years' undergraduate course in the University School of Arts and Sciences before entering the School of Engineering. By proper elections during the general course, the studies of an engineering course can be completed in two additional years. By this plan a solid educational foundation is laid for the specialized studies of the engineering student, and the best conditions are developed for his ultimate success in professional work. The plan offers two other points of advantage: First, the student comes to his professional studies in the engineering courses with a more matured mind, which is of much importance; second, students without the taste for hard engineering work, which is required for their future success in technical industries, will not often attempt a technical course after having completed a general course.

We can now usefully inquire into the specialized work that should be prescribed for the average electrical engineering student during his last two years at college. Up to this point, students in mechanical and electrical engineering courses have received virtually the same instruction. Here, we hold, with several others, their paths should diverge. The student of mechanical engineering goes into careful study of shop practice, designing and utilizing various types of machinery, and similar subjects. The electrical engineering student must receive a good working knowledge of the problems of the mechanical engineer, but he must, above all, be trained in the practical problems of electrical engineering. He, therefore, goes into a study of that which will aid most in making him truly an electrical engineer. His knowledge must all be based on mechanical laws, but he must be much more than one-tenth electrical.

Before reaching his truly professional studies, the student should gain, during his course in physics, a common-sense grasp of the elementary notions of electricity and magnetism, and of the "all-pervading law of Ohm." The latter can be properly enforced in the laboratory by placing in the student's hands ordinary electrical instruments, such as bridges, galvanometers, amperemeters, voltmeters, etc. Before beginning his specialized work, the student's knowledge of Ohm's law and its common results should have become almost instinctive.

With due regard for his preparation, it seems best to arrange the professional studies for the average electrical engineering student in four divisions, thus:—

1. Electro-magnetism and its application to practical uses, with special reference to dynamos and motors.

2. Electro-chemistry (including primary and secondary batteries) and electro-metallurgy.

3. Alternating currents and alternating current machinery, including dynamos, converters, condensers, etc.

4. The special application of the preceding divisions in electric light, power, railway, mining and other types of plants.

The last division is allotted about twice the amount of time given to each of the others.

While higher mathematics is a useful aid in each of the divisions, its limitations as an agent must be carefully set forth in the class-room and laboratory. For the purpose of educating the judgment and fully defining the limitations of theories and mathematical deductions, the laboratory is indispensable. As much as one-half of the total time spent by the student under the direct instruction of the professors of electrical engineering, should be devoted to the laboratory. This work, moreover, should as far as possible deal with commercial instruments and machinery, and actually follow the methods of testing and research used in practice. Physics, chemistry, mechanics, the steam engine, hydraulics, dynamos, electrolysis, alternating currents, and other subjects, should all be properly represented by a commercial laboratory equipment, which is made useful in every day instruction under the direction of a man who has had experience in similar commercial work. The laboratory method of educating the student is unfortunately too little developed in many of our engineering schools, but a strong movement has begun in most schools to increase it in efficiency and amount. At the University of Wisconsin, we carry the laboratory instruction as a part of the required work in every subject in which it is possible.

While the specialized course of the electrical engineering student during the last two years is largely devoted to strictly electrical engineering, he is also given proper class-room and laboratory instruction in useful allied subjects, such as the steam engine, boilers, water-wheels, laws of contracts, etc., as has been already explained.

Students who are mature and show that they can usefully specialize more severely than is done in the regular prescribed course, are permitted, by election, to devote a greater proportion of their time to either of the first three divisions already enumerated. Thus a student may have reason to know that a thorough course in electro-metallurgy will be specially useful to him. In this case, his work in the second division is increased beyond the course requirements, and his work in the first and third divisions is proportionately decreased. Other things being equal, a student who has thus arranged his course may graduate with his classmates who have followed the fixed course, as laid down. In the same way, a student of sufficient maturity, who feels assured of special advantages in the field of electric transmission of power or electric railways, may increase his work in the first or third divisions and proportionately decrease it in the second.

The student who satisfactorily completes a proper professional course at college, whether laid down in the college catalogue or carefully elected from that prescribed, is not likely to become one who "turns out results like a cornsheller, and never grows wiser or better tho' it grinds a thousand bushels of them." In order that he may have a fair opportunity of growing "wiser and better" in the practice of his art, he should be given reasonable encouragement. As Mr. Holley one time said, an understanding should obtain "among the owners, directors, and commercial managers of engineering enterprises that it is not a matter of favor, but a matter of as much interest to themselves as to any class, that young men of suitable ability, and of suitable preliminary culture, however acquired, should have an opportunity and encouragement to master the practical features of technical education in works, not as mere apprentices, but under reasonable facilities for economy of time and completeness of research."

A legend on the cover of a circular lately issued by the Engineering School of the University of Wisconsin, gives the true object of the technical college, when it says, "We do not aim to produce engineers, but to produce men with great capacity for becoming engineers." If our product is accorded the treatment advised by Mr. Holley (himself an experienced manufacturer), we feel sure the work of our school and of similar technical schools will not be useless.

Madison, Wis., May, 1892.

day in a specially rich field for study in geology and botany, and where entomology was not lacking in opportunity. Those who were compelled to return took the afternoon trains, and a few who could remain assembled and took tea at the home of the president, where they spent the evening. The meeting broke up with the conviction that the first summer gathering of the young Academy had been a pleasant and successful occasion.

—In a paper read before the Washington Chemical Society, May 12, the carbohydrates of the coffee-berry were discussed by Erwin E. Ewell. Our knowledge of the carbohydrates has been materially extended during very recent years, in consequence of which investigation in this line has been greatly stimulated. Maxwell has demonstrated the presence of an insoluble, galactose-yielding carbohydrate; Reiss has reported an insoluble carbohydrate that yields mannose by hydroysis with dilute sulphuric acid. The water-soluble carbohydrates have received less attention; indefinite statements concerning sugar, gum, and dextrin make up the existing literature of the subject. By experiments made in the laboratory of the United States Department of Agriculture, cane-sugar, accompanied by small percentages of a substance resembling dextrin and some reducing sugar, has been shown to make up the water-soluble carbohydrate material of coffee. The cane-sugar was obtained in pure and well-defined crystals. A gum was prepared from the portion insoluble in water. The latter has been shown to be a galactose and pentose-yielding substance, and is now being studied farther. At the same meeting, K. P. McElroy and W. D. Bigelow described a new method for the qualitative separation of calcium and strontium, based on the solubility of calcium chromate in dilute acetone. The chlorides of these metals are dissolved in 50 per cent acetone, and a solution of potassium chromate in 50 per cent acetone added. After standing ten minutes no strontium can be detected in the filtrate, and the precipitate is practically free from calcium salts. These investigations will be continued with the hope that the separation may prove quantitative.