OPPORTUNITIES FOR BIOLOGICAL STUDY IN PARIS AND THE REQUIREMENTS FOR THE NEW DOCTORATE.

It is not probable that many Americans, going to France for study in science, will think of locating elsewhere than in Paris. For while there are fourteen French universities outside of Paris, most of them well equipped for scientific work and holding the names of eminent men in their faculties, yet Paris with her numerous scientific institutions, with her unsurpassed facilities for research, with her array of famous biologists, shines with a refulgence which draws the eyes from the rest of France. But the scientific life of Paris is not and ought not to be the only attraction for the student seeking foreign study. The stores of art, the libraries, the historical associations, the political heart of the French Republic are all attractive to the enquiring American, and should each leave its impress upon him.

A very brief description of the institutions in Paris offering opportunites for biological study will indicate to some degree the extent of the field, which is as free to foreigners as to native Frenchmen. These institutions are five in number: the University, the College of France, the Museum of Natural History, the Pasteur Institute, the School for Higher Studies. All of these with the exception of the Pasteur Institute are to a greater or less extent controlled and supported by the Goverment.

I. THE UNIVERSITY OF PARIS.

The school of letters and of pure science of the University is denominated the Sorbonne. The buildings of the Sorbonne have been reconstructed and greatly extended during the past decade, so that the new Sorbonne is now composed of an immense collection of beautiful auditoriums and laboratories, all in a compact but well-lighted mass, located in the heart of the city, in the midst of the famous Latin Quarter. The laboratories are well appointed, displaying the usual equipment of modern institutions of a like nature. Students here, as in other countries, receive the attention of the director of the laboratory, and the aid of a corps of subordinates. In botany, the professors are Bonnier and Daguillon; in zoology, Lacaze-Duthiers, Delage, and Perrier; in physiology, Dastre.

Besides the Sorbonne, there are two institutes belonging to the University, primarily professional, but doing a considerable amount of purely scientific work. These are the Medical School and the Pharmacy School. The former has its buildings five minutes' walk to the north of the Sorbonne. Among the famous names in its faculty may be mentioned that of the physiologist Langlois.

The School of Pharmacy is nearly a mile to the south of the Sorbonne, occupies a beautiful site on the Avenue de l'Observatoire, and has fine buildings and a flourishing botanic garden of about one acre in extent in the court of the quadrangle. The school is attended by over 1700 students, this number being nearly equal to the number of students in letters at the Sorbonne, and also equal to the number in pure science. The professor of botany at the School of Pharmacy is Guignard, well known to American students for his contributions to vegetable cytology.

Should the student desire to pursue his study of biology during the summer, he may follow Bonnier to Fontainebleau or resort under other professors to one of the marine stations.

II. THE COLLEGE OF FRANCE.

In a square adjoining the Sorbonne is the Collège de France, with an organization independent of the University, yet working in harmony with it. This institution has its own lecture rooms, laboratories, and

faculties, and its professors are equally famous with those of the University. Botany is not included in the curriculum of the College, but in zoology there are Balbiani and Ranvier, and in experimental psychology, Ribot.

III. THE MUSEUM OF NATURAL HISTORY.

To the biologist, of perhaps greater interest than the Sorbonne, or the Collège de France, is the so-called Museum of Natural History. It is probably unnecessary to say that this noted institution is a great inclosure of approximately seventy acres, containing auditoriums, laboratories, museums, a zoological garden, and a botanic garden. The enclosure is more commonly known as the Jardin des Plantes. It is located on the south bank of the Seine, only ten minutes' walk from Notre-Dame. This spot is consecrated by the memories of such great men as Buffon, Jussieu, Lamarck, De Candolle, Cuvier and Milne-Edwards père. Its laboratories are to-day well directed by Van Tieghem, Bureau, Bornet, Deherain, and Maquenne in botany, by Milne-Edwards fils, Vaillant, Bouvier, and Perrier in zoology, and by Gréhant in general physiology. Besides the three subjects just named, the Jardin does work also in anthropology, geology and mineralogy. The roll of the scientific staff bears twenty names.

The opportunities for biological study here are unsurpassed. It is true that both the zoological and the botanical gardens come to have a shabby aspect in a dry summer, and suffer for lack of water, and the plants in the glass-houses are so crowded that they are unhealthy from insufficient light. But the living plants and animals are so numerous and accessible, the museums are so extensive, the laboratories are so adequate, and the library so full, that an investigator may be assured of all that equipment can supply. The museums of zoology and of comparative anatomy are probably the best in existence. The mounting and the grouping of the objects are elegant and effective.

