order that specific references might be made to the state bulletin in my U. S. Geological Survey paper, as it would appear long before the latter and would cover much the same ground. There are actually twenty or more references to the Mississippi Survey bulletin or to the work of W. C. and P. F. Morse given in the forty-six pages of the text of the U. S. Geological Survey bulletin, besides numerous references to the analyses by Dr. W. F. Hand, of the Mississippi Agricultural College, and to the material furnished me by the Mississippi Bauxite Co.

I have herein endeavored to make clear what is not clear in Dr. Lowe's letter—namely, that I have published two papers, one of which was sent to the Geological Society before the Mississippi report was available for reference, and that the second, or Federal Survey report, contains many references, giving full credit to Mississippi Survey Bulletin 19. In view, therefore, of the absence of intent to reflect on any of the geological workers, and in view of the specific credit that has been given in the survey bulletin to the Mississippi Geological Survey and others whose results were used, I trust that the charge that I have been guilty of a "lapse of courtesy" may be considered as without adequate basis.

E. F. BURCHARD

UNITED STATES
GEOLOGICAL SURVEY

SCIENTIFIC BOOKS

MEDICAL RESEARCH IN CHINA[1]

IN the "Contributions from the Peking Union Medical College" will be found a record of contributions to medical science which have been made under peculiar and interesting conditions, without parallel in history.

Here, within the great oriental city of Peking, have been transplanted the seeds of western learning, which are wholly different from the influences that have hitherto shaped the destinies of Chinese civilization. Instead of attempting to obtain truth through the power of the human intellect alone, as did the ancient Chinese philosophers, to whom all thoughtful persons owe a debt of gratitude, stress is placed upon the experimental method, upon accuracy in observation and upon skill in deduction. Thus, the problem of "the transformation of the mind of China" is faced, in a constructive sense, in the most humanitarian of sciences. But to be successful more is needed than a revolutionary point of view among the intellectuals and the generation of a lively feeling of compassion and of personal responsibility for the sick and dying. It is also essential that the attitude of the people as a whole to the medical profession be changed, that the status of the profession be raised from that of an unattractive cult, drenched in superstition, and pursued by men of little training and few ideals, to one which will appeal to the genius of the best minds of China. It is probably with this objective in mind that the reorganizers of the Peking Union Medical College selected for a site the palace and estate of a Manchu prince and that they erected thereon buildings which constitute a wonderful blend of the best in Chinese and foreign architecture, with the result that the college as it now stands possesses a dignity all its own and commands admiration in a capital famed for its architectural masterpieces.

The volumes under review are prefaced by a brief introduction written by the director of the college, in the course of which the following statements appear:

> In establishing the Peking Union Medical College its trustees have laid emphasis on the encouragement of research, especially with reference to problems peculiar to the Far East. . . .
>
> The problems and potentialities of the Orient, political, economic and scientific, have been drawing the interest of the world to this hemisphere with increasing force during the past few years. In the field of medicine, particularly as regards communicable disease, Asia compels a growing attention from physicians, sanitarians and government forces. China and its neighboring countries are being recognized as reservoirs of certain diseases, endemic in localities specially favoring their existence, and on occasion becoming epidemic with a velocity and extent which keeps even pace with the increase in transportational facilities and the growing readiness of the Chinese to move about the country. . . .
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> Various other morbid conditions are of special interest; the animal parasites of man are particularly abundant in China and offer unusual opportunities for studies in bionomics; anemias associated with splenomegaly of uncertain origin are frequently seen; diseases arising from dietary abnormalities offer an inviting field for the food chemist and the clinician alike. The investigation of physiological and anatomical norms of the Asiatic has scarcely begun. To these and kindred problems it is hoped that, as time goes on, the studies carried on in the laboratories of this institution may make an effective contribution.

