which 24 photographs can be exhibited, the effect being very much that produced by the use of a microscope (Fig. 15, *page* 136).

By this means it is possible to demonstrate bacteria, protozoa, blood changes, new growths and other pathological conditions, almost exactly as they appear under the microscope. There are eight of these viewing-boxes in the Museum at the present

time, and, amongst other things, they demonstrate helminth eggs, malaria parasites, spirochætes, blood changes, new growths and intestinal infections. It is possible to show very high magnifications. Staining of the slides is very important, they must be well stained in contrast colours to get the best effect; it is also important only to use stains with which the average student is familiar.

The teaching value of such a system is obvious; it is possible to demonstrate the microscopic appearance of any lesion in close proximity to the original specimen; indeed, the clinical pictures, the pathological specimens and the microscopic slides of a case can all be reviewed together.

Pathological Models

The value of wax or composition models, for illustrating pathological conditions, is doubtful, in view of the high degree of perfection possible with colour preservation. It is very difficult with such a method to reproduce the finer points of detail which can be seen with the naked eye, and the more carefully such a model is studied the more misleading it becomes. Several museums have such models, and often the first impression is admirable: they are, however, superfluous and should be avoided. This does not apply to the representation of skin lesions, which will be discussed later.

CHAPTER VI

SYMPTOMATOLOGY

Waste of Material—Photographs and Paintings—Models—Radiographs—Laboratory Work—Transparencies—Temperature Charts

VERY few schools in the past have made much use of their museums for *clinical teaching*. This is, to a certain extent, natural, for it is in the wards and out-patients' department that the student must learn the signs and symptoms of disease.

Clinical Paintings and Photographs

The use of paintings and photographs, as a means of recording the stages and variations of disease, has been largely neglected except for the purposes of publication or for the private records of the physician in charge of the case. A large number of photographs are taken in the hospitals, but the results are either buried in the records of the Registrar's office or in the negatives of the photographic department. The functions of the medical museum could advantageously be extended to include the systematic collection, storage, classification and exhibition of clinical pictures and charts. Such a demonstration adds to the value of the pathological collection, and provides an opportunity for students to see much which otherwise they must inevitably miss, now that an increasing number of aspirants for the profession has rendered the available clinical material relatively scarce.

Several diseases lend themselves especially well to this mode of demonstration—exophthalmic goitre, acromegaly, cretinism, myxœdema, gout, chronic rheumatoid conditions, new growths, splenic enlargements, malformations, skin lesions, syphilis, various tuberculous affections, the infectious exanthemata, leprosy, etc. (Figs. 16, 17 and 18, *pages* 137, 138 *and* 139). Paintings are of special value in blood conditions—pernicious anæmia, chlorosis, polycythemia, secondary anæmia, purpura and leukæmia (Fig. 19, *page* 140).

Much valuable material might be collected by keeping pictorial records of characteristic postures and the facies indicative of disease: to describe these in words is quite inadequate. Such

photographs can be arranged so as to occupy very little space in the museum. They can be placed in albums or, better, in swinging leaf screens, or the scheme the writer has recently devised for hygiene illustrations may be used—a shallow receptacle which hangs flat against the wall and can be raised to form a desk at which the student can work. Inside the desk are the illustrations carefully arranged and pasted on large sheets of cardboard (Fig. 20, *page* 141). Where space is available, it is better to have large screens, with the photographs and paintings arranged in their respective groups.

Environment

The inclusion of pictures in a museum adds very much to its attraction, and there is no reason why a medical museum should not be attractive; indeed, there is every advantage in making it a place pleasant and comfortable for study. Beautiful work in photography and painting, well-executed wax or plaster models, well-mounted zoological specimens, well-planned screens and cases, and carefully arranged exhibits all contribute to the success and teaching value of such a museum. The cumulative experience of the last few years has proved the truth of this statement, which is in agreement with psychological teaching.

In medical museums a natural interest in the subject may be taken for granted, but that interest may be greatly stimulated by special features, special methods of demonstration, attention to lighting effects, harmonious arrangement, cleanliness, smartness and comfort. Chairs and small tables should be scattered throughout the museum for the use of students, also portable library steps, so that any specimen or illustration at a high level can be easily studied.

Clinical Models

Occasionally, of greater value than pictures are wax, plaster or composition *models*, which can reproduce with great fidelity the surface characteristics of disease (Fig. 21, *page* 142). They have a special value for illustrating skin diseases, as is emphasised by the fact that some of the most famous skin atlases have taken their illustrations not from life but from the famous collection of wax models at the St. Louis Hospital, Paris. Here is a wonderful collection of 2345 wax models illustrating every known skin disease, and executed with superb skill.

It is an expensive matter to have wax models prepared from life, but, under certain conditions, the expense is fully justified. The Guy's Hospital Museum has a very fine collection of wax models, mostly made by one man (Towne). This has been the history of many of the best collections: the preparation of such models requires special talent—the ability is inborn and cannot be acquired. M. Baretta, who made the models in the Royal College of Surgeons Museum, has been responsible for a large number of those existing at the present time—it has been his life's work. The Deutsches Hygiene-Museum, Dresden, constructs such models, covering a large range of diseases, as a commercial undertaking. They are not expensive and faithfully represent the disease. A large number of these have been obtained and are used in The Wellcome Museum of Medical Science.

Very striking effects can be obtained with models showing throat lesions—diphtheria, tonsillitis, etc.—provided a suitable method of lighting is adopted (Fig. 22, *page* 143).

The examination of stools of patients suffering from intestinal diseases is a routine of medical procedure. Many stools are characteristic—cholera, typhoid fever, dysentery and various infantile conditions: these can be faithfully represented by means of models, and such a method is of practical value (Fig. 23, *page* 144).

Radiographs

The clinical sections must also include radiographs, where applicable. Here, again, the value of linking up the radiographic picture with the other clinical manifestations and the pathological findings is obvious. In the various forms of heart lesion it is possible to show the pathological condition, the electro-cardiographic findings, the radiographs, and a chart of the main signs and symptoms; with paintings of the characteristic facies as, for instance, in mitral stenosis and heart failure. The apparatus used may also, with advantage, be demonstrated. Moreover, with the heart specimen will be shown all the other organs affected by the main lesion, so that a very complete picture is provided.

In tuberculosis, tumours, rickets and many other diseases, the radiograph would be an important feature of the exhibit (Fig. 24, *page* 145). Here also is an example of waste of valuable teaching material. In very few hospitals does the museum contain a radiographic exhibit. Where there is such a collection for the use of the student, it is generally kept in the radiographic department, where the same facilities for study cannot possibly be provided.

Clinical Laboratory Work

The work of the clinical laboratory can also be well shown as a museum demonstration. Here again the only way to learn the subject is to carry out the various processes in the laboratory, but, for revision purposes, such an exhibition, accompanied by suitable descriptive text, must prove invaluable to the student and practitioner.

As examples of suitable subjects for such a method of demonstration may be mentioned examination of fæces—for bacteria, protozoa and helminths ; examination of the urine ; estimation of blood urea ; estimation of blood sugar ; examination of the blood ; serological tests—Wassermann reaction, agglutination, etc. ; measurement of basal metabolism (Figs. 25 and 26, *pages* 146 *and* 147). Each of these processes can be described, the apparatus mentioned in the text can be shown, and the various details can be demonstrated by pictures or actual experiments. Many complicated processes of investigation are included in the medical curriculum : these are taught and practised during some phase of the student's education. Subsequently they are replaced by other necessary branches of study, and the essential steps of the procedure may well be enshrined in some museum exhibit which will serve as a means of revision and a constant reminder of the details of the process.

Application to Public Health Museums

The possibility of such a method being of value first occurred to the writer in connection with public health work, where the student has to study many processes of chemical and physical analysis which are difficult to revise. A Public Health Museum should certainly include a complete demonstration of all such processes. A double purpose would be served in that it would also provide a schedule of apparatus required for Public Health Departments.

Transparencies

Transparencies are of value for clinical teaching as well as pathological. Colour photographs of cases are very effective, X-ray negatives should always be shown where possible. The value of transparencies for teaching is well illustrated in Professor Schmorl's department at Dresden. Here he shows in the museum a large number of slides illustrating his original work on rickets and other bone conditions. At the writer's request for prints to show in The Wellcome Museum, he expressed the opinion that transparencies offer a far more graphic and convincing picture of the lesions, and has since presented the Museum with a complete duplicate exhibit.*

Selection of Method of Demonstration

It is, therefore, obvious that selection must be made in every case of the best pictorial method of representation, a wide choice being offered—paintings, coloured photographs, prints, photographs, models or transparencies.

Temperature Charts

Temperature Charts are of great value for the clinical sections, and a carefully selected series of such charts possesses high teaching value; they may be utilised to show the result of treatment or to illustrate some special feature characteristic of the disease, as, for example, in malaria, relapsing fever, undulant fever and rat-bite fever. The temperature chart may also be used in the case of malaria to illustrate the phases in the life-cycle of the parasite in its intermediate host, man (Fig. 27, *page* 148).

Physical Signs

To show in a graphic manner the physical signs of a disease is not so easy, but many diagrammatic methods have been devised, using certain conventional signs. A good example is seen in the "Atlas of Clinical Diagnosis and Internal Disease," by Jakob (Fig. 28, *page* 149). Such diagrams can be used in a museum for completing the clinical section.

The part played by the museum in the teaching of clinical medicine can only be a supplementary one, but it has a very real

* This exhibit comprises a very large number of transparencies, and a case has been designed for their demonstration which takes up a minimum of space. It consists essentially of a framework, the left half of which is enclosed by wooden panels, whilst the right half is open and has a ground-glass background, which can be illuminated by electric bulbs placed behind. In the enclosed portion are a number of wooden frames on runners, which can slide in front of the illuminated background. Each of these frames is capable of holding 6–12 transparencies, according to size.

With such an arrangement, transparencies of any sort can readily be studied and are protected from dust, light or injury (Fig. 43, *page* 164).

Part played by Museum in Clinical Teaching

value. It serves as a storehouse of clinical material; it illustrates conditions which may be common elsewhere but are not available at the centre of teaching, as, for instance, tropical diseases; it illustrates lesions, which at one time were common but have now been practically banished by modern methods of treatment and prevention, as, for example, the more severe manifestations of syphilis, smallpox and typhoid fever. Every student must know these manifestations, for the fire still smoulders and may blaze again should the restraining influence be removed.

In this section also all important points with regard to diagnosis are emphasised, and the various special methods of examination are illustrated.

For the demonstration of certain clinical manifestations—more especially those of diseases of the central nervous system—the kinematograph will be much used in the future. It is probable that apparatus of this type will have to be included in the equipment of every up-to-date medical museum. Possibly an adaptation of the small slot machine used for moving pictures in side-shows might be adopted.

CHAPTER VII

TREATMENT

Photographs—Charts—Medicinal Preparations—Vaccines and Sera—Pharmacology

THE section on *treatment* forms a natural sequel to that which deals with clinical manifestations and diagnosis. Here are shown in photographs, paintings and temperature charts the results of various methods of treatment (Fig. 29, *page* 150).

Treatment: "Before and After"

It is necessary to emphasise the need for caution in arranging such an exhibition—a picture may give an excellent representation of a clinical condition, it may also give a very false impression with regard to the results of treatment. Every vaunted treatment of leprosy has supported its claims by dramatic photographs of *before* and *after*, and many, which have offered the most convincing pictorial proofs, have passed to a deserved oblivion. Leprosy, like many other diseases, has its ebb and flow of symptoms and signs; more especially are the more conspicuous evidences of nodular leprosy subject to such fluctuations. It is, therefore, easy to make out a good case for any form of treatment provided the moment is carefully chosen for illustrating the *result*.

Fallacies

At times a false impression is given by the method of presentation. To take the first photograph under conditions of intensified gloom, and the second under the stimulus of adventitious aids to happiness—toys for children, etc.—neutralises any value the pictures might otherwise possess. The conditions under which such photographs are taken should be as nearly as possible comparable before and after treatment; to allow the patient to be serious and unkempt in the first picture, and to induce him to laugh and to brush his hair in the second is merely deceptive. The area of body exposed in both photographs should be the same.

As an extreme example of bad arrangement may be mentioned a case which occurred in the writer's experience some years ago

when he was trying to obtain photographs illustrating the results of a certain treatment. In the first series the patients were stripped and obviously uncomfortable under the ordeal of the camera; in the second they were clothed—indeed, almost overclothed—so that in many cases even the site of the original lesion was concealed.

Temperature charts are of greater value, for here a comparison with the normal charts of the disease will show clearly the deviation produced by the treatment.

Examples

The results of treatment upon various orthopædic conditions may be demonstrated in a very striking fashion by means of photographs (Fig. 30, *page* 151). Sir Henry Gauvain possesses a wonderful series of photographs showing the results of combined sunlight, fresh air and surgical measures in the treatment of various forms of bone and joint tuberculosis. Dr. J. H. Sequeira had a large series of photographs taken illustrating the effect of light treatment upon lupus. In this, and many other skin conditions, the results of treatment can be faithfully represented by photographs or, better still, by paintings. Another valuable series represents the results of operative treatment upon exophthalmic goitre and of thyroid treatment on cretinism and myxœdema.

Materia Medica

In the section on treatment are shown any medicinal preparations which have been found to influence favourably the course of the disease under consideration. It is, however, not sufficient to show merely the drug, serum or vaccine used for treatment; of greater interest are the source and the various steps in the process of preparation.

To meet this requirement, cases have been constructed for each drug, in which are shown, by maps, pictures and actual specimens, the country, source and various stages involved in the preparation of the final product (Fig. 31, *page* 152). Such a method adds greatly to the interest of the subject and possesses a positive teaching value.

By the graphic method may also be shown the dangers attached to any specific form of medication. In the same way the preparation of vaccines and sera may be demonstrated, but much more room is required for such an exhibit, and a central

case can be suitably devoted to such an important subject. Here is shown the whole process in the preparation of anti-typhoid vaccine, anti-diphtheritic serum, anti-tetanic serum and tuberculin. The whole of each process is described and every stage is illustrated by pictures and specimens (Fig. 32, *page* 153). In a similar manner is demonstrated the Schick test and, in the scarlet fever section, illustrations are shown of the Dick test. Such demonstrations are in every way suitable for a medical museum, they are in harmony with the main scheme and enable the student to study, in detail, a variety of processes of vital importance to his future work, and about which very little may be taught in the routine curriculum.

Pharmacology

The section dealing with treatment is capable of expansion in many directions. Such an exhibit may include all matters relating to pharmacy, pharmacology and therapeutics: it may illustrate Materia Medica in its widest sense.

By means of appropriate charts and diagrams, the changes induced in living tissues, by various organic and inorganic substances, may be illustrated so as to emphasise their possible application to the treatment of disease.

The Materia Medica Museum has fallen into disrepute because its possibilities have never been appreciated. To make such a demonstration effective, it must not only include the agent and the source from which it is derived, but must also take into consideration its place of origin, mode of preparation, method of action and practical application, so that a complete picture is provided for study, reference and further research.

As an example, may be mentioned atropine. The source of supply might be shown by means of maps; by drawings and specimens, the various plants of the Order *SOLANACEÆ*, from which the allied alkaloids of the atropine series are derived, could be illustrated. The various methods of preparation could be demonstrated in detail and specimens shown of the products resulting from the processes employed. By means of diagrams and tracings the pharmacological effects upon animals and man could be shown, and possibly photographs or paintings could be employed to

emphasise the teaching—dilatation of the pupil, flushing of the skin and convulsive movements could all be illustrated in this manner. Finally, a graphic demonstration could be given of its therapeutic effects and of its diagnostic value in such conditions as typhoid fever and the paratyphoid fevers. Here, by diagrams, could be shown the acceleration of the pulse induced by the drug under normal conditions, as compared with the absence of such acceleration during an attack of one of these fevers.

Such a method of illustration might also be used to emphasise the contrast between the lethal action of various substances upon micro-organisms *in vitro* and *in vivo*, thus emphasising the need for caution in estimating the rationale of any given method of treatment.

CHAPTER VIII

PREVENTION

General Scheme—Models—Statistics—Descriptive Matter—Recent Work

THE last section is devoted to prevention and is found to form a corollary to that dealing with causation. In some diseases this section must, of necessity, assume extensive proportions.

General Scheme Illustrating Preventive Measures

In malaria, for instance, prevention has become almost more important than treatment to the tropical practitioner (Fig. 33, *page* 154). An elaborate scheme of prevention has been devised, which embraces the sick person, the mosquito and the healthy person. By treatment of the sick person with quinine, and by isolating him under a mosquito net, his powers of transmission are curtailed. Attention is paid to the insect vector—the Anopheline mosquito ; measures are directed against both the adult and the developmental stages. By the use of natural enemies, drainage, training of streams, filling-in of marshes, control of engineering enterprise, oiling ponds and the employment of Paris green, the mosquito population is decreased. Finally, by personal measures, such as mosquito-proof houses, mosquito nets, and other domestic adjuncts, the healthy individual is guarded.

Here is a vast body of material available as photographs and specimens for demonstration purposes ; moreover, models may be constructed which can teach more effectively than any words the rationale of malaria prevention.

As an example of such a model, may be mentioned one designed to show the various types of breeding-place and the methods which may be adopted to deal with each. The model is divided into eight sections, four on one side showing the four types of breeding-ground—marshland, woodland, ponds and streams, domestic ; these have been neglected and are therefore a source of danger. On the other side are shown the same types of breeding-place on the property of a careful

householder, who has effectively dealt with them. The marshland is levelled up; holes in trees, cut bamboos, etc., have been filled; weeds have been removed from the stream; broken guttering has been repaired, rubbish got rid of, and the yard cleared up. This model was not difficult to construct, and affords a graphic demonstration for teaching purposes.

Hygiene Models

In teaching hygiene and preventive measures, models are of great value, but they should be carefully designed to illustrate and amplify the lectures delivered in the school. To exhibit models merely because they are artistic, elaborate or expensive, regardless of their teaching value, is to waste space and to confuse the student. In the prophylactic section the importance of propaganda work must be emphasised (Fig. 34, *page* 155).

Ætiology, the Clue to Prevention

The mode of prevention in the various groups of diseases is essentially different, but always the clue may be found in a study of the ætiological factors. In the intestinal group of infections, prophylaxis depends upon the control of human carriers, flies, water supplies, disposal of excreta, etc.; in the respiratory group, upon the control of housing, ventilation, nutrition and dangerous trades.

Whatever may be the group, there is material for graphic demonstration and visual teaching, especially suited for a hygiene exhibit, but to a lesser extent demanding inclusion in any medical museum; this is well illustrated in the Plague section, where a consideration of methods of rat destruction is inevitable (Fig. 35, *page* 156).

Problems of inoculation and vaccination especially claim attention in the section dealing with prophylaxis.

Wider Application of Scheme

A suitable scheme of demonstration for each disease has now been considered; the various sections follow one another in an orderly sequence common to the whole Museum. This graphic method of demonstration has a very wide application: special methods of diagnosis or treatment—Wassermann reaction, intravenous injection (Figs. 36 and 37, *pages* 157 *and* 158), the use of the spectroscope, and many other processes may be shown in detail.

It is frequently useful to show models of familiar objects for the purpose of fixing a mental picture in the mind of the observer. The question of food deficiency is a good example, where a few simple plaster models of carrots, potatoes, eggs, beans, peas and other foods are of great value as an aid to memory and a stimulus to curiosity.

Statistics

Statistics should also be shown in a simple and graphic manner. For this purpose the writer designed an illuminated box faced by two sheets of glass, between which a piece of thick black paper is placed. This paper is cut like a stencil in any manner desired, columns of figures being represented by circles coloured red or green by transparent paper—each circle representing some definite numerical unit. Headings and descriptive matter are cut, above and below these columns, and are covered by white transparent paper. Electric light bulbs are placed in the box so as to provide a uniform illumination through every part of the stencil (Fig. 44, *page* 165).

Any form of chart can be represented in this manner, and it provides a demonstration which is easy to study and which, for popular exhibitions, commands attention.

Labelling and Descriptive Text

Descriptive matter.—The question of labelling and description is one of great importance (*see Appendix* D, *page* 76). An exhibit which is imperfectly described loses much of its value (Fig. 38, *page* 159).

Each disease commences with a short summary dealing with the disease as a whole (Fig. 39, *page* 160) : this is amplified at intervals by any further description which may be necessary. Each illustration, model and specimen bears a descriptive label which also acknowledges its source—individual or publication. Such acknowledgment is very important, quite apart from the fact that it is courteous. Frequently students wish to follow up an exhibit or obtain further information about it : the acknowledgment enables them to do this.

Recent Work

At the end of each disease section is a box containing a file (Fig. 40, *page* 161). In this file are cuttings of all the recent important work on the subject. Any matter is easy to find, as the files are divided into sections corresponding to those which

are found under the various diseases—ætiology, pathology, etc. These files are regularly kept up to date from the current literature, use being made of the excellent summaries provided in many Journals—the *British Medical Journal*, the *Journal of the American Medical Association*, the *Tropical Diseases Bulletin*, the *Bulletin of Hygiene*, the *Transactions of the Royal Society of Tropical Medicine*, etc.

Great use is made of these files, which have a special value now that the literature of medicine has assumed such formidable proportions.

CHAPTER IX

Possible Objections to the Synoptical Method of Demonstration

"Spoon-feeding"—Superficial Teaching—Neglect of Practical Work—Observation Discouraged

Limitations

It is essential to realise the limitations of such a Museum: it can never replace any part of the ordinary routine medical curriculum; especially it can never replace the practical work in the laboratories, autopsy room, out-patient department and wards.

Objections

Four possible objections have been suggested:—

(1) That such a system is "spoon-feeding."

(2) That it provides a short cut to a superficial knowledge which might satisfy the student.

(3) That it might induce students to neglect their practical work.

(4) That it tends to reduce observation rather than to increase it.

"Spoon-feeding"

(1) *That such a system is "spoon-feeding."*—Theoretical considerations do not support this idea. If the Museum were in any way a summary of disease, there might be justification for such a suggestion; where, however, a disease is dealt with completely, in all its phases and variations, where all new knowledge is incorporated and every section kept up to date, the charge of undue simplification can hardly stand.

Practical experience also has rather indicated the reverse. The tendency of "spoon-feeding" is to satisfy the appetite with the minimum of effort to the recipient and to induce a feeling of unwarranted satisfaction. In practice it has been found that intensive effort is demanded of the student, and that humiliation rather than self-satisfaction is the outcome. One famous physician, after a tour of the Museum, exclaimed: "I never realised before

how little I knew." A similar remark has been made on several occasions. It is difficult to conceive a more complete answer to the charge of "spoon-feeding."

Superficiality

(2) *That it is a short cut to learning.*—In substance this is a similar objection to the last, and can be answered in the same manner. In one sense the Museum may be regarded as a "short cut," in so far as it brings together for immediate consideration and comparison all the phases and varieties of a disease, which must of necessity require a large series of demonstrations and clinics for practical and complete teaching in the hospital. For revision purposes such a system is invaluable, and it is for the advanced student and post-graduate that the system has been specially designed.

Neglect of Practical Work

(3) *That it might induce students to neglect their practical work.*—The Museum is not primarily intended for the use of students before they have completed the scheduled list of appointments, demonstrations and clinics. The need for signatures before entering for examination would prevent any neglect of this practical work, and it is only in the light of past experience with actual cases that satisfaction can be obtained from the synoptical method of demonstration, and, should such experience be lacking, the tendency would be to stimulate the student to further practical work.

A photograph or painting of a beautiful landscape, of mountain scenery, or of a seaside resort is utilised to arouse enthusiasm and stimulate the will to visit such surroundings or, alternatively, to recall or revivify some past impression or experience. It has never been suggested that such illustrations tend to reduce the desire to travel.

On the other hand, it is impossible for any one person to see everything; illustrations and books on travel can do something to supplement an inevitable deficiency and to widen the field of knowledge in any one individual.

Harmful to Observation

(4) *That such a system may tend to reduce the faculty of observation.*—This is rather a subtle suggestion, in view of the fact that one would naturally regard a visual system

of demonstration as automatically stimulating the powers of observation.

The gravamen of such an objection lies in the fact that illustrations, models and even specimens can only present to the observer a partial picture of any condition; moreover, the salient feature is emphasised by the method of demonstration, so that the necessary information is presented to the student and not extracted by his own powers of observation and reflection.

It is possible to show a photograph of a case of acute pulmonary tuberculosis; it is possible to show the radiograph and temperature chart. The pathological specimen and microscopic picture may be placed in close proximity; the physical signs may be indicated by various types of diagram; but it is impossible to demonstrate the auditory phenomena upon which the investigator is wont to base his diagnosis and confirm his conclusions. The picture can, at the best, be only a partial one.

Within the limits of the demonstration, however, observation can be stimulated, and the enthusiastic worker will inevitably seek out any fresh points of interest which may be brought out in the illustration, specimen or model under consideration.

A Stimulus

To anyone who has made full use of his educational opportunities, a pathological specimen stimulates thought on many other aspects than the purely pathological, the mind instinctively reviews the clinical aspect of such a condition and the therapeutic possibilities. Such reflection is encouraged by the system described, which places in association with the primary lesion the other organs secondarily affected by the morbid condition.

It must, moreover, never be forgotten that examinations are not the main object of medical education. It is more, as Dr. J. A. Nixon has well said, to train the student partly in the science of "looking and seeing" and partly in the craft or technique of "doing."

The synoptical museum will appeal with increasing cogency to the post-graduate and advanced student.

Method of Study

To obtain full value from such a museum each disease must be studied as a whole, the introductory summary must be read, the various sections considered in due order and, finally, the file of recent work surveyed for any fresh material which may throw light upon the subject.

A Pioneer Effort

The system is a new one, and it will take many years before any one part of the Museum can be regarded as complete ; indeed, it is doubtful if such completeness can ever be attained in view of the rapid advance of scientific knowledge. It is hoped, however, that this description will enable others to carry on the work, and that the wider application of such methods will help to solve some of the ever-increasing difficulties with regard to medical education.

CHAPTER X

THE MUSEUM OF THE FUTURE

A Wider Outlook—Co-operation—Simplification—Education of the Public—Practical Value of System

SUCH is the type to which, in the opinion of the writer, medical museums of the future will conform. The education of the student is inevitably carried out in water-tight compartments. Students say that they are *taking gynæcology* and *surgery*. The mention of medicine draws from them the confession that they have hardly started to think about *that*, except in so far as they have completed their clerking in the wards. They visualise some mystic dividing line between the various subjects, yet each dovetails into the other, and no student should study one to the exclusion of the others. Water-tight Compartments

Even more does this prevailing heresy hold with regard to other branches of medicine: bacteriology is for the bacteriologist, helminthology for the helminthologist, protozoology for the protistist, radiology for the radiologist, prophylaxis for the Health Officer. To a certain extent this must be so, for each is the study of a lifetime.

It is, however, essential that the student shall be able to visualise medicine as a whole: common factors run through the subject which link up the various specialities. In typhoid fever the *Bacillus typhosus*, one factor in the ætiological picture, plays a dominant part in each succeeding section. It is an integral factor of the pathology, exerts its influence on the clinical picture, controls the diagnosis, determines many details in the treatment, and provides the most satisfactory method of prevention. Links

Here, too, many so-called specialisations are involved. It is a disease which primarily comes under the control of the physician, yet all through its course he is watching for indications which may necessitate an appeal to some other department. For diagnosis he invokes the aid of the bacteriologist or, in the atropine

test, of the pharmacologist; in perforation, he calls in the help of the surgeon; in the bone complications, the orthopædic specialist may be required; ulceration of the larynx, suppurative otitis, or an optic neuritis may each demand expert advice from some special department, whilst every phase in the disease makes a call upon his anatomical, physiological and pathological knowledge.

In diabetes the physician, the surgeon, the biochemist, the ophthalmic surgeon and the pathologist share the responsibility.

Premature specialisation may be a great evil, and a museum of the type described forms an admirable corrective to such a tendency; indeed, experience has indicated that, even for the specialist, such a museum may be of material value as a means of maintaining that broader outlook which is so essential in medicine.

Co-operation

It is important for effective education and investigation that there shall be an increasingly close co-operation between the various branches of medical work, that there shall be some closer link between the various departments. A comprehensive medical museum, such as has been described, would form such a link, for it must, of necessity, deal with every branch of the work. It should have a whole-time Director, with wide general medical knowledge and possessed of sufficient tact to enable him to work harmoniously with all the different departments.

The museum would be a centre from which material could be drawn for lectures and classes of every kind: it would also provide a definite course of revision demonstrations for students in their last year, so as to keep them in touch with the various subjects they have already studied.

Confusion

One of the great problems of such a museum, as indeed of every type of museum in the world, is the tendency for material to accumulate to such an extent as to cause confusion. This issue has to be faced, and some system adopted which brings the main teaching exhibits into the foreground, whilst, at the same time, conserving the duplicates, variations and abnormalities for the purposes of reference and research. There has recently

been a popular outcry in the press on this question, as applied to the national collections, and a study of a large number of museums—more especially ethnographical—convinces the writer that there was reason for such a protest.

It is quite possible, by a system of marking and numbering, or by some special mode of demonstration, to clarify the main teaching without sacrificing the other uses of the museum. A system of "key" illustrations and "key" exhibits, to which prominence is given by their position or mode of exhibition, would achieve this object.

To apply this to medical museums: a large number of photographs are shown demonstrating a certain disease; some are typical examples; from these a few are selected and emphasised by being given a special type of mount or label, by being enlarged, by bearing a red star on the mount, or by some other method which will at once attract the attention of the visitor. With regard to models and specimens, a similar system may be adopted.

Specimens for Exhibition and Research

The collections are generally stored on shelves placed at different levels. One shelf may be used for providing a continuous exhibition of classic specimens and models. This shelf will be at the level most convenient for study: each exhibit demonstrates a certain well-defined condition; on the shelves, or in cupboards placed below, or in an adjacent room, are stored the collection of specimens illustrating variations and abnormalities of the condition shown above, from which material for more advanced study may be drawn. By such a system there is economy of space, and rare specimens can be shielded from the light—a matter of some importance where colour preservation is required. The wall space may be divided up so that the upper part is used for illustrations, and the lower part given up to shelves and cupboards for specimens.

Economy of Space

In crowded museums the use of bays in the main hall increases the exhibition area and is a great improvement for teaching and study. Each bay is flanked by screens for illustrations and has in its centre a stand for additional specimens (*see Appendix* C, *pages* 74 *and* 75).

The first step in all museum arrangement is to determine for whose use it is intended: upon this consideration depends every detail of its subsequent development—under no conditions must it be regarded and treated as a depository of valuable material—a museum lives more by what it gives than by what it receives.

The Lay Public and Medical Museums

It is possible that in the future the large public medical museums will play an increasingly important part in educating the general public.