IV. THE PASTEUR INSTITUTE.

The Institut Pasteur is located a mile or more to the west of the Sorbonne. In the present Institute, Pasteur did not live long to enjoy his enlarged quarters. His famous discoveries were made in a little building still standing in Rue d'Ulm near the Panthéon. In 1888 the present laboratory was opened, but Pasteur died in 1895. His tomb rests in a crypt beneath the building. The present Institute has already proved itself too small, and there is now nearing completion across the street an annex, larger than the present laboratory, and costing $400,000. This Institute is preëminently for investigation in bacteriology, fermentation, and biological chemistry, and for the preparation of serum for the prevention of disease. One will find in this great Institute excellent provision for research, yet not great complexity of means. Here work Duclaux, Roux, Chamberland, and Metchnikoff, names well known to biologists.

V. THE SCHOOL FOR HIGHER STUDIES.

The École Pratique des Hautes-Études is *sui generis*. This institution has no buildings of its own, but designates noted men anywhere in Paris, and in some marine laboratories, as members of its faculty. All its work is that of the seminar and the laboratory. Some of its professors are men with private laboratories, while some receive students in their own homes. The work of this institution is gratuitous to the student, and no degrees are conferred. The organization attempts to make available for research all the public and private resources of the great city. For its work in biology, it designates as its professors, the professors in the University, in the

Collège de France, in the Museum of Natural History, and in the Pasteur Institute. Admission to work is a matter of agreement between professor and pupil, the latter having to demonstrate his competency to the professor.

The foregoing brief account may suffice to show that the scientific institutions of Paris in equipment of laboratories and in facilities for research are the equal of those of any nation, and what is still more important than equipment, that the foremost scientists of France are professors in these institutions.*

ADMISSION TO RESEARCH. THE DOCTORATE OF THE UNIVERSITY.

A student is admitted to lectures in the University with no more requirement than the presentation of an admission card which is obtained gratuitously on application. Savants, French and foreign, may be admitted free to work in laboratories, on the recommendation of the dean or director or professors.

The ordinary investigator or student who is not a candidate for a degree, must present his certificates from the institutions where he has studied; and if these are acceptable, he must then matriculate with an annual fee of 20 francs. Besides this, he must pay an annual library fee of 20 francs, and a quarterly fee of 22.50 francs for each biological laboratory in which he works.

The laboratory investigator, not a candidate for a degree, will therefore pay annually in fees to the University 26 dollars.

In 1898, the French Government gave the French universities permission to establish a new degree—the university doctorate. This degree corresponds with the German and American doctorate. It differs from the usual French doctorate in that the latter requires longer to obtain and confers various privileges. The new university doctorate confers no privileges.

To enter upon a candidacy for a university doctorate in the University of Paris, one must present certificates showing his attainments. Graduates of good American colleges will generally find their credentials sufficient. The petitioner having been accepted, inscribes his name in the register, pays an annual library fee of 20 francs, a quarterly inscription fee of 20 francs, and a quarterly fee of 22.50 francs, for each laboratory in which he works.

If the foreigner enters on a scholastic level with the graduate *lycée*, *i. e.*, on a level with the French bachelor, he must complete two *superior studies* and a thesis. The superior studies correspond to minors, and may be selected from seventeen departments of learning. The minimum time for these two minors and the thesis is two years. But the candidate who can present and pass examinations in equivalents to these two superior studies may have the time of residence required for the doctorate reduced to one year. The candidate must present a thesis embodying original research, must defend this thesis before an assembly of professors, and must answer questions on other subjects proposed by the examiners. The examination fee in pure science is $60; in medicine, $135; in pharmacy, $186. The candidate must print his thesis, and furnish the University with 150 copies. The total fees, besides the cost of printing the thesis, will be therefore about $100 if the student

* A considerable amount of information concerning the subject discussed in this paper may be obtained from two pamphlets recently issued. The first is the *Guide illustré de l'étudiant etranger à Paris*, to be obtained from any bookdealer of Paris for 1 franc, 50 cent. The second is *The Universities of France*, published by the Franco-American Committee, to be obtained from Professor Michel Bréal, 70 Rue d'Assas, Paris. Professor Bréal is also prepared to answer any inquiries relating to study in France.

Some of the information contained in the last named pamphlet can be found in the Report of the U. S. Commissioner of Education for 1897-98, Vol. I., p. 749.

takes one year and about $150 if he takes two years in preparation for the doctorate. In comparison with this, one pays in science about $70 for one year and $120 for two years at the University of Leipzig.

Especial mention should be made of the fact that a student may pursue his work for the doctorate, not only at the Sorbonne, but instead at the School of Pharmacy, at the Jardin des Plantes, at the Collège de France, at the Pasteur Institute, or under the auspices of the École pratique des Hautes Études. That is to say, all these great and independent institutions are affiliated with the University, so that the University gives credit for their work. Thus a man who wishes to make his major with Bonnier at the Sorbonne, or with Van Tieghem at the Jardin des Plantes, or with Guignard at the Ecole de Pharmacie, or with Duclaux at the Institut Pasteur will find these various routes to the doctorate equally open. In all of these institutions the lectures are wholly free and gratuitous. In each of them, except in the Institut Pasteur, the fees of any one laboratory for a year are less than $20 dollars. In the Institut Pasteur the fee is $10 per month.

