SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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VOL. XVI. NEW YORK, SEPTEMBER 26, 1890. No. 399.

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IMPERIAL UNIVERSITY OF JAPAN.

INASMUCH as the Teikoku Daigaku, or Imperial University, owes its existence to the union of the late Tōkyō Daigaku and Kōbu Daigakkō, it seems fitting, that, in tracing its history, reference should be made to the origin of these two institutions.

The four departments of law, science, medicine, and literature, which composed the Tōkyō Daigaku, sprang, with the one exception of the department of medicine, from an institution of some antiquity, founded by the Tokugawa Government, and known first as the Yōgakujo, and afterwards as the Kaiseijo. This institution was, after the restoration of 1868, revived by the Imperial Government, and in January of the following year it opened its doors anew for the first time. Special attention was devoted to instruction in English and French, to which languages German was soon afterwards added. In December of the same year the college received the name of "Daigaku Nankō," or South College, because of its location at Hitotsubashi to the south of the central Daigaku, to which it was attached. The central Daigaku was situated in the old Gakumonjo at Yushima.

The Daigaku having been abolished in the year 1871, the Daigaku Nankō, known simply as the Nankō, came directly under the control of the department of education; and in the following year, when the country was mapped out into educational districts, it received the name of the "First Middle School of the First Grand Educational District."

In April of 1873 the name of the institution was changed to "Kaisei-Gakkō," and special courses of studies were instituted in law, chemistry, engineering, polytechnics, and mining. In the same year the institution was transferred to the new buildings just completed at No. 1 Nishikichō Sanchōme (Hitotsubashi Soto). In 1874 the word "Tōkyō" was prefixed to the name of the institution, and it was called the "Tōkyō Kaisei Gakkō." In April of 1876 the department of education united this institution and the Tōkyō Igakkō, or Medical College, so as to form the Tōkyō Daigaku or Tōkyō University, comprising the four departments of law, science, medicine, and literature. The departments of law, science, and literature were combined in one institution, and one president was appointed for all three. Another president had charge of the medical department.

The medical department sprang out of the Igakujo,—an institution in Shitaya originally belonging to the Tokugawa Government, and revived by the Imperial Government in 1868. In the following year this school and the hospital established for the tending of the wounded in the war of 1868 were united under the name of the "Medical School and Hospital." Soon afterwards the combined institution was attached to the Daigaku, and received the name of "Daigaku Tōkō," or East College, because of its position to the east of the central Daigaku. In 1871 it shortened its name to "Tōkō," and in 1872 assumed the name of "Igakkō," or "Medical College in the First Grand Educational District," which title was again changed to "Tōkyō Igakkō" in the year 1874.

In 1876, the new buildings at Hongō having been completed, the college was transferred thither from Shitaya. In 1877 the college became the medical department of the Tōkyō Daigaku, or Tōkyō University. In 1881 the organization of the Tōkyō Daigaku was modified by the appointment of a president who should have control not only of the four departments of law, science, medicine, and literature, but also of the preparatory school. In September of 1884 the departments of law and literature removed to the new brick building in Kaga Yashiki, Hongō.

During the year 1885 various changes occurred. The central office of the university was transferred to a building in the compound at Hongō, the preparatory school dissolved its connection with the university and became an independent institution, the department of science also removed to Hongō, and the Tōkyō Hōgakkō or Law School, under the control of the department of justice, was merged in the university. Also in the same year the department of technology was created; and courses in mechanical and civil engineering, mining, applied chemistry, naval architecture, and kindred subjects were transferred to the new department from the science department. The course of politics in the literature department was likewise transferred to the law department, henceforward to be known as the "Department of Law and Politics."

The Kōbu Daigakkō, originally known as the "Kōgakkō," was instituted in 1871 in connection with the Bureau of Engineering in the Public Works Department of the Imperial Government. The institution was in 1872 divided into the college and the preparatory school. In 1874 the preparatory school was actually opened for instruction in Yamato-Yashiki Tameike; and in 1876 an art school was created in connection with the college.

In 1877 the Bureau of Engineering was abolished, and the college was thenceforth called the "Kōbu Daigakkō," or "Imperial College of Engineering." The same year witnessed the completion of the large new buildings at Toranomon, containing a central hall, classrooms, laboratories, dormitories, and the full equipment necessary for such an institution.

In June, 1882, the term of engagement of the head professor, Mr. Henry Dyer, expired. He first arrived in Japan in June, 1873, was appointed head professor, and occupied at the same time the chair of civil engineering. When he first arrived, the college was still in its infancy; and he set himself to plan the curriculum, and formulated the various college rules and regulations. He also planned the college building. As head professor, he discharged his duties with untiring diligence for the long pe-

riod of almost ten years. For these reasons, when he was leaving Japan, he was decorated with the third order of the Rising Sun, and was also appointed honorary head professor of the engineering college.

In 1882 the art school was discontinued. In 1885 the Department of Public Works was abolished,—an event which caused the college to be transferred to the control of the department of education.

In the late Tōkyō Daigaku and Kōbu Daigakkō, the following degrees were conferred on the graduates by their respective authorities: *Hōgakushi* in the department of law, *Rigakushi* in science, *Igakushi* in medicine, *Bungakushi* in literature, and *Kogakushi* in engineering.

On the 1st of March, 1886, the Imperial Ordinance No. 3 was promulgated for the organization of the Teikoku Daigaku, or Imperial University, and the Tōkyō Daigaku and Kōbu Daigakkō were merged in the new institution. H. E. Hiromoto Watanabe, then the governor of Tōkyō, was appointed president of the university. In April, curricula of instruction for the several colleges of the university were established. Each course extends over three years, excepting the course in medicine, which extends over four years. In the same month the Tōkyō Shokkō Gakkō (School of Industrial Technology) was placed under the control of the university. In November the five principal private law schools in the city were placed under the supervision of the university. A supervising committee for these schools was formed among the professors of the College of Law, who became responsible for the courses of instruction and the method of examining the students. In December of the same year a marine zoölogical station was established at Misaki, a town situated at Cape Miura, in Sagami.