We have reached a preventive age in medicine. Everywhere are health organisations, public bodies are spending more and more money on the prevention of disease, propaganda work has become a definite responsibility of the Health Authority. The result is that large numbers of people outside the medical profession are actively interested in health matters—in disease, its manifestations, causes and prevention—and amongst these are included many of the most liberal supporters of Medical Schools and Hospitals. To such people the medical museum is a matter of real interest and, if suitably arranged, may be a great benefit to the community. The medical profession has realised its need of such assistance, for the public must be educated if we would reduce the mortality and disability due to certain diseases, such as cancer, rheumatism and syphilis.

A medical museum which is merely a pathological collection is quite useless for such a purpose, but a medical museum designed on the principles which have been described can be of great educational value to the public, more especially for the purpose of systematic demonstrations. This was proved to be true at the two Wembley Exhibitions, and is illustrated in the increasing popularity of health weeks and hygiene exhibitions amongst those responsible for the health of the public. The writer has discussed such propaganda work, and the methods adopted in various countries, in a series of papers,* but they do not concern the subject beyond the points which have already been mentioned.

* *Bulletin of Hygiene*, Vol. I, *pages* 167 *and* 929, Vol. II, *page* 343, Vol. III, *page* 1

Final Conclusions

In conclusion, the Museum is one of the most powerful instruments in the hands of the teacher ; in the past it has not made full use of its opportunities. The advance of knowledge is calling attention to the need for reform, for the adoption of some system which will make further use of the educational facilities possessed by such institutions. In medical education this applies with special force.

The various medical Museums of each teaching body should be united and centralised so that they form a nucleus for the co-ordination of all the various branches of medicine. In such a museum each section can maintain its own individuality whilst contributing to the main scheme of organisation. The methods outlined in this volume are experimental, but their practical utility has been demonstrated, and they indicate a reasonable line of progress in museum administration.

The impetus of medical education must be centripetal : all the subjects which are included in the curriculum focus on one central point—the human body as a whole. Chemistry, biology, physiology, anatomy and pathology all play their parts in building this complete conception, and those who specialise in such subjects, in their relationship to the human body, do so in order to contribute more fully to this ultimate knowledge.

A vast majority of those who study medicine will eventually be engaged in a mental process of working backwards, from various structural and functional disabilities of the body as a whole, to an analysis of the chemical, biological, physiological, anatomical or pathological changes which have led to such deviations from the healthy normal. The utilitarian stimulus is a most powerful incentive to study and research ; such a stimulus may be provided by a museum in which there is a clear indication of the ultimate value of each branch of study.

APPENDIX A

HYPOTHETICAL APPLICATION AND DEVELOPMENT OF THE SYSTEM

To devise an experimental arrangement for an existing museum so as to harmonise with the scheme which has been outlined presents many difficulties. Hospital museums vary considerably in size and design; their collections also have grown in special directions, so that there is much lack of uniformity.

The needs of the students and methods of teaching call for special consideration. Lack of space is inevitable, and generally there is also lack of funds. It is obvious, therefore, that each case must be considered on its merits: there can be no scheme which is universally applicable.

General Arrangement

In order to draft a general scheme which may form a basis upon which to work, a building of the type usually met with has been adopted—a rectangular hall with one gallery. It may be assumed that the hall is about 80 feet long by 40 feet wide: this would correspond in size with several of the smaller hospital museums, but is too small for a very elaborate scheme. By careful arrangement, however, it would be possible to include all the more important exhibits, as well as the additional material required to complete the demonstration according to the system which has been described.

Much additional space is required for illustrations, charts and diagrams. This is provided by utilising screens so as to make a series of bays along the wall; there should also be a long central screen, with wings, so as to form bays in the centre of the hall. In addition, exhibition cases are provided to stand in the open space between the central and wall exhibits.

By a system of lettering and numbering, the sequence of teaching is clearly outlined.

In the peripheral bays are exhibits dealing with the various diseases, arranged on similar lines to those adopted in The Wellcome Museum of Medical Science; in the centre are the more special exhibits dealing with anatomy, surgery, gynæcology, embryology and physiology. In the cases are demonstrations dealing with protozoology, helminthology, bacteriology, and the special methods of clinical investigation. The anatomical and physiological exhibits would be arranged so as to have direct reference to their ultimate bearing upon surgery and medicine.

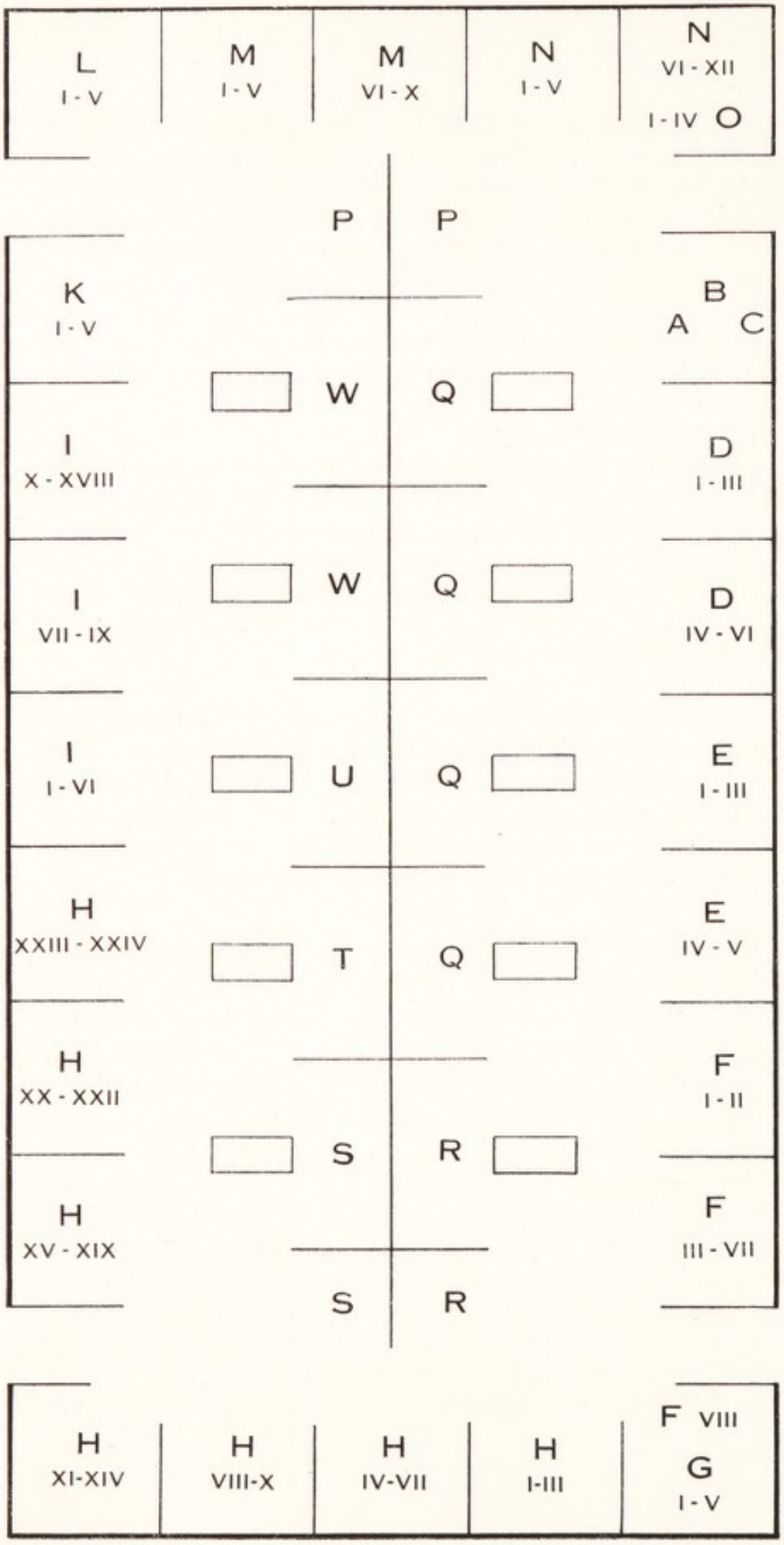
Descriptive anatomy, surgical anatomy and appropriate operations would be carefully linked together by dissections, models and illustrations—the demonstration would be essentially one of applied anatomy. In the same way the anatomy of bones and joints would be applied to orthopædic surgery, and that of the female generative organs and pelvis to gynæcology and midwifery.

In special cases would be shown the various bio-chemical investigations which are of importance to the student and practitioner. In the gallery would be the main pathological exhibits, classified topographically, and with each section sub-divided by movable partitions so as to indicate the various pathological groups, according to the system of classification adopted.

Classification

The classification must depend upon the pathological teaching of the Institute. For the purposes of this hypothetical scheme the classification described by Dr. Maude Abbott has been adopted (*see Appendix* H, *pages* 87–89), and this ingenious system of labelling and numbering, originally devised by Dr. Wyatt Johnston, will be utilised in outlining the method of keeping records.

The general arrangement of the hall and gallery is shown in Plan A (*page* 66) and Plan B (*page* 68). The space allotted to each disease must, of necessity, vary with the material available; some diseases require much space for specimens, others require chiefly pictorial representation; some require much space for ætiology, others for treatment. Each disease must be carefully scrutinised and the space allotted accordingly. Where the illustrations are likely to be very numerous, leaf screens must be utilised.



PLAN A

A—SNAKES

B—OTHER VENOMOUS BEASTS

C—MYIASIS

D—HELMINTHIC

E—PROTOZOAL

F—SPIROCHÆTAL

G—MYCOTIC

H—BACTERIAL

I—INFECTIONS (DOUBTFUL ORIGIN)

K—FOOD DEFICIENCY

L—METABOLIC

M—ENDOCRINE

N—BLOOD

O—ORGANIC POISONS

P—INJURIES

Q—ANATOMY. APPLIED ANATOMY SURGERY

R—ORTHOPÆDICS

S—GYNÆCOLOGY

T—MIDWIFERY

U—EMBRYOLOGY

W—PHYSIOLOGY

Reference Numbers

Any system adopted for labelling specimens must enable parallel specimens to be found with ease, must provide easy reference to the catalogues, and may, with advantage, indicate the ætiological group, the disease, the age of the specimen. the organ affected and the nature of the lesion. This may be accomplished in the following way :—

$$\frac{\text{E V (3) 5 } \cdot(3)71}{24/\prime 28^{1}}$$

E = Ætiological group. Protozoal (*see* Plan A)
V = Disease. Amœbic dysentery.
} Clinical Section.

(3)5 = Intestine (Maude Abbott)
·(3)71 = Protozoal inflammation (M.A.)
} Pathological Section.

24/′28[1] = Catalogue number of case. [1] = Specimen 1 of series (sequence indicated by number and year).

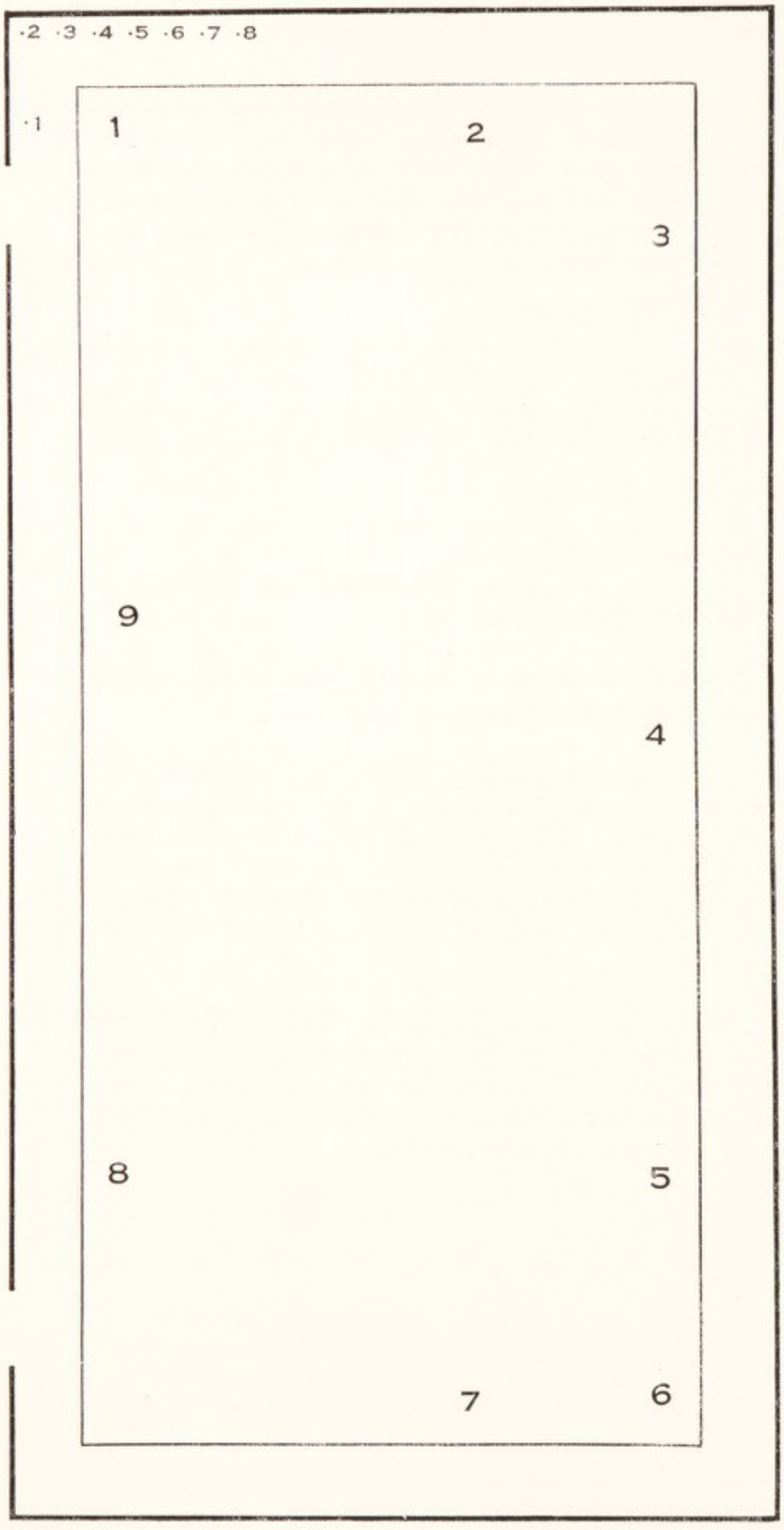
In the upper line are numbers before and after the decimal place—the first numeral (in a bracket) refers to the corresponding topical section in the gallery, and the first numeral after the decimal point (3) refers to the subdivision in that section. It is thus easy to compare any given specimen with corresponding pathological states, as similar numbers mean similar pathological lesions.

Entries

It is probable that, for most museums, this system of classification could be simplified, but the various reference details would have to be retained. There would be a register, also a reference catalogue on the card-index system for each section. In the register and for reference to specimens,

$$\frac{\text{E V}}{24/\prime 28^{1}}$$

would be sufficient, or for gallery specimens $91/.372^{1}$ = syphilis of bones of cranium (1st specimen). All entries regarding specimens would be kept in a loose-leaf note-book until observations had been completed. They would then be transferred to the



PLAN B

1—CIRCULATORY

2—RESPIRATORY

3—DIGESTIVE

4—HÆMOPOIETIC DUCTLESS GLANDS

5—UROGENITAL

6—FEMALE GENITALIA

7—NERVOUS

8—SKIN AND MUSCLE

9—BONES AND JOINTS

·1—DEVELOP-MENTAL

·2—CIRCULATORY

·3—INFLAMMATORY

·4—INFECTIONS AND PARASITES

·5—METABOLIC AND INTOXICA-TIONS

·6—RETRO-GRESSIVE

·7—PROGRESSIVE

·8—TRAUMATA

main register, and appropriate card-index slips made out for the reference catalogues. Should the specimen be in the clinical section, a descriptive slip of a different colour could be placed amongst those in the corresponding pathological section. In this way every specimen in the clinical section would have a cross-reference for students working at the collection in the gallery.

Fastened to the shelf, below each specimen, would be a short descriptive label. This would be of value for visitors who had not mastered the system of labelling and classification, or for rapid revision. A register of illustrations and models should also be kept.

Microscopic Sections

Microscopic sections should be prepared and stored in such a way that they can easily be referred to; indeed, it is a good plan to keep not only slides, but also the paraffin blocks for purposes of further investigation. Small cardboard boxes which will hold two or three slides and some blocks can be conveniently stored in cabinets with trays, each box bearing the corresponding catalogue number.

Staff

Such a museum would require a director or curator, with a secretary or typist, a pathological assistant (with a boy to help him, unless he had help from the pathological department), an artist (when needed), a photographer, or the right to use the hospital photographic department, and a whole-time or two half-time cleaners. The pathological assistant should be a man of many parts — able to cut sections and mount pathological material, also skilful with his fingers and good at carpentry and simple metal and glass work. Above all things, he must be thoroughly reliable.

Accommodation

Additional accommodation would include an office, a laboratory, a preparation room and a store. It is probable that in many cases the pathological department with a small extension of its staff, and close co-operation with the various departments of the hospital, could carry out such a scheme without great additional expense.

Alternative arrangement

An alternative arrangement would be specially suitable for large museums with ample space. Here the wall bays could be used as before for the clinical scheme of demonstration,

PLAN C

	Traumata ·8	Progressive Changes ·7	Retrogressive Changes ·6	Metabolic Disturbances ·5	Infections and Parasites ·4	Inflammatory Processes ·3	Circulatory Disturbances ·2	Malforma-tions ·1	Normal
—Circulatory 1									
—Respiratory 2									
—Digestive 3									
—Hæmopoietic 4									
—Urogenital 5									
—Female Genitalia 6									
—Nervous 7									
—Skin and Muscle 8									
—Bones and Joints 9									

the centre of the hall being devoted to general pathology, the specimens being grouped in such a way that the requirements of both an anatomical and a pathological classification were satisfied. The demands would be met both of those studying the various lesions affecting any given organ, and of those wishing to compare similar pathological states in various organs (*see* Plan C). Running in one direction the rows have an anatomical arrangement, whilst in the other they have a pathological.

Such schemes are purely experimental; they have never been tested, and it is only experience which can justify or condemn a system. They are offered as possible lines for further progress, and each is capable of modification in any requisite direction. In the first scheme it would be advisable to start with a few diseases and expand gradually; the second would have to be moulded to suit the supply of specimens, the type of building, and the educational requirements of the museum.

APPENDIX B

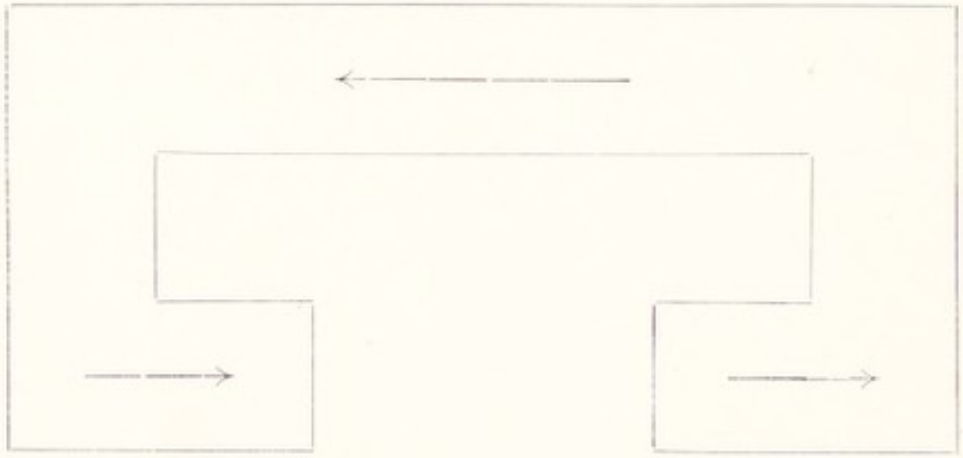
TYPES OF BUILDING

General Design

The usual type of building is that which has been already described—a large central hall with one or more galleries and top lighting. Occasionally the museum consists of several small halls, each with its galleries.

Such a design takes advantage of all the daylight which is available, a matter of considerable importance in large cities. There is, however, great waste of space, and lack of space is the fault of most museums; moreover, a consecutive scheme of arrangement is difficult in this type of building.

The Natural History Museum, Vienna, is designed to overcome many of the difficulties inherent to museums. The building has two floors, there are no galleries, and ample window space is provided for effective natural lighting. The halls are shaped and arranged in such a way that it is possible to follow the complete system of teaching without traversing the same ground twice—there is perfect continuity; on the upper floor one passes in a sequence of orders, genera and species from the protozoa to man.



Such a system should be the ideal of every Natural History Museum, and may be applied with modifications to all types of educational exhibits. Small halls leading off the main hall offer special facilities for collections which are better considered apart,

but have a direct bearing upon the general subject—materia medica, medical jurisprudence, trade diseases.

The offices should be in proximity to the main hall, whilst preparation rooms and stores occupy the basement. Where such a scheme is possible the museum should be made to form the nucleus of the medical school, readily accessible for students at all times, and in convenient proximity to all departments, to the lecture halls and to the library.

The *lighting* of medical museums is of great importance. To study a pathological specimen in detail requires a good light, and at certain times of the year it is impossible to rely upon natural lighting; every part of the museum must be provided with effective artificial lighting; if this is neglected, students avoid that part of the building. Lighting

In one hospital museum, the writer was told that certain specimens were never studied, the students seemed to avoid that section; the reason was obvious, for the lighting made any detailed examination of the specimens impossible.

As far as possible, glare and deep shadows should be avoided—light reflected from a white surface, a system adopted in many operating theatres, is especially suitable, or opalescent globes may be used.

For flooring, the new rubber composition so much used in large stores is very suitable; it is warm, restful and quiet. Flooring

Some system of central heating should always be adopted. Heating

APPENDIX C

WALLS, SCREENS, CASES, ETC.

Wall Illustrations

Illustrations must be attached to the walls above the shelves or to screens.

It is a great convenience to have the walls lined with some material suitable for a drawing-pin or small screw—a soft wood or composition wall board may be used. This system has a special value, for exhibits need adjustment and re-arrangement, and a plaster wall quickly becomes disfigured.

A special wall-screen has been designed which can be fixed to such a surface, and in which several illustrations can be exhibited under glass—yet easy to re-arrange in a few minutes so as to suit any demonstration. This screen is a simple frame fastened to the wall and fitted with a removable dust-proof glass front. Smaller pictures are placed in these frames, whilst larger illustrations are framed in passe-partout and fixed to the surface by a very simple process. Two pieces of plain black picture-moulding are cut to the width of the framed picture, and the ends are painted black. These are fixed by screws to the wall horizontally and parallel to one another so that the picture can slide into the natural groove formed by the rebate in the moulding.

The wall should be painted in some pale colour for the sake of light—a green is very suitable.

Screens

Several *types of screen* are available (Figs. 41 and 42, *pages* 162 *and* 163) for illustrations, and by judicious use they can do much to increase the exhibiting area of the hall. The essential features are that the screen itself shall be of some soft wood suitable for drawing-pins, and the framework of a well-seasoned, hard wood, such as mahogany or oak, which will not warp. The glass frames must be easy to remove, and fit so closely that the case is dust-proof.

If large screens are used they should not be glazed—the illustrations can be mounted in passe-partout frames and fixed as already described.

Leaf-screens are made by many firms and are very suitable for economising space; it has been noticed, however, that

students do not find them as easy for study and are apt to pass them by. They are of special value for a series of illustrations dealing with one special subject.

Cases

Cases must be used for fragile exhibits, wax models, glass-ware, etc., but not for pathological specimens, which require to be handled by the student—the jars containing these should be placed upon shelves or stands. It is a great mistake to place museum pathological specimens in glass cases or cupboards, even if the doors can be opened; they are always apt to be neglected under such conditions.

Stands

Stands for pathological specimens may be made of metal with glass shelves, as in the Royal College of Surgeons Museum, or of wood. As far as possible specimens should be placed at a convenient level for study—lower shelves being used for duplicates, etc.

Exhibition Cases

Cases for exhibition purposes may be of many types, but for medical demonstration the type used at the two Wembley Exhibitions offers special facilities. The case is 7 feet long, 3 feet wide and 4 feet high, with a central partition 7 feet by 4 feet. The whole is glazed with plate glass, and is raised on a stand to about 3 feet 9 inches from the ground. There are therefore two exhibition areas 7 feet by $1\frac{1}{2}$ feet for specimens, and two sides of a 7 feet by 4 feet screen for illustrations.

Viewing-Box

A useful type of viewing-box has been devised for colour photographs, in which 24 plates can be studied, and only one lamp is required (*see* Fig. 15, *page* 136).

Large wall-cases, with glass fronts, are chiefly of value for osteological specimens. The framework should be of metal and as light as possible, so as not to hide specimens or disturb the continuity of the series.

APPENDIX D

LABELS AND DESCRIPTIVE TEXT

Labels and Text

The value of a museum depends very largely upon its descriptive matter and specimen labels; indeed, by neglect of these essentials, a collection may be rendered practically worthless for educational purposes.

A short précis should form an introduction to every section—this should not be too exhaustive or technical, as it will be a source of information for all types of student, and each sub-section and exhibit will be dealt with subsequently in greater detail.

Summaries

The summary may either be printed, or typed in "caps." with wide spacing, and should bear a bold heading. This may be stencilled or printed by the "Econosign," which has been found most useful for this purpose, and also for making labels for hygiene models and other large exhibits. The writer prefers typing to printing, as a printed summary assumes a permanency which is out of keeping with medical progress. Each section needs constant revision, and a typed summary is economical and easy to revise. More detailed descriptions may be in smaller type and with close spacing.

The typing must be well done, and the ribbon used must be of excellent quality so that it will not fade rapidly when exposed to the light—an Underwood ribbon (black) has been found to be in every way satisfactory; red inks invariably fade. Any correction of the typescript in pen or pencil is unsightly and should never be allowed.

Specimen Labels

Specimen labels are not subject to revision in the same degree as descriptive text or summaries; they may be printed, but this is very expensive, and a good substitute has been found in carefully-set-out labels typed in red ink and photographed. The result is a label which is neat and permanent.

Heading Labels

Large labels for heading sections may be printed by a signwriter to any required size. White lettering, on a black background, has been found to be effective. "Cutter-crush" labels have been extensively used for this purpose in The Wellcome Museum of Medical Science; they are striking in appearance and satisfactory in every way, except for the fact that there is a slight tendency for the white letters to peel off.

APPENDIX E

ILLUSTRATIONS

Uniformity of mounting adds greatly to the appearance of a museum ; a good colour for the mount is a dark olive green.

Book Illustrations

Illustrations from books or atlases may be used, but ordinary text figures are liable to fade and should be photographed for the sake of permanence.

Coloured book plates are usually quite stable and are valuable for museum exhibition purposes ; many atlases of pathological lesions and skin conditions contain a wealth of suitable material.

Photographs

For photographs, a glossy bromide paper should be used, which in certain suitable cases may be sepia-toned. A glossy surface is little affected by atmospheric conditions, and sepia toning reduces the liability to fade.

Dry mounting is very little used in The Wellcome Museum of Medical Science ; illustrations are mounted on a stout card for which wet mounting is in every way suitable.

An ordinary half-plate camera, with triple extension, may be used for museum work ; it should be fitted with an anastigmat or good R.R. lens. Plates are used in preference to films and should always be " backed."

Small illustrations are practically useless for museum purposes—half- or whole-plate photographs are excellent for clinical conditions.

Colour Photomicrographs

Colour Photomicrographs.—The process does not differ materially from the ordinary routine of photomicrography. Special attention must be paid to the lighting. A 4–5-ampere arc lamp, with resistance, a clockwork automatic feed, and a handle at the side for fine adjustment has been found to give excellent results. Absolute accuracy of work, however, cannot

be guaranteed unless an ampmeter is employed—this is the most important point in colour photomicrography. The length of exposure must vary with the magnification and lighting, *e.g.*, 3·8 amps, magnification × 250 = ten seconds.

It is only experience which can provide the necessary data, and a record should be kept from which eventually a table can be drawn up.

APPENDIX F

MOUNTING OF SPECIMENS

Specimen jars may be circular, oval or rectangular in section. With circular jars much distortion is produced, and they should only be used for special organs, *e.g.*, heart, brain, etc. Jars with an oval or lenticular section produce slight distortion, but are, on the whole, satisfactory. Rectangular jars with one or two polished surfaces should always be used when possible: they produce no distortion and are easy to handle. Jars

The glass should be of good quality, free from flaws, cracks or blemishes of any sort, and as clear as crystal. The top edge should be ground so as to enable the cement to grip. The glass cover may be cut from 21-oz. window glass, the edge being ground with carborundum powder where the cement will hold. In the cover, more especially of jars holding large specimens, there should be a small air-hole with a wooden plug. This is also useful in the case of ferrocyanide and hydrochloric acid specimens, in which the blue colour, should it fade, can be restored by the admission of air.

Sealing of Jars.—A mixture of litharge and Norwegian tar has proved satisfactory, provided sufficient time is allowed for the paste to set firmly before moving the specimen: this is frequently a matter of some days. The gutta-percha and asphaltum of Baird and Tatlock is also quite effective. A similar material has been used for many years at the Royal College of Surgeons Museum, where asphaltum and gutta-percha are heated together. The edge of the jar must be thoroughly cleaned with benzol and the mixture applied hot. Sealing

Recently, at The Wellcome Museum of Medical Science, some refined bitumen, which was being employed by builders for asphalt flooring, was tried. It was found to be in every way satisfactory and very easy to manipulate. A little is heated in the flame on a broad knife blade and smeared along the upper edge of the jar. The glass cover, previously heated so that it can just be held in the hand, is placed on the jar and the seal completed by pressing a heated piece of metal along the glass surface above the bitumen.

For small specimens mounted in spirit, the following material has been used :—

Scrap rubber	2 parts
Paraffin wax (m.p. 56° C.) . .	1 part

These are melted together in a tin and applied when warm. The process is carried out as described above.

Back-grounds

Backgrounds.—Certain specimens may be much improved by appropriate backgrounds—white or black. This is only applicable where it is not necessary to examine both sides of the specimen. The colour must be carefully selected so as to form a contrast, and thus emphasise the salient features. A white background for specimens containing much red colour is good, but has one serious objection—it also emphasises any tint the preserving fluid may have acquired, and frequently with organs such as spleen or liver, it is difficult to prevent some slight colouring of the fluid. A black background for such organs is not as striking, but, in view of the fact that it conceals this colour defect, it is probable that its universal adoption would be an advantage. All the Vienna specimens, referred to in the text, have black backgrounds without any loss to their teaching value. At first, plaster backgrounds were used, but after some time they were found to break up, and wax was substituted. This material—a pure white paraffin wax with a melting-point of about 160° F. has proved very satisfactory. It may be mixed with lamp black to give a black surface.

