the French Academy. Hence we have a more reliable sketch of this infant prodigy than is possible to obtain in most other cases; for instance, in the case of his countryman, Pascal. The facts that Bertrand was permanent secretary of the Academy of Sciences for more than a quarter of a century, that he is the author of many theorems relating to modern mathematical subjects, and that he lived so recently, add interest to the account of his marvelous early aducation.

In the article already cited, which comes from the Psychological Seminary of Cornell University, Mitchell gives an interesting study of arithmetical prodigies and devotes considerable space to his own case. We add some of his conclusions.[3] "Mathematical precocity, then, stands in a class by itself, as a natural result of the simplicity and isolation of mental arithmetic. There is nothing wonderful or incredible about it. The all-round prodigy like Ampère or Sir William Rowan Hamilton or Macaulay is possible only in a well-to-do and cultured family, where books are at hand and general conditions are favorable, and he must possess genuine mental ability. The musical prodigy, again—Mozart is the stock instance—must come of a musical family, hear music, and have at least some chance to practise, and hence can not long hide his light under a bushel. But the mathematical prodigy requires neither the mental ability and cultured surroundings of the one nor the external aids of the other. He may be an all-round prodigy as were Gauss, Ampère and Safford, but he may also come of the humblest family, and be unable, even under the most favorable conditions, to develop average intelligence."

G. A. Miller

University of Illinois

[3] Page 39.

SCIENTIFIC BOOKS

THE HARVEY LECTURES FOR 1905–6

This volume consists of thirteen lectures given during the year to the Harvey Society of New York. This organization was founded in the spring of 1905, largely through the initiative of Professor Graham Lusk, for the diffusion of knowledge of the medical sciences by means of lectures given by authoritative research workers. The first volume constitutes a most valuable collection of first-hand information given by some of the most prominent investigators in this country and Europe and the reviewer finds before him an embarrassment of riches from which it is difficult to make a selection since all is good.

The first lecture by Professor Hans Meyer, of Vienna, is devoted to "The Theory of Narcosis" upon which subject no one is more competent to speak than this distinguished exponent of pharmacological research. So soon as scientific medicine began to break away from, or at least to seek, other support than blind empiricism, inquiry into the relation between the physiologic action of a drug and the physical and chemical properties began. One of the first investigations of this kind was carried out by Crum-Brown and Fraser, who discovered that practically all the organic bases in which the pentavalent nitrogen is connected by four of these valences with carbon have the same physiologic action notwithstanding other differences in their constitution and nature. The strong basic properties of these substances seem to be the determining factor in their effects upon the animal cell. Hofmeister and others pointed out that the laxative and diuretic effects of the neutral salts of the alkaline bases are due to their diffusibility and osmotic strength. The anesthetics include many substances that differ from one another chemically, while all depress the central nervous system. Meyer has made a careful study of the distribution coefficient of the narcotics between fatty and watery solutions and arrives at the following explanation of narcosis:

The narcotizing substance enters into a loose physico-chemical combination with the vitally im-

portant lipoids of the cell, perhaps with the lecithin, and in so doing changes their normal relationship to the other cell constituents, through which an inhibition of the entire cell chemism results. It also becomes evident that the narcosis immediately disappears as soon as the loose, reversible combination, which is dependent on the solution of the tension, breaks up. It follows further that substances chemically absolutely indifferent, as the volatile saturated hydrocarbons, can act as narcotics.

In the second lecture, Professor von Noorden states "the modern problems of metabolism" in his usually interesting style. Some of the statements in this lecture might be criticized, but the reviewer has no desire to be captious, and when he notices that nearly two years have passed since the lecture was given and probably all of that since it was prepared he is ready to admit that it is only just not to be too critical. The confusion of erepsin with the cellular proteolytic ferments would not be made now, and the fact that the circulating proteins are strictly specific for every species of animal seems to be abundantly demonstrated by biologic tests, which are much more delicate than chemical analyses in distinguishing between proteins. Professor von Noorden points out clearly that the greatest interest and importance are now attached to the study of the intermediary products of metabolism. If the protein molecule is wholly disrupted into amino-groups in the alimentary canal, are these all or in great part synthesized into body proteins or are they treated as waste, converted into urea and thrown into the sewer? Is the man who follows Voit's average and eats 118 grams of protein a day simply wasting his energy in the manufacture of amino-acids which serve neither bone, muscle nor brain, but only tax the liver and fatigue the kidney? These are some of the questions that are now puzzling the physiological chemist, but he is a lusty young fellow and will solve the riddle by and by.

