perature in roughly proportional amounts, and permits us, without undue assumptions, to explain such remarkable differences of gradient. There is much work to be done in this direction, for well-known cases exist where exceptional gradients in deep borings have been encountered—exceptional both as regards excess and deficiency.

JOHN JOLY

(To be continued)

ABSTRACTS FROM THE ANNUAL REPORT OF THE PRESIDENT OF CORNELL UNIVERSITY

THE number of students enrolled in the university for the year ending September, 1908, was 4,465, of whom 3,734 were regularly enrolled students during the academic year from September to June, and the rest attendants at the summer session and the winter school in agriculture. This is an increase of 240 over the enrollment for the preceding year and an increase of more than 1,000 over the enrollment of four years ago, when the figures were 3,423.

A little more than half (2,025) of these 3,734 regular students came from New York State. From Pennsylvania came 322; New Jersey, 190; Ohio, 155; Illinois, 108, and Massachusetts, 101, while 690 came from forty-five other states and territories of the United States (including Porto Rico, Hawaii and the Philippine Islands), and 143 from twenty-eight different foreign countries (including China, 28; Cuba, 14; Argentine Republic, 14; Canada, 12; India, 11; Japan, 11; Mexico, 7; Brazil, 7; Peru, 6; England, 4; Australia, 3; Switzerland, 3, etc.).

The total number of students who have been enrolled in the university since it opened in 1868 is approximately 26,000 and the number of degrees conferred during these forty years is 10,475, more than three fourths of which have been conferred by President Schurman in the last sixteen years. The number of degrees granted in June, 1908, was 715, of which 649 were first degrees and 66 advanced degrees.

The number of members of the instructing staff is given as 548, and, excluding the members of the staff of the Medical College in New York City, the faculty at Ithaca is found to be made up as follows: 75 professors, 64 assistant professors, 6 lecturers, 122 instructors and 144 assistants. Twenty years ago there were 33 professors, 4 associate professors, 13 assistant professors, 41 instructors and 4 assistants.

President Schurman dwells on the necessity of higher professorial salaries for the purpose of maintaining the dignity, importance and attractiveness of the teaching profession in America. If intellect is to be well-trained in America there must be tangible evidence that the public set a fair value on highly educated men. Otherwise the best brains of the country will be lost to the teaching profession. As Burke has well said, "The degree of estimation in which any profession is held becomes the standard of the estimation in which the professors hold themselves." Hence it is scarcely an exaggeration to assert that the provision in Colonel Vilas's magnificent bequest to the University of Wisconsin for the establishment of certain professorships with salary of not less than $8,000 each will, if it becomes at once effective, mark an epoch in the development of a proper standard for the estimation of professors in the United States.

The problem of securing men of the highest character, ability and training to fill professorial vacancies is at best a difficult one. Cornell has never limited herself to the graduates of the university, to the state in which it is located, or even to America. Two years ago a gentleman in

France was appointed to a professorship; this year Leeds University, England, and Edinburgh University, Scotland, have furnished two professors.

One of the most important pieces of educational legislation, as President Schurman points out, was the establishment by the College of Arts and Sciences of an administrative board with direct supervision over the work of freshmen and sophomores in that college, and President Schurman states the underlying motive for this action in the following words:

> Among the best of our colleges and universities the great break in the course of a collegiate or liberal education comes at the end of the second year, both as regards the curriculum and the methods of instruction. This differentiation of the work, methods of instruction and educational aims of the first two years of the course in the college of arts and sciences in contrast with those of the later years of that course calls for a corresponding differentiation in the staff of instruction, which could not fail to insure greater thoroughness of instruction, greater simplicity and effectiveness of administration and closer personal and social intercourse between teachers and students.

It has been recognized at Cornell University that a scheme of education which permits students to elect their own studies, whatever its advantages, is at any rate attended with great risks, especially for the younger and inexperienced undergraduates; and for some time past a considerable portion of the work of freshmen and sophomores has been prescribed. But the care and supervision of these underclassmen has hitherto remained in the hands of the entire faculty of arts and sciences, a very large body, many of whom give no instruction whatever to freshmen and sophomores in arts. Now, however, these underclassmen will be under the direct charge of a distinct administrative board, composed of 17 members (of whom 14 are of professorial rank) selected from the teachers of freshmen and sophomore courses and this board is given full power to supervise their work and to provide means for making it effective.

In effect this board will be a separate faculty, which will have special charge of freshmen and sophomores, thus giving these underclassmen all the advantages of the small college faculty.