The jar is smeared with glycerine and laid on its side, a dam of plasticine is erected at the open end and the melted paraffin poured into the trough, so formed, to the requisite depth. When hard, the slab is removed from the jar and trimmed. Xylol will smooth out irregularities. The wax plate is easy to work and holes can be made for threads by means of a hot needle.

If a transparent backing is required for specimens, old X-ray films may be used (St. Mary's Hospital Museum).

For worms, and other small white specimens, a black glass forms a good background. The specimens are fixed to the glass by means of gelatine or celloidin, and spirit is used as the preserving fluid.

APPENDIX G

METHODS OF PRESERVATION

Mounting in Gelatine.—After a time gelatine tends to assume a yellow or brownish tinge: it is very difficult to prevent this. A modification of the Delépine method has been used for soft or cystic specimens and serves admirably to preserve the natural shape and colour of the specimen. Delépine's Method (Modified)

It is possible that a strict adherence to the original method would have given a more perfect colour in the gelatine, but the length of time required for filtration of the final medium (24–72 hours at a temperature of 50° C.) is a great objection to the wide adoption of the system in museums where only a few specimens are put up in this way. In a thin layer the colour is not very obvious, but with bulky preparations it spoils the appearance of the exhibit.

The greatest use for gelatine is in sections of organs put up in flat glass cells, as has been already described. These " plate " preparations are easy to transport and can be passed round classes without fear of damage. With a black background the colour effect is perfect.

The method adopted in The Wellcome Museum of Medical Science has been to use an ordinary formalin fixative as described below (*see* Judah's method). The specimen is developed in the ordinary way in spirit. It is then placed for from two days to two or three weeks in a mixture of pure glycerine 6000 cc., and arsenious acid solution 4000 cc.

The latter is prepared by boiling an excess of arsenious acid in water for two hours, allowing to stand for 12 hours and then decanting. The specimen is then mounted in arsenious acid glycerine jelly. This is prepared as follows:—

Coignet's gelatine (gold label)	..	425 gm.
Arsenious acid (satd watery sol.)	..	1500 cc.

The gelatine is added to the hot arsenious fluid, in which it should be dissolved in half-an-hour. This arsenic-gelatine mixture is allowed to cool to 20° C. and to it are added, with thorough mixing, the whites and shells of six eggs. The gelatine is then brought to nearly boiling-point and maintained at this temperature

for two hours. It is then filtered through a Chardin filter paper in a steamer, with a cloth lightly thrown over to form a cover (if the metal top is kept on, the temperature becomes too high). In the steamer is a vessel containing 5800 cc. of pure glycerine, which is mixed with the arsenic-gelatine directly filtration is completed.

Such a large quantity is only prepared when many specimens require mounting; as a rule, enough is required for two or three specimens, and the quantities are reduced accordingly. Occasionally, specimens have been mounted in an ordinary gelatine-glycerine mixture with a small quantity of carbolic to inhibit the growth of moulds; the result has not been as good as with the arsenic-gelatine. To fix the gelatine in such a preparation, a small quantity of formalin is added.

Judah's Method

Judah's Modification of the Kaiserling Method.—(*See* "International Association of Medical Museums," Bulletin No. VIII, December, 1922). A short summary of the method will be given.

Specimens must be obtained fresh from the autopsy or operation and not allowed to soak in water for more than a few moments. No cloth, metal pins or paper must be allowed to come into contact with the specimen. Large bodies of fresh fluids must be used.

Fixing Fluid

Pot. acetate	170 gm.
Pot. nitrate	90 gm.
40 per cent formalin	1600 cc.
Water	8000 cc.

The chemicals must be pure and the formalin as free from formic acid as possible. The reaction should be tested, and if the solution is strongly acid it should be neutralised with caustic soda (Shore). The specimen must be thoroughly fixed, so that no blood will ooze out when it is firmly pressed between the fingers. Intestines may be left in this solution for from 10–12 hours, other specimens for from one to five days.

On removal, the specimen must be thoroughly washed in running water. It is then developed in 95 per cent alcohol, which must not be allowed to fall below 80 per cent. The process of development must be watched in the same way as with a photographic plate. After development, the specimen is again

thoroughly washed. No formalin should carry over to the alcohol, nor alcohol to the final solution.

The final mounting fluid consists of :—

Pot. acet.	4 lbs.
Glycerine	2000–4000 cc.
Water	10,000 cc.

+ 20 cc. of carbolic acid.

This method has been used by the writer with success, more especially with thin pieces of tissue or small specimens. With larger organs the fluid is liable ultimately to become discoloured, and it is probable that the fixing process must be considerably prolonged where there is much blood. Certainly a specimen should rather be over-fixed than under-fixed. In every specimen there has been good colour preservation up to date.

Pick's Method

L. Pick's Process.—A complete survey of museum technique as employed by L. Pick has been described in his *Anleitung zur Konservierung und Aufstellung des Sektionsmaterials*, included in Nauwerck's *Sektionstechnik*, 6th edition, 1921. The importance of such a technique is admirably stated in his opening remarks :—

> " In preserving post-mortem material for pathological-anatomical instruction, whether for purely scientific or for forensic purposes, two fundamental requirements should be kept in view—first, the permanent preservation, with the closest possible fidelity to nature, of the external appearance of the object; second, the bringing out of all purely anatomical peculiarities and refinements in such a way that the observer shall see at a glance what the specimen is intended to teach. The first requirement is complied with by those modern methods of preserving which have replaced the once universal hardening in alcohol; the second, however, involves not infrequently a careful trimming with knife and scissors of the roughly-excised organ, or at least a special attention to the handling of the preparation in its passage through the preserving media and its ultimate setting up. The medical expert alone can know what is useful and necessary in this direction, and he it is who should play the decisive rôle in producing the final result."

No attempt is made to give an exhaustive survey of this admirable article, which should be in the hands of everyone responsible for the management of a pathological museum.

A brief summary of the main procedure as now carried out at The Wellcome Museum of Medical Science may, however, be of value.

The fixing fluid is a mixture of 5 per cent formalin solution, with five parts by weight of artificial Karlsbad salts (sod. sulph. 22, pot. sulph. 1, sod. chlorid. 9, sod. bic. 18). The high proportion of sodium bicarbonate appears to influence favourably the formation of the alkaline hæmatin. Large enamelled baths with tightly-fitting wooden covers are recommended for this solution.

As soon as possible after excision—careful superficial rinsing does no harm—the preparations are placed in a generous quantity of the solution. All necessary dissection must be carried out before the preparation is placed in the formalin saline solution. Hollows must be stuffed with defatted cotton-wool for 24 hours so as to preserve their natural shape; cut surfaces, later to be exposed, are held apart.

The preparations remain in this solution until all oxy-hæmoglobin has been changed into acid hæmatin. Large organs should not be injected but deep incisions made, after 24 hours fixation, so as to permit of even penetration of the fluid in all directions. The object must remain in the fixing fluid as long as possible within the limits of effective colour preservation. Under-fixation is a very common error in museum preparations; more especially does this apply to bulky objects and those containing much blood, clots, etc.

Large specimens may be left in the fixing fluid for from one to several weeks. Hearts, enlarged kidneys and pelvic organs require from 3–4 days, smaller organs two days, and membranous tissues about one day. The object is inspected every 24 hours and, if necessary, its position changed.

If the preparation fades in the fixing fluid, this may be due to formalin of an inferior quality or to the fact that decomposition has already set in and the oxyhæmoglobin has undergone material changes.

Development of Colour.—After sufficient fixation, the preparation, freed as far as possible from the formalin solution by draining, is transferred to alcohol, where the acid hæmatin is changed into the permanent alkaline modification. The best results are obtained by the use of 80–85 per cent alcohol—which can be used again and again, provided it is kept up to strength.

Medium-sized objects—spleen, kidney, heart and sections of liver—should remain for from 10–12 hours in the alcohol, large objects proportionately longer. Very bulky objects may remain without danger for 36 hours. With delicate material the sojourn in alcohol must be as short as possible—it must be developed like a photographic plate.

Final Mounting.—The alcohol is allowed to drip away as completely as possible. The specimen is then placed in the final solution:

Distilled water	9000 cc.
Glycerine	5400 cc.
Sod. acetate	2700 gm.

The glycerine must be chemically-pure and free from acid.

For certain objects which may become too transparent in this fluid, *e.g.*, skin, the sodium acetate should be omitted and distilled water and glycerine used in equal parts.

Where for economy, or other reasons, it is necessary to do without alcohol, L. Pick recommends the process invented by Jores in 1913. In this method, chloral hydrate is added to the formalin fixing fluid, and the permanent alkaline hæmatin is formed during the act of fixation. The fluid used is:—

Distilled water	1000 parts
Artificial Karlsbad salts	50 gm.
Formalin	50 parts
Sat. sol. chloral hydrate in distilled water ..	50 parts

Organs are left in this fluid just long enough for complete fixation. They are then thoroughly washed in running tap-water, and finally transferred to the sodium acetate glycerine solution.

Bone Preparations

Bone Specimens.—L. Pick has invented a special apparatus for the preparation of permanent bone specimens. For such work the bones must be macerated, freed from fat, and bleached. The process is complicated, but the results obtained are practically perfect; a full description is included in L. Pick's article.

Preservation of Green Colour in Plants

Preservation of Green Colour in Plants.—It is frequently necessary to preserve botanical material for demonstration in a medical museum of the type described; for example, pharmaceutical plants or fruit for the materia medica section, larvivorous weeds for the malaria section, watercress for the typhoid fever section.

The following method has been found to preserve the green colour of botanical specimens exposed to light. Saturate strong commercial acetic acid with acetate of copper, shaking the bottle occasionally until no more will dissolve, some acetate being left at the bottom of the bottle. Pour off the clear solution, and add an equal volume of distilled or very soft water. Of this fluid, enough is poured into an open enamelled or earthenware dish to allow the specimens for treatment to be submerged in it while it is being boiled over a suitable gas-burner.

The specimens may be put at once into the boiling fluid, and should be immersed in it for a period varying with the texture, from two minutes to about 20 minutes. The fumes of boiling acetic acid are apt to be irritant to the eyes, nose and throat, and also injure certain metals: hence, it is well, if possible, to boil the specimens in a fume chamber, or in a place where the vapour can readily escape.

The specimens should be lifted out with wooden forceps, and if they appear to have been boiled long enough they should be washed for a few minutes in water, and if necessary brushed or rubbed to remove deposits on their surfaces. They may then, in most cases, be prepared at once for permanent preservation, either in any of the usual preservative fluids, or dried (*Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew* [1908]; *Museum Preparations*—Trail).

APPENDIX H

ABSTRACT FROM PROF. WYATT JOHNSTON'S CLASSIFICATION AS APPLIED BY DR. MAUDE ABBOTT*

The anatomical classification is represented by numbers *before*, and the pathological condition by numbers *after*, the decimal point.

Anatomical Classification

1.—Circulatory System.

- 11. Pericardium.
- 12. Myocardium.
- 13. Endocardium.
- 14. Heart as a whole.
- 15. Arteries.
- 16. Veins.

2.—Respiratory System.

- 21. Nares.
- 22. Larynx.
- 23. Trachea and Bronchi.
- 24. Lungs.
- 25. Pleura.

3.—Digestive System.

- 31. Teeth.
- 32. Mouth. Tongue. Pharynx.
- 33. Œsophagus.
- 34. Stomach.
- 35. Intestines.
- 36. Peritoneum and Mesentery.
- 37. Liver.
- 38. Gall Bladder and Bile Ducts.
- 39. Pancreas.

4.—Hæmopoietic Organs and Ductless Glands.

- 41. Bone Marrow.
- 42. Lymph Nodes.
- 43. Spleen.
  - 431. Spleen Capsule.
- 44. Thymus.
- 45. Thyroid.
- 46. Parathyroid.
- 47. Adrenal.
- 48. Carotid and Coccygeal Glands.
- 49. Pituitary Body.

5.—Urogenital System.

- 51. Kidney.
- 52. Ureter.
- 53. Bladder.
- 54. Prostate.
- 55. Urethra.
- 56. Penis.
- 57. Seminal Vesicles. Vas Deferens and Cord.
- 58. Testis. Epididymis. Tunica Vaginalis.
- 59. Perineum.

* *The International Association of Medical Museums*, Bull. IV., pp. 23–26

Anatomical Classification—*continued*

6.—Female Genitalia.

- 61. External Genitalia.
- 62. Vagina.
- 63. Uterus.
- 64. Fallopian Tube.
- 65. Ovary and Parovarium.
- 66. Pelvic Peritoneum and Connective Tissue.
- 67. Breast.
- 68. Generative System in Pregnancy.
- 69. Ovum as a whole.

7.—Nervous System.

- 71. Membranes.
- 72. Cerebral Vascular System.
- 73. Cerebrum.
- 74. Cerebellum.
- 75. Spinal Cord.
- 76. Nerves.
- 77. Nerve Ganglia.
- 78. Eye.
- 79. Ear.

8.—Musculo-Cutaneous System.

- 81. Skin.
- 82. Hair.
- 83. Nails.
- 84. Muscle.
- 85. Fascia.
- 86. Cellular Tissue.
- 87. Tendon.
- 88. Ligaments.
- 89. Bursæ.

9.—Osseous and Articular System.

- 91. Bones of Cranium.
- 92. Bones of Face.
- 93. Vertebræ.
- 94. Sternum.
- 95. Ribs.
- 96. Bones of Upper Extremity.
- 97. Pelvic Girdle.
- 98. Bones of Lower Extremity.

0.—Regional.

- 01. Head.
- 02. Face.
- 03. Neck.
- 04. Back.
- 05. Thorax.
- 06. Abdomen.
- 07. Pelvis.
- 08. Upper Extremity.
- 09. Lower Extremity.

Pathological Classification

·1.—Ante-Natal Structures and Abnormalities of Development.

- ·11. Fœtal Structures (Normal Anatomy).
- ·12. Malformations of Incomplete Development.
- ·13. Reduction in Size (Hypoplasia).
- ·14. Reduction in Number (Syndactylism, etc.).
- ·15. Persistent Fœtal Structures.
- ·16. Excess in Size.
- ·17. Excess in Number.
- ·18. Malposition or Heterotaxis. Aberrant Structures.
- ·19. Abnormalities due to Fœtal Disease.

·2.—Circulatory Disturbances.

- ·21. Anæmia.
- ·22. Congestion or Hyperæmia.
- ·23. Hæmorrhage.
- ·24. Thrombosis.
- ·25. Embolism.
- ·26. Infarction.
- ·27. Œdema.

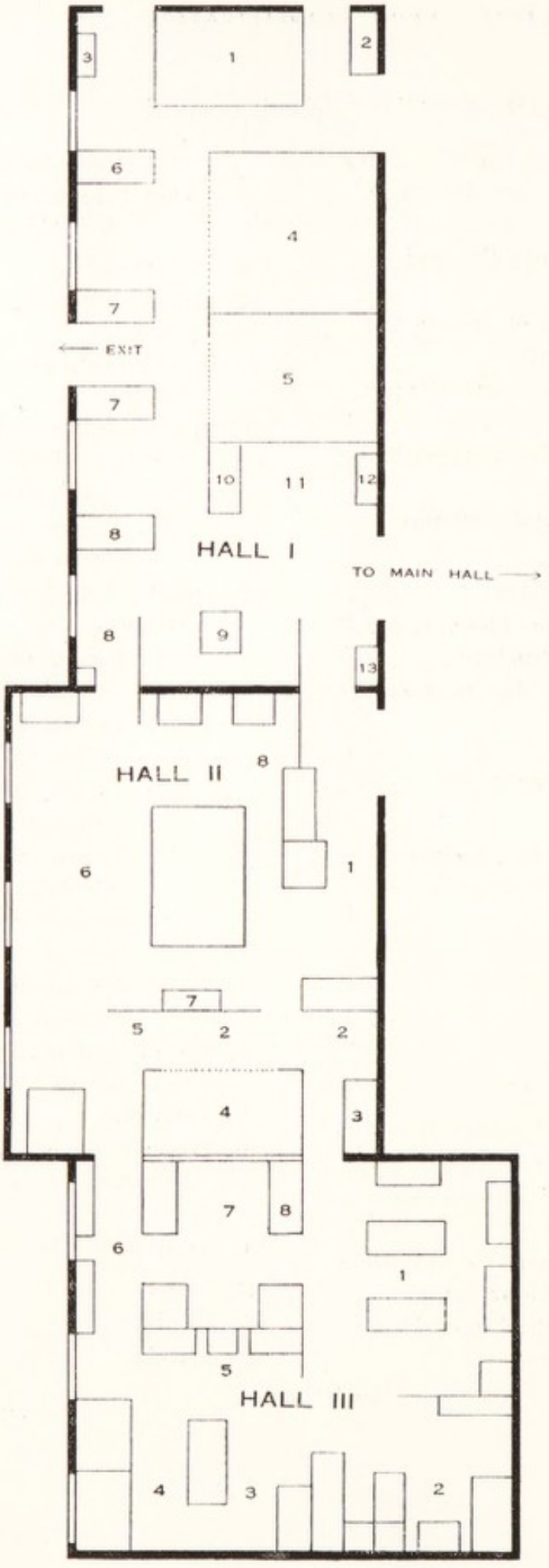
·3.—Inflammatory Processes.

- ·31. Catarrhal or Desquamative.
- ·32. Exudative.
  - ·321. Sero-Fibrinous Inflammation.
  - ·322. Fibrinous or Plastic Inflammation.
  - ·323. Diphtheritic or Membranous.
  - ·324. Hæmorrhagic.
  - ·325. Suppurative or Purulent (Abscess).
- ·33. Destructive.
- ·34. Specific Inflammation due to Cocci.
- ·35. Specific Inflammation due to Bacilli.
- ·36. Specific Inflammation due to acid-fast Bacilli, Spirilla, Yeasts and Moulds.
  - ·361. Lesions due to *B. tuberculosis*.
- ·37. Specific Inflammation due to Protozoa.
  - ·371. Lesions due to *Amœba dysenteriæ*.
  - ·372. Lesions due to *Treponema pallidum*.
  - ·373. Lesions due to Trypanosomata.
  - ·374. Lesions due to spirochætes.
  - ·375. Lesions due to Leishmania.
  - ·376. Lesions due to Hæmosporidia.
- ·38. Specific Inflammations, causative agents still undetermined.
- ·39. Productive or proliferative Processes.

·4.—Infections and Parasites.

- ·41. Cocci.
- ·42. Bacilli.
- ·43. Spirilla.

etc., etc.



MINISTRY
OF
HEALTH
SECTION
WEMBLEY
1925

APPENDIX I

EXTRACT FROM GUIDE TO MINISTRY OF HEALTH EXHIBIT WEMBLEY, 1925

Hall I. (Past and Present)

1. The Medicine Man.
2. Amulets, Charms and Votive Offering
3. The Pictorial Indicator.
4. The Alchymist.
5. The Modern Laboratory.
6. Leprosy.
7. Malaria.
8. Plague.
9. Port Work.
10. Louse-Borne Diseases.
11. Disinfection.
12. Bacteria.
13. Ancient Toilet Requisites.

Hall II. (Present)

1. Infectious Diseases.
2. Sepsis.
3. The Lister Ward.
4. Modern Operating Theatre.
5. Treatment by Baths.
6. Town Cleansing and Flies.
7. Water Purification.
8. Sewage Disposal.

Hall III. (Present and Future)

1. Maternity and Child Welfare.
2. Tuberculosis and Sunlight.
3. Housing.
4. Town Planning.
5. Smoke Abatement.
6. Trade Diseases.
7. Food.
8. Pure Milk.

INTRODUCTION

TO GUIDE TO MINISTRY OF HEALTH EXHIBIT, WEMBLEY, 1925

ON THE stage of life man plays many parts, but one scene is common to all human experience—the final scene, which rings down the curtain for the last time.

Disease and death have been the lot of man from the beginning, and the prevention of the one and the postponement of the other have concerned humanity from prehistoric times.

In its early stages the practice of medicine was mainly a matter of superstition—"the gods are angry, they must be appeased." Disease was either an evil spirit or the work of an evil spirit, who must be propitiated, cajoled or frightened into a more favourable attitude towards his victim. Sacrifices were offered, rites were performed, and the medicine man, by uncouth noises and hideous grimaces, strove to expel the unwelcome visitor.

Even now traces of such primitive superstitions with regard to disease and its prevention persist, fostered by ignorance and misinterpretation of cause and effect.

The contrast presented by modern knowledge and practice regarding disease and its prevention is striking enough. These have been achieved by steps as civilisation has grown; an irregular progress, marked by much fruitful and unfruitful labour, controversy and doubt, but, as a whole, a marvellous progress, never greater than in the last half-century, and never with brighter prospects of further achievement. There is no finality in public health work or doctrine, but it is useful to all to possess a notion of the position which has been reached at the present day, and to realise something of what is known of the greater health problems, and what is done or advocated in the name of public health.

It is manifestly impossible in a popular Exhibition to deal exhaustively with any one branch of Public Health work; any single subject could fill the whole space available and yet be incomplete. On the other hand, many lessons can be learned from a general survey of the problem which might be missed in a more detailed and exhaustive demonstration of the subject.

The exhibit of the Ministry of Health is designed to interest, educate and stimulate to further study, those who find in the problem of health and disease-prevention a key to happiness and prosperity.

It is no exaggeration to say that health constitutes one of the main topics of conversation—in the drawing-room, in the office, in the club-house, in the train, in the street; it is impossible to get away from it. Joining in such discussions, one is impressed by the demand for more and more knowledge which they imply.

Man is ever groping after the truth, and his search is stimulated by any consideration which touches his dear ones, his home, or his pocket. The financial side of the health problem is an important one; to the man of moderate means, the doctor's bill, the surgeon's fee, the cost of public health services to be paid for by rates and taxes, must be faced; whilst the possibility of loss of employment or limitation of working capacity are constant sources of anxiety. Day by day victories are being won by the forces of preventive medicine: the expectation of life is increased, life insurance becomes cheapened. An intelligent consideration of the various sections of the Health exhibit will do much to explain how this is being brought about; and will help the individual to avail himself of the benefits conferred by science, and to regulate his life in accordance with standards of known value.

At every point of our existence we are in contact with some subject which is included in this demonstration. Before the child is born much can be done to safeguard his health interests, as well as those of his mother. As an infant, he calls for special care with regard to food, clothing, fresh air and sunlight. As a child, the problems of nourishment, development and education predominate; whilst various hindrances to progress, such as physical deformities and infectious diseases, call for special precautions. As the child grows into the man, his work is beset by certain dangers, and calls for adequate nourishment and, once again, a suitable environment. Marriage brings into prominence the housing problem and the need for suitable provision for the next generation. As age advances, fresh problems are caused by the strain incidental to our advanced civilisation, the need of adjustment of food and drink to our changing bodily activities,

and a realisation of our limitations. Practical advice is given on these matters in the various sections of this exhibit. Short summaries are displayed to emphasise the main teaching in each case.

Prominence is also given to the Engineering side of Public Health. It is impossible to over-estimate the importance to the health of the community of a pure and ample water supply, of a pure atmosphere, and of the rapid, efficient and economical removal of waste products. It has been shown experimentally that an animal can be killed by the accumulation of its own waste products, and practical experience has proved that foul air, polluted soil, and filth generally are "trusty captains in the army of death."

SOME REFERENCES AND ABSTRACTS ON MUSEUM TECHNIQUE

METHODS OF ARRANGEMENT AND DISPLAY

ALBERT, H. (1911). A portable museum case. *The International Association of Medical Museums.* Bulletin No. III. 16–18.

BLAIR, D. P. (1918). A teaching collection connected with the department of surgical pathology, Harvard Medical School. *Ibid.* Bulletin No. VII. 39–41.

BRANCH, A., BROW, G. R., and BINGER, C. A. L. (1925). Method of demonstrating the pulmonary artery supply of the dog's lung. *Ibid.* Bulletin No. XI. 48–54.

FELDMAN, W. H. (1925). A modification of Day's method for mounting museum specimens under watch glasses, and a means for their display. *Ibid.* Bulletin No. XI. 18–24.

FREEDMAN, A. O. (1925). Simple method of exhibiting dry museum specimens. *Ibid.* Bulletin No. XI. 31–33.

KLOTZ, O. (1913). Slide cabinet for storage of large numbers of slides. *Ibid.* Bulletin No. IV. 48–49.

POLLOCK, M. (1924). Methods for concentration of museum specimens. *Ibid.* Bulletin No. X. 34–37.

PONFICK, E. (1904). Über neue Aufgaben des pathologisch-anatomischen Unterrichtes an der Hand holoptischer Betrachtungsweise. *Verhandlungen der Deutschen Pathologischen Gesellschaft.* 6. Tag. 4–20.

(A plea for teaching by means of sections showing all the organs in their natural relations, instead of isolated organs).

ROBERTSON, H. E. (1924). The " battery " system for preservation of museum specimens. *The International Association of Medical Museums.* Bulletin No. X. 32.

WELLER, C. V. (1915). The use of large sections mounted as lantern slides, as an aid in museum teaching. *Ibid.* Bulletin No. V. 46–48.

WULLSTEIN. (1906). Demonstration von pathologisch-anatomischen Präparaten, welche nach der Eisler'schen Methode konserviert sind. *Zentralblatt für Chirurgie.* XXXIII. Beilage Nr. 38. 148–152.

(Demonstration of various specimens embedded in glycerine jelly).

ALBERT, H. (1913). The use of oil as the final preservative for specimens, the natural colour of which is to be retained. *The International Association of Medical Museums.* Bulletin No. IV. 44–45.

BLUM, F. (1893). Der Formaldehyd als Härtungsmittel. *Zeitschrift für wissenschaftliche Mikroskopie.* X. 314–315.

————. (1896). Über Wesen und Wert der Formolhärtung. *Anatomischer Anzeiger.* XI. 718–727.

(A description of the chemical action of formalin).

BRUERE, A. A., and KAUFMANN, J. (1911). Neutral-tinted glycerine-jelly as a medium for the mounting of pathological specimens. *The International Association of Medical Museums.* Bulletin No. III. 11–15.

BURZYNSKI. (1901). Über die Conservirung der Organe in ihren natürlichen Farben. *Polnisches Archiv für biologische und medizinische Wissenschaften;* summarised in *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XII. 738–739.

[For fixing sections of organs (preferably not more than 2–3 cm. thick), author uses 4% formaldehyde solution (10% formalin) 100 parts; acetone, acetate of potassium, nitrate of potassium and sodium chloride, of each 5 parts. After 3–5 days' fixation the preparations are rinsed in water and then (to restore the colour) placed for 1–2 days in alcohol containing 15% potassium acetate, after which they are kept in the dark in a mixture of water and 20–30% glycerine. A demonstration of the preparations in Cracow in 1900 proved them excellent].

CALLENDER, G. R., COUPAL, J. F., and PRIOR, F. E. (1924). True colour reproduction of pathological specimens. *The International Association of Medical Museums.* Bulletin No. X. 38–41.

CHRISTELLER, E. (1925). A new simple method for the normal and pathological histotopography of organs. *The International Association of Medical Museums.* Bulletin No. XI. 28–31.

(The preparation of stained sections of whole organs).

COPLIN, W. M. L. (1904). The permanent preservation of anatomic, embryologic, pathologic and bacteriologic specimens. *Journal of the American Medical Association.* XLIII. 441–446.

(Preserved by Kaiserling's method and embedded in a solid gelatin medium in sealed glass dishes or jars; illustrations).

CRAIG, H. K. (1914). A new method of preparing museum specimens. *Ibid.* LXII. 1241–1242.

(To supersede Kaiserling. Can be used with success to revive old Kaiserling preparations. For details, see *Laboratory Journal.* 1914. IV. 35).

————. (1916). A new method of preparing museum specimens. *The International Association of Medical Museums.* Bulletin No. VI. 54–57.

(The use of saturated solution of sodium chloride, followed by a potassium acetate and potassium nitrate solution, to replace development in alcohol).

CROWELL, B. C. (1924.) The value of Jores' method of preservation of museum material, as modified by Klotz and associates. *Ibid.* Bulletin No. X. 24–26.

DELÉPINE, S. (1914.) On the arsenious acid-glycerin-gelatin ("arsenious jelly") method of preserving and mounting pathological specimens with their natural colours, and on the use of new forms of receptacles for keeping museum specimens. *Journal of Pathology and Bacteriology.* XVIII. 345–350.

————. (1914). Addendum to the arsenious jelly method of mounting pathological specimens. *Ibid.* XVIII. 478–479.

(Treatment of specimens which it is not desirable to embed).

ECCLES, W. McA. (1894). Formic acid as a rapid hardening reagent for animal tissues. *British Medical Journal*, 26th May. 1124.

(In seeking a quicker method than those commonly in use, the author tried formic aldehyde and finds it most satisfactory in a 40% solution for very soft tissues, 20% for firmer, and 10% for very firm material. It does not render the tissue brittle or interfere with the action of stains).

ELLIS, E. B. (1918). A modified sugar solution as a final preservative for museum specimens. *The International Association of Medical Museums*. Bulletin No. VII. 32–33.

FLINT, J. M., and KELLNER, C. (1912). A new preservative for Pick-Kaiserling specimens. *Journal of the American Medical Association*. LVIII. 1277–1278.

————————, and ————————. (1913). An inexpensive oil method for mounting. *The International Association of Medical Museums*. Bulletin No. IV. 42–44.

FROST, R. L. (1913). A new and inexpensive solution for the mounting of museum specimens. *Ibid*. Bulletin No. IV. 41–42.

HAYTHORN, S. R. (1915). An efficient and inexpensive permanent mounting fluid for gross specimens. *Ibid*. Bulletin No. V. 66–68.

HERMANN, F. (1893). Notiz über die Anwendung des Formalins als Härtungs- und Conservirungsmittel. *Anatomischer Anzeiger*. IX. 112–115.

(In praise of the transparency and natural coloration of objects fixed by Blum's formalin method).

HEWITT, J. H. (1915). The advantages of Jores' fluid, as modified by Klotz, for teaching demonstrations. *The International Association of Medical Museums*. Bulletin No. V. 61–62.

HIRSCHFELD, S. (1922). The use of antiseptics in museum fluids. *Ibid*. Bulletin No. VIII. 65–67.

JORES, L. (1896). Die Conservirung anatomischer Präparate in Blutfarbe mittels Formalin. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* VII. 134.

(1. Fix in: 1 part sodium chloride, 2 parts magnesium sulphate, 2 ,, sodium sulphate, 100 ,, water + 5 to 10 parts formalin (40%).

2. When sufficiently fixed, free from formalin and rinse with 90% alcohol.

3. Place in 95% alcohol till colour returns or till object is saturated.

4. Place in equal parts of glycerine and water.

The author says the results are superior to those of Melnikow-Raswedenkow, 1896).

———. (1913). Über eine verbesserte Methode der Konservierung anatomischer Objekte. *Münchener medizinische Wochenschrift.* LX. 976.