Professor Novy speaks interestingly and somewhat at length "on trypanosomes." Probably no other branch of microbiology has been developed so rapidly as that of protozoology and no other promises more benefit to mankind. While the bacterial diseases predominate in temperate regions, the question of the development and the civilization of the tropics depends largely upon man's ability to destroy the protozoal parasites and the scientist must be the pioneer in this work. Novy's discovery of the methods of growing the trypanosomes in artificial cultures is a long step in the right direction. In 1841 Valentin reported the first of this large class of parasites in the blood of the salmon and a year later Gruby found a first cousin in the frog and proposed the generic name, *Trypanosoma*. During the sixth decade of the last century similar parasites were found in moles, rats and mice, but these findings were practically ignored until Lewis in 1877 made his classical contribution to the subject. Three years later Evans found a trypanosome in the blood of animals suffering from a disease afflicting horses and camels in India and known as surra. In 1894 Bruce began his studies of the tsetse-fly disease known in Zululand as nagana and demonstrated that it was due to a trypanosome which is transmitted from infected to healthy animals by the fly. This disease was observed by Livingstone and is widely distributed over middle and southern Africa, extending up the west coast to Senegambia and on the east to the Red Sea. It affects the horse, mule, donkey, dog, ox, cat and many wild animals. Indeed, the chief occupation of the tsetse-fly seems to be to transmit the trypanosome from wild to domesticated animals and in the horse, donkey and dog the disease is said to be invariably fatal. Moreover, the tsetse-fly seems to have a monopoly in this business, since it has been shown that infected animals may be kept in the midst of uninfected ones in regions where this fly does not exist. Two Togo ponies were found in the Berlin zoological gardens to be infected and notwithstanding the presence of other biting insects the disease was not transmitted to other animals in the gardens. In the wild animals of Africa this parasite is either wholly harmless or kills so slowly that the supply does not run out. Since the rinder-

pest has found its way among the game animals the fly disease has become less prevalent and in some localities has been reduced to a negligible quantity. This seems to be an instance of driving out the Devil with Beelzebub. The trypanosome of dourine was discovered by Rouget, a French army surgeon, in 1894, the same year that Bruce began his work on the tsetse-fly disease. Dourine is apparently transmitted only during the sexual act and for this reason the French know it as *mal du coit,* and in English it is sometimes designated as "horse syphilis." It is especially prevalent on the shores of the Mediterranean. Its presence in America has been frequently suspected and within the past few months it has apparently been demonstrated in the Canadian Northwest in imported stock. *Mal de caderas* is the only trypanosomatic disease known to be indigenous to the New World. It is prevalent in South America from the Amazon to Bolivia and is due to *T. equinum,* discovered in 1901 by Elmassian. It is most frequently found in horses, in which it causes a remittent fever leading to loss of weight and finally to paralysis of the hind quarters. It is to the last-mentioned symptom that the disease owes its name. The agent of transmission in this disease is not known. Gambian horse disease was first observed by Dutton and Todd in 1902 in the horses of Senegambia. It is not known to infect other animals and in the horse is much milder than nagana. The parasite exists in two forms, a short and a long, and is known as *T. dimorphon.* A trypanosomiasis, much milder in character than nagana, exists throughout southern Africa, is confined to cattle and is known as gall-sickness, or galziekte. Sleeping sickness has been known since Winterbottom wrote concerning it among the slaves in 1803. Hundreds of slaves with this disease were shipped to the western world, but there was no diffusion here because of the absence of the agent of transmission. It is now known that sleeping sickness is due to *T. gambiense* and that it is transmitted by a species of tsetse-fly different from that which disseminates nagana. It is said that hundreds of thousands of people have died in recent years in Uganda from this disease which is quite surely fatal.

In the fourth lecture Professor Levene discusses "Autolysis" in a most satisfactory way. It was once supposed that the disintegration of organic matter was wholly a process of oxidation and that in order to prevent decay it was necessary to exclude the air. On this erroneous principle a wise Frenchman taught the world how to can fruits and vegetables; so good came, as it often does, from reasoning founded on a false premise. Then Pasteur taught us that putrefaction is due to microorganisms and gave the true explanation of sterilization, but the generalization that the world drew from Pasteur's work was in part erroneous. We came to believe that absolutely no change takes place in organic matter if bacteria be excluded; but Hoppe-Seyler and Salkowski have demonstrated that animal tissue at least carries in itself ferments that under certain conditions disrupt its own protein molecules, breaking them down into smaller particles such as amino-acids. Moreover, the work of Schulze and his students has demonstrated that the seeds of plants contain three important substances, the embryo, a ferment and the stored food supply. In the presence of heat and moisture the ferment splits up the food material and the bodies resulting from this digestion begin to react on the constituents of the embryo and latent life is awakened into the active form. Levene has himself made important contributions to the problems of autolysis and consequently he speaks authoritatively and interestingly.

