dore Strong and Joseph Winlock. In the year 1925 the Mathematical Association of America established a prize for the best expository paper published in English during successive periods, which is now awarded every three years and is called "The Chauvenet Prize."

The name of Chauvenet is therefore also now well known to the mathematical public of our country as an important contributor to the advancement of their subject, especially along the line of clear exposition. The remaining four names of the first mathematics section of the National Academy of Sciences are probably now less widely known among American mathematicians but they also became known internationally as results from the fact that a number of the publications of each of them are noted in the widely used periodical called *Poggendorff's Handwörterbuch*. This was started in the same year as the National Academy of Sciences and is still being continued with increasing completeness as regards advances in science in the different countries of the world.

It is interesting to note that the later developments have proved that the National Academy of Sciences selected its first mathematical members with reasonable wisdom since the merits along this line are unusually difficult to judge by those working in other scientific fields. While this Academy has served from its beginning as an adviser of the national government along scientific lines it has wisely aimed also to encourage scientific work of high order throughout the nation by maintaining high standards for membership. By the election of a small number of "Foreign Associates" it has aimed to extend its influence beyond the borders of our own land and by including W. R. Hamilton and Michel Chasles in the first list of ten it has also exhibited wisdom along the line of mathematics in these selections.

Recently J. L. Coolidge of Harvard University published "A History of Geometric Methods" which was explicitly inspired by a work of Michel Chasles published a little over one hundred years ago (1837) but which is still widely used. This shows that some writings on the history of mathematics have been useful during a long period of time notwithstanding the fact that many more recent ones were so written that they were very soon regarded as out of date. Recently the Royal Irish Academy began the publication of the mathematical papers of W. R. Hamilton. The first volume appeared in 1931 and the second in 1940. Hence the early members of the National Academy of Sciences also made wise selections as regards the mathematical "Foreign Associates" in view of the enduring value of their works.

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SCIENTIFIC BOOKS

INFECTIOUS DISEASE

Biological Aspects of Infectious Disease. By F. M. BURNET, M.D., assistant director, Walter and Eliza Hall Institute, Melbourne. x + 310 pp. Illustrated. New York: The Macmillan Company; Cambridge, England: At the University Press, 1940. $3.75.

THE dawn of bacteriology was not interested to answer the question: In what manner have the human race and the Animal Kingdom become subject to the multiform epidemization so vividly experienced in the mass mortalities during the centuries preceding the discovery of bacteria? An elucidation of the nature of the infections prevailing at that time promised results of great practical and theoretical significance. To view an infection from the standpoint of the naturalist as analogous to or identical with the biological phenomena of parasitism is an achievement of recent years. By taking an anthropocentric attitude, the student of human disease, a human being himself and trained solely in medical bacteriology, conceived the infection as a struggle between man and microbe being waged with special weapons. In the foreground of his study was placed the altered state of the host—the disease. With the recognition of the so-called latent infections and the infections without an infectious disease, this strictly utilitarian concept was found untenable. With the realization that an infection may be studied with advantage as a branch of academic biology, it was likewise appreciated that it may be analyzed along ecological lines as a struggle for existence between man and microorganisms of the same general character as the competition between plant or animal species in nature. Those who by necessity were forced to interpret the dangers of infections, which emanate from the vast reservoir in the Animal Kingdom, fully acknowledge the guiding hand in the ecological concept of the epidemics induced by the population regulators—the microbian or virus parasites. Humble attempts to focus attention on both man and animal and on the microorganism as objects of equal interest have been made by a few authors in special monographs, but it is to the great credit of Burnet to present the teacher and, in particular, the student with a remarkable example of scientific writing and an invaluable summary on the biological aspect of infectious disease.

In 6 parts, subdivided into 15 chapters and dili-

gently, but with rare discrimination, compressed into 308 pages, the reader will find a classical condensation of every important fact and principle gathered during the past 60 years by the sciences of bacteriology, physiology, immunochemistry, epidemiology and public health. Whenever it appeared necessary, carefully selected impressive examples of disease states or epidemics are chosen to illustrate the microorganisms and their way of infection or the processes which govern their action. Every sentence incorporates one or several facts, and may on ultimate analysis review years of research and the final conclusions derived from many publications. Needless to emphasize, such a book requires slow and attentive reading in order that one may derive all the benefits of the review. Although intended to be "interesting to the layman with a taste for science," it must be admitted that even the seasoned expert and teacher will find the presentation stimulating to his memory and challenging to his intellect.