JUDAH, E. L. (1922). Personal modifications in the technique of the Kaiserling methods of colour preservation. *The International Association of Medical Museums.* Bulletin No. VIII. 62–64.

KAISERLING, C. (1896). Über die Conservirung von Sammlungspräparaten mit Erhaltung der natürlichen Farben. *Berliner klinische Wochenschrift.* XXXIII. 775.

———. (1897). Weitere Mittheilungen über die Herstellung möglichst naturgetreuer Sammlungspräparate. *Virchows Archiv.* CXLVII. 389–417.

———. (1900). Über Konservirung und Aufstellung pathologisch-anatomischer Präparate für Schau- und Lehrsammlungen. *Verhandlungen der Deutschen Pathologischen Gesellschaft.* II. 203–217.

(A recapitulation of his colour-preserving process in the light of some years' experience. He finds his preparations will bear even direct sunlight without fading, but considers it still advisable to protect them from the light as far as possible).

KLOTZ, O. (1915). The staining of pathological specimens in the gross. *The International Association of Medical Museums.* Bulletin No. V. 51–53.

————, and COBURN, W. H. (1916). A mounting fluid for gross specimens in their natural colours. *Ibid.* Bulletin No. VI. 51–53.

————, and MACLACHLAN, W. W. G. (1915). A modified Jores' method for the preservation of colours in gross specimens. *Ibid.* Bulletin No. V. 59–60.

LITTLEJOHN, H. (1902). A new method of mounting museum specimens. *Journal of Pathology and Bacteriology.* VIII. 369–373.

(Preserved specimens moistened with strong spirit were placed on cotton-wool in air-tight jars. They remained in excellent condition, but moisture condensed upon the glass. This was remedied by soaking the objects in glycerine and water for several weeks and replacing them in their jars with a small quantity of pure glycerine under the wool. Some were first preserved by Kaiserling's method. For sealing the jars nothing was found so easy and effective as common putty. These dry preparations keep for years).

LUNDQUIST, R. (1925). A proposed modification of the Kaiserling method for preserving gross specimens. *The International Association of Medical Museums.* Bulletin No. XI. 16–18.

————, and ROBERTSON, H. E. (1925). Proposed modification of the Kaiserling method for preservation of specimens for display purposes. *Journal of Laboratory and Clinical Medicine.* X. 665–667.

MAGNUS, G. (1913). Konservierung von Dauerpräparaten in konzentrierter Zuckerlösung. *Berliner klinische Wochenschrift.* L. 636–637.

(The specimens, fixed in formalin, developed in alcohol and preserved in a concentrated solution of good quality beet sugar, were found to keep well, to retain their colour even when exposed to light, and to be as good as fresh material for microscopical examination).

MANKOWSKY, A. (1906). Eine Methode zur Anfertigung von dicken Schnitten ganzer menschlicher Gehirne mit dem Mikrotom von Marchi. Die Konservierung haltbarer Schnittpräparate, eingebettet in Gelatine und Formalin. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XVII. 467–470.

MELNIKOW-RASWEDENKOW, N. (1896). Notiz über die Herstellung und Conservierung pathologisch-anatomischer Präparate. *Medicinische Rundschau,* Moscow. No. 1. 82. (Original in Russian).

———————————. (1896). Über das Aufbewahren pathologisch-anatomischer Präparate. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* VII. 49–50.

———————————. (1897). Eine neue Conservirungsmethode anatomischer Präparate. *Zieglers Beiträge zur pathologischen Anatomie.* XXI. 172–199.

[A repetition in German of his Russian paper (1896), with further details].

———————————. (1897). Über die Herstellung anatomischer Präparate nach der Formalin-Alkohol-Glycerin-essigsauren-Salz-Methode. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* VIII. 121–128.

(Amplification of earlier papers).

———————————. (1898). Über die Herstellung anatomischer, besonders histologischer Präparate nach der Formalin-Alkohol-Glycerin-essigsauren-Salz-Methode. Eine Ergänzungsnotiz. *Ibid.* IX. 299–301.

MILLER, J. (1922). A method of mounting museum specimens with a minimum of fluid. *The International Association of Medical Museums.* Bulletin No. VIII. 74–75.

———————. (1924). Further experience in mounting museum specimens with a minimum of fluid. *Ibid.* Bulletin No. X. 30–31.

ORTH, J. (1913). Demonstration topographisch-pathologisch-anatomischer Präparate. *Berliner klinische Wochenschrift.* L. 365.

(Frozen sections of organs in their natural relations fixed in formalin, developed in alcohol and impregnated with a preserving fluid. Hints by Kaiserling as to procedure).

PEIRCE, S. J. S. (1915). Colour preservation in gross specimens by formalin chloral-hydrate method. *The International Association of Medical Museums.* Bulletin No. V. 68–69.

PICK, L. (1900). Über die Methoden, anatomische Präparate naturgetreu zu konservieren. *Berliner klinische Wochenschrift.* 906–910 and 935–939.

(Discusses the methods of Melnikow-Raswedenkow, Jores and Kaiserling, and his own modifications based on a careful study of their procedure).

————. (1921). Anleitung zur Konservierung und Aufstellung des Sektionsmaterials. In NAUWERCK'S "Sektionstechnik für Studierende und Ärzte," 6th edition. 206–243.

(A very complete description of many methods of preparation and preservation).

PLATZKER, J. S. (1920). A new method for the preservation of specimens. *Journal of Laboratory and Clinical Medicine.* V. 126–128.

RHEA, L. J. (1922). Method used in the army zone for the preparation of lesions resulting from the injuries of war. *The International Association of Medical Museums.* Bulletin No. VIII. 40–44.

ROBERTSON, H. E. (1913). A convenient Kaiserling bath cabinet. *Ibid.* Bulletin No. IV. 40–41.

————. (1916). The rôle of organic acids in the preservation of specimens. *Ibid.* Bulletin No. VI. 54.

RÖTHIG, P. (1908). Technik : 5. Herstellung und Konservierung von Demonstrationspräparaten. *Lubarsch-Ostertags Ergebnisse der allgemeinen Pathologie und pathologischen Anatomie des Menschen und der Tiere.* 12. Jahrg. 655.

(A review of 20 papers on the subject).

ROUSSY, G. (1909). Conservation de pièces macroscopiques dans la gélatine glycérinée en boîtes de Pétri. *Comptes Rendus des Séances de la Société de Biologie.* LXVI. 308–309.

ROYCE, C. E. (1915). Delépine's arsenic-glycerin jelly method of preserving gross specimens. *The International Association of Medical Museums.* Bulletin No. V. 76–80.

———————. (1925). On the permanence of Delépine's arsenic-glycerin jelly method of mounting. *Ibid.* Bulletin No. XI. 24–25.

RUPP, C. (1916). Das Konservieren und Herstellen der Gehirne und Organe als Trockenpräparate mittels Stearin in einem Konservier-Apparat. *Zeitschrift für wissenschaftliche Mikroskopie.* XXXIII. 129–137.

(Procedure, with text figs. of apparatus and plates showing specimens).

SCHMORL, G. (1912). Die pathologisch-histologischen Untersuchungsmethoden. Leipzig.

SCHORR, G. (1911). Zur Frage der Konservierung pathologisch-anatomischer Präparate. *Virchows Archiv.* CCVI. 471–474.

(Describes a method of dry preparation with good colour preservation).

SILVESTER, C. F. (1915). A few effective methods of preparing and mounting specimens for exhibition purposes. *The International Association of Medical Museums.* Bulletin No. V. 45–46.

———————. (1922). Retrospect : Preserving fluids for gross pathological specimens, with review of literature. *Ibid.* Bulletin No. VIII. 53–60.

SPALTEHOLZ. (1914). Über das Durchsichtigmachen von menschlichen und tierischen Präparaten. 2nd edition. Leipzig. Quoted in *Enzyklopädie der mikroskopischen Technik.* 1926. Vol. I, p. 94.

[Fix well in formalin, alcohol, sublimate or Kaiserling solution. Decalcify. Treat till white with commercial hydrogen peroxide, diluted with water for delicate objects, and frequently changed. Wash thoroughly, 2–6 days in running water, 1–2 days in frequently changed distilled water. Dehydrate in the alcohol series. After the absolute alcohol, place for 1–2 days in benzene, changing frequently, and then in the final fluid (wintergreen oil and benzylbenzoate, wintergreen oil and isosafrol, or safrol and benzylbenzoate, the mixture being adjusted for each object). For older human embryos SPALTEHOLZ allows 5 parts by weight of wintergreen oil to one part of benzylbenzoate, for younger 3–1, for bones 5–3, for whole rats 4–3, etc.]

(Preparation sealed in vacuo, using air-pump).

STIEDA, L. (1905). Über die Verwendung des Glycerins zur Konservierung anatomischer Präparate. *Anatomischer Anzeiger.* XXVII. Erg. H. 237–238

(An historical survey of the use of glycerine with description of his own glycerine method—addition of a small quantity of carbolic acid—used with satisfaction for 30 years).

TERRY, R. J. (1915). Experience in the use of gelatin in mounting anatomical preparations. *The International Association of Medical Museums.* Bulletin No. V. 73–76.

WATTERS, W. H. (1909). Demonstration of the gelatin method of preserving specimens. *Ibid.* Bulletin No. II. 18.

————————. (1924). Ultimate result of the gelatin method of mounting specimens. *Ibid.* Bulletin No. X. 28–30.

WESTENHOEFFER, M. (1904). Die Konservierung harnsaurer Niederschläge in Organen, zugleich eine Vereinfachung der sogen. farbigen Konservierungsmethoden. *Beiträge zur wissenschaftlichen Medicin und Chemie* (Festschrift zu Ehren des sechzigsten Geburtstages von Ernst Salkowski). Berlin: Hirschwald. 405–422; and *Verhandlungen der Deutschen Pathologischen Gesellschaft.* 1904. VII. Tag. 259–264.

(An historical survey of formalin fixation since I. and F. BLUM introduced the method in 1893. The discovery that mercuric oxide hinders the solution of uric acid salts. Details of the method used for preserving infarcts in kidneys of the new-born and gout preparations. Most satisfactory results in rescuing material in which putrefaction had commenced).

SPECIAL METHODS OF PREPARATION

(*a*) *Bones*

FIBIGER, J. (1913). An easy method of substituting the skull-cap. *The International Association of Medical Museums.* Bulletin No. IV. 27–28.

FREEDMAN, A. O. (1925). New method of demonstrating the labyrinth of the inner ear *in situ*. *Ibid.* Bulletin No. XI. 33–36.

IZZARD, F. A. (1913). A rapid method of macerating bones. *Laboratory Journal.* I. 10–11.

————————. (1925). A rapid method of macerating bones. *Ibid.* VI. 35–36.

JOHAN, B. (1924). A simple and rapid method for preparing (macerating) macroscopic bone specimens. *The International Association of Medical Museums.* Bulletin No. X. 22–24.

JUDAH, E. L. (1915). Rapid method of cleaning bone. *Ibid.* Bulletin No. V. 90–91.

MOŽEJKO, B. (1910). Eine schnelle Methode zur Darstellung der Knochen für osteologische Untersuchungen. *Anatomischer Anzeiger.* XXXVI. 314–316.

(The specimen is freed of brain, intestines, muscles and blood and the animal then boiled—if large in a solution of eau de Javelle, if small in soda solution or plain water—till all the soft parts are cooked through, but not separated from the bones. It is then placed in a solution of caustic potash till the soft parts are dissolved—tendons and very tough parts must be removed with forceps—and afterwards washed with frequent changes of water. A day suffices to prepare a guinea-pig skeleton for demonstration).

PFITZNER, W. (1889). Erfahrungen über das Teichmann'sche Knochenmazerationsverfahren. *Ibid.* IV. 687–703.

PICK, L. (1909). Ein Apparat zur Entfettung mazerierter Knochen. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XX. 2–9.

(Hermetically-sealed, water-heated, sheet copper cylinder, using either ether or benzene vapour. Illustrations of exterior and interior).

SKODA, C. (1906). Über eine kombinierte, plastische Leimmasse und ihre Anwendung bei der Verfertigung von Knochenpräparaten. *Anatomischer Anzeiger.* XXIX. 380–382.

TEICHMANN, L. (1887). Über Knochenmaceration. *Ibid.* II. 461–468 and 495–502.

[Finding no satisfactory method of maceration in force in Germany, author devised his own. The bones are roughly freed from soft parts, care being taken not to let the knife touch the bones. The bones are separated into groups of convenient size for the vessels used. Parts with many small bones are put into a net. The skull is treated apart. All are placed in a suitable stoneware vessel, distilled water is poured on, the lid is put on and the jar left at 30°–40° C. for not more than 7 days. The bones must not be allowed to float; evaporation must be compensated by the addition of water. About the 6th day the bones are transferred to a prepared hot soda or potash solution (about 1 : 10 by weight) and boiled slowly for a few minutes (large bones must be left for some time at 75° C.). To emulsify the contained fat, the bones should be constantly stirred, withdrawn, allowed to drip, and replaced in the soda lye. They must not float. The hot soda solution is poured off, the bones are freed as far as possible from soap and lime by shaking, dripping and washing in warm water; again boiled briefly in clean water, and the process repeated till they are clean. Fragments of tendon, etc., may be wiped off with a cloth or removed with forceps. Scraping should not be resorted to. The cleaned bones are allowed to dry. The apparatus is described].

WALDEYER, W. (1907). Die Mazerations-Einrichtung an der Anatomischen Anstalt zu Berlin. *Ibid.* XXXI. 246–251.

(Describes, with illustrations, the macerating and defatting apparatus).

(*b*) *Various*

ADAMI, J. G. (1915). On the preservation of war material for museum purposes. *The International Association of Medical Museums.* Bulletin No. V. 63–66.

BENDA, C. (1900). Eine makro- und mikrochemische Reaction der Fettgewebs-Nekrose. *Virchows Archiv.* CLXI. 194–198.

(The use of copper salts).

————. (1913). Zwei kleine Mitteilungen über Technik von Sammlungspräparaten. *Verhandlungen der Deutschen Pathologischen Gesellschaft.* 16. Tag. 268–270.

(Use of Sudan III or scharlach-roth to demonstrate fatty foci. Deposits of urates preserved by Spalteholz's method).

BOYD, W. (1922). The preservation of amyloid specimens. *The International Association of Medical Museums.* Bulletin No. VIII. 77–78.

BLUM, J. (1893). Formol als Conservierungsflüssigkeit. *Zoologischer Anzeiger.* No. 434. 450.

(A diluted formalin solution gives brilliant results for preserving fish and reptiles, leaves, flowers and fruit; slimy creatures do not lose their mucin).

CRISTIANI, H., and DE MICHELIS, G. (1905). Pièces anatomiques conservées par injection vasculaire de liquides glycérinés à base d'acide salicylique et de formaline. *Anatomischer Anzeiger.* XXVII. Erg. H. 226–227.

[For embalming, these authors inject into the vessels a mixture of glycerine to which is added salicylic acid dissolved in alcohol and a formalin solution saturated with chloroform. A monkey so treated 13 months previously (1/10 of its weight of the liquid was injected) was shown, and it was said that the eyes had remained convex and almost transparent for 8 months.]

EHLERS. (1894). Mit Formol conservirte Fische und wirbellose Thiere. (Demonstration). *Verhandlungen der Deutschen Zoologischen Gesellschaft.* 4th Annual Meeting, Munich. 92–93.

GIROUX, J. (1925). The use of celluloid to enclose cavity contents in mounted specimens. *The International Association of Medical Museums.* Bulletin No. XI. 27.

GROSS, L. (1918). On the methods of organ reconstruction by injection of the arterial tree. *Ibid.* Bulletin No. VII. 33–36.

HAUSER, G. (1910). Über die Konservierung von Thorax-Gefrierschnitten nach Kaiserlingscher Methode. *Verhandlungen der Deutschen Pathologischen Gesellschaft.* 14. Tag. 286–288.

(Details of preparing holoptic sections of the thorax).

HENRICI, A. T. (1916). A method for obtaining satisfactory sections of teeth with the soft tissues *in situ*. *The International Association of Medical Museums.* Bulletin No. VI. 45–47.

HOCHSTETTER, F. (1927). Die Paraffindurchtränkung zur Erhaltung von Tieren und Pflanzen in ihrem natürlichen Aussehen. *Die Umschau.* XXXI. 650–652.

(Describes, with illustrations, his method of preserving the natural form and colour by means of paraffin impregnation. Relies essentially on the complete substitution by paraffin of the water in the tissues, as occurs when embedding tissues in paraffin for making microscopic sections. The objects to be preserved are first fixed by immersion in, or injection of, suitable fluids. Before fixation the objects must be given the position they are intended to retain. Water is withdrawn by increasing strengths of alcohol: this is then replaced by a paraffin solution, and the object then transferred to a paraffin bath in which it remains at 57° C. until the paraffin solution has been completely replaced by paraffin. The object is next freed of superfluous paraffin at 57° C. If kept at ordinary temperature it will lose neither its form nor its colour).

[This process is very similar to that described by D. Wolhard (1915), *see page* 112].

HOFER, B. (1894). Conservierung von Fischen. *Verhandlungen der Deutschen Zoologischen Gesellschaft.* 4th Annual Meeting, Munich. 93–94.

($\frac{1}{2}$–1% formalin solution found vastly superior to alcohol for brightly-coloured fishes).

JACKSON, F. S. (1922). The preservation and mounting of small organisms by the formalin-sugar method. *The International Association of Medical Museums.* Bulletin No. VIII. 75–77.

KAUFMANN, J. (1915). India-ink injection of bursal spaces of heart, showing distribution of auriculo-ventricular bundle. *Ibid.* Bulletin No. V. 50–51.

———— and JUDAH, E. L. (1915). Rapid colour method for differentiation of fat in gross specimens. *Ibid.* Bulletin No. V. 55–56.

LIEPMANN, W. (1902). Über die Benda'sche Reaction auf Fett-Nekrosen. *Virchows Archiv.* CLXIX. 532–535.

(An experiment to determine whether the fatty necroses revealed by Benda's reaction were merely post-mortem changes. They were found to be intravitam changes).

MALONE, R. H., and HEDDICK, L. (1914). The employment of fat stains for differentiation in preparing museum specimens. *Journal of Pathology and Bacteriology.* XIX. 102–104.

(With coloured plate).

———— and ————. (1915). A new method of preparing museum specimens to show differentiation of tissues. *The International Association of Medical* Museums. Bulletin No. V. 53–55.

MEAKINS, J. C. (1915). On the application of Wolhard's method for the preservation of the heart. *Ibid.* Bulletin No. V. 49–50.

MENTZER, S. H. (1925). Methods of preparing gall-bladders and calculi for study and museum display. *Ibid.* Bulletin No. XI. 37–40.

NELSON, W. A. (1925). Treatment of brains to make good museum specimens. *Laboratory Journal.* VI. 82–83.

SCOTT, W. J. M. (1924). Gross demonstration of adrenal lipoid changes. *The International Association of Medical Museums.* Bulletin No. X. 27.

SHORE, T. H. G., and JACKSON, W. T. (1923). Restoration of the colour in faded museum specimens intended to demonstrate free iron by the Prussian blue method. *Laboratory Journal.* V. 95.

(Addition of hydrogen peroxide).

SKODA, C. (1906). Eine weichbleibende Masse zur Injektion von Glyzerin-Präparaten. *Anatomischer Anzeiger.* XXIX. 602–605.

[Fluid fish-glue 2.0, white dextrin 1.0, stain (cinnabar for arteries, ultramarine for veins) 0.5–1.0, ground together with the gradual addition of sufficient water to render it of a thick, honey-like consistency].

WARTHIN, A. S. (1915). On the demonstration of microchemical reactions in museum specimens. *The International Association of Medical Museums.* Bulletin No. V. 56–58.

WILLIAMS, A. H. (1924). Fixation of a cystic ovary as a museum specimen. *Laboratory Journal.* V. 142.

WOLHARD, D. (1915). Eine neue Methode zur Konservierung des Herzens. *The International Association of Medical Museums.* Bulletin No. V. 48–49.

BLOCHMANN, F. (1904). Die Verwendung von Schieferplatten zum Aufstellen von anatomischen Präparaten. *Anatomischer Anzeiger.* XXV. 105–106.

(Recommends the use of slate slabs instead of black glass. They are cheaper, do not reflect, are easy to pierce and can be sawn with a fret-saw).

COPLIN, W. M. L. (1922). Permanent mounting of Kaiserling and gelatin-surfaced specimens without immersion in fluid. *The International Association of Medical Museums.* Bulletin No. VIII. 68–72.

CHIARI, H. (1915). Eine zweckmässige Methode der Aufstellung von Präparaten von Schussfrakturen. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XXVI. 505–509.

(Sets up fractures by means of graduated wire supports attached to a board in such a way that, without handling, the whole fracture and all its parts can be viewed from every aspect).

GIBSON, A. (1922). A method of mounting wet specimens. *The International Association of Medical Museums.* Bulletin No. VIII. 72–73.

HEWITT, J. H. (1913). A method of mounting thin membranous tissues and slices of organs in gelatin between plates of glass, fixed by Kaiserling's method. *Ibid.* Bulletin No. IV. 29–37.

———————. (1913). The use of metallic and hard rubber frames in mounting tissues between plates of glass. Two models of racks that may be used for exhibiting such mounts. Advantages. *Ibid.* Bulletin No. IV. 37–39.

———————. (1915). On the use of agar-agar for mounting specimens between glass plates. *Ibid.* Bulletin No. V. 82–85.

HEWITT, J. H. (1915). A method for permanent exhibition of tissues in agar-agar between glass plates, and the microscopical appearance of the same. *The International Association of Medical Museums.* Bulletin No. V. 91–95.

JACOBS, W. F. (1925). Demonstration of special method of mounting museum specimens. *Ibid.* Bulletin No. XI. 25–27.

(Black background).

JUDAH, E. L. (1916). Mounting specimens under petri dishes and clock glass. *Ibid.* Bulletin No. VI. 48–51.

PATTEN, C. J. (1904). A suggested method of mounting anatomical specimens for museum purposes. *British Medical Journal.* 19th November. 1378–1379.

(The specimens are attached to plaster slabs by means of glass rods driven through them and into the plaster before this has quite set. The slabs with the attached specimen can be removed bodily from the jars for closer study).

ROYCE, C. E. (1915). The use of plaster of Paris in mounting gelatin preparations. *The International Association of Medical Museums.* Bulletin No. V. 80–82.

WALDIE, W. (1913). Improved method of mounting permanent museum preparations, with the aid of sheet glass supports. *Laboratory Journal.* I. 22–23.

WEIDMAN, F. D. (1918). Methods of mounting animal parasites in solution, including the use of plaster of Paris. *The International Association of Medical Museums.* Bulletin No. VII. 36–39.

RECEPTACLES, SEALING OF JARS, ETC.

ALBERT, H., and BENNETT, V. (1916). A new museum jar for the preservation of eye specimens. *The International Association of Medical Museums.* Bulletin No. VI. 42–45.

COBURN, W. (1915). Cement for sealing rectangular museum jars. *Ibid.* Bulletin No. V. 86.

DE GROOT, J. G. (1904). Ein neuer Kitt zum Schliessen von Gefässen mit Alkoholpräparaten auch für den Versand. *Zoologischer Anzeiger.* XXVIII. 406–407.

(4 gm. gelatine, 8 gm. zinc oxide, 30 cc. water. The zinc oxide must be rubbed to a paste in a little of the water before mixing. The whole is warmed over a flame but not allowed to boil, stirred well and applied with a brush).

JUDAH, E. L. (1915). Series of sizes for square museum jars in use at the medical museum of McGill University, Montreal, Canada. *The International Association of Medical Museums.* Bulletin No. V. 89–90.

————————. (1922). On the construction of glass shades or boxes for the delicate dry specimens for the Canadian Army Medical Museum. *Ibid.* Bulletin No. VIII. 44–48.

LLOYD, E. O. (1927). Celluloid museum jars. *Laboratory Journal.* VI. 144–147.

(With illustrations).

MUIR, W., and JUDAH, E. L. (1915). The sealing of museum jars. *The International Association of Medical Museums.* Bulletin No. V. 87–88.

O'KELLY, W. D. (1924). Celluloid museum jars. *Journal of Pathology and Bacteriology.* XXVII. 116–118.

(Overcome difficulties of size and storage).

POPE, G. (1924). Cement for specimen jars. *Laboratory Journal.* VI. 13.

SCHORR, G. (1907). Zur Frage der Konservierung pathologisch-anatomischer Präparate. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XVIII. 602.

(Describes a cement of gutta percha, black pitch, asphalt, tallow and resin, and also a fluid for treating dry preparations fixed and developed by the colour-preserving methods).

TERRY, R. J. (1922). Museum jars of porcelain and terra-cotta. *The International Association of Medical Museums.* Bulletin No. VIII. 79–82.

LABELLING AND CLASSIFICATION

ABBOTT, MAUDE E. (1925). Wyatt Johnston classification. *The International Association of Medical Museums.* Bulletin No. XI. 78–89.

BELL, D. (1911). On a new and rapid method of indelibly lettering glass museum jars. *Ibid.* Bulletin No. III. 20–21.

COUPAL, J. F. (1924). Modification of the Wyatt Johnston museum classification in use at the Army Medical Museum, Washington, D.C. *Ibid.* Bulletin No. X. 47–73.

JUDAH, E. L. (1913). The tagging of museum specimens. *Ibid.* Bulletin No. IV. 45–47.

PAYNE, J. F. (1922). A permanent tag for museum specimens. *Ibid.* Bulletin No. VIII. 82–83.

SILVESTER, C. F. (1922). Typewriting labels on museum jars. *Ibid.* Bulletin No. VIII. 83–86.

BITTERMAN, T. (1922). The photography of gross pathological material. *The International Association of Medical Museums.* Bulletin No. VIII. 87–92.

CHRISTELLER, E. (1916). Über die photographische Darstellung makroskopisch-anatomischer Präparate. *Zeitschrift für wissenschaftliche Mikroskopie.* XXXIII. 113–128.

(Careful instructions for macroscopic-anatomical photographs, with plates and diagrams).

———————. (1925). A method of obtaining stereoscopic microphotographs for all magnifications. *The International Association of Medical Museums.* Bulletin No. XI. 41–47.

(Reprinted from *Verhandlungen der Deutschen Pathologischen Gesellschaft,* 1921).

DE LA CAMP. (1904). Verhandlungen des XXI. Kongresses für innere Medizin in Leipzig vom 18–21 April, 1904. Demonstration. *Zentralblatt für allgemeine Pathologie und pathologische Anatomie.* XV. 406.

(Author showed frozen sections of dead bodies with the organs outlined with lead wire, whereby he claimed that a correct explanation could be found of every shadow in the corresponding X-ray plates, many current interpretations being, in his opinion, false).

FITZGERALD, R. R. (1924). A background for under-water photographs. *The International Association of Medical Museums.* Bulletin No. X. 42–43.

HARVEY, H. F. (1922). Stereo-photography and stereo-projection. *Ibid.* Bulletin. No. VIII. 92–100.

KAISERLING, C. (1900). Über die Herstellung von Gips- und Wachsabgüssen. *Verhandlungen der Deutschen Pathologischen Gesellschaft.* II. 217–235.

(Detailed instructions for preparing plaster and wax models).

LAMBERT, R. A., and HEMBERGER, A. B. (1924). Combination of photography and drawing medical illustration. *The International Association of Medical Museums.* Bulletin No. X. 46–47.

MALLORY, F. B., and LEAVITT, L. M. (1922). The essentials of photomicrography. *Ibid.* Bulletin No. VIII. 100–104.

WILLIAMS, E. J. (1924). Personal method of preparing coloured photographs. *Ibid.* Bulletin No. X. 43–45.