Professor Park tells of the "results of serum therapy in the diseases of man." The discovery of diphtheria antitoxin is one of the most brilliant and at the same time one of the most beneficent that the genius of man has accomplished. Your reviewer was fortunate enough to be present at a meeting of sanitarians in Budapest when Roux confirmed the observations of von Behring as to the curative value of diphtheria antitoxin and he well remembers the enthusiasm with which the announcement of Roux was greeted, and now

after thirteen years it must be said that the hopes then awakened have been more than realized. Thousands of lives have been saved and the once dreaded scourge of diphtheria has been robbed of its horrors. However, the dream that an antitoxin for each and every one of the infectious diseases would be secured within a few years has not developed into a reality and is not likely to do so. Indeed, it is possible that the attempt to work out an antitoxin for typhoid fever has delayed the discovery of the true method of treating that disease.

Professor Barker discourses on "the neurons," the theory of which has aroused much discussion and some bitterness of expression among histologists and it is all about the exact relation between the nerve cells and the nerve fibers. However, this is by no means a matter of trifling importance, because upon it rests problems not only of structure, but of function as well. The theory, founded largely upon the work of His, Forel and Cajal, was evolved by the genius of Waldeyer and it supposes that there is no nerve fiber independent of nerve cell and that the cell with all its prolongations is a unit or a neuron; that these units are not united to one another anatomically, but act together physiologically by contact; that the entire nervous system consists of superimposed neurons; that the neurons are so arranged that an impulse can pass only in one direction and starting in the dendrites it is carried to the cell body and thence along the axis cylinder to the dendrites of another neuron; that every part of the neuron is dependent for its nutrition on the nucleus of the cell body, and that when a nerve fiber is injured or severed the regeneration of the axis cylinder is accomplished by an outgrowth from the central end and in no other way. This theory has met with wide acceptance, but also with some strong opposition. The most vigorous opponents being Apathy, Bethe and Nissl; and Professor Barker, while supporting the theory is generous in his estimate of the value of the work done by these men. The lecture is most instructive and brings the whole subject up to date (January, 1906). The important work, illuminating this subject, done by Harrison is mentioned and has been more fully developed since.

Professor Lee discusses the old, but always interesting, subject of "fatigue." Why do we tire, is it in the nerve or the muscle, and what are the fatigue-producing substances? The nerve-muscle machine is a great invention, the first used by man, and still there are many things about it and its action that we do not understand. The scientific study of fatigue has been carried out largely by Mosso and his students and the ergograph in its improved form gives accurate results. The weight of evidence at present is that the nerve is not fatigued and that the tired sensation is due to peripheral exhaustion. However, the question in all its details can hardly be considered as finally settled. Hodge and others have demonstrated microscopical changes in certain nerve cells after muscular exertion and the experiments of Sherrington seem to show that in fatigue there must be something at fault in the nervous connections. He takes a spinal center which has several afferent tracts and but one efferent to a given muscle, and he finds that when he has exhausted the muscle by stimulation through one afferent nerve, it acts with renewed vigor when the stimulation is sent through another. The muscle, the motor nerve and the center are the same and renewed vigor is secured by sending the stimulation through another afferent. Sherrington thinks that the trouble lies at the point of contact between the afferent and efferent neurons. The fatiguing metabolism products are believed to be potassium acid phosphate, sarcolactic acid and carbonic acid. The statement of Weichardt that he had not only found a toxin that is responsible for fatigue, but had produced an antitoxin with which weary people might be treated, seems to have met with but little appreciation.

Professor Mandel points out the "recent advances in our knowledge of the formation of uric acid." It was formerly believed that uric acid was a product of deficient oxidation

and its presence in unusual amount in the urine led to the administration of oxidizing agents, such as nitrohydrochloric acid. Horbaczewski was the first to give us a start in the right direction in the study of uric acid metabolism, and we now know that, in a general way at least, the amount of uric acid formed is a measure of the metabolism of nucleoproteids, and since these are found in our daily food we have two sources of uric acid: the exogenous that comes from the nucleoproteids of the food, and the endogenous that result from the metabolism of the nucleoproteids of the body itself. Quite naturally the daily output from the first source is quite variable, depending upon the kind and amount of food, while that from the second source is fairly constant in the individual, but quite variable as between individuals. However, all the uric acid formed in the body is not eliminated as such and there is some doubt as to the form in which the lost part is eliminated. It may possibly be converted into urea, allantoin, glycocoll or oxalic acid, or into two or more of these. In this connection the recent suggestion of the etiological significance of glycocoll in gout is interesting.