Under the heading of the "evolution of infection and defence," the genesis of parasitism is traced from the amoeba ascending to the highly developed man as a progressively increased ability to accept parasites. The elementary interaction between parasite and cell remains deeply impressed on the evolution of the defense reactions. To-day nobody will doubt the facts recognized by Metchnikoff that the phagocytic cells of the blood and of the fixed tissues *are* the defenders of the body. In Part II the author designates the bacteria, protozoa and viruses as the "aggressors." Perhaps it is unfortunate that this term was chosen, since it conveys the impression of a struggle between the parasite and the host being waged by special weapons —the "aggressins" of Bail. In reality it is not the power to induce disease, the so-called "pathogenicity," but the ability of the parasite to settle and to grow in living tissues, which is of biologic interest and worth detailed research. As a thorough student and pioneer in the realm of viruses, Burnet is well qualified to dissect these important enemies of life, and the methodology elaborated for their study. Concerning the biological position of viruses, he apparently favors the hypothesis that they are "the diminished descendants of pathogenic bacteria."

In Part III following a discussion of the fundamental physiologic activities of the blood and blood vessels as a part of the defenses against bacterial infections, the "wider significance of immunity," the "function and the formation of antibodies," the "species disposition" and "what makes bacteria dangerous" receives detailed consideration. According to the author, the substance which controls the permeability of the capillaries is histamine. In the light of Menkin's studies, the nitrogenous compounds responsible for these reactions exhibit significant properties which do not resemble those of histamine. The recovery from pneumonia, the nature and function of antibodies, and the interrelation of toxin and antitoxin, as viewed by the immunochemists, are intriguing summaries and examples of fine scientific writing. One wonders what Burnet means when he says:

> If in this immune reaction we have a means of transferring "reminders" to other cells, and so modifying their behavior appropriately without their having had direct experience of the appropriate stimulus, it becomes somewhat less fantastic to think that perhaps after all the sequences of altered habit, improved function and structural modification may in the long run convey some appropriate "reminder" to the reproductive cells and incorporate the change into the inheritable constitution of the species.

Acquired immunity alters the susceptibility but, as for example, in measles the descendants of resistant parents have shown for centuries a remarkably stable susceptibility and reactibility to the virus. Thus the immunity is not inherited, but the potentiality of acquiring immunity or the efficiency of the immunity mechanism is apparently dependent on constitutional factors. Concerning the harmful effects of bacteria, Burnet is not specific relative to the terminology as to what constitutes virulence and what is invasiveness. The latter depends on the surface structure of the bacteria, while the former is rather an intangible quantity which is difficult to measure. The capacity to produce a generalized deleterious effect or the so-called virulence depends on diverse poorly understood genotypic and phenotypic factors, that bacteriologists have in recent years hesitated to use the term.

The natural history of infectious disease, the "why epidemics," "how infections spread," reviewed in Part IV, considers the infection chains, the animal reservoirs, the cause of epidemic and endemic distributions, the age-incidence of disease, immunity as an epidemiological factor and the general principles of control. Part V is principally devoted to a detailed discussion of the important infectious diseases: diphtheria, influenza, tuberculosis, plague, cholera, malaria and yellow fever. The big three: influenza, plague and cholera, are treated from a historical point of view, and the latest scientific data are well analyzed. Despite the existence of different antigenic types of the influenza, Burnet hints that it might be possible to obtain "master strains" with antigenic pattern which would immunize against any but the wholly new types, such as the 1918 pandemic strain. In regard to tuberculosis, attention is called to the fact that with the isolation of patients and the diminution of frank cases an in-

creasingly large number of people will reach adult life without exposure to a tubercle bacillus infection; some sort of vaccination may have to replace the "normal childhood infection."