One is safe in saying that in no other city in the world can be found such a brilliant array of professors and laboratories. Truly France has shown a spirit of liberality toward educational matters unsurpassed by any country.

When, however, one studies the register of the University of Paris, one is struck with amazement at the smallness of the number of names of foreign students, especially with the smallness of the number of Anglo-Saxons. In the year 1897–98, the total registration of the University was over 14,000. The total number of Americans present was 44. Of these 44, 28 were in the college of letters, and hence we may assume that the most of them were in the University for the study of the French language. There were only 6 Americans studying pure science, 6 studying medicine, and one studying pharmacy.

The University of Paris contains, it is safe to say, nearly all the Americans who are studying in the universities of France. But compare the number of Americans who are studying in German universities and technical schools. The report of the U. S. Commissioner of Education for 1897–98 shows a registered attendance of 514, and estimates the total number as being over 1000. The registered Americans in Austrian institutions numbered at that time 106; and in Swiss institutions 65. In the year 1895, the University of Berlin had 4018 matriculates, of whom 159 were Americans; Leipzig 2798, of whom 53 were Americans; and Göttingen 878, of whom 30 were Americans. In the same year, Paris, with an enrollment of 10,951, had only 32 Americans.

Moreover the number of Americans in the University of Paris seems not to be on the increase, though the total number of students there is constantly rising. Thus in 1891, there were 45 Americans there; in 1896, 38; in 1897, 51; and in 1898, a recession to 44.

Naturally one pauses to enquire why Americans are so loth to choose Paris as their place of study. It cannot be due to the expense of living; for Paris is scarcely more expensive than Berlin or Munich. It cannot be due to the university fees; for, though for laboratory work and for the diploma, the expense may be somewhat greater in Paris, the expenses for lectures in Paris are nothing, and hence for the student in studies other than natural science, the university fees are lower at Paris than in Germany. The discrimination against Paris cannot for the most part be due to the previously existing requirements for the doctorate; for not half the Americans who go abroad for study seek the doctorate.

It is probable that the most potent influence turning the tide toward Germany rather than toward France, at least for the sciences, is to be found in the attitude of the American professors themselves, in the advice they give their students. This, however, cannot be held as an ultimate explanation.* Why do these men in American universities advise their students to go to Germany? Why are the scientific libraries in this country so much better stocked with German literature than with French literature? I cannot help the feeling, though I have no statistics, that on the whole Germany has, within the past forty years, produced more scientific men and more scientific literature than has France. It is doubtless true that we neglect unduly French scientific literature in this country. But it is probably also true that to-day, as forty years ago, we justly look to Germany as the seat of the leading spirits in the progress of biological science.

As a second reason cited by some to account for the lack of American interest in French universities, is the apparent distance placed by the French professor between himself and his students.

Finally we have the possible barrier of the difference in race, with all that this implies. Science is supposed to know no racial boundaries; but even scientific men are influenced by the hereditary and acquired ideas and ideals of their race.

Frederick C. Newcombe.

Ann Arbor, April 14, 1900.

*As bearing on this topic, see 'Notes on the History of Foreign Influence upon Education in the United States,' by Hinsdale. Report U. S. Commissioner of Education, 1897-98. Vol. I., p. 591.

THE SENSES OF PRIMITIVE MAN.†

There is a general belief that savages are able to see things that are invisible to the European, and the question is how far this alleged superiority is due to power of observation or to actual acuteness of vision. For the elucidation of this and many other problems in experimental psychology exact investigation is necessary on savages under natural conditions. This Dr. Rivers was enabled to do during the recent expedition to Torres Straits and New Guinea, which was organized by Dr. A. C. Haddon. Although the Torres Straits islanders are not now savages, they may fairly be described as primitive since a generation ago they were naked savages. The greatest amount of work was done on Murray Island, and the people readily allowed themselves to be experimented upon. The conditions were, as a whole, very favorable, the great majority of the natives investigated did their best as is evidenced by the smallness of the mean variation in most of the quantitative investigations. The Murray islanders are dolichocephalic Papuans with a very dark skin and the typical black frizzly hair. They also have the characteristic excitable Papuan temperament.

The visual acuity of these people was found to be superior to that of normal Europeans, though not in any very marked degree. The visual powers of savages, which have excited the admiration of travellers, may be held to depend on the faculty of observation; starting with somewhat superior acuteness of vision by long attention to minute details coupled with familiarity with their surroundings, they become able to recognize things in a manner that at first sight seems quite wonderful. But such exclusive attention as they have learned to pay to objects of sense appears a distinct hinderance to the development of the higher faculties. This view might at first seem paradoxical, since sense impressions are the foundation of the intellectual processes; but, on the other hand, the intellectual superstructure must suffer if too much

†Abstract of three lectures delivered by Dr. W. H. R. Rivers, before the Royal Institution of Great Britain, London, on Jan. 18, 25, and Feb. 1.