The contributions themselves number 211, of which 91 are given only by title. Their subject-matter is so varied that to review them adequately would require the close cooperation of specialists in all the main branches of medical science. They range from very brief notes on special topics to a cooperative monograph on Schistosomiasis japonica of over three hundred pages. For a single individual to attempt to give more than a general and very superficial idea of their contents would savor of the presumptuous. They are arranged without order as to subject-matter, anatomy rubbing shoulders with pharmacology and

[1] "Contributions from the Peking Union Medical College, Volume I–IV, 1921–1924, Peking, China.

clinical neurology with dietetics, so that in these days of specialization the honest reader may well admit that it is difficult fully to comprehend six consecutive articles. But he will notice that there is evidence of a clear appreciation of the great purpose dominating the enterprise. The contributions lend themselves to definite grouping which may or may not have been premeditated. Indeed, this circumstance may constitute merely the unconscious expression of a well-balanced medical faculty, in which each individual attacks the problems which he is by nature and training best fitted to solve.

(1) Thus, the subject of the history of Chinese medicine is logically made the basis for several communications written by both Chinese and foreigners. An obvious effort is made, not to present certain peculiar practices and customs as curiosities to be wondered at, as has been so frequently done in the past, but rather to penetrate more deeply and to discover the underlying causative factors which alone will furnish the necessary background for the introduction of what we are pleased to call "modern" medicine. The scope of this inquiry, which should be broadened, is revealed by the following titles: "A review of ancient Chinese anatomy," "Taoist ideas of anatomy," "The office of imperial physicians," "The renaissance of medicine in China," a comparison of ancient Chinese anatomical charts with the "Fünfbilderserie" of Sudhoff, and "The Ta Sheng Pien, a Chinese household manual of obstetrics."

(2) With the evident object of adapting the teaching in the college to the special needs of the students, other workers have made detailed studies of the methods of pedagogy now in vogue in the medical sciences in schools under Chinese and Japanese control. Information of this kind will be found under: "Health education in schools of higher learning in China," "Anatomy in China," "Anatomy in Japan," "Hospitals in Japan," "Japanese influence in Chinese medical education."

These papers show how very praiseworthy and successful have been the attempts of Chinese and Japanese educators. It is to be regretted that none of the Chinese members of the staff have themselves written independently along these lines. They are by nature very courteous and slow to come forward and to express their opinions, but they should be urged to do so, and adverse criticism should be received with special favor, because without it how can foreigners hope to fulfil their educational mission in China?

Broadminded as this attitude of the members of the staff must seem to be in regard to their special mission as teachers, the reviewer is surprised to notice the absence of any papers dealing with the normal psychology of Orientals, because it seems clear that even from a purely utilitarian point of view a consistent advance in this direction by one versed in the science of psychology would be beneficial not only as a guide in teaching but also in the interpretation of abnormal mental states. The same may be said in regard to philosophy. If Chinese efforts throughout the ages to interpret natural phenomena remain a closed book, how can the methods of western science be presented in their proper perspective?

(3) Fortunately, from a slightly different angle—that is to say, from the standpoint of anthropology—many papers bear witness to a desire for scientific information of a fundamental character regarding the Chinese as a race. Here "the physiological and anatomical norms of the Asiatic" referred to by the director are under discussion, and a fruitful attempt is commenced to push back or rather to base the investigation upon a sound knowledge of the prenatal stages of development. It will readily be seen that information of this kind is prerequisite to the intelligent interpretation of disease and to the initiation of measures of public hygiene.

Another contribution to human welfare that the Peking Union Medical College is qualified to make in the years to come lies also in the sphere of physical anthropology. In the inevitable adjustment between Orientals and Occidentals scientific information regarding the inherent capacities of the Chinese and of the effects of climatic changes and of interbreeding with other races will be of great value, supplemented, it is hoped, by a sympathetic understanding of their psychology and philosophy of life. The following papers represent a beginning in this direction: "A collection of Chinese embryos," "The anthropology of Asiatic peoples," "Concerning anthropometry and observations on healthy subjects," "Some vital statistics, based on a study of 4,000 Chinese family histories," "On an anomalous digastric muscle in the thigh of a Chinese," "The significance of certain endocranial markings in man and the importance of endocranial anatomy from the standpoint of anthropology."