In a thoughtful epilogue, one is again reminded of the well-known fact that "wars, internal and external, financial depressions and labor troubles are all breeders of infectious disease. Who knows, a serious world-wide epidemic might perhaps do more to initiate a sense of genuine international cooperation." Artificial dissemination of disease as a war measure is likely to be unsuccessful, but such a weapon could be created. To combat it, Burnet believes "would require a wholly new social technique, which would bring to light as leaders men of entirely different instinctive qualities from those who now stand in authority."

This book in its handy and convenient form and with its vast store of material carefully and attractively presented is highly recommended to everybody, but in particular to all students in medicine and biology.

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SPECIAL ARTICLES

THE EFFECT OF 17-HYDROXYCORTICOSTERONE AND RELATED ADRENAL CORTICAL STEROIDS ON SODIUM AND CHLORIDE EXCRETION[1]

RECENT studies[2] suggested that adrenal cortical steroids with a hydroxyl group on C_{17} induced an increased excretion of sodium and chloride in contrast to the well-known sodium and chloride "retaining-effect" of other adrenal steroids such as corticosterone and desoxycorticosterone.[3] For this reason a comparison has been made of the effect of a number of adrenal cortical steroids on the renal excretion of sodium and chloride in an effort to determine, if possible, the relationship of chemical structure to physiological activity. The experimental methods which have been used are similar to those which have been reported previously.[3]

The subcutaneous injection of 5 and 8 mg respectively of 17-hydroxycorticosterone was followed by a significant increase in the renal excretion of sodium and chloride in a normal dog (Table 1). 1 mg of this substance was ineffective in this respect. The injection of 25 mg of 11-dehydro-17-hydroxycorticosterone was followed by a striking increase in sodium and chloride excretion in both a normal dog and an adrenalectomized dog maintained on a low sodium chloride intake. In the normal dog, sodium excretion increased from a level of 10 m.eq. per day prior to treatment to 25 m.eq. on the day of therapy. In the adrenalectomized dog sodium excretion increased from a level of 10 m.eq. per day prior to treatment to 48 m.eq. on the day of therapy. In both instances chloride excretion paralleled the changes in sodium excretion. In normal rats the injection of 6 mg of 11-dehydro-17-hydroxycorticosterone increased the 24-hour excretion of sodium chloride by approximately 75 per cent. during the day of therapy. Potassium, nitrogen and inorganic phosphorus excretion were increased appreciably during treatment with either 17-hydroxycorticosterone or 11-dehydro-17-hydroxycorticosterone in normal and adrenalectomized dogs and rats. The relation of these changes to changes in carbohydrate metabolism have been considered.[1]

In contrast to the effect of these two compounds, treatment with desoxycorticosterone or corticosterone was followed by a significant retention of sodium and chloride (Table 1). Allopregnane-3,11,17,20,21-pentol and allopregnane-3,17,20-triol were found to be inactive. When 11-desoxy-17-hydroxycorticosterone is available for experimental use it will be possible to determine the physiological effect of the hydroxyl group on C_{17} in the absence of an oxygen atom on C_{11}. The relation of chemical structure to physiological activity is illustrated in Fig. 1.

TABLE 1

THE EFFECT OF ADRENAL CORTICAL STEROIDS ON THE RENAL EXCRETION OF SODIUM AND CHLORIDE IN NORMAL DOGS

24-hour period	Urine volume cc	Sodium m.eq.	Chloride m.eq.	Substance	Quantity mg
Control	480	56	53		
Treated	640	71	67	17-Hydroxycorticosterone	5
Control	500	50	50		
Treated	600	69	62	17-Hydroxycorticosterone	8
Control	450	54	55		
Treated	520	46	49	Corticosterone	4
Control	470	56	56		
Treated	420	29	38	Desoxycorticosterone	1
Control	530	57	59		
Treated	480	56	57	Allopregnane-3,17,20-triol	5
Control	650	57	61		
Treated	640	58	61	Allopregnane-3,11,17,20,21-pentol	5

[1] This study was aided by a grant from the Committee on Research in Endocrinology, National Research Council.

[2] G. W. Thorn, R. A. Lewis, G. F. Koepf and S. S. Dorrance, *Trans. Assoc. Am. Phys.*, 56: 1941 (in press).

[3] G. W. Thorn, L. L. Engel and H. Eisenberg, *Jour. Exper. Med.*, 68: 161, 1938.