

brilliantly, the illumination waxing and waning as the movable electrode moves in and out.

We have been able to repeat some of these results with furnaces of a non-electric character.

In a further series of experiments various modifications were introduced. The two electrodes were replaced by two co-axial tubes, which were mounted within the furnace. The central smaller tube was of brass, through which a rapid current of water was sent; this formed the "cold" electrode. The surrounding larger tube of carbon constituted the hot electrode, and received its heat from the furnace. The electrodes were insulated as before, and into the annular space between them hydrogen or nitrogen was continually passed. No potential was applied, and the currents we obtained with a steadily rising temperature and a new carbon electrode are shown in Fig. 6. It will be seen that there was first a small "positive" current (which would be produced by positive ions crossing from the hot to the cold electrode), which soon changed into a much larger

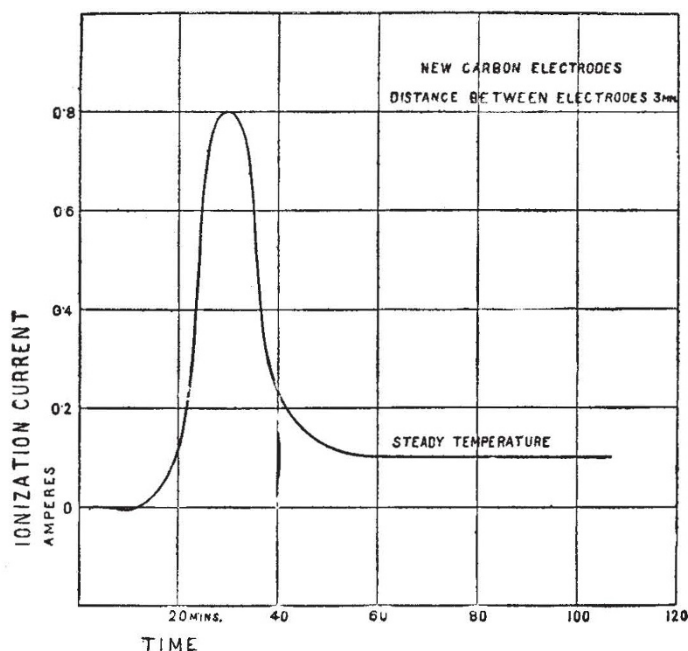


FIG. 7.—Relation between ionisation current and time for two new carbon electrodes, one hot, the other water-cooled. No potential was applied. The temperature was rising for the first fifty minutes, and was afterwards steady.

"negative" current (in the usual direction); the intensity of the latter dropped, and then showed a progressive increase with temperature. On taking down the apparatus we found that the brass tube was coated over most of its length with a thick and coherent deposit of carbon, which had evidently crossed over from the hot electrode. Towards one end the deposit was rarer and whitish—presumably silica. We associate the maximum negative current of Fig. 6 with the passage of silicon and other impurities, which are volatilised at about 2000° C. out of the carbon electrode. On a second heating neither positive rays nor a negative maximum was detected, but the ionisation current increased steadily with temperature. The transference of carbon from the hot electrode to the cold may possibly prove to be an explanation, not only of the contamination phenomena which gave rise to these experiments, but also of the comparatively large accompanying currents.

Fig. 7 illustrates the results obtained when steps

had been taken to increase the difference of temperature between the hot and cold electrodes. The carbon was new, and the negative maximum again appears. Afterwards the furnace temperature was steadied, and the ionisation current also kept steady in consequence. It will be noticed that we were now dealing with currents amounting to large fractions of an ampere, and the experiments may fairly be regarded as providing a novel means of generating electricity. Their direct bearing on the problems of the electric arc and the carbon filament lamp is obvious, and we are continuing the research with the view of elucidating the many underlying phenomena.

#### UNIVERSITY EDUCATION IN GERMANY.<sup>1</sup>

THE development of the German universities during the last hundred years has undeniably raised them in the eyes of the scientific world, but at the same time it has given rise to practical difficulties which are more and more felt, and, here and there, much deplored. German professors regard scientific research rather than teaching as their distinguishing task, or at least their teaching mostly takes the shape of initiation into the methods of research. Their lecturing has thus assumed such an abstract character that the student coming from a higher school in the proud possession of a "certificate of maturity" usually finds the transition to the new atmosphere of thought very hard, and commonly wastes more than one term merely in finding a footing. At the other end, the step from the university into a profession is the reverse of easy; the medical faculty, with its clinical hospitals and similar arrangements, is really the only one which offers a direct training for the future.

A more adequate view of the matter seems, however, to be spreading. In the meantime a year's practical training, complementary to the studies and examinations, has been added to the medical course, and a similar provision has been made for evangelical theology. In the university itself the importance of mental intercourse between the professors and their students is more widely recognised, due to the further development of the university seminaries; even those professors and "privatdozenten" who do not conduct official seminaries usually hold so-called "exercises" in addition to their lectures. The throng of students is great on all such occasions; they themselves feel strongly how much less they gain in mental culture from mere listening to lectures. Nevertheless the institution must be regarded as in some respects very incomplete.

In many subjects the seminary deals only with strictly scientific questions (from which the themes for dissertations are frequently drawn), whereas more practical discussions are equally desirable. Besides this the number of those admitted is usually rather small, and indeed not unwisely so, because it is only then that a lively debate becomes possible; a too numerous membership easily tends to make the individuals embarrassed and silent. In most cases, too, only those students are admitted who have already been several terms in the university, whereas it is precisely the freshman who is most in need of help.

<sup>1</sup> Abridged from an article by