One of the most important problems which press for settlement upon the administrative board for freshmen and sophomores is the proper method of instructing underclassmen, and President Schurman brings forward the question in the following terms: The colleges and universities have in the past given less attention to improving the methods of teaching than the schools; and universities certainly have made the mistake of applying to freshmen the methods suitable to the graduate school or to the popular rostrum. But the freshman should not be treated either as an investigator or as a passive listener. Recitation, question and answer, and constant drill are the methods of instruction proper to the freshman class room. The object is assimilation by the ignorant pupil of knowledge with mental reaction upon it.

If the modern undergraduate is unresponsive in the class room, that is a natural result of the exclusive use of the lecture system. As one of the professors puts it in his report: "Intellectual overfeeding without intellectual exercise is bound to bring about mental torpor."

President Schurman also discusses fully the functions of graduate study. In the graduate department as in the university as a whole there is constant danger that the national tendency to worship mere magnitude may distort the vision of the faculty and especially of the trustees and friends of the university. It is important, therefore, to keep clearly in view the essential objects of a graduate school. These are

the enlargement of existing knowledge and the training of young men and women of superior ability and education in methods of independent investigation so that they too may, in time, make some contribution to the stock of human knowledge. A love of knowledge, an ardent desire to wrest something from the unknown, a conviction that science and scholarship are along with virtue the chief good of human life, would seem to be the animating motives of a life of research. Given this subjective equipment in combination with superior powers of observation, reasoning and imagination, and productive scholarship and science are assured. But these gifts are not possessed by all professors, and still less by all graduate students. And it is a grave question whether graduates of mediocre ability—minds lacking in energy, ambition and imagination—should, after they have demonstrated their quality in a probationary year, be encouraged or even permitted to continue work intended to fit men to become scholars and investigators.

The recommendations contained in President Schurman's report of last year in regard to the requirement of arts work for admission to the professional schools, have been under careful consideration by the faculties of the various colleges of the university and by the trustees, but final action has been deferred. The faculties of engineering and architecture have drawn up five-year courses as alternatives to the present four-year courses, in which they include over 70 hours in arts and sciences and at least 30 hours in literary and historical subjects. The faculty of law favor the requirement of a year and in the near future of two years of arts work for admission to the course in law. All these proposals are now under consideration. The medical college, on the other hand, has so advanced its requirements that a bachelor's degree or its equivalent is required for admission to the course in medicine. Finally, courses suitable for students in preparation for the vocations of teaching, organized philanthropy, the civil service and business management were arranged by the faculty of arts and sciences for the benefit of juniors and seniors in that college, and these groups of studies will hereafter be included in the list of electives.

President Schurman next devotes considerable space to the work and needs of the New York State Veterinary College which is by law dedicated to both instruction and research. Dr. Veranus A. Moore, the distinguished pathologist of the university, who has for years held the position of professor of pathology and bacteriology in the veterinary college, has been appointed director of that college to succeed Dr. Law, who retires on a pension provided by the Carnegie Foundation for the Advancement of Teaching. The minimum requirements which Dr. Moore sets down for next year are an increase of the annual legislative appropriation for maintenance from $30,000 to $40,000; a new annual appropriation to begin with $10,000 for research, experimental investigations and extension work; and a special appropriation of $125,000 for buildings and equipment for the clinical work of the college.

The total expense of adequately maintaining this college together with the interest on the first cost of the buildings when completed would equal but a fraction of one per cent. of the loss to our state by the death of animals from diseases that are largely preventable.

The great event of the year for the New York State College of Agriculture was the purchase by the university of additional farm lands which in combination with present holdings now gives the college of agriculture 579 acres for farming purposes, in addition to the 100 acres provided for the veterinary college for an experimental

station. Now that the university has greatly enlarged its farm, it will be possible, if state funds are available, to add to the live stock of the college, which is needed as material both for demonstration to students and research by professors. New York state produces about one ninth of the hay and forage of the United States, and the animal industries of the state are of enormous value. This is a field, therefore, to which the instruction and investigation of the college should be peculiarly directed, and the state appropriation of $25,000 for barns has solved the problem of housing facilities as the purchase by the university of land has solved the problems of pastures and fodder.

New courses have been added to the curriculum in the college of civil engineering, notably in the field of sanitary engineering, but President Schurman points out that there is still necessity for improvement in the field of hydraulics, and he adds that strong as the department of hydraulics now is it is greatly in need of development to meet the demands of the age and the prospects of the future. Water is destined from now on to play a great part in the economic development of the United States, for apart from its uses for domestic and sanitary purposes, it is hereafter to be used on a vast scale for power and for irrigation as well as for navigation. The maximum benefit to be got will be sought in the east from navigation and power and in the west from irrigation and power. For the new work to come in these vast fields there will be needed a type of engineer highly specialized in hydraulics.