In May, 1887, the Imperial Ordinance No. 13 was promulgated, establishing regulations for learned degrees; and in June of the same year by-laws connected with these regulations were issued by the minister of state for education. In July it was decided that graduates of the colleges should be entitled to call themselves *Hōgakushi*, *Igakushi* (*Yakugakushi* in the case of graduates in the course of pharmacy), *Kōgakushi*, *Bungakushi*, and *Rigakushi* respectively, according to the course which they had pursued; and that *Jun-igakushi* of the Tōkyō Daigaku, and graduates of the Kōbu Daigakkō who had not received degrees, should be allowed to call themselves *Igakushi* and *Kōgakushi* respectively, after obtaining the sanction of the president of the university, to whom a formal application must be made, and a history given at length of their professional career after graduation.

In October the Tōkyō Shokkō Gakkō was separated from the university. In March, 1888, the powers and duties of the president of the university were formally fixed by the minister of state for education. In the same month a notification was issued by the education department, regulating the income, from tuition fees and various other sources, of all educational institutions under the direct control of the department, with the object of supplying each with a capital fund. In May the university was released from the duty of supervising the five principal private law schools in Tōkyō.

The Tōkyō Observatory was established at Iigura in the month of June. This institution, formed by the amalgamation with the University Observatory, of the Astronomical Section of the Home Department and the Astronomical Observatory of the Imperial Navy, was placed under the control of the Imperial University, which was accordingly intrusted with the duty of publishing the Astronomical Almanac.

On July 31 the College of Engineering was moved to the new brick building just completed for its use in the compound at Hongō. On the 30th of October of the same year a temporary committee for the compilation of the national history was established. This was due to the disestablishment of the temporary board for the compilation of the national history in the Naikaku, and to the subsequent intrusting of the work to the Imperial University. On the 20th of December of the same year the College of Science was removed to the new building then completed.

The Imperial University is under the control of the minister of state for education, and depends for its revenue upon annual allowances from the treasury of the Imperial Government. The tuition fees and other sources of income are allowed to accumulate year by year, so as to form a large fund. A certain portion of this fund is, however, to be paid out in some cases towards the current expenditure of the university, when the cases are of such a nature as to demand the outlay.

The whole university—viz., the offices of the university, the university library, the colleges of law, medicine, engineering, literature, and science, the First Hospital of the College of Medicine, and the dormitories of the colleges—is situated in the extensive grounds at Motofujichō, Hongō, Tōkyō, known as Kagayashiki. The Botanic Garden is located at Koishikawa, the Tōkyō Observatory belonging to the university at Iigura, and the Second Hospital of the Medical College at Shitaya, all within the city limits. The Marine Biological Station of the university is situated at Misaki, a town on the north side of the entrance to the Bay of Tōkyō.

THE CHEAPEST FORM OF LIGHT.[1]

THE object of this memoir is to show, by the study of the radiation of the fire-fly, that it is possible to produce light without heat other than that in the light itself, that this is actually effected now by nature's processes, and that these are cheaper than our industrial ones in a degree hitherto unrealized. By "cheapest" is here meant the most economical in energy, which, for our purpose, is nearly synonymous with "heat;" but, as a given amount of heat is producible by a known expenditure of fuel at a known cost, the word "cheapest" may also here be taken with little error in its ordinary economic application.

We recall that in all industrial methods of producing light there is involved an enormous waste, greatest in sources of low temperature, like the candle, lamp, or even gas illumination, where, as has already been shown, it ordinarily exceeds 99 parts in the 100; and least in sources of high temperature, like the incandescent light and electric arc, where yet it is still immense, and amounts, even under the most favorable conditions, to very much the larger part.

It has elsewhere[2] been stated, that, for a given expense, at least one hundred times the light should in theory be obtainable which we actually get by the present, most widely used methods of illumination. This, it will be observed, is given as a minimum value; and it is the object of the present research to demonstrate that not only this possible increase, but one still greater, is actually obtained now in certain natural processes, the successful imitation of which we know of nothing to prevent.

It is now universally admitted that wherever there is light there has been expenditure of heat in the production of radiation, existing in and as the luminosity itself, since both are but forms of the same energy; but this visible radiant heat which is inevitably necessary is not to be considered as waste. The waste comes from the present necessity of expending a great deal of heat in invisible forms before reaching even the slightest visible result; while each increase of the light represents not only the small amount of heat directly concerned in the making of the light itself, but a new indirect expenditure in the production of invisible calorific rays. Our eyes recognize heat mainly as it is conveyed in certain rapid ethereal vibrations associated with high temperatures, while we have no usual way of reaching these high temperatures without passing through the intermediate low ones; so that, if the vocal production of a short atmospheric vibration were subject to analogous conditions, a high note could never be produced until we had passed through the whole gamut, from discontinuous sounds below the lowest bass, up successively through every lower note of the scale till the desired alto was attained.

There are certain phenomena, long investigated yet little understood, and grouped under the general name of "phosphorescent," which form an apparent exception to this rule, especially where

[1] Abstract of an article by S. P. Langley and F. W. Very, published in the American Journal of Science for August, 1890.

[2] See results of an investigation by S. P. Langley, read before the National Academy in 1883, and given in Science for June 1, 1883, where it is shown that in the ordinary Argand burner gas-flame indefinitely *over* 99 per cent of the radiant energy is (for illumination purposes) waste.