ILLUSTRATIONS

OF

TYPICAL SECTIONS AND EXHIBITS

IN

THE WELLCOME

MUSEUM OF MEDICAL SCIENCE

Beneath each photograph will be found a reference to the page on which descriptive matter appears in the text

The figures above and at the sides of the illustrations indicate the dimensions of the screens or other exhibits

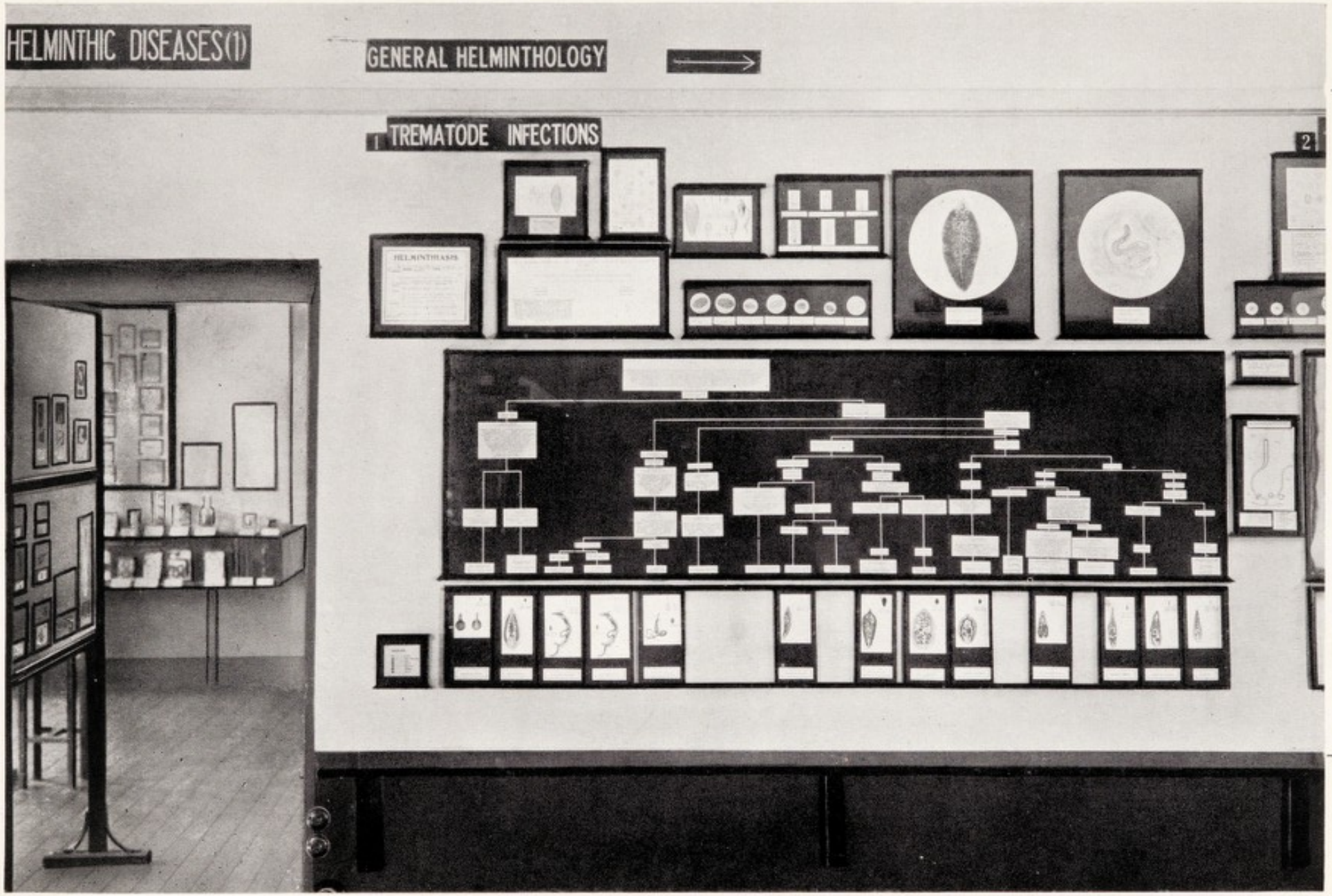


FIG. 1

Commencement of Section on HELMINTHIC DISEASES, showing part of general survey and system of labelling

See pages 27 and 28

FIG. 2

Commencement of Section dealing with AMŒBIC DYSENTERY and LIVER ABSCESS, to illustrate division of exhibit into sub-sections—Ætiology, Pathology, etc. Illustrations are on the wall, pathological specimens on the shelf below

See page 28

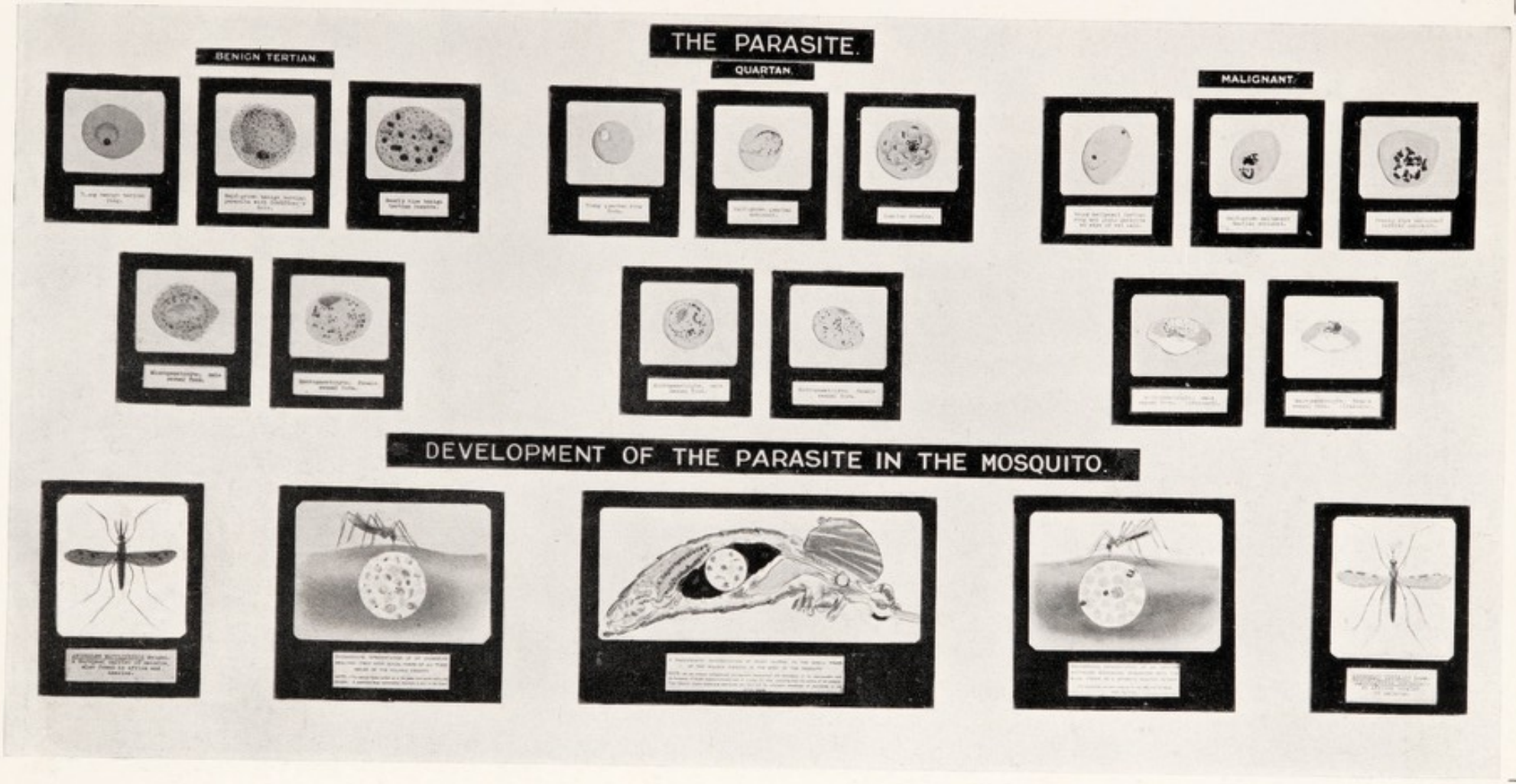


FIG. 3

Upper portion of ÆTIOLOGICAL SCREEN in the MALARIA SECTION, illustrating all forms of the tertian, quartan and malignant parasites, also their development in the mosquito

See page 29

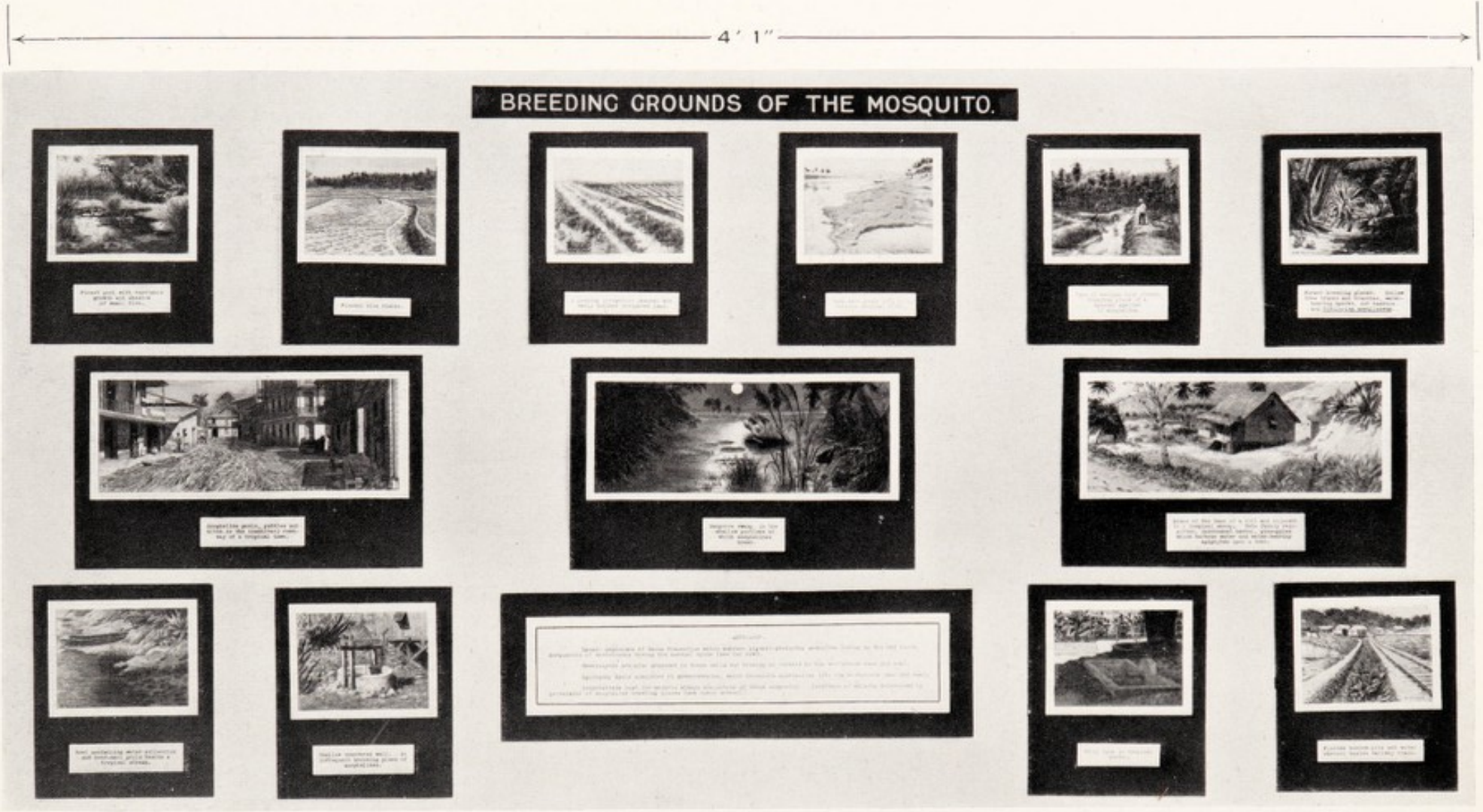


FIG. 3A

Lower part of ÆTIOLOGICAL SCREEN in the MALARIA SECTION, showing various breeding-grounds of the mosquito

See page 29

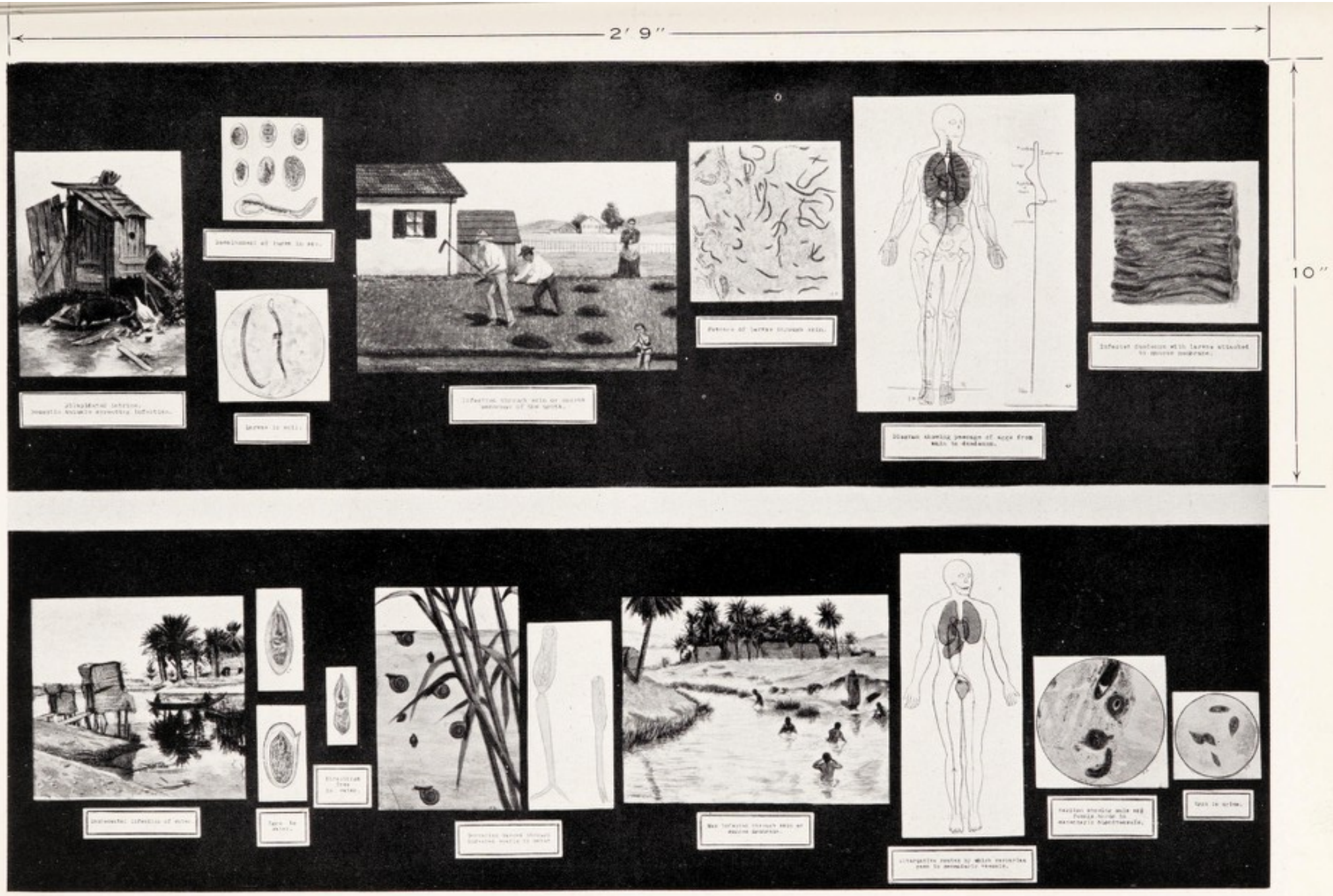


FIG. 4

Pictorial demonstration of passage of infection in two important helminthic diseases—
ANKYLOSTOMIASIS *(above)* SCHISTOSOMIASIS *(below)*

See page 30

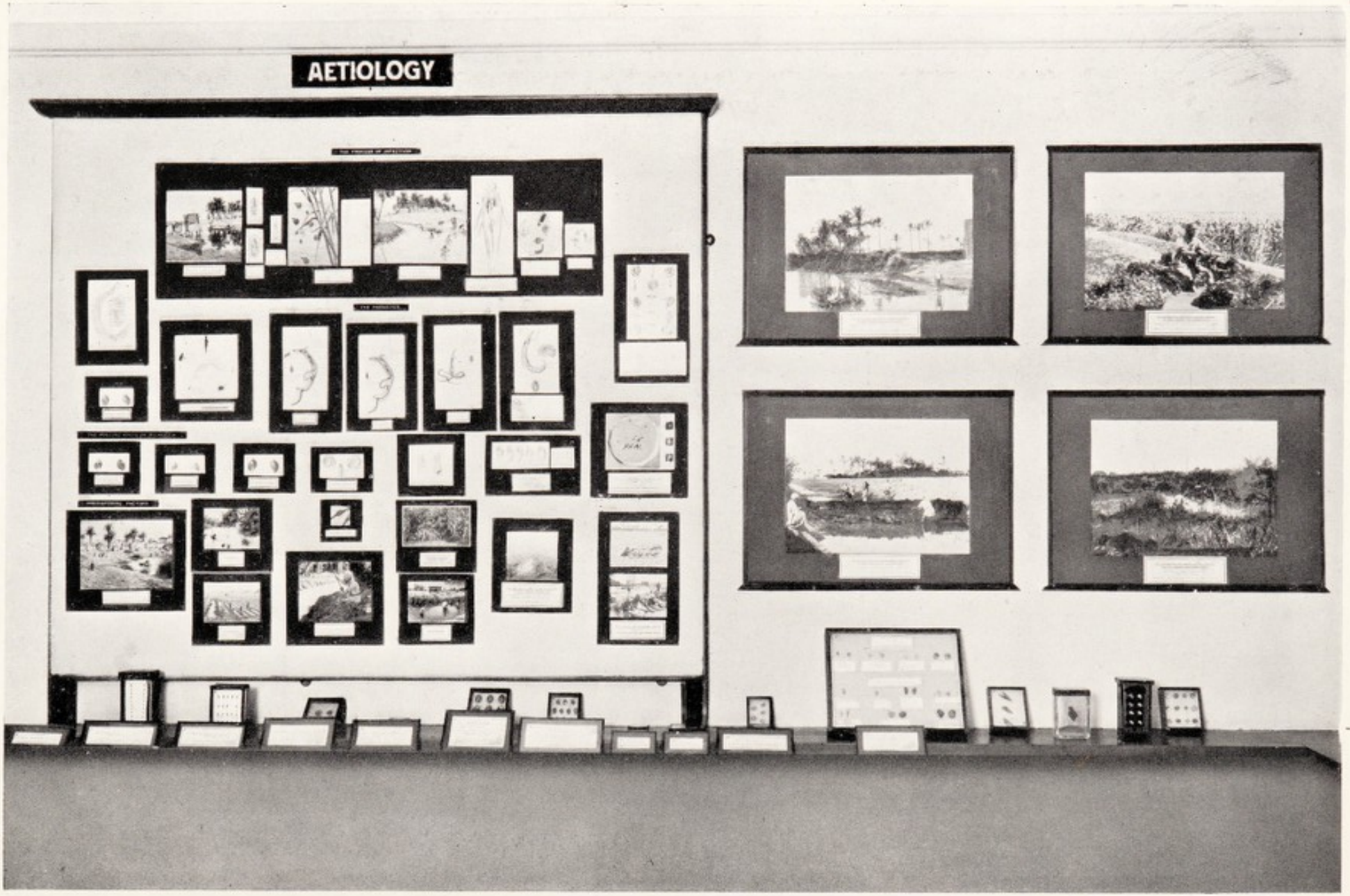


FIG. 5

Complete exhibit illustrating the ÆTIOLOGY OF SCHISTOSOMIASIS, upon which all investigations with regard to prevention are based. Here are shown the various species of parasite responsible for the disease, the mollusc hosts, and various conditions which predispose to infection

See page 30

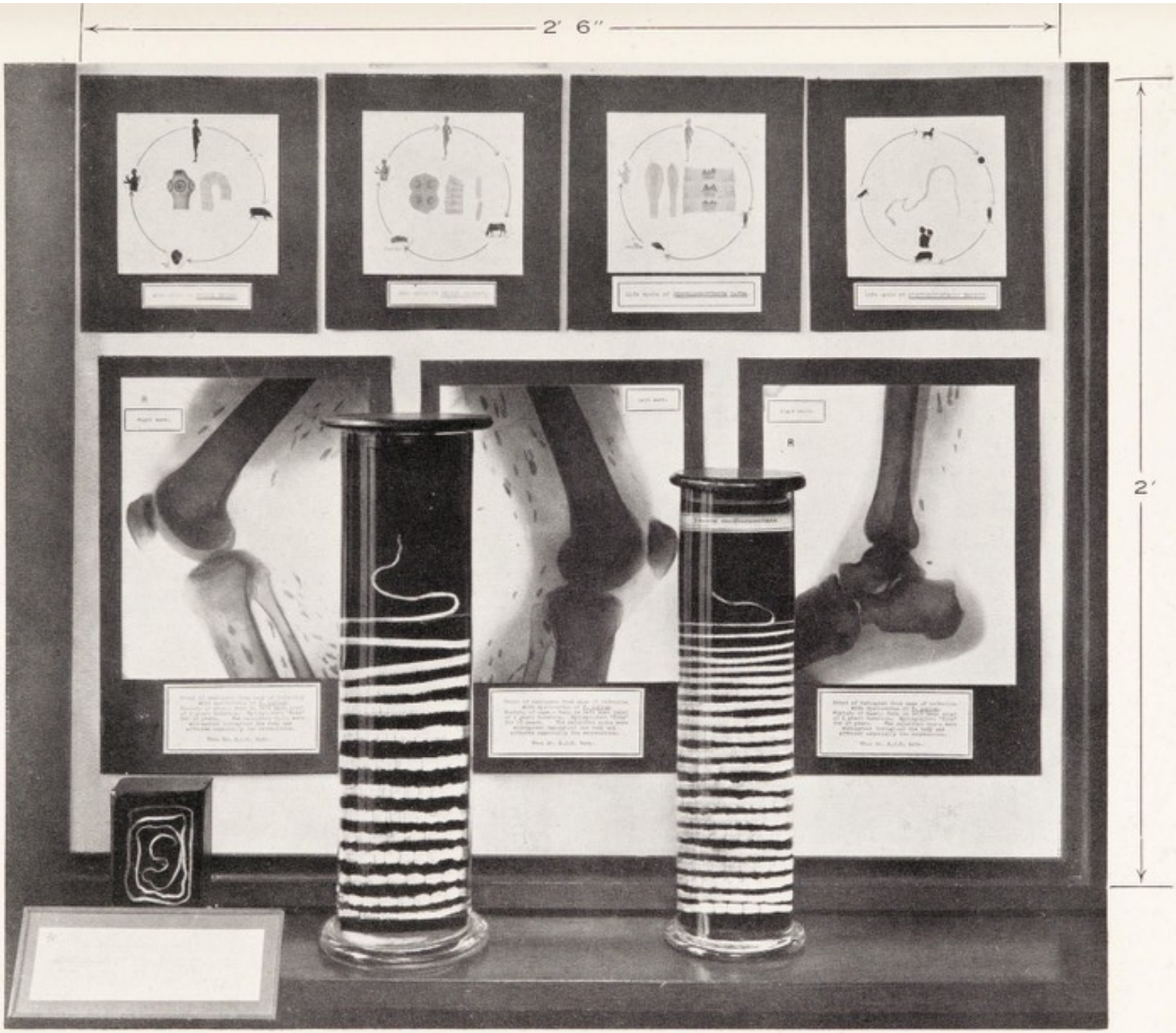


FIG. 6

A corner of the Section dealing with the CESTODA, showing schematic life-cycles: (1) *Tænia solium*, (2) *Tænia saginata*, (3) *Diphyllobothrium latum*, (4) *Sparganum mansoni*. Below are specimens of tapeworms and radiographs showing cysticercus infection in man

See page 30

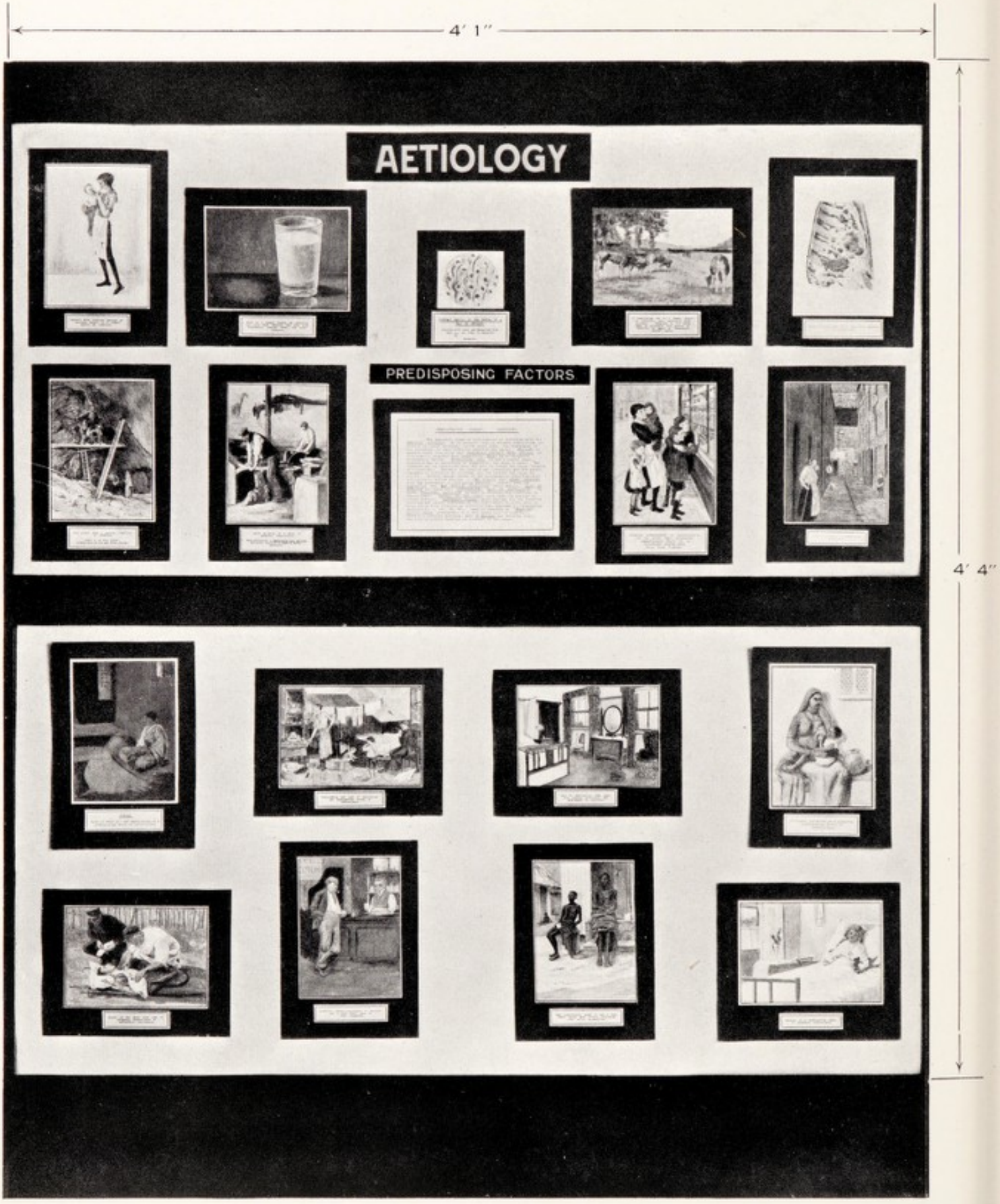


FIG. 7

A SCREEN in the TUBERCULOSIS SECTION, with pictures illustrating the ætiology of this disease—methods of infection and predisposing factors

See page 31

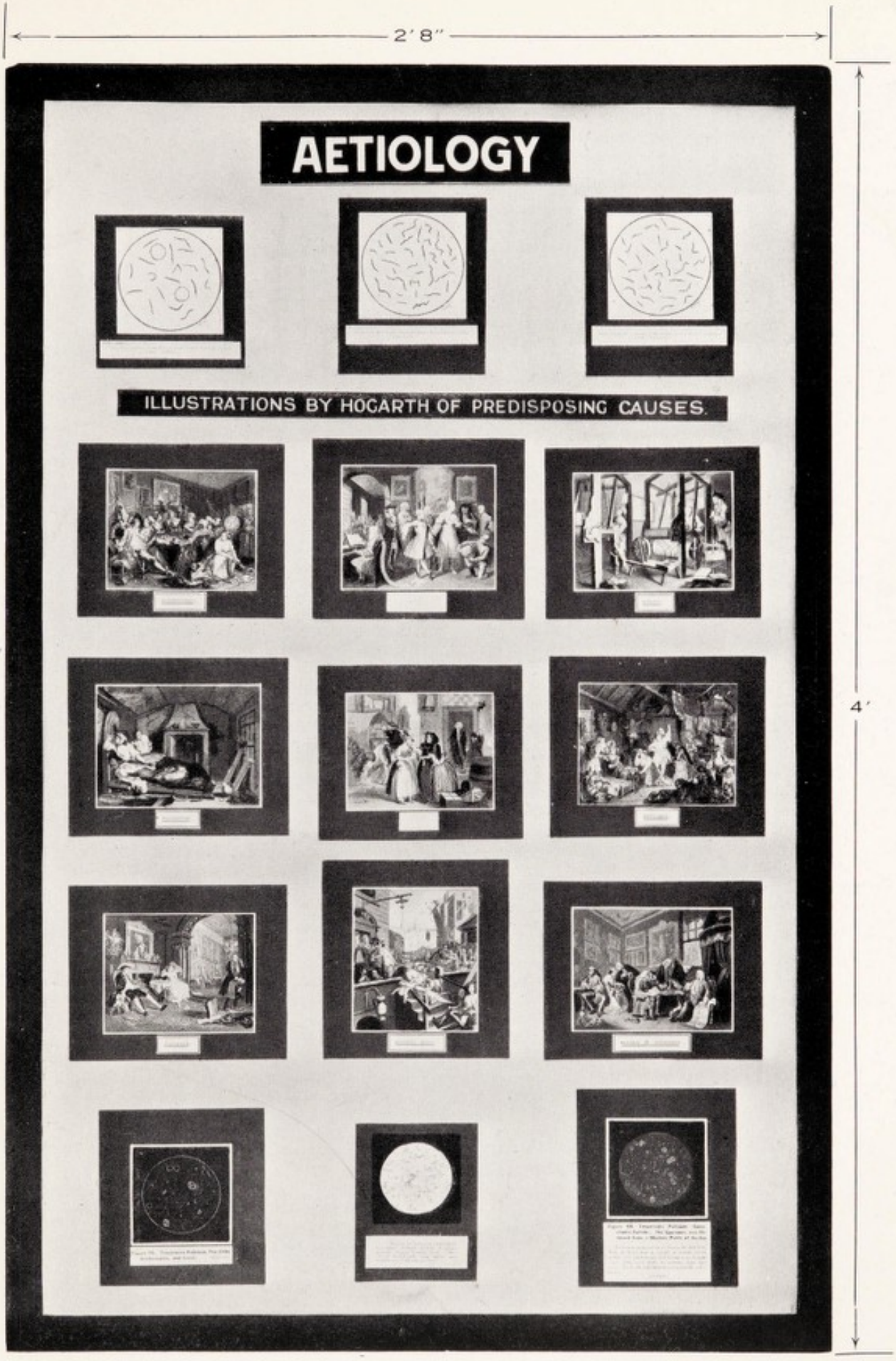


FIG. 8

ÆTIOLOGICAL SCREEN in the SYPHILIS SECTION, showing *Treponema pallidum* and prints from Hogarth, illustrating various predisposing factors—prostitution, ignorance, alcohol, etc.