In addition to the farm lands purchased for the State College of Agriculture and the State Veterinary College, President Schurman announces the acquisition of nearly 50 acres of land as an extension of the campus proper on the southeast, thus making the entire area now included in the campus 350 acres, the distance north and south being about five eighths of a mile, and the distance east and west about a mile. The university campus and farms now aggregate nearly 1,100 acres.

Coming to the finances of the university, President Schurman reports that excluding the medical college in New York City, which is maintained by separate funds, the productive funds of the university amounted on August 1, 1908, to $8,628,-370.31 as compared with $8,550,916.84 on August 1, 1907, while the inventoried value of the university grounds and buildings at the present time is given as $4,263,405.07. The most marked changes in the investments during the year were an increase in steam railroad bonds from $1,019,500 to $1,414,100 and a decrease in real estate mortgages from $1,515,538.48 to $1,324,-217.66. The income statement shows a total income from all sources of $1,356,-498.59. The income of the university at Ithaca, excluding the state colleges, ran short of the expense budget by $12,242, as a result of the purchase of campus lands.

President Schurman closes his report with a brief but cogent statement of the most pressing needs of the university, first among which he places endowments for the augmentation of the present low salaries of professors and instructors, who, as the president points out, are the vital and energizing soul of any university. Next comes the need of a system of residential halls and commons for the young men of the university, thousands of whom are now obliged to seek accommodations in private boarding and lodging houses throughout the city. After these in order of importance, though equally urgent for the conduct of the work of the university, are mentioned the need of a general assembly hall capable of accommodating the entire student body, a new and greatly enlarged armory, a new laboratory for veterinary

clinics, a new testing and experimenting laboratory in civil engineering, new machine shops in mechanical engineering, and an entirely new establishment for the department of chemistry, where the great increase in the number of students taking the work has created serious embarrassment even necessitating the exclusion from the already overcrowded laboratory of undergraduates in whose courses chemistry is a prescribed or elective subject. A new chemical laboratory entirely adequate for the purpose would, as President Schurman estimates, cost from $300,000 to $400,000.

THE DELOS ARNOLD COLLECTIONS OF NATURAL HISTORY SPECIMENS

HON. DELOS ARNOLD, of Pasadena, has presented to the department of geology of Stanford University his great collection of fossils, shells, corals, minerals, ethnologic materials, etc. This collection is a gift to the university on the condition that it be kept intact, and that it be properly cared for, labeled and exhibited. It represents the work of a lifetime by an enthusiastic student and collector, and is one of the finest private collections of fossils in the country. It is especially valuable on account of the large amount of recent and Tertiary material collected on the west coast of North America. For the use of students of the geology of California and the west coast generally, it is without an equal.

The collection was begun by Mr. Arnold in 1860 when he lived in the state of Iowa, and besides the constant work done upon it by him, it has received many acquisitions up to 1908, and it is stipulated by the donor that still further additions may be made to it in the future. Most of the minerals were collected in Colorado in the seventies and in Arizona in the eighties.

The collection of recent marine shells so necessary in the study of Tertiary geology is one of the finest in this part of the country, and it embraces a large amount of material collected on the Atlantic coast from Maine to the West Indies. It includes most of the common forms both of shells and corals and a large number of the rarer ones collected by Mr. Arnold at Jacksonville, Key West, St. Augustine and New Orleans. Of the west coast materials, it embraces collections made by Mr. Arnold and his son Dr. Ralph Arnold almost continually all the way from Puget Sound to Panama, and includes both the littoral species and the deeper water forms obtained by dredging. There are also a good many shells obtained by exchange and purchase from Europe and other parts of the world, and especially from the Mediterranean Sea, from the coasts of France, and from the Hawaiian Islands. A representative collection of fresh-water shells from various parts of the United States is also included in the materials.

The fossils, however, form the most important part of the collection. These embrace Paleozoic, Mesozoic, Tertiary and Pleistocene forms. The paleozoic materials include one of the best collections ever made from the famous crinoid-bearing Kinderhook beds (Carboniferous) at Le Grand, Iowa. Many of these fine specimens are types, and are figured in Wachsmuth and Springer's monograph on the crinoids. Of especial interest in connection with the collection of fossil crinoids is a beautiful specimen of a living crinoid from the China Sea.

The Mesozoic materials of the collection come from different parts of North America, notably from California, and the Dakotas, and from Europe.

The collection of Tertiary and Pleistocene fossils is among the best of the kind in existence, and, in many respects, it is unique. It includes a number of types and a large number of specimens that have been figured in publications upon the Tertiary and Pleistocene of the Pacific coast, notably in the papers published by Dr. Ralph Arnold, the distinguished son of the donor. Getting together this particular part of the collection has occupied Mr. Arnold's time for twenty-two years. At San Pedro, one of the richest and most important localities where collecting