in session at the University of Illinois on March 23 and 24. Those in attendance and the papers that they read at this conference were: Dean Davis, of Nebraska, "Incentives to Scholarships"; Dean Jones, of Missouri, "Systems of Grading"; Dean Hoffman, of Indiana, "What can be done for the Freshmen"; Dean Townsend, of Illinois, "Faculty Advisers"; Dean Reed, of Michigan, "What should be done with Large Classes"; Dean Downey, of Minnesota, "Group Requirements for the A.B. Degree"; Dean Greene, of Illinois, "The Future of the A.B. Degree"; Dean Templin, of Kansas, "The College and the Professional Schools"; Dean Birge, of Wisconsin, "The Building of a Faculty." Assistant Deans Rawles, of Indiana and Meyer, of Illinois, were also in attendance.

UNIVERSITY AND EDUCATIONAL NEWS

Haverford College has completed the collection of a fund for pensions amounting to about $150,000.

Sir Francis Galton has made a further donation of £500 for the maintenance of the Francis Galton Laboratory for the Study of National Eugenics in the University of London during the year 1911–12.

Vivian A. C. Henmon, A.B. (Bethany), Ph.D. (Columbia), now professor in the University of Colorado and dean, has been elected associate professor of educational psychology in the University of Wisconsin.

R. M. Ogden, A.B. (Cornell), Ph.D. (Würzburg), has been promoted to a professorship of philosophy and psychology in the University of Tennessee.

Dr. A. G. G. Richardson has been elected professor of veterinary medicine of the Georgia State College of Agriculture. Dr. Richardson was in the United States Bureau of Animal Industry for a number of years.

Dr. A. O. Shaklee, assistant in physiology and pharmacology of the Rockefeller Institute, has accepted the position of associate professor of pharmacology in the Philippine Medical School, Manila. Mr. Elbert Clark, associate in anatomy in the University of Chicago and Rush Medical College, has been appointed assistant professor of anatomy at Manila.

Professor William Moore, of Cornell University, has received an appointment to a chair in the faculty of the British Agricultural College in the Transvaal.

Sir Alfred Keogh, K.C.B., who has been elected rector of the Imperial College of Science and Technology, London, retired last year from the post of director-general of the Army Medical Service.

DISCUSSION AND CORRESPONDENCE

FRACASTORIUS, ATHANASIUS KIRCHER AND THE GERM THEORY OF DISEASE

In Science for February 18, Dr. William A. Riley gives a clear and interesting account of the relation of Athanasius Kircher to the germ theory of disease. In connection with this paper it may be of moment to note that, as Osler has pointed out,[1] the true author of the germ theory is neither Kircher nor Hieronymus Mercurialis, but Fracastorius, a Veronese physician of the fifteenth century, whose chief title to fame has been hitherto that "most popular" of medical poems, if least savory in theme, "Syphilis, sive morbus gallicus" (1530). Geronimo Fracastorio, born in 1484, studied medicine at Padua, led a tranquil, easy life as physician and poet in the countryside near the Lago di Garda, and died in 1553. His work "De contagione et contagiosis morbis et curatione," published at Venice in 1546, contains the first scientific statement of the true nature of contagion, of infection, of disease germs and the modes of transmission of infectious diseases. The latter he divides into (1) diseases infecting by immediate contact (true contagions), (2) diseases infecting through intermediate agents like fomites, (3) diseases infecting at a distance or through the air, of which class he instances phthisis, the pestilential fevers, a certain kind of ophthalmia (conjunctivitis),

[1] *Proceedings of the Charaka Club*, New York, 1906, II., 8–11.

etc. In all this Fracastorius shows himself to be a highly original thinker, far in advance of the pathological knowledge of his time, which was mainly reducible to the old Hippocratic doctrine of disease as a corruption of the humors of the body. But it is in his remarkable account of the true nature of disease germs, or *seminaria contagionum*, as he calls them, that we find him towering above his contemporaries. He seems, by some remarkable power of divination or clairvoyance, to have seen morbid processes in terms of bacteriology more than a hundred years before Kircher, Leeuwenhoek and the other men who worked with magnifying glass or microscope. These germs he describes as particles too small to be apprehended by our senses (*particulæ illæ insensibiles*), but which, in appropriate media, are capable of reproduction and thus of infecting the surrounding tissues (*prima enim seminaria, quæ adhæserunt e vicinis humoribus ad quos habent analogiam consimilia sibi alia generant et propagant, et hæc alia donec tota humorum massa et moles afficiuntur*). These pathogenic units Fracastorius clearly surmises to be of the nature of colloidal systems, for if they were not viscous or glutinous by nature, he holds, they could not be transmitted by fomites (*cujus signum est, quod quæcunque per fomitem afficiunt omnia lenta glutinosaque conspiciuntur*); while germs transmitting disease at a distance must be able to live in the air a certain length of time (*non solum in fomite sed in aere per certum tempus servari*), and this condition is only possible when the germs are gelatinous or colloidal systems; for only hard, inert, discrete particles could endure longer (*sed certe, quæ lenta sunt et glutinosa, quamquam parvissima sint, possunt quidem si non omnino tantum quantum dura, vivere, at paulo minus possunt*). These colloidal particles have the power of resisting forces of small magnitude, but can not resist such agencies as extremes of heat or cold, which reduce them to phases of dissipated energy (*non solum dura, sed et lenta sese defendunt ab alterationibus multis, si mediocres sint, magnas autem non ferunt: propter quod et ab igne absumuntur seminaria omnium contagionum, et ab aqua etiam frigidissima franguntur*). Finally Fracastorius conceives that the germs become pathogenic through the action of animal heat (*et ipsa actu fiunt a calore animalis*), and that in order to produce disease it is not necessary for them to undergo dissolution, but only metabolic change (*quantum quidem sufficit ad putrefactionem faciendam, non necesse esse corrumpi particulas ipsas, sed alterari solum . . . nihil tamen prohibet et corrumpi etiam, sed non necesse est, quatenus attinet ad faciendam putrefactionem*). Thus Fracastorius seems to have had a clear notion (or prevision) of the causation of disease by microorganisms, and he appears to have seen these organisms as made up of those gelatinous or "dispersed" systems which modern physical chemists call colloidal states of substance. The agreement of his imaginative hypothesis with the physicochemical view-point is little short of wonderful, when we consider that he had no microscope nor other instrument of precision save his own mind.