Professor Morgan is not ready to satisfactorily explain why "the power to regenerate lost members" is so feeble in man and other high vertebrates compared with the ready regeneration observed in some of the lower animals; however, he thinks that it is due to the fact that the different tissues regenerate at different rates and consequently there is lack of cooperation and harmony in development. The skin regenerates; the muscle does so, though less well; nerves and blood-vessels regenerate, and the bones have a not inconsiderable power to mend. Hence, the failure to develop a new limb does not appear to be due to the failure of the individual elements to regenerate, but to their failure to regenerate concurrently.

Professor Minot offers an interesting scientific explanation of "the nature and cause of old age." He thinks that senescence is due to a relative increase of the protoplasmic to that of the nuclear content of the cell. "Growing old, in other words, consists primarily in an increase in the proportion of protoplasm. We thus have a cytological mark by which old age can be distinguished, and we are able to connect senescence with visible changes in cells: we are able to say there is a histological basis or cause of old age." He shows that the animal grows old most rapidly during intrauterine life and that after birth the rate of growing old decreases. However, what is ordinarily denominated as old age is, from the intellectual side at least, the reaching of a point where the accumulated losses result in comparative mental fixity. Changes in the nervous system diminish its adaptability and we are not able without ever-increasing difficulty to turn to new forms of mental activity. We may continue to do well the kind of thing which we have learned to do, but if we try to overstep the limits of our acquired expertness we find that we are held up by a sense of permanent mental fatigue.

Professor Webster discusses quite exhaustively "modern views regarding placentation" and the text is accompanied by explanatory figures.

Professor Smith discourses in a broad, scientific way upon "the parasitism of the tubercle bacillus and its bearing on infection and immunity." The thesis held is that the tendency of such a chronic disease as tuberculosis is towards a balanced parasitism with reduced mortality but probably with increased morbidity. The effect of immunization of man, if it ever can be attained, on the destiny of the tubercle bacillus is an open question. Trying to stamp out tuberculosis by increasing man's resistance should be secondary to efforts to destroy the bacillus. The former is a compromise and a recognition that the bacillus is here to stay, and if it be permitted to continue among us, as we increase our resistance, it will probably grow in its virulence. Increased resistance may save the individual, but to save the race we should destroy all tubercle bacilli, and knowing how they find access to the human body and how they leave it, this does not seem an impossible task. Cer-

tainly it is one in which every intelligent man and woman should take an active part.

Professor Howell in the last lecture treats of "the cause of the heart beat." After dwelling for some time upon the arguments for the two theories, the myogenic and the neurogenic, he concludes that the weight of evidence is in favor of the former. Then, he discusses the deeper and more fundamental question of the initial cause, whether acting through the nerve or directly on or in the muscle. He calls attention to the influence of the inorganic salts, especially those of calcium, first observed by Ringer and concludes as follows:

> The well-nourished heart contains a large supply of energy-yielding material, which is in stable form, so that it neither dissociates spontaneously, nor can be made to do so by the action of external stimuli. It is possible that this stable, non-dissociable form consists of a compound between it and the potassium or the potassium salts and that herein lies the functional importance of the large amount of potassium contained in the tissue. This compound reacts with the calcium and sodium salts, and a portion of the potassium is replaced and a compound is formed which is unstable. At the end of the diastolic period this compound reaches a condition of instability such that it dissociates spontaneously, giving rise to the chain of events that culminates in the normal systole. This dissociation may be made to take place prematurely by an external stimulus, such as a mechanical or electrical shock applied to the heart at any time after diastole has begun.

The first course of lectures before the Harvey Society forms a valuable contribution to medical science and the members are to be congratulated on their wise selection of lecturers. VICTOR C. VAUGHAN

Deutsches Bäderbuch. Prepared with cooperation of the German Imperial Health Office. Quarto. Pp. civ + 536 and 13 colored plates. Leipzig, Weber. 1907. Price 15 M.

It is believed that this book will prove of interest to scientists engaged in various lines of work. It is the joint work of a number of distinguished chemists, clinicians, pharmacologists, geologists, meteorologists, etc., and is designed to give a complete, impartial account of the leading German baths and mineral springs from various points of view. The greater part of the volume is occupied by detailed chemical analyses, but with these is given much valuable information concerning the geology, climatology, etc., of the individual springs. Especially noteworthy and of very general interest are the introductory chapters on geology, chemistry, climatology, pharmacology, and general therapeutic uses of baths and mineral springs; there is also a short chapter on the radioactivity of mineral springs.

An examination of this volume will well repay any one whose work is connected in any way with this subject. The economic importance of this subject is indicated by the fact that nearly $100,000,000 are spent annually at the German baths and springs.

R. H.

Further Researches on North American Acridiidæ. PROFESSOR A. P. MORSE. Publication No. 68 of the Carnegie Institution, Washington, 1907.

The second report on North American Acridiidæ by Professor A. P. Morse is an interesting pamphlet of 54 pages, a frontispiece and nine plates. This, like the first report, is a well-prepared paper and treats of the acridiian fauna of the central southern states. General notes on the regions traversed and the life zones of localities visited are followed by a discussion of locust coloration and variation. Habits and habitats are discussed in connection with various local lists and then follows a detailed list of localities at which collecting was done and an annotated list of the 124 species of Acridiidæ taken. The plates are from photographs taken by the author and represent typical habitats of some of the species taken. A. N. CAUDELL

U. S. NATIONAL MUSEUM

Catalogue of Type and Figures, Specimens of Fossils, Minerals, Rocks and Ores. GEORGE P. MERRILL. U. S. Nat. Mus., Bull. 53, Part II., Washington, 1907, pp. 370.

The second part of the "Catalogue of Type and Figured Specimens" in the Department of Geology of the United States National Museum consists of three sections in continuation of the Catalogue, Part I., dealing with the fossil invertebrates; section II. treats of the fossil vertebrates, section III. of fossil plants and section IV. of minerals, rocks and ores.

All working paleontologists will welcome this volume as one which will greatly facilitate their work, and botanists in general will find section III. of much value. This part, constituting the greater portion of the volume, has been compiled by Dr. A. C. Peale, with the cooperation of Dr. F. H. Knowlton and Mr. David White. The specimens are described under their catalogue numbers, and the description in each case includes the name, authority, locality and geological horizon, together with citation of publication giving the first description and figure.

The entire catalogue closes with January 1, 1905, and includes all changes to that date. It may, therefore, be regarded as substantially up to date. D. P. Penhallow

N. H. Abel. Sa vie et son œuvre. Par Ch. Lucas de Pesloüan. Paris, Gauthier-Villars. 1906. Pp. xiii + 168.

The writing of popular or semi-popular biography of scientific men, like the sketch of Faraday by Tyndall, or of Clerk Maxwell by Glazebrook, is highly commendable. A popular biography of a mathematician like Abel, who, though he died at the age of twenty-seven, made, according to Hermite and Sylvester, several discoveries of such originality as probably to keep mathematicians busy for one hundred and fifty years in the fuller unfolding of his ideas, can not be without interest. Mr. de Pesloüan, the author of the present sketch, has done his work fairly well.

In the case of a few technical matters he did not exercise sufficient care in the reading of the proofs, but with that exception the work is creditable. This booklet does not pretend to offer new facts on the life of Abel, nor is it intended to supplant the larger biography, written in 1885 by C. A. Bjerknes. De Pesloüan exhibits great admiration and much sympathy for the subject of his sketch. The title-page is preceded by a good picture of Abel. Florian Cajori

Discussion and Correspondence

An Adams Journal Conducted by the American Experiment Stations

The interesting communication of Dr. H. J. Webber, in Science of October 18, touching the publication of research to be made under the Adams Act, is quite timely and, as to every point discussed, most commendable. Formerly connected with one of the stations and yet deeply interested in the work, a teacher in an agricultural college, and publisher of the *Journal of Mycology*—on one or all these grounds may I take the liberty of offering some suggestions.

The necessity of such a publication—distinct from the popular bulletins—could not for a moment be questioned. I believe the plan essentially as proposed could be carried out. A committee of three for each subject or division, elected for three years (election of one member each year) but eligible for re-election, to pass on the completed work submitted by the directors of the stations, would doubtless be acceptable to all. Here, of course, if anywhere, there would be friction—*censorship!* some one would be sure to say!—yet the arrangement would probably and almost universally encourage, not discourage, investigators.

The classification is on a generous scale, and could be taken up, one division after the other as occasion demands. But I would suggest that the name *Adams Journal* (conducted by the American experiment stations) be used; that series be established, as "Agronomy Series, No. 1" (No. 2 *et seq.*); "Horticulture Series, No. 1" (No. 2 *et seq.*); "Plant Pathology Series, No. 1" (No. 2 *et seq.*), etc. Each number should contain only an investigator's work on one subject; a full index should be appended to each number, and the numbers should be sold separately (at or below cost). The pagination should be continuous