See page 31

FIG. 9

Some MAMMALS which may serve as RESERVOIR HOSTS for the *Bacillus pestis*: *Arctomys bobac*, the marmot; *Rattus rattus*, the black rat; *Rattus decumanus*, the brown rat; *Geosciurus capensis*, the ground squirrel (South Africa)

See page 31

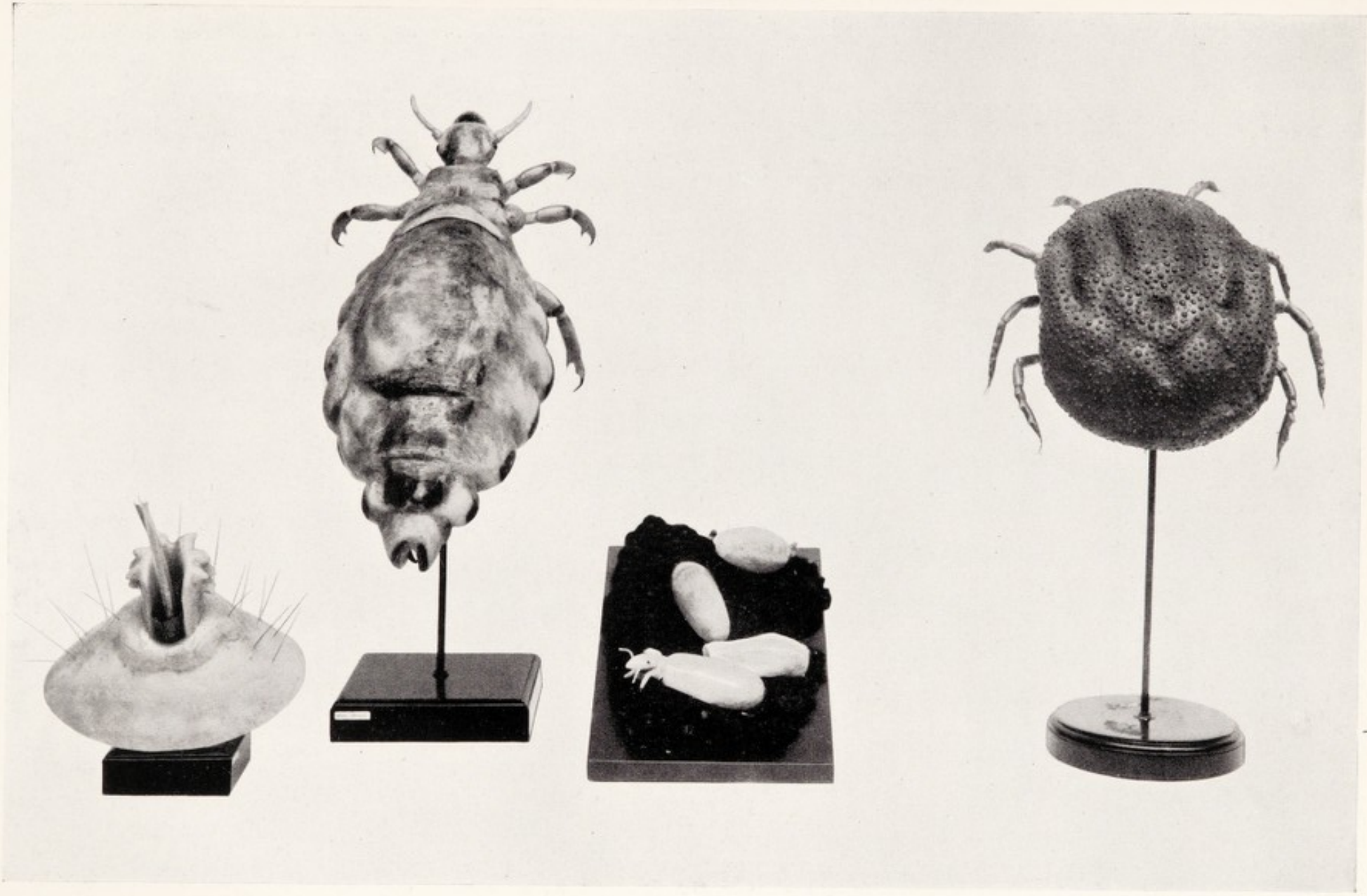


FIG. 10

WAX MODELS OF ARTHROPOD VECTORS exhibited in the RELAPSING FEVER SECTION: *Pediculus humanus*, the louse, showing mouth parts and eggs; *Ornithodorus moubata*, a tick which carries the infection of Central African relapsing fever

See page 31

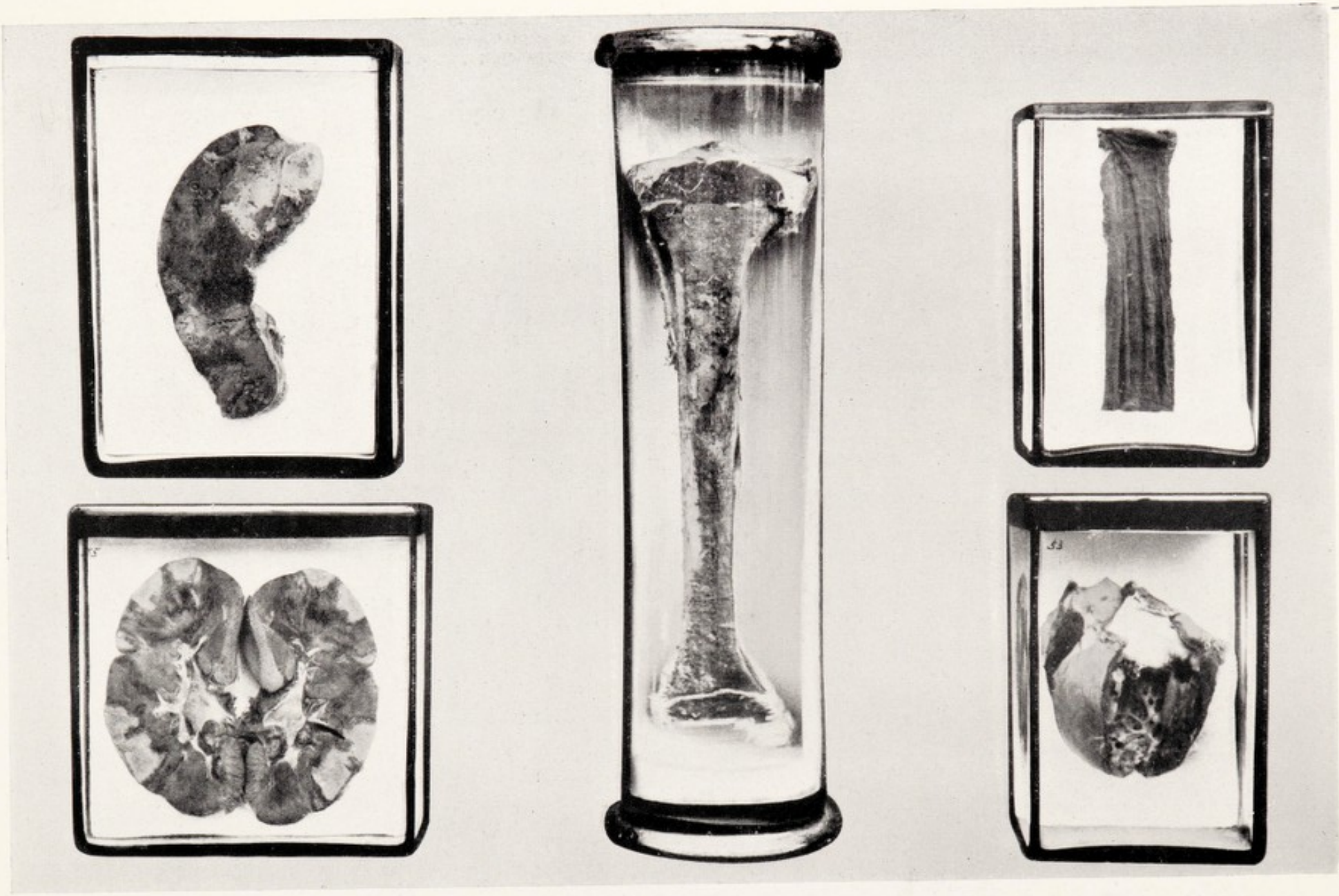


FIG. 11

Specimens from a case of ACUTE OSTEOMYELITIS OF THE TIBIA, showing associated lesions in spleen, kidney, intestines and heart.
To illustrate "clinical grouping" of pathological specimens

See pages 33 *and* 34

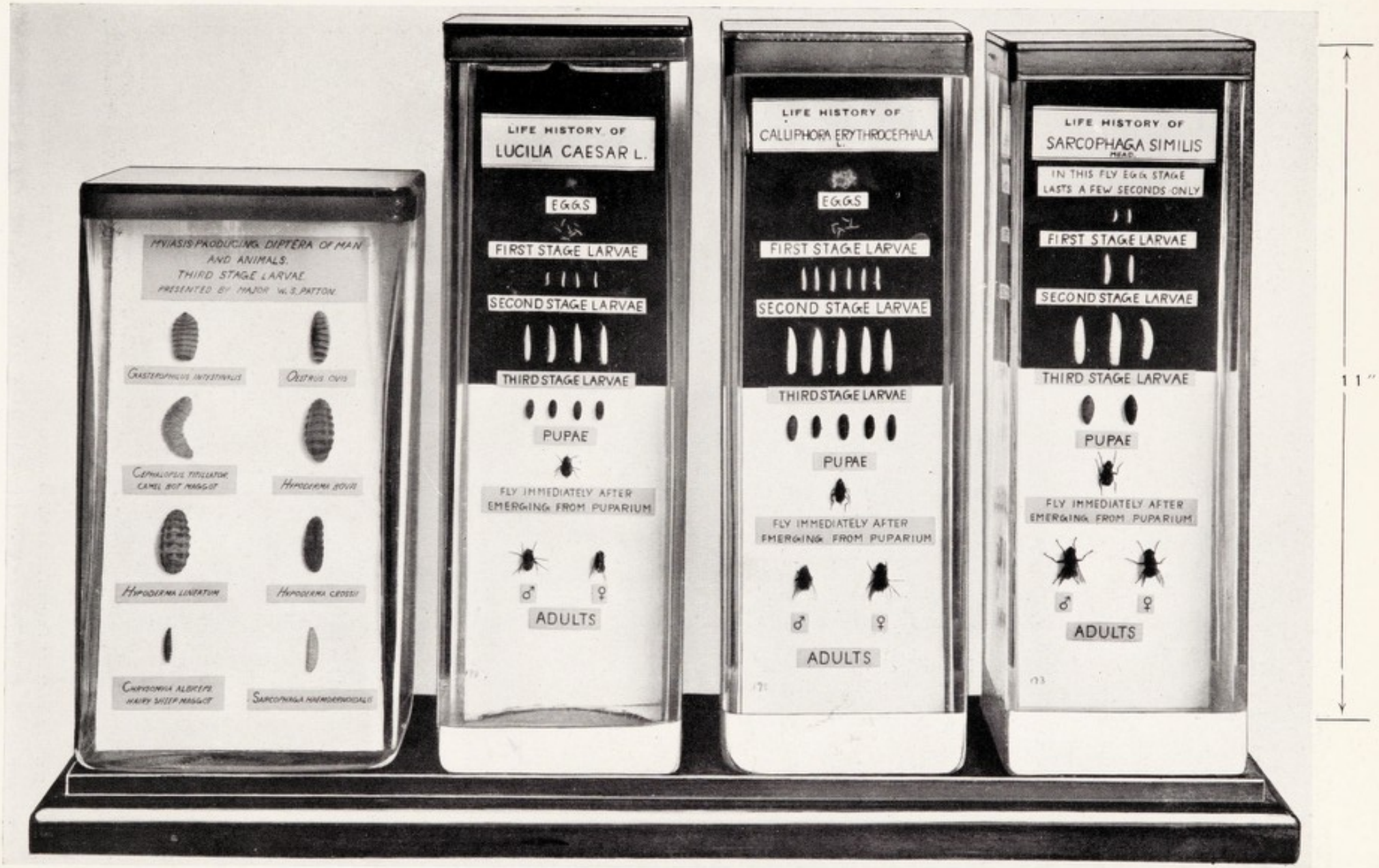


FIG. 12

Method of demonstrating the LIFE-HISTORY OF INSECTS responsible for disease, either as direct agents (myiasis) or as transmitters of infection

See page 36

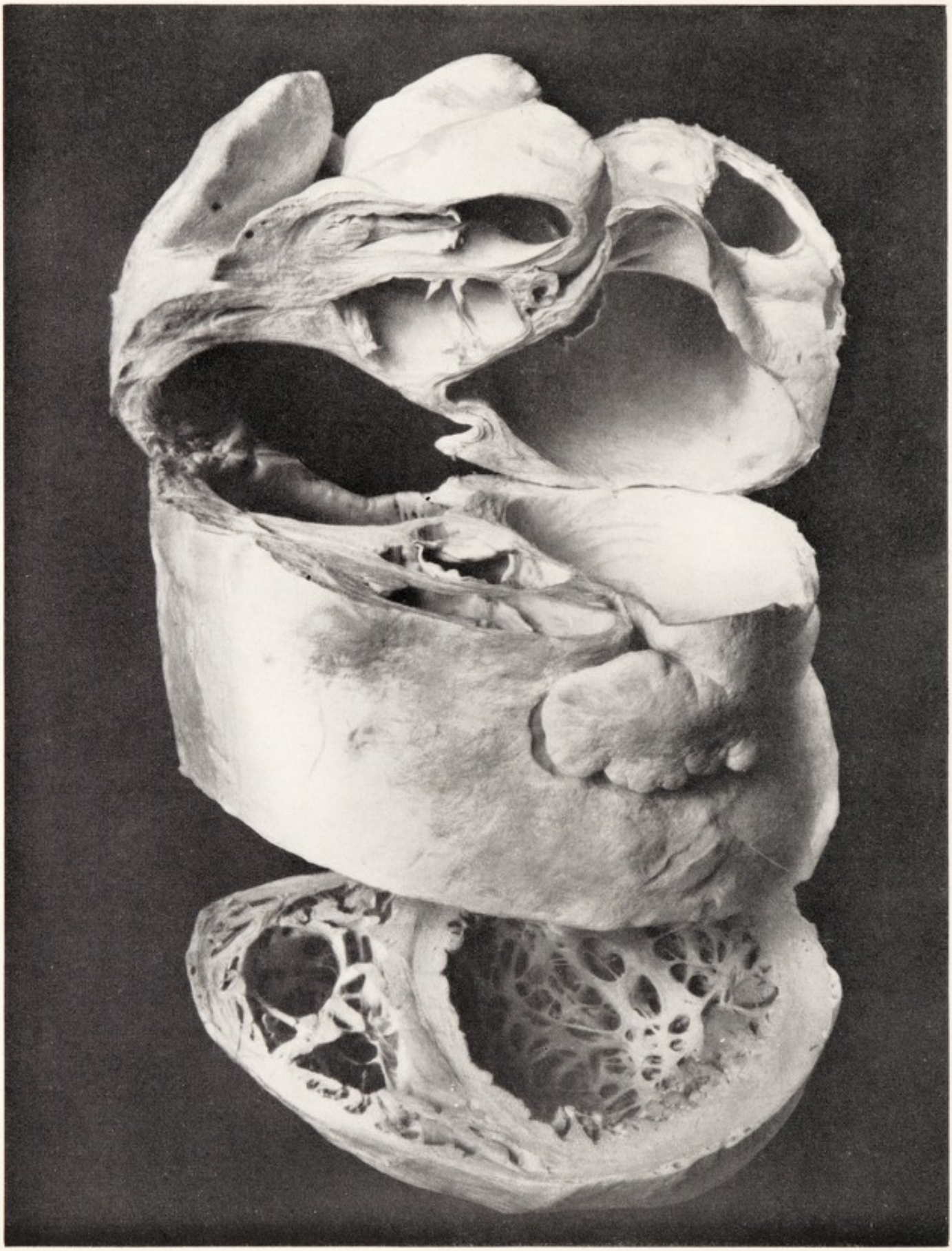


FIG. 13

HEART prepared by Professor Schmorl's method, to illustrate HYPERTROPHY and DILATATION

See page 36

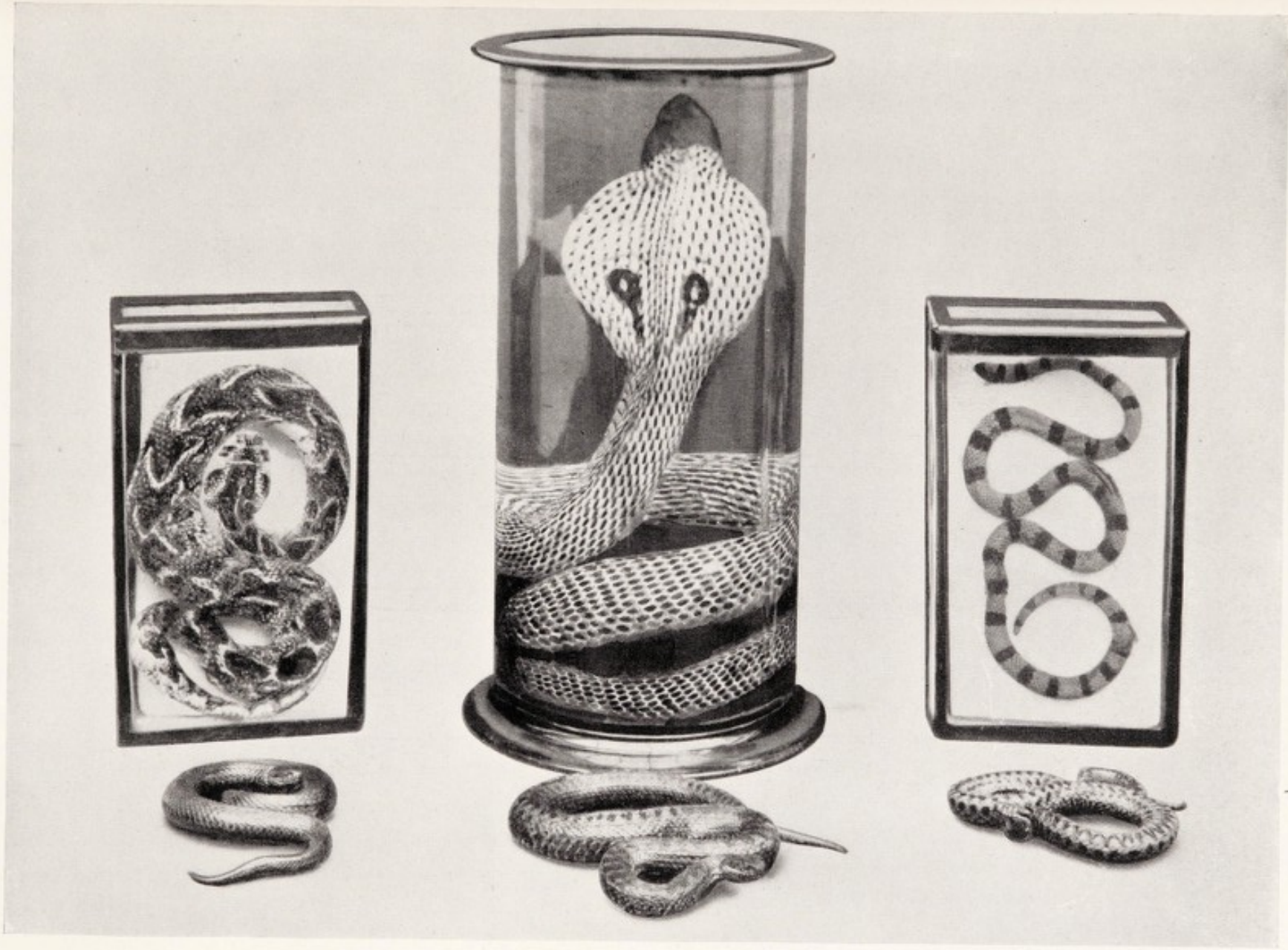


FIG. 14

A comparison between the WET METHOD OF PRESERVING SNAKES and HOCHSTETTER'S PARAFFIN PROCESS. The snakes exhibited are: *Bitis arietans*, the puff-adder; *Naja tripudians*, the cobra; *Elaps fulvius*, a coral snake; and, by the DRY METHOD, three specimens of *Pelias berus*, a European Viper

See page 36

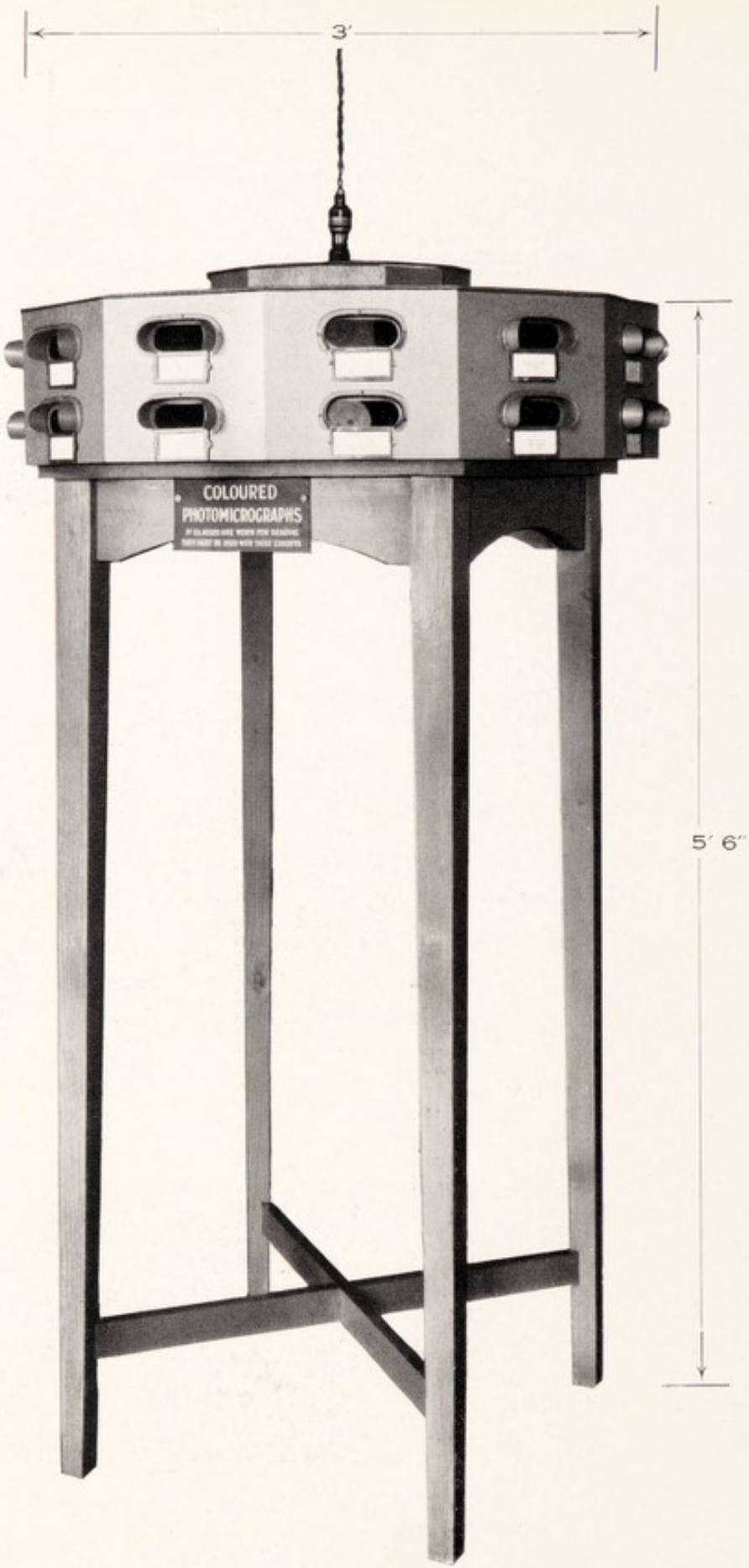


FIG. 15

Special VIEWING-BOX for exhibiting COLOUR PHOTOMICROGRAPHS.
There is one central light, and twenty-four slides can be exhibited

See page 39

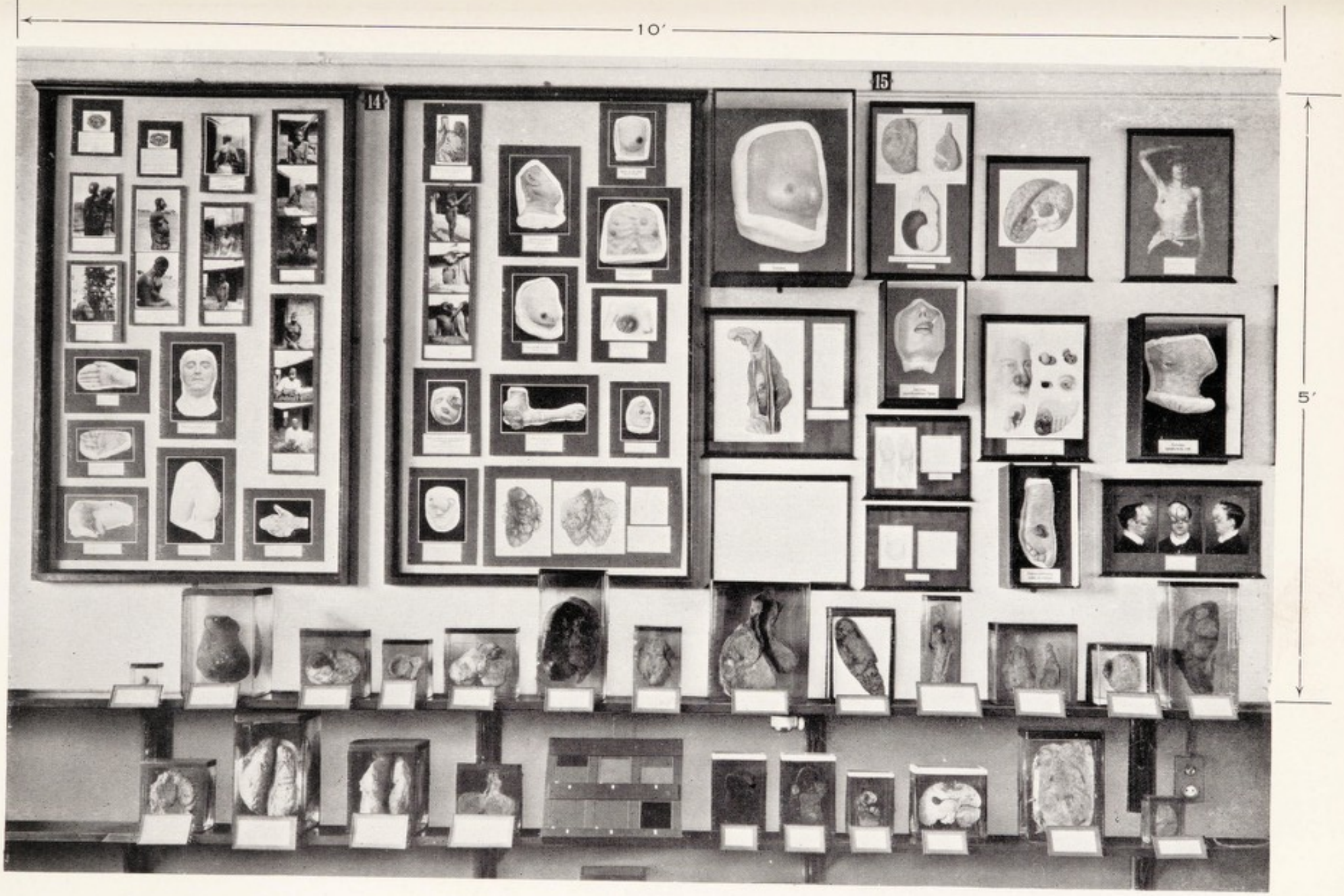


FIG. 16

A section of the Hall dealing with NEOPLASMS—Innocent connective tissue tumours and sarcomata

See page 41

FIG. 17

HALL OF SKIN DISEASES. A SCREEN in the LUPUS SECTION, showing various types of this disease

See page 41

FIG. 18

A portion of the LEPROSY SECTION showing various clinical aspects of the disease, with pathological specimens

See page 41

FIG. 19

A portion of the Section dealing with BLOOD DISEASES, showing employment of life-sized paintings to illustrate the characteristic appearances in pernicious anæmia, chlorosis, secondary anæmia, polycythæmia, etc.

See page 41

FIG. 20

Special type of DESK FOR ECONOMISING SPACE with regard to the exhibition of photographs. These desks hold many photographs, pasted on thick cards, and hang flat against the wall when not in use. Size 24″ × 20″

See page 42

FIG. 21

A series of WAX MODELS, interspersed with PAINTINGS, illustrating the skin lesions of SECONDARY SYPHILIS.
On the shelf are pathological specimens of various syphilitic conditions

See page 42

FIG. 22

WAX MODELS in the DIPHTHERIA SECTION, showing the characteristic appearance of the throat, in mild and severe forms of the disease, also in follicular tonsillitis. A special device is adopted for illuminating these Models

See page 43

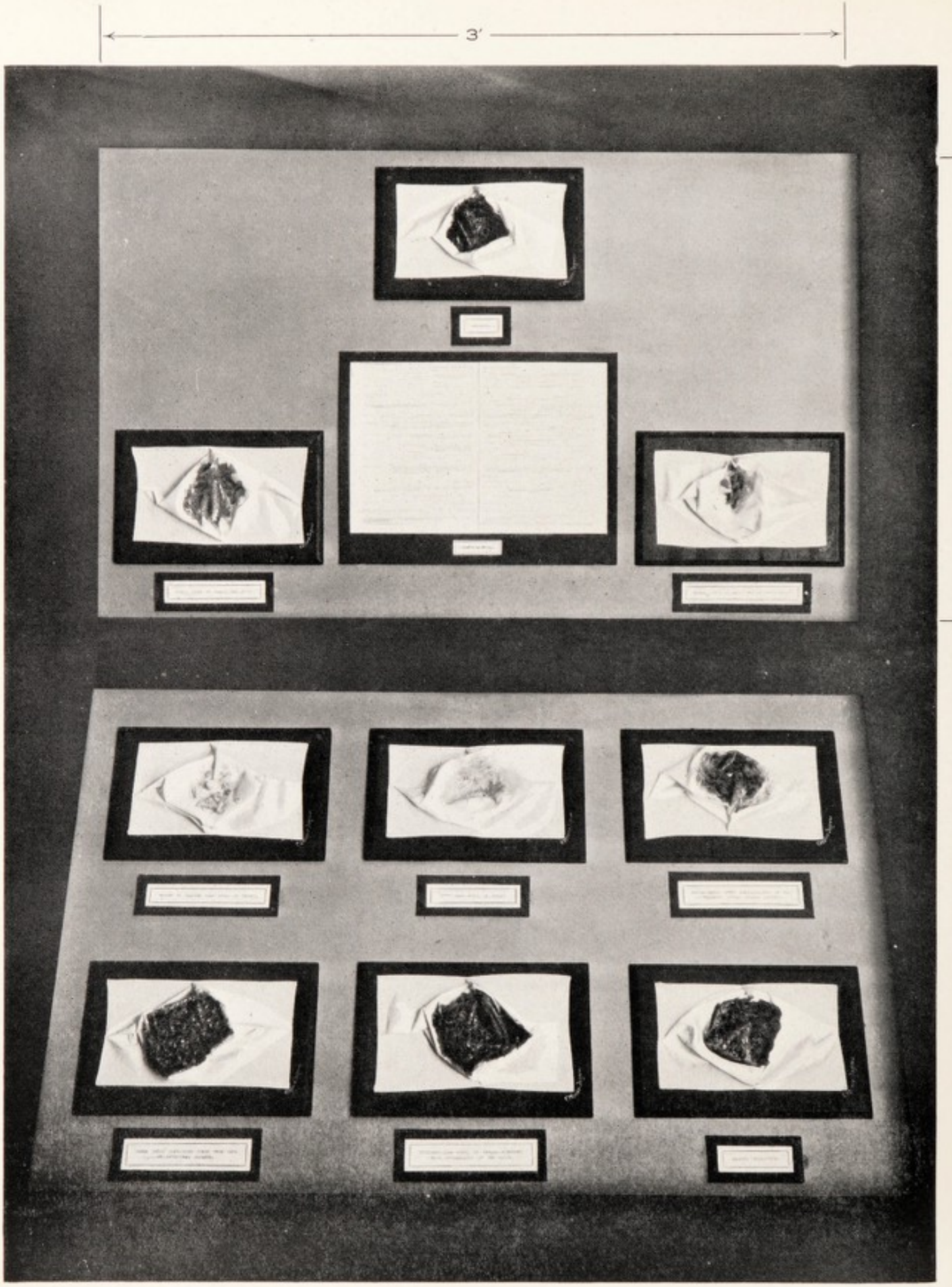


FIG. 23

Series of MODELS illustrating the NORMAL AND ABNORMAL STOOLS OF INFANTS

See page 43

FIG. 24

A SCREEN in the TUBERCULOSIS SECTION, showing CHARACTERISTIC RADIOGRAPHS

See pages 43 and 44

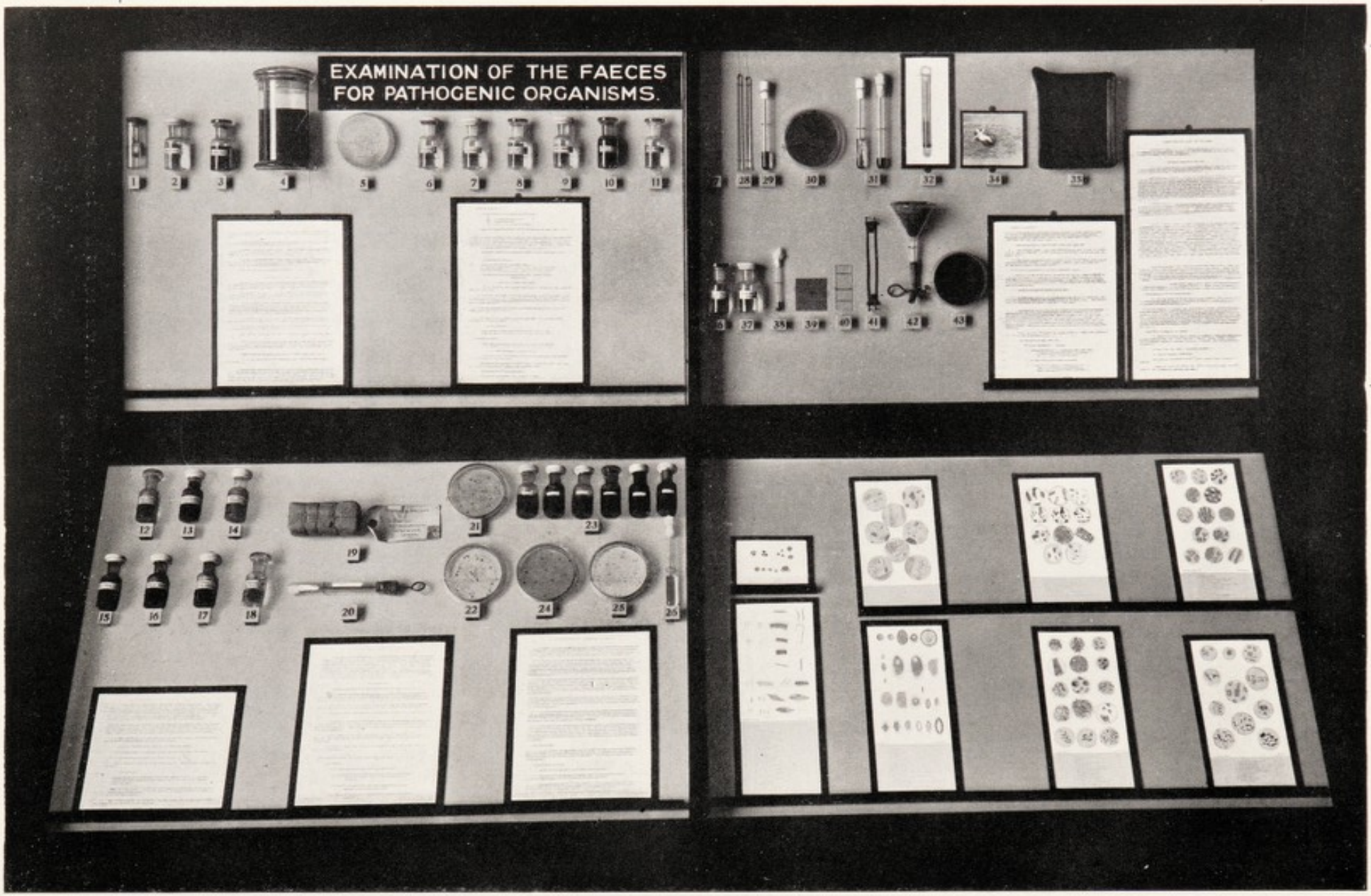


FIG. 25

A demonstration of the various methods employed in the EXAMINATION OF FÆCES, for bacterial, protozoal, or helminthic infections

See page 44

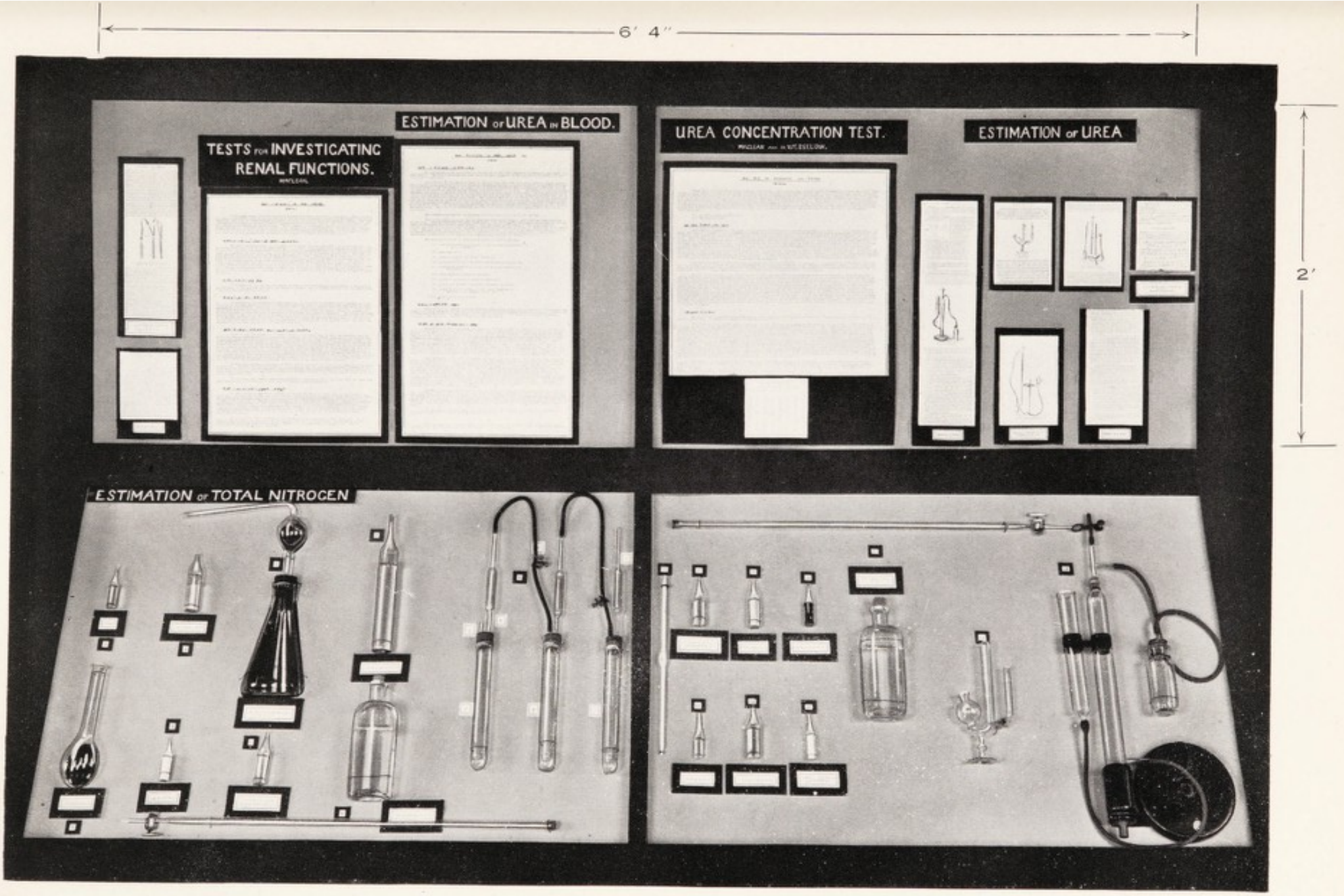


FIG. 26

A CASE in the Section on METABOLIC DISEASES, showing various methods employed in the clinical laboratory—estimation of urea in blood, urea concentration test, etc.

See page 44

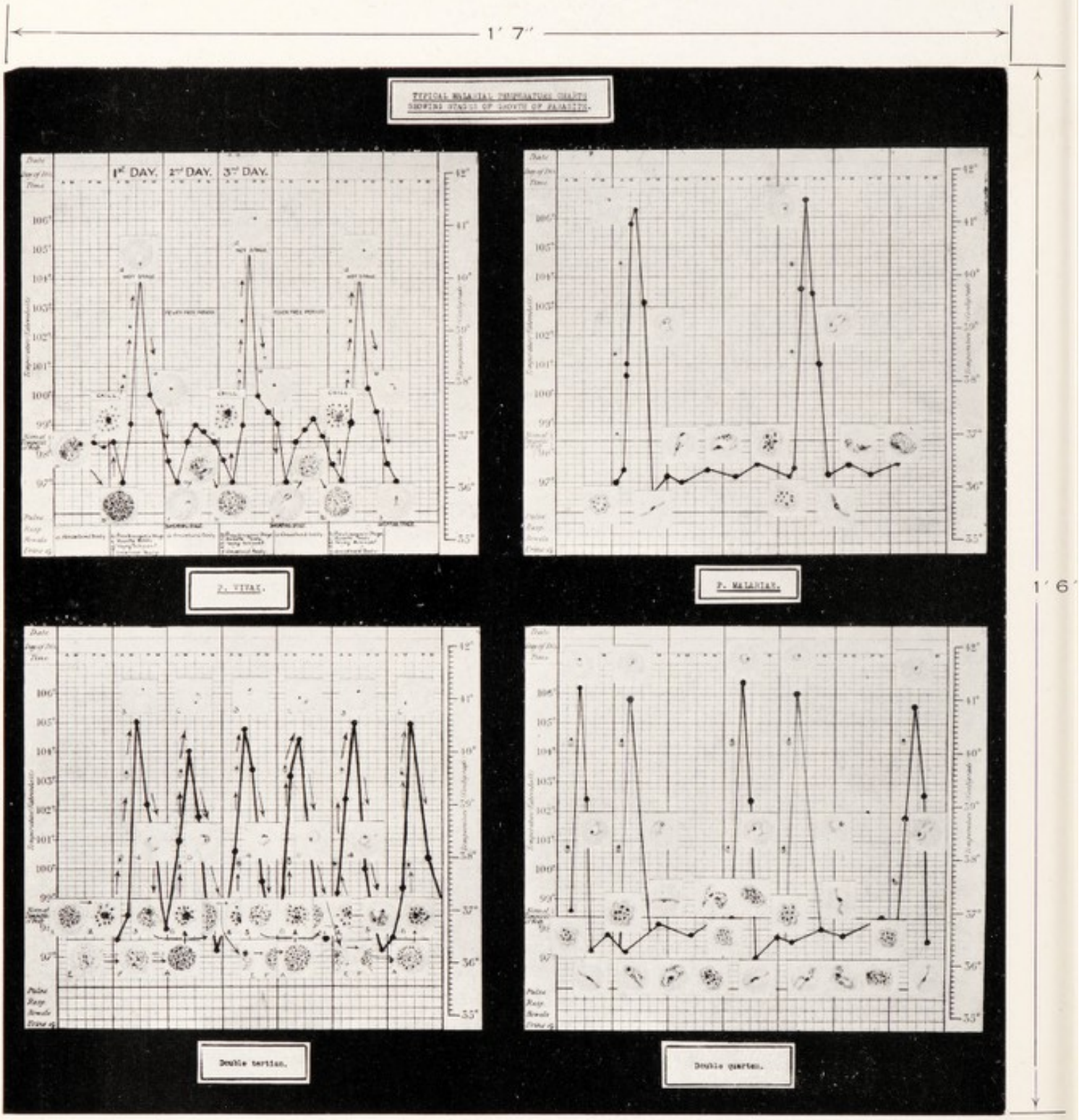


FIG. 27

MALARIA TEMPERATURE CHARTS, showing phases in the life-cycle of the various parasites and their relationship to the fever

See page 45

FIG. 28

A portion of the Section dealing with ACUTE RHEUMATISM AND MORBUS CORDIS, showing a series of illustrations from Jakob's *Atlas of Clinical Diagnosis*, which demonstrate the physical signs in heart disease.

See page 45

FIG. 29

LEPROSY SECTION. Portion of the exhibit dealing with treatment—Illustrations of cases, and specimens of various remedies employed

See page 47

FIG. 30

TUBERCULOSIS SECTION. Photographs showing a series of ORTHOPÆDIC CASES, before and after treatment: also methods of diagnosis

See page 48

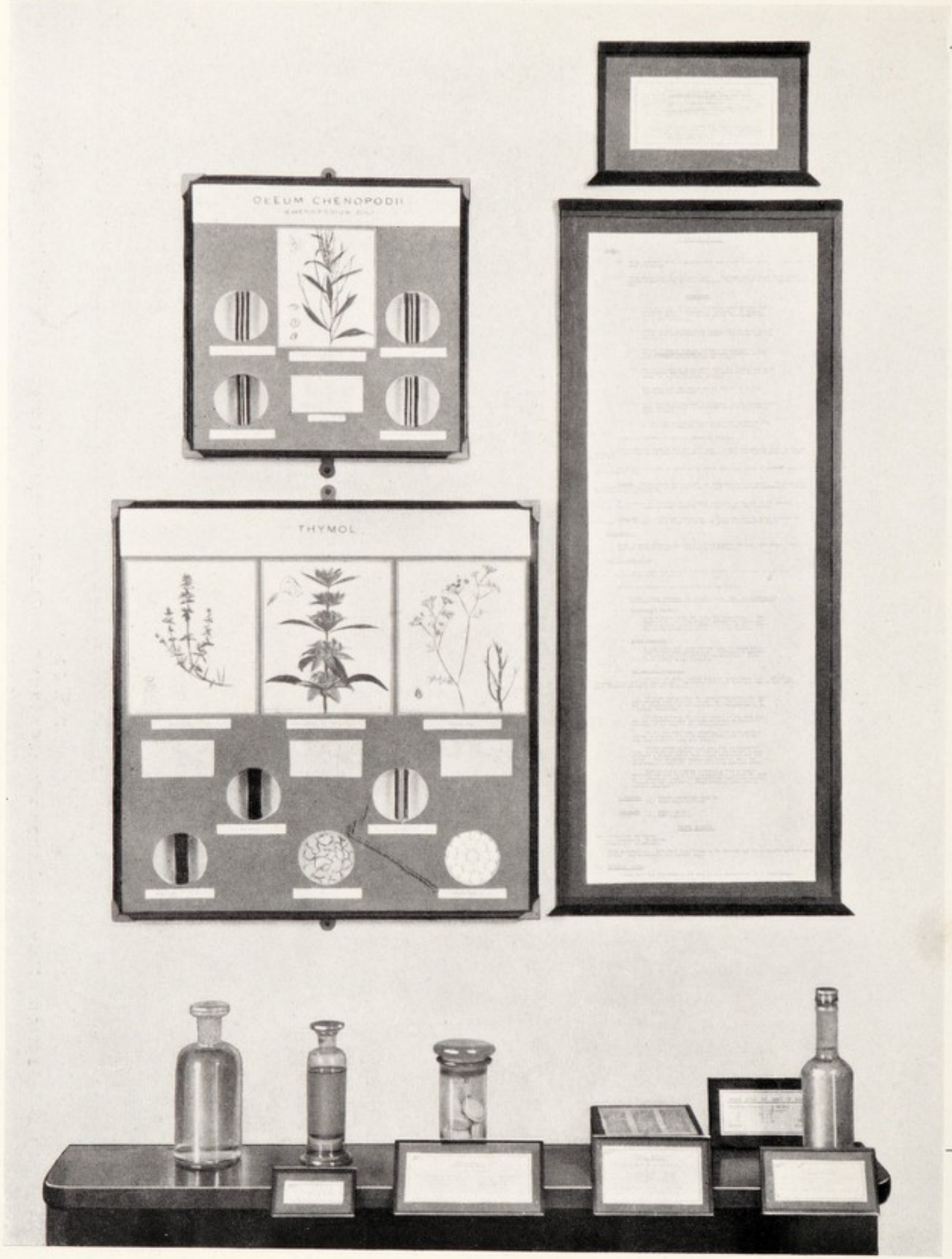


FIG. 31

A demonstration on treatment in the ANKYLOSTOMIASIS SECTION, with full descriptive text. Two Exhibition Cases are shown, illustrating the production of thymol and oil of chenopodium. On the shelf are specimens of carbon tetrachloride, beta-naphthol and other medicinal preparations

See page 48

FIG. 32

Large Centre Case, in which are demonstrated and described the methods of preparation of VACCINES AND SERA. This Case is 8′ long, 7½′ high and 3½′ wide. The exhibit includes the preparation of typhoid vaccines, anti-diphtheritic serum, anti-tetanic serum and tuberculin. There is also a demonstration of the SCHICK TEST

See page 49

FIG. 33

A corner of the Section illustrating various methods of MALARIA PROPHYLAXIS—the use of natural enemies, drainage, etc.

See page 51

FIG. 34

PROPAGANDA POSTERS in the TUBERCULOSIS SECTION
These have been obtained from the Deutsches Hygiene-Museum, Dresden

See page 52

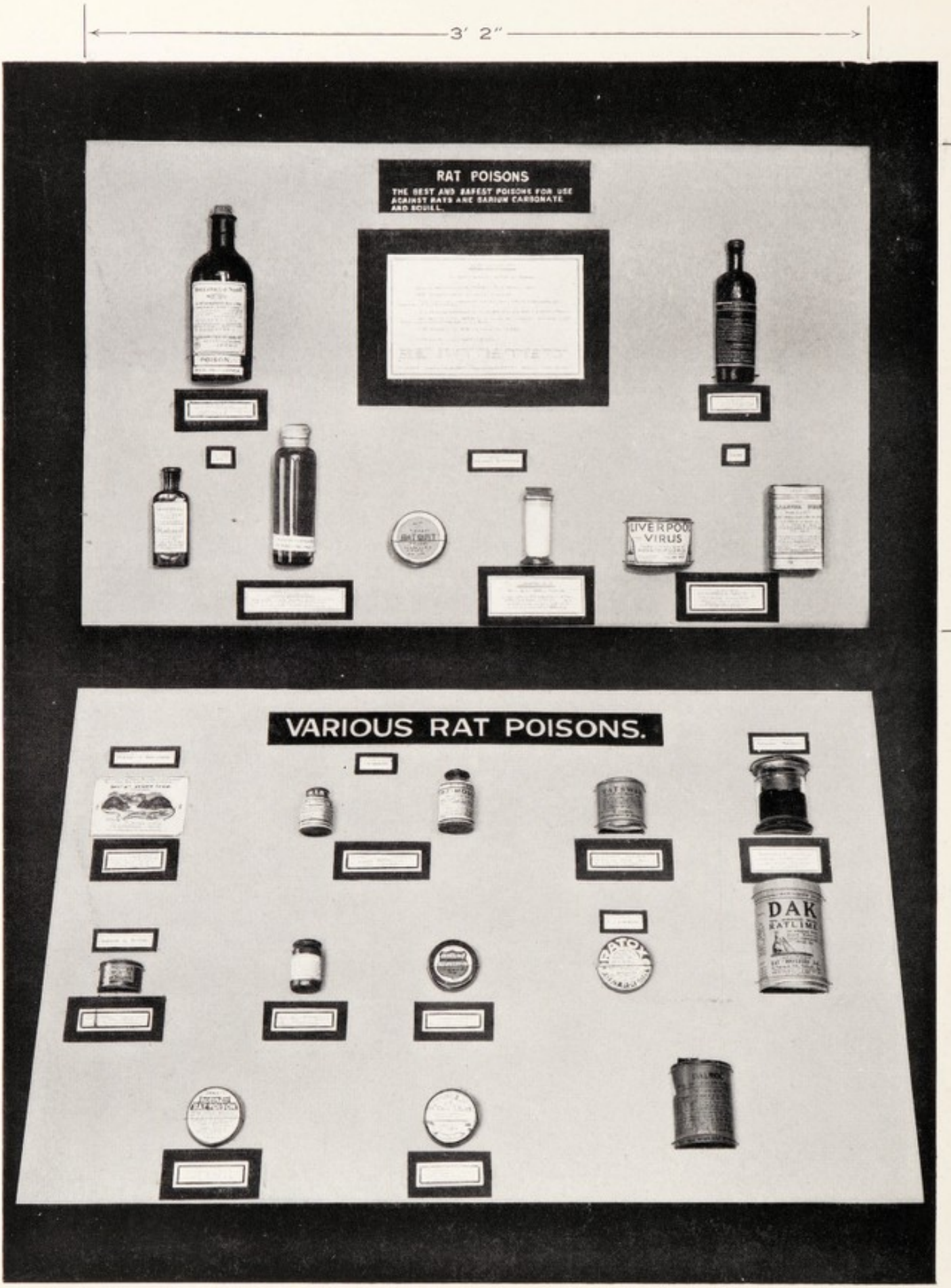


FIG. 35

An Exhibit demonstrating one method of RAT DESTRUCTION. The more important rat poisons are shown, also virus and tangle-foot

See page 52

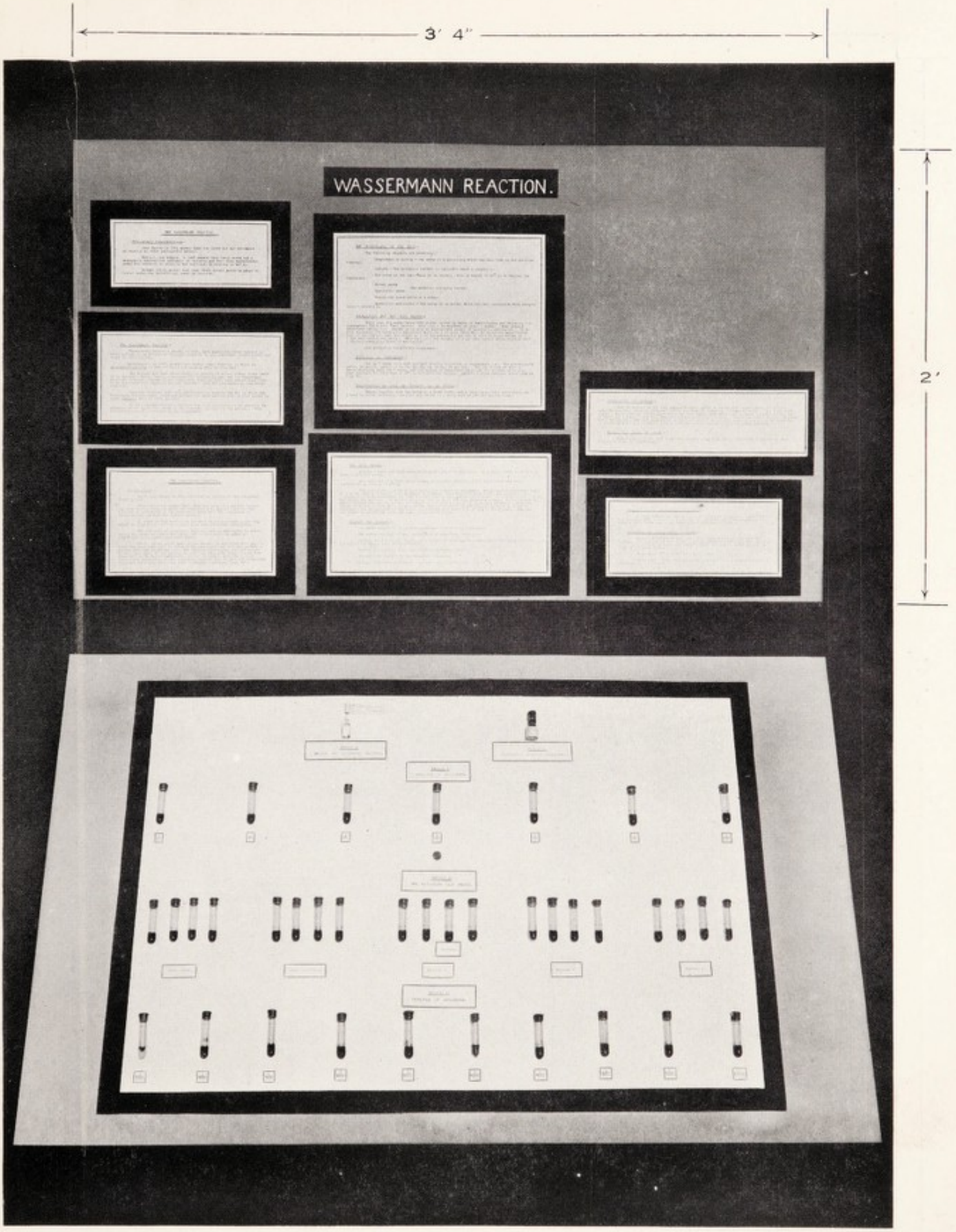


FIG. 36

A CASE in the SYPHILIS SECTION demonstrating the WASSERMANN REACTION

See page 52

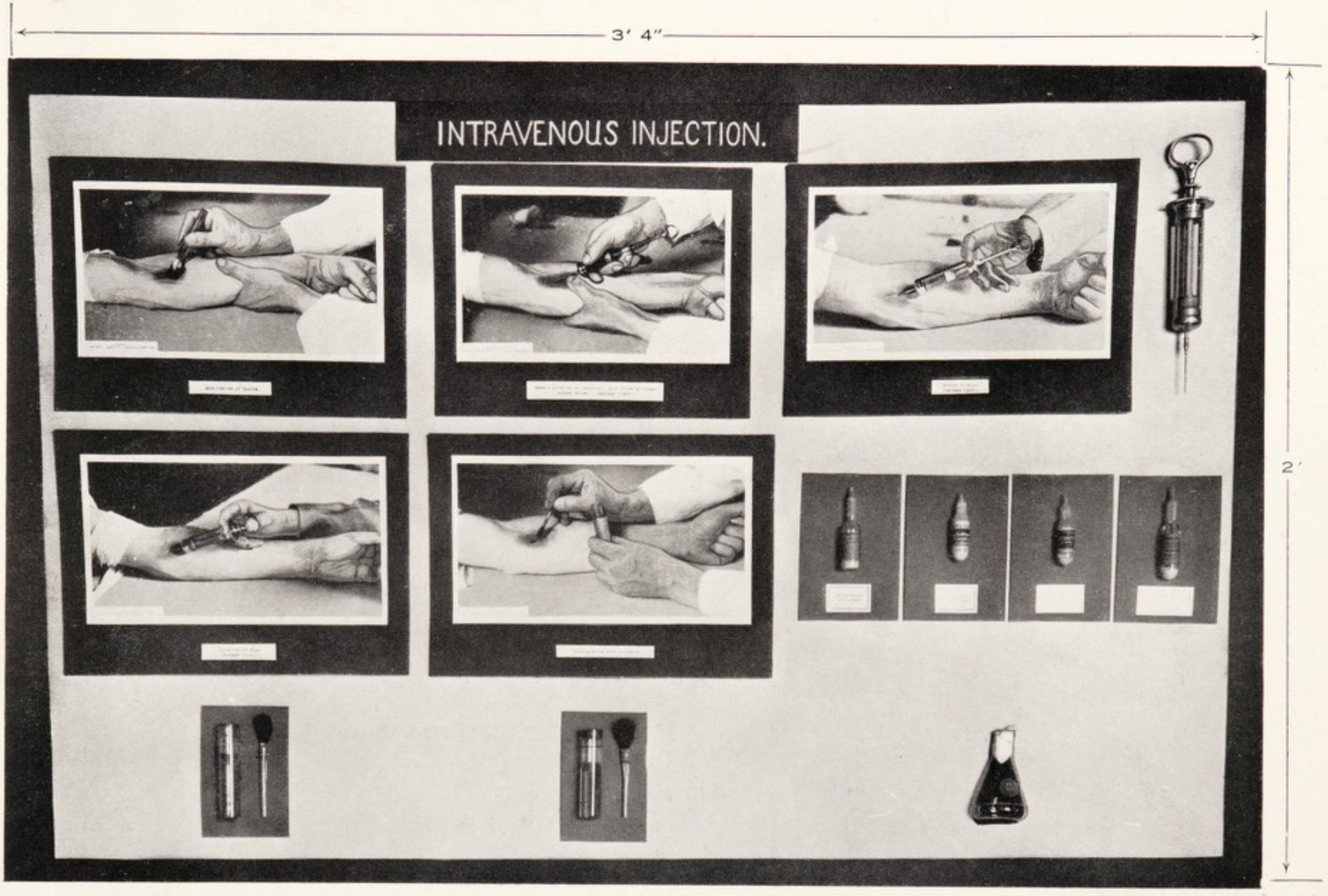


FIG. 37

THE TREATMENT OF SYPHILIS. A demonstration of the technique of intravenous injection

See page 52

FIG. 38

A portion of the Section dealing with TREMATODE INFECTIONS—to illustrate the METHOD OF LABELLING and DESCRIPTION

See page 53

FIG. 39

A PHOTOGRAPH of the SCARLET FEVER SECTION, to show the summary which outlines the main features of the disease
There is a similar summary in each Section

Box
container
= 15½"
×
11"

191

K

FIG. 40

FILE OF CUTTINGS AND BOX CONTAINER. These Files are in every Section, and contain cuttings of all the recent work dealing with the disease which is being demonstrated

See page 53

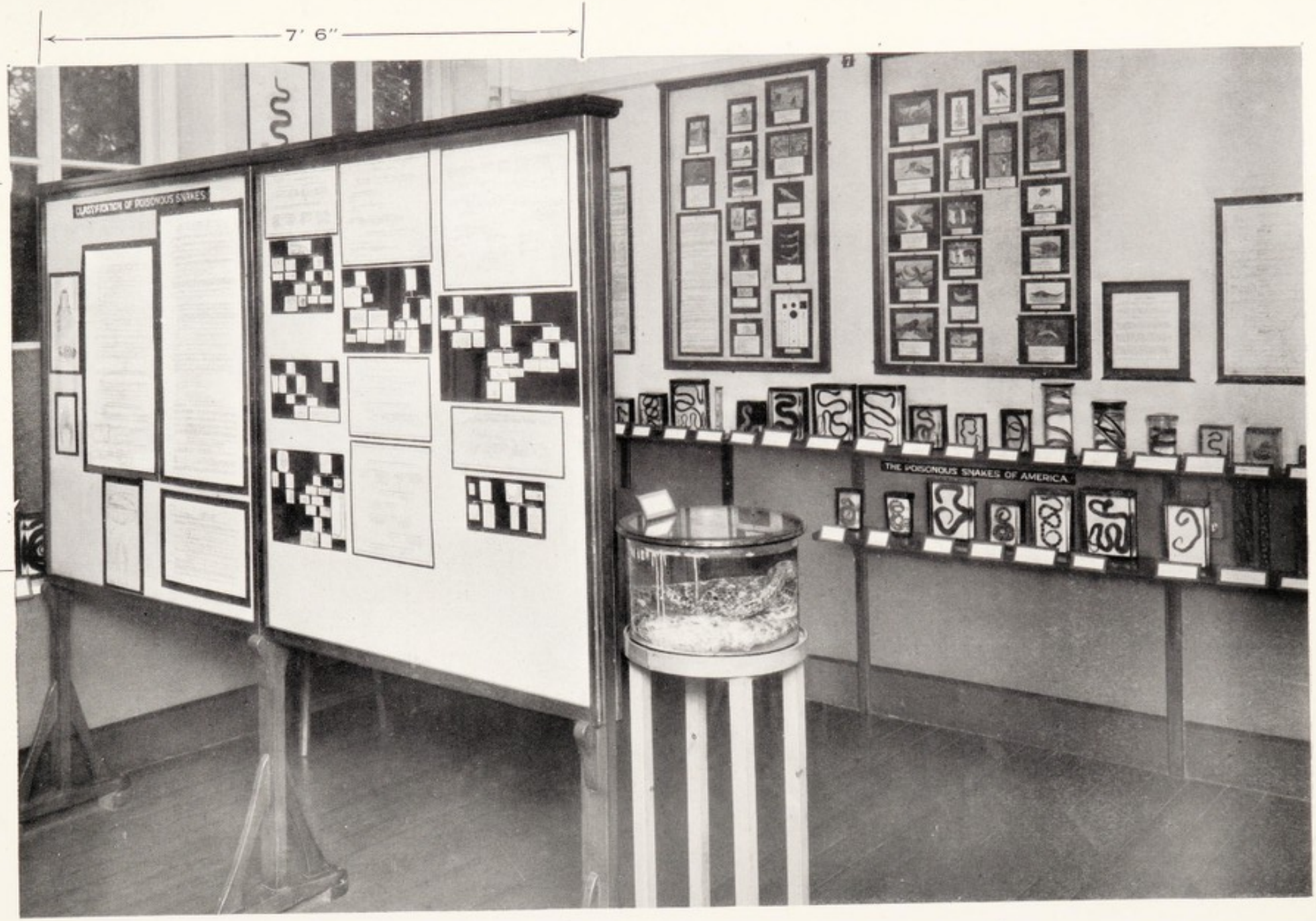


FIG. 41

Large DOUBLE SCREEN used in the Section devoted to VENOMOUS BEASTS

See page 74

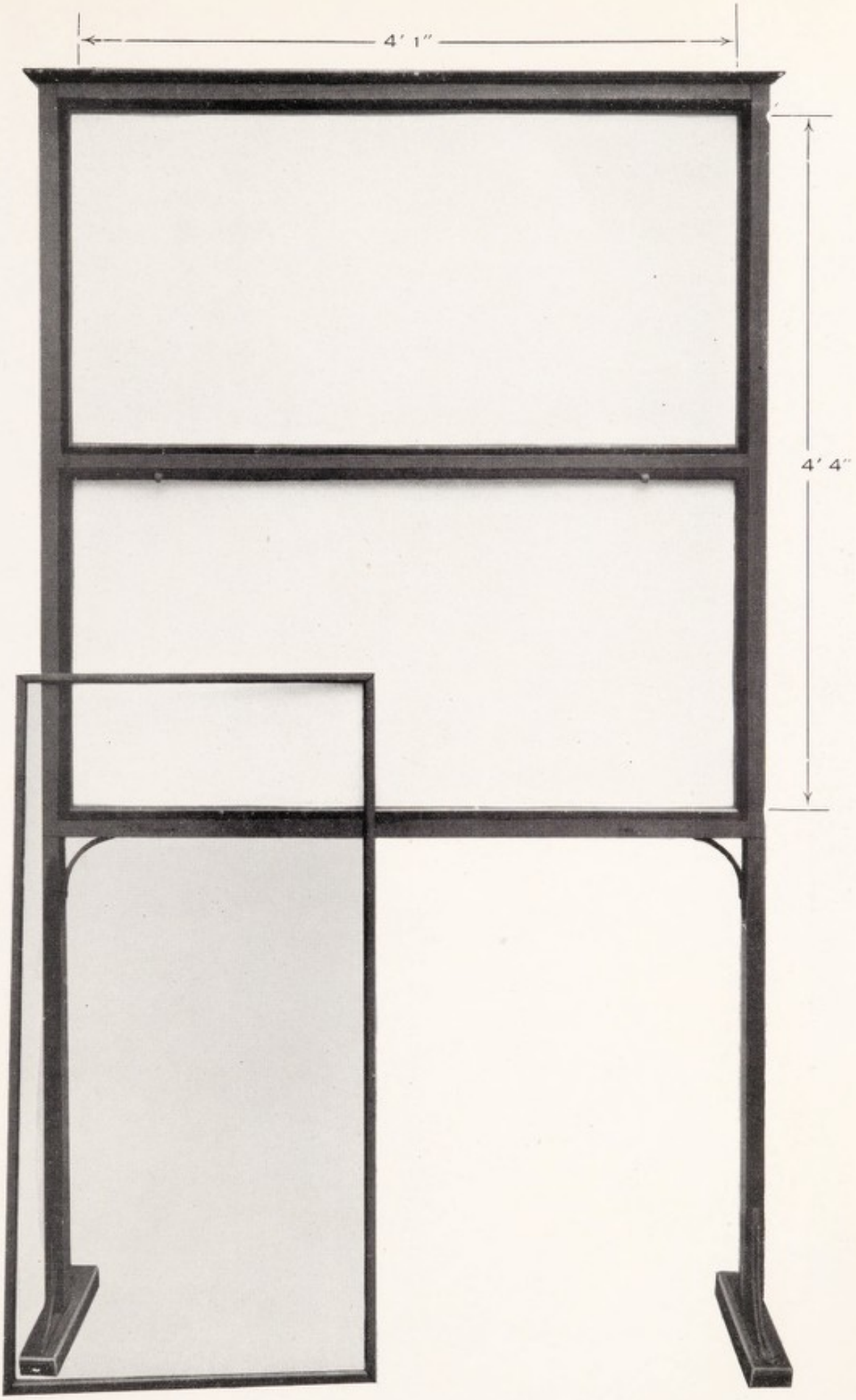


FIG. 42

Type of SINGLE SCREEN, used throughout the Museum

See page 74

FIG. 43

Type of CASE specially designed for VIEWING TRANSPARENCIES

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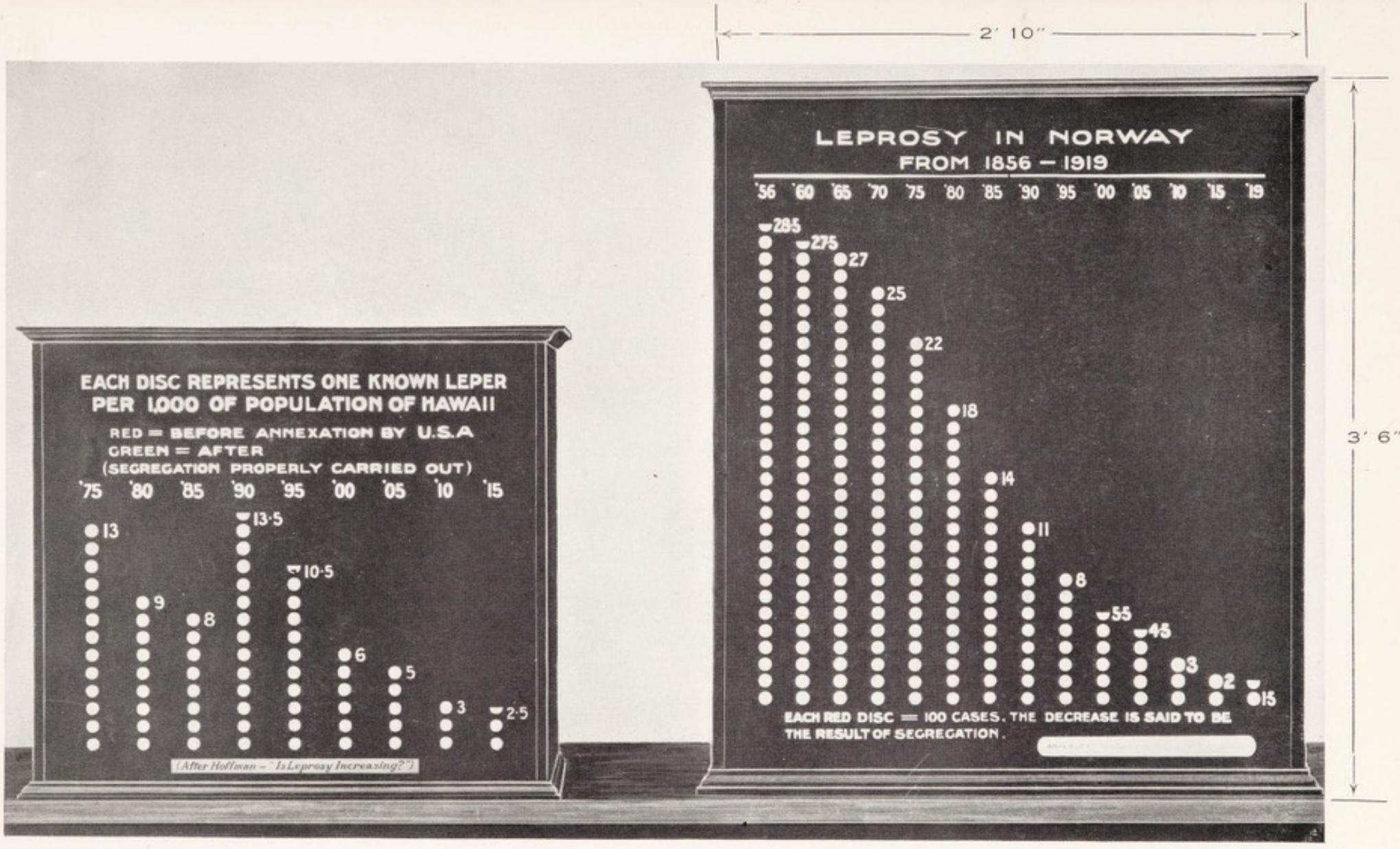

FIG. 44

ILLUMINATED CASES designed for the DEMONSTRATION OF STATISTICS

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PUBLISHERS' ANNOUNCEMENTS

PUBLICATIONS OF THE WELLCOME BUREAU OF SCIENTIFIC RESEARCH

BARRIER CHARTS FOR HEALTH OFFICERS (SECOND EDITION): A synopsis of Preventive Measures against Communicable Disease, in Four Tables. By S. H. DAUKES, O.B.E., B.A., M.D., B.CH., D.P.H., D.T.M. & H. Each Chart is printed on a separate four-fold card in red and black inks, the whole being enclosed in a strong case. The Charts deal with four groups of diseases—ALIMENTARY, RESPIRATORY, INOCULATION, CONTACT—and each Chart gives tabulated information regarding: Habitat of Infective Agent, Incubation, Infective and Quarantine Periods, and the Barriers which can be set up against each disease, etc. Embracing, as they do, that branch of preventive work which deals with the control of communicable disease, these Barrier Charts have proved of special value for the teaching of Hygiene, not only as regards popular education, but also as a foundation upon which an advanced syllabus may be built. They provide a synopsis of routine measures to be taken, and are also of great value for reference in emergency. They embrace the more important communicable diseases of tropical as well as temperate climates. They are of special interest and particular value to Medical Officers of Health; Sanitary Inspectors; Professors; Lecturers; Demonstrators and Students of Medicine; Public Health Preventive Medicine; Hygiene and Sanitation; Hospitals and Medical Schools—Civil, Naval and Military; Public Health Departments; Schools of Army or Navy Sanitation; Medical Missionaries; Medical Officers of Shipping Companies; Port Sanitary Authorities; etc., etc. Published by Baillière, Tindall & Cox, London (Eng.), for The Wellcome Foundation Ltd.

EXTRACTS FROM PRESS REVIEWS:

"A volume of absorbing interest."—*Lancet.*

"Bound to make a wide appeal to all those engaged in the administration "of our Colonies and Dependencies, as well as to those concerned with sanitary "service."—*Tropical Diseases Bulletin.*

WAR AGAINST TROPICAL DISEASE (SECOND EDITION): Being Seven Sanitary Sermons addressed to all interested in Tropical Hygiene and Administration. By ANDREW BALFOUR, C.B., C.M.G., M.D., F.R.C.S. In seven profusely-illustrated chapters this volume places the extensive experience of the Author at the disposal of all interested in hygienic methods for combating Tropical Diseases. The results recorded are the fruits of special study and observation extending over a number of years and a wide area, both in the New World and the Old.

Experience has been gathered by the Author as a result of civilian work and military service—the latter in the South African Campaign and in nearly all the fields of operations in the Great War.

The conditions prevailing in many countries have been studied and, during the late war, a unique opportunity was available, owing to the fact that practically all the tropical and sub-tropical war areas were visited, thus permitting useful comparisons to be instituted.

The book has been written along somewhat novel lines, so that it may appeal to a wider class of readers than that usually served by works on Preventive Medicine. For the same reason it has been lavishly illustrated, and care has been taken to include many illustrations which are both interesting and informative.

Contains 220 pages, with 180 illustrations in colour, half-tone and line, and 8 pages of index. Frontispiece and maps in colours. Published by Baillière, Tindall & Cox, London (Eng.), for the Wellcome Foundation Ltd.

Crown Quarto. Cloth Binding.

EXTRACTS FROM PRESS REVIEWS:

" . . . . . In addressing different audiences, Dr. Balfour treats his subject from " many points of view, but always with an erudition and felicity of expression which " do the fullest justice to the intrinsic interest of his theme. Interwoven with the " subject-matter is a wealth of anecdote and apt quotation, and the result is a volume " of absorbing interest, which the reader is not likely to lay aside till he has perused " it to the last word. In a lecture on preventive inoculation against typhoid and " cholera, originally delivered at a meeting of the Research Defence Society, nothing " is lost through the presentation of the subject in non-technical language, and the " essential facts of immunity are indicated in a manner which is intelligible to those " who do not possess a strictly scientific training . . . . ."—*Lancet.*

" . . . . . A very good series of sermons they are; well calculated to impress " the lay public, for whom they are chiefly intended, with the vital importance of " hygiene in the Tropics.

" Dr. Balfour is well equipped for the rôle of an Apostle of Health. Not only " has he himself been a redoubtable warrior in the War against Tropical Disease, " but he has also made a place for himself in literature and brings the pen of an " experienced writer to support his doctrines.

"Though primarily addressed to the general public, the book is bound "to make a wide appeal to all those engaged in the administration of our "Colonies and Dependencies, as well as to those concerned with sanitary "services . . . . . "—*Tropical Diseases Bulletin.*

" . . . . . Dr. Balfour's volume is an important and interesting record of "researches undertaken in the course of the work of the Bureau, founded in 1913, "by Mr. Henry S. Wellcome.

" . . . . . It is plentifully illustrated by documentary photographs, and gives "ample evidence that the Bureau is doing noteworthy work in the advancement "of medical science and sanitary administration."—*Scotsman.*

HUMAN INTESTINAL PROTOZOA IN THE NEAR EAST: By C. M. WENYON, C.M.G., C.B.E., M.B., B.S., B.Sc., F.R.S., and F. W. O'CONNOR, M.R.C.S., L.R.C.P., D.T.M. An enquiry into some problems affecting the spread and incidence of intestinal protozoal infections of British Troops and Natives in the Near East, with special reference to the "carrier" question, diagnosis and treatment of amœbic dysentery, and an account of three new intestinal protozoa.

The work carried out in Egypt, of which this paper forms the report, was undertaken at the request of Surgeon-General Sir WILLIAM BABTIE, V.C., K.C.M.G., at that time P.D.M.S., M.E.F., in consultation with the Medical Advisory Committee. Its object was threefold, namely, an investigation into the carrier problem of amœbic dysentery amongst the troops with a view to the possible elimination of the carriers; secondly, an inquiry into the best method of administering emetine to carriers and actual dysenterics, with the object of establishing some uniform line of treatment which would give the maximum of good result; and, thirdly, an examination of the fly transmission of amœbic dysentery by means of cyst carriage, and a determination of the best means of destroying the resistant amœbic cysts after their escape from the body.

Contains 218 pages, including 8 pages of index; 4 pages of plates, with complete descriptions of each; and other illustrations. Published by John Bale, Sons & Danielsson, Ltd., London (Eng.), for The Wellcome Foundation Ltd.

Crown Quarto Size. Cloth Binding.

EXTRACTS FROM PRESS REVIEWS:

"The publication is a very valuable one, and presents many new aspects of "intestinal protozoal infection, particularly in relation to *Entamœba histolytica.*

"The book is divided into four parts, dealing respectively with:—

"I. The incidence of protozoal infections amongst British troops and natives in "Egypt, with special reference to the carrier problem of the amœbæ of dysentery.

" II. The characters and diagnosis of the various intestinal protozoa of man in Egypt, " with a description of three new forms.

" III. Treatment of *E. histolytica* and other protozoal infections of the human " intestine.

" IV. Experimental work with the human intestinal protozoa, their carriage by " house-flies and the resistance of their cysts to disinfectant and other agents.

" There is also an Appendix with histories of cases treated and some most useful " plates illustrating the different types of intestinal protozoa. Altogether a most " useful book."—*Medical Journal of Australia.*

" This very helpful volume contains a revised issue of the authors' well-known " Report on the human intestinal protozoa in Egypt, published during 1917 in the " *Journal of the Royal Army Medical Corps*, to which has been added an Appendix " giving the history of the cases treated. After giving an account of the methods of " collecting material and of examining various groups of men for protozoal infections, " the authors describe the characters of the intestinal organisms, especially *Entamœba* " *histolytica*, *E. coli* and *E. nana*, the last-named being a new species which proved " to be one of the commonest protozoa in the human intestine in Egypt.

" One of the chief practical problems considered is that relating to carriers: " ' cases may remain as healthy carriers for long periods without showing any signs " of dysentery,' but on microscopical examination of their fæces the characteristic " quadrinucleate cysts of *Entamœba histolytica* are found. Observations on " the part played by house-flies in carrying protozoal infection from fæces " to food demonstrate the importance of the measures directed against flies. " Examination of the droppings of 229 flies captured in a hospital compound " showed that eighteen of the flies had deposited cysts of protozoa or eggs of " parasitic worms."—*Edinburgh Medical Journal.*

MOSQUITO SURVEYS: A Handbook for Anti-malarial and Anti-Mosquito Field Workers. By MALCOLM E. MACGREGOR, M.A., Entomologist, The Wellcome Field Laboratory, The Wellcome Bureau of Scientific Research. With Foreword by Sir RONALD ROSS, K.C.B., K.C.M.G., F.R.S. An essential addition to the library of all those whose work is wholly, or partly, concerned with the study and prevention of mosquito-borne disease in all parts of the world.

Sufficiently portable to be the constant companion of the field worker and so comprehensive as to be an encyclopædia of reference for laboratory workers. Deals exhaustively with Laboratory and Field Technique. Medical Officers of Health and all engaged in anti-malarial and anti-mosquito campaigns will find " Mosquito Surveys " indispensable in the hitherto difficult task of identification and classification of species.

Contains 282 pages, liberally illustrated, 62 maps, diagrams and photographs. Published by Baillière, Tindall & Cox, London (Eng.), for The Wellcome Foundation Ltd.

Crown Octavo. Cloth Binding.

EXTRACTS FROM PRESS REVIEWS:

"A valuable aid to the campaign against Mosquitoes."—*The Times.*

". . . . For all the detail of a mosquito survey, undertaken as one of the essentials "of a malaria survey, the worker in the field and the laboratory could not wish a "better book than this."—*Tropical Diseases Bulletin.*

"Too often medical sanitarians concerned in anti-mosquito work find themselves "sorely handicapped by the lack of a guide over the great gulf between the necessarily "elementary instruction they have received and the highly technical monographs "which assume wide previous knowledge on the part of their readers. Those "who have suffered thus will find in this volume the essential information "they require."—*Journal of the Royal Army Medical Corps.*

"Sir Ronald Ross tells us in his foreword that 'Mosquito Surveys' was written "for The Wellcome Bureau of Scientific Research, Endsleigh Gardens, by 'a very "accomplished expert in the subject of which he treats, and the book "itself is, perhaps, a fuller exposition of that subject than has yet appeared.' "We are in whole-hearted agreement with these statements, which call for no "further comment."—*Journal of Tropical Medicine and Hygiene.*

"Sanitary Inspectors in the Tropics will learn from this book much which "will make their work more interesting to themselves and more valuable to "others."—*Journal of the Royal Sanitary Institute.*

"This concise handbook is a valuable addition to the general works on "this subject, as it condenses the descriptions of the various techniques employed "by numerous workers, brings up to date the minor but none the less "important details, and gives new methods which are of real, practical and tested "value."—*West African Medical Journal.*

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DE ARTE PHISICALI ET DE CIRURGIA of Master John Arderne, Surgeon of Newark, dated 1412. Translated by Sir D'ARCY POWER, K.B.E., from a transcript made by ERIC MILLAR, M.A. Published by John Bale, Sons & Danielsson, Ltd., London (Eng.), for The Wellcome Foundation Ltd.

60 pages. 14 plates in colour and monochrome.

Crown Quarto. Cloth Binding.

EXTRACTS FROM PRESS REVIEWS:

"Mr. Henry S. Wellcome has increased the already heavy debt of gratitude "owed him by historical students by causing to be published a translation of the "old Newark practitioner's De Arte Phisicali et de Cirurgia. The editor and translator "is Sir D'Arcy Power, which is a concise way of saying that text, notes and intro- "duction leave nothing to be desired. The translation is of an illuminated MS. "from an early fifteenth century hand, preserved in the Royal Library, Stockholm. "The editor says that it 'omits much, adds something, and takes out entirely the "personal element and quaint touches which make the original manuscript such "excellent reading.' Sir D'Arcy Power is much too modest in the appraisement "of his literary wares; indeed, any one of the thirteen beautiful plates with which "the volume is embellished established a better claim to be called picturesque than "most historical monographs."—*British Medical Journal.*

"This translation has been carried out by Sir D'Arcy Power, K.B.E., F.R.C.S., "from a transcript made by Mr. Eric Millar, M.A., from a replica of the Stockholm "manuscript in The Wellcome Historical Medical Museum. Born in 1307, Arderne "practised in Newark from 1349 until 1370, when he came to London. He was "essentially an operating surgeon whose practice lay amongst the nobility, wealthy "landlords and higher clergy. He was evidently a sound practical surgeon and

" well abreast of knowledge of surgical craft in his days. The manuscript, which " is here given, is an epitome in Latin made some years after Arderne's death. " The present volume contains thirteen plates and a coloured frontispiece, and the " numerous and unique illustrations mirror well the quaint ingenuity of those " responsible for art in the fourteenth century. The book will afford fascinating " reading, and will assuredly stimulate interest in the study of medical and surgical " lore of bygone days."—*Medical Times.*

" This excellent rendering of the text into modern English makes this volume " a most convenient peep-hole into mediæval medicine."—*Times.*

MAGISTRI SALERNITANI NONDUM COGNITI: A Contribution to the History of the Medical School of Salerno, by Doctor PIETRO CAPPARONI, General Secretary of the " Instituto Storico Italiano dell' Arte Sanitaria," Counsellor of the " Società Italiana di Storia delle Scienze mediche e naturali." With a Foreword by Sir D'ARCY POWER, K.B.E. Published by John Bale, Sons & Danielsson, Ltd., London (Eng.), for The Wellcome Foundation Ltd.

68 pages. 28 plates in colour and monochrome.

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EXTRACTS FROM PRESS REVIEWS:

" This book constitutes a valuable contribution to the history and diplomatics " of the Medical School of Salerno. When on military duty in Salerno in 1916 " Dr. Capparoni had an opportunity of studying a very rare manuscript belonging to " the Library of St. Matthew's Cathedral, and from this was gleaned much information " not hitherto known relating to this medical school, which has been incorporated " in the present volume. Sir D'Arcy Power points out that a medical school was " founded at Salerno in the twelfth century. This school increased until the " fourteenth century, after which it gradually diminished in importance until it was " summarily suppressed by Napoleon in 1811. This book, which is the second " volume of Research Studies in Medical History issued by The Wellcome Historical " Medical Museum, is illustrated by a coloured frontispiece and twenty-seven unique " and exquisitely executed plates, and cannot fail to attract the attention of keen " students of medical history, all the more so if they are interested in medical " archæology."—*Medical Times.*

" Everything connected with Salerno is of interest to the medical profession, " and we congratulate Dr. Capparoni on having made some notable additions to the " already published and valuable researches of De Renzi and Piero Giacose, the fruit " of his study of a MS. belonging to the Library of the Cathedral of Salerno. Before " entering on a description of the MS. and his researches therein, Dr. Capparoni " gives a most interesting historical review of Salerno and its medical school, " which probably began somewhere about the eleventh century, though there had " been a hospital as early as the year 820. He gives his readers a number of " illustrations, reproduced from photographs of various leaves of the MS. and of " other documents in the Cathedral of St. Matthew. Dr. Capparoni has conferred " a real benefit upon all those interested in the history of medicine, and altogether " the book is a joy both to read and to look at."—*Lancet.*

THE ICONOGRAPHY OF ANDREAS VESALIUS (André Vésale), Anatomist and Physician. 1514–1564. Paintings—pictures—engravings—illustrations—sculpture—medals. With notes, critical, literary and bibliographical, by M. H. SPIELMANN, F.S.A. Published by John Bale, Sons & Danielsson, Ltd., London (Eng.), for The Wellcome Foundation Ltd.

244 pages. 68 plates in addition to text illustrations.

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The Iconography of Vesalius was for many years a mixed question of debate in artistic and medical circles, and everyone, except perhaps the owners of certain of the "portraits," will welcome the critical and authoritative contributions to the question which Mr. M. H. Spielmann has now made. Vesalius, by the publication of his "De humani corporis fabrica," in 1543, laid the foundation of genuine anatomy and freed medicine from the trammels of authority. The general opinion of men of science was voiced by Sir Arthur Keith when he wrote that "in the quality of his work Vesalius is akin to Shakespeare." In characteristic fashion he continues: "Now and again there is born into the world a man who, turning his back on the lore of his forefathers, seeks for his information direct from the book of nature. Vesalius was one of these; he read and translated for his fellows the text of the human body from the original imprint. He studied the dead body to learn how the living body moved and had its being. Vesalius breathed life into the dead human body; in this act he still stands supreme."

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"Mr. Spielmann's iconography is a large and admirably produced volume, a "credit to all concerned. It represents a world's tribute, which, under the "direction of Prof. Paul Heger, of Brussels, would have appeared earlier but for the "war, with contributions from other writers. These contributors, still identified "with it, have left the work in Mr. Spielmann's hands, and hence it appears a critical, "biographical, bibliographical and artistic volume on a subject of front-rank "importance."—*Graphic.*

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THE LISTER CENTENARY EXHIBITION, 1927, SOUVENIR AND HANDBOOK. This souvenir handbook was prepared for the exhibition held at The Wellcome Historical Medical Museum in connection with the official centenary of the birth of Lord Lister. It contains an introduction on the Evolutions of the Lister Systems on Antiseptic Surgery by Sir HECTOR C. CAMERON, C.B.E., M.D., LL.D.; a life of Lord Lister; chapters on Lister's Pioneer Work in Antiseptic Surgery, on various Experimental Researches, Original Scientific work, Lister's Associates, the influence of Lister's work, Lister's Academic and other honours, and a very complete bibliography of Lister's Writings, arranged chronologically, and a full list of Biographies and Personal Reminiscences, in addition to a fully-illustrated catalogue and description of the exhibits.

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ANGLO-EGYPTIAN SUDAN

THE WELLCOME TROPICAL RESEARCH LABORATORIES, Gordon Memorial College, Khartoum, were founded in 1903, for the following purposes :—

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(*b*) The study of plant diseases, both those due to fungi and other vegetable parasites, and those caused by insects ; the study of harmful and beneficial insects, and especially of insects in their relation to tropical medicine.

(*c*) To carry out investigations in connection with cases of poisoning, and to develop methods for the detection of the toxic agents which may be employed by the natives.

(*d*) To carry out chemical and bacteriological tests in connection with water, foodstuffs, and other sanitary questions.

(*e*) To make analyses or assays of minerals, ores, fuels, etc.

(*f*) To carry out investigations in connection with agricultural and forest products or operations, and, generally speaking, of any material which may be of practical interest in the economic development of the Sudan.

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SECOND REPORT, 1906. Contains results of fresh researches on a great number of Tropical Diseases, etc., including Sleeping Sickness, etc., etc. 255 pages, including 16 coloured plates; 51 reproductions of black-and-white drawings; 75 reproductions of photographs; and 7 maps and plans.

THIRD REPORT, 1908. Record of extensive Tropical Research; special features include a chapter on Sanitation and a number of sciences connected with Tropical Medicine. Contains 477 pages, including 27 pages of index; 28 coloured plates; 51 reproductions of black-and-white drawings; 263 reproductions of photographs; and 19 maps and plans.

REVIEW OF RECENT ADVANCES IN TROPICAL MEDICINE—

SUPPLEMENT TO THE THIRD REPORT. By BALFOUR and ARCHIBALD. Contains Reviews of some ninety Tropical Diseases with précis accounts of new articles on them. 251 pages, including 13 pages of index.

FOURTH REPORT, 1911.

VOLUME A—MEDICAL. Record of extensive researches in Tropical Diseases. Contains 404 pages, including 34 pages of index; 14 coloured plates; 44 reproductions of black-and-white drawings; 104 reproductions of photographs and wash drawings; and 12 maps and plans.

VOLUME B—GENERAL SCIENCE. Record of extensive research in Economic Branches, ranging over a very considerable variety of Scientific Subjects. Contains 334 pages, including 22 pages of index; 9 coloured plates; 52 reproductions of black-and-white drawings; 98 reproductions of photographs and wash drawings; and 30 maps and plans.

SECOND REVIEW OF RECENT ADVANCES IN TROPICAL MEDICINE—

SUPPLEMENT TO FOURTH REPORT, 1911. By BALFOUR and ARCHIBALD. Summarises the most important recent discoveries in Tropical Medicine and covers the period from the First Review to June, 1911. 440 pages, including 23 pages of index. Published by Baillière, Tindall & Cox, London (Eng.), for The Wellcome Tropical Research Laboratories, Khartoum.

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