In referring to the organisms seen by Kircher, Dr. Riley asserts that he must have seen "the larger species of bacteria" long before Leeuwenhoek's discovery. But neither Kircher nor Leeuwenhoek could have seen bacteria of any kind with the lenses at their command, although the latter undoubtedly saw various animalculæ, diatoms, blood corpuscles and the finer anatomy of the tissues. According to Müller and Prausnitz,[2] Kircher saw in the blood of plague patients "a countless brood of worms not perceptible to the naked eye," and he was not staggered by the fact that these "worms" could also be found in healthy blood. The explanation is simple. His glass or microscope was only 32-power at best, and the worms he thought he saw were (as in Malpighi's case) simply rouleaux of red blood corpuscles.

To sum up, over one hundred years before Kircher, Fracastorius gave the first definite statement of the true nature of infection by disease germs; Kircher then boldly restated

[2] "Handbuch der Geschichte der Medizin," Jena, 1905, II., 805.

the hypothesis in the light of what he saw through the microscope, but the germ theory had to wait for laboratory verification at the hands of Pasteur. In connection with the theory of the transmission of disease by insects it is of interest to note that Sir Henry A. Blake, governor of Ceylon, has pointed out[3] that the mosquito theory of the origin of malaria is as ancient as the Susruta, a Sanskrit medical classic at least 1,400 years old. Quite an anthology might be compiled of references from secular literature in which swamps, mosquitoes and malaria were vaguely associated as if in causal connection before King enunciated the theory in 1882. But no one ever thought of mosquitoes in relation to yellow fever before the time of Finlay and Walter Reed.

Fielding H. Garrison
Army Medical Museum

The Lower Tertiaries of Louisiana

To the Editor of Science: In preparing manuscript for publication on the lower Tertiaries of Louisiana it has seemed desirable to have a formational name for that portion of the Eocene usually styled in our former publications "Lower Claiborne." In accordance with the wishes of the committee on nomenclature the geographic name *St. Maurice* is here proposed for these well-known Mississippi embayment marine beds.

G. D. Harris

The Length of Service Pensions of the Carnegie Foundation

The articles by Professors Cattell and Jastrow following that of Professor Lovejoy and the *Nation* editorial, have put in such strong light the disadvantages and the injustice of the recent ruling by the Carnegie Retiring Board, that it might seem little remains to be said. There can be little doubt that these articles express the sentiment of a great majority among those who have been looking forward to a service retiring allowance upon the Carnegie Foundation. Some professors who have considered the system a great aid in securing stronger American universities, have now lost all interest in it. If a professor who entered early upon teaching must continue for forty years as a professor in order to acquire any benefits from the foundation, not much inducement is offered him.

There are, as it seems to me, two considerations not specially emphasized in the articles cited, which might well be taken up. In his report recently published, the president of the foundation lays stress upon the fact that the professors thus far retired upon the foundation because of age, all laid down their work with regret, and in some cases felt hurt that they had been induced to do so. No one familiar with university men will for a moment doubt that these statements represent the facts as regards an even larger body of the older professors. Among the middle-aged and young men of universities, and it might be added the student body, the opinion is probably as general that professors generally remain at their posts after their best work of teaching has passed. This opinion of the younger men does not spring altogether from a selfish desire to fill the positions of their seniors, since their conclusion expresses a law of human nature which is exemplified in every walk of life, but perhaps most strikingly upon the concert stage. When nowadays a young man states openly that he will retire from his post voluntarily before his powers have been impaired by age, he is perhaps cynically requested to set the statement down in writing; for, once admitted into the group of the older men, it is notorious that he acquires their point of view as naturally as liberals become transformed into conservatives after their admission to the British House of Lords.

The question of the relative teaching efficiency of professors at the different ages between forty and seventy-five years, is one to be decided by results, and it would be of special interest if the statistics recently gathered by the Carnegie Foundation from the so-called accepted institutions were compared and published. If the average age of the

[3] *Jour. Ceylon Branch Brit. Med. Assoc.*, Colombo, 1905, II., 9.