(4) It is refreshing to observe that the foreign members of the staff approach their duties without dogmatism, as seekers ready and eager to learn of the real discoveries which they believe that the Chinese have already made unaided. This is particularly evident in the case of papers dealing with the Chinese materia medica. Indeed, the efforts in this regard are among the most systematic and careful that have ever been made. Certainly never before has the opportunity been so great, involving as it

clearly does close and friendly cooperation between both Chinese and foreigners, the advice of specialists in many branches of medicine, adequate facilities and a systematic program apparently extending over a sufficient period to be effective. Reference in this connection should be made to: "Botanical, chemical and pharmacological reference list to Chinese materia medica," "Toxicology in China," "A new viewpoint in pharmacology."

(5) The members of the staff have labored to fulfil the wishes of the trustees in regard to problems peculiar to the Far East, so that the bulk of the contributions fall under this heading. These problems are, however, so insistent and replete with human interest that no special stimulus was needed. What, for instance, can be of more pressing importance to residents in China than the detailed chemical information regarding Chinese foods with data concerning the distribution of vitamines, supplemented by studies on the communicable diseases of domestic servants and investigations into the health of missionary families, all of which are to be found in these volumes? Special diseases such as plague, trachoma and kala-azar have also been attacked, the latter very systematically, and the unique opportunities for the study of parasitology have been comprehensively exploited. From the many reports the following may be selected as typical: "The etiology of the last cholera epidemic," "Mastoiditis in Peking," "Filariasis in China," "The prevalence of syphilis in Peking," "Causes of blindness among the Chinese," "Osteomalacia in China," "Bronchospirochetosis in China," "Incidence of abdominal diseases among Chinese."

(6) Encouragement of research in this special field of oriental and tropical medicine is fully justified from the opportunistic point of view and in consideration of the chief purpose of the organization. But when inclination and official sanction point in the same direction, it is possible that a slight tendency to overbalance may develop, although no evidence of such a tendency is to be found in the volumes under review. Evidently a group of specialists in the medical sciences must include some men and women who, by virtue of their special training and inclinations, are not qualified to study problems thus restricted. It is obviously their duty to attack with equal enthusiasm the fundamental problems of anatomy, physiology and pathology, and of medicine and surgery, the solutions of which are of vital importance to mankind everywhere, to the nations of the west as well as to those of the east. It is with pleasure, therefore, that the reader will find many contributions of this type emanating both from the preclinical and the clinical departments. Space permits reference to a few only, which are, however, indicative of the ground covered: "Studies of gas and electrolyte equilibria in the blood," "Experiments on the hyperplasia of nerve centers," "Studies on experimental tetany," "The motor nuclei of the cerebral nerves in phylogeny," "Experiments on the production of specific antisera for infections of unknown cause," "Problems in the diagnosis and treatment of injuries to the peripheral nerves."

But biology, chemistry and physics, considered as pure sciences apart from their direct application to medical problems, are wholly without representation, although active research in these subjects would exercise a very helpful influence. Indeed, it is frequently emphasized that one of the most highly prized assets of the newly organized medical school of the University of Chicago is its close association with well-developed and very productive departments of biology, chemistry and physics, and other instances of this arrangement might be cited. When the Peking Union Medical College was reorganized, provision hitherto unsurpassed in China was made for teaching in these subjects, on the understanding that instruction would be discontinued as soon as the other schools and colleges became able (with the generous assistance of the China Medical Board) to care for high-grade premedical education. This discontinuation is even now in process of realization, with the result that the basic sciences of biology, chemistry and physics, in which active research was difficult owing to impermanency and emphasis upon teaching, are being dropped from the curriculum of the college. In this way a desirable element of university atmosphere is being lost, which is partly but not wholly compensated for by the activity in the preclinical subjects of anatomy, physiology and pathology, mentioned in the foregoing paragraphs.

In his book, "Medical Education, a Comparative Study," Abraham Flexner remarks that medical science (throughout the world) "profited enormously by the accident that in Germany it started not in a hospital but in a university in which research was as prominent as instruction." At this critical period in China, when educational ventures are being launched in all the important centers of the republic, it is desirable that a similar tendency be initiated in favor of university medical schools as contrasted with professional medical colleges. But the reverse seems to be the case, and Chinese medical education appears to be developing chiefly upon the basis of more or less well-equipped hospitals. Indeed, it is doubtful if there exists anywhere in China a medical school which is an outgrowth of a university in which research is actually as prominent as instruction. It

is interesting to note that the Japanese have, on the other hand, followed the example set by Germany and that their remarkable success in the introduction of western medicine is to be attributed, in no small measure, to the continued influence of the Imperial University Medical Schools on premedical education and especially upon research in the sciences fundamental to medicine.

In concluding this review, attention may be called to a noteworthy feature of the contributions, namely, to the cooperation of foreigners and Chinese. Long may this friendly association continue! In the four volumes under consideration, which represent the initial achievements of the enterprise (so far as they have been published), it is naturally chiefly a matter of the teacher working side by side with his Chinese student, although some of the more mature Chinese have already made important discoveries alone. Let us hope that in the years to come the tendency to work together, once happily initiated, will continue. The reviewer confidently believes that when experienced and fully trained Chinese and foreigners will join hands in united effort, fortified as they are by their peculiar heritages and intellectual endowments, a new force will be brought into medicine, and that mysteries will give way which have long baffled the best minds of England, France and Germany, indeed of all the nations of the west, laboring alone. That this new combination should act in one of the greatest of oriental cities, in an environment rich in intellectual and artistic achievement and altogether different in character from that which has fostered the advancement of science along certain lines in the west, is another factor which may be productive of surprising results. The future is full of promise, and there is a chance that the Peking Union Medical College may contribute, as few other institutions are privileged to do, toward the purpose of the Rockefeller Foundation, namely, "the welfare of mankind throughout the world."

E. V. COWDRY

THE ROCKEFELLER INSTITUTE

SPECIAL ARTICLES

EFFECT OF FREEZING AND THAWING ON THE BACTERIOPHAGE[1]

GENERALLY speaking, there are two conceptions as to the nature of the bacteriophage: (1) a living organism and (2) an enzyme. Its transmissibility in series favors the former view, while its "growth" curve and certain of its described physical and chemical properties would appear to class it among the latter.

Temperatures at or slightly below the freezing point are stated to be uninjurious to this lytic substance, but so far as the writer has been able to determine, the effect of repeated freezing-thawing has not been studied.

A bacteriophage active for *Staph. muscae* (Glaser), and another lytic for a human strain of *Bact. coli* were used. Heating at 60° C. for forty-five minutes inactivated the former, whereas the latter was only partially destroyed at this temperature. Using standardized procedures, the lytic titers of the two were very constant.

One cc quantities of the phages were frozen in small, sterile, cotton-plugged tubes on a freezing microtome with CO_2 gas. The cap of the freezing box was first unscrewed and the gas outlet covered with a piece of wire gauze to prevent the small tubes from resting in it. Over the small tubes was inverted a large test-tube, four and one half inches by one and one quarter inches, with a hole in the bottom of sufficient size to permit the escape of gas. CO_2 freely expanding in this chamber quickly lowered the temperature to a point where solid CO_2 was produced, approximately $-78°$ C.

The two phages were frozen and rapidly thawed ten, fifteen and twenty successive times, yet when titrated the titers never varied from those of non-frozen portions run as controls. Even when diluted ten thousand times with bouillon and then subjected to the freezing process for fifteen times no deleterious effect was to be noted on the staphylococcus phage.

By way of contrast, the following figures are given, indicating the numbers of a twenty-four hour old bouillon culture of *Bact. coli* which failed to survive after the first, tenth and fifteenth freezing, respectively: 16 per cent., 86 per cent., 94 per cent.

The results would indicate the bacteriophage to be something other than a viable organism, unless it constitutes an exception to the generally accepted rule that repeated freezing-thawing is injurious to living cells.

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THE RELATION OF MOISTURE CONTENTS OF WOOD TO ITS DECAY

EARLY in 1920, the senior writer began a comprehensive study of the relation of the moisture contents—or air-moisture balance—of wood to its decay and of woody plants to disease. During the past two years, the junior writers have been engaged in working out certain phases of both problems in collaboration with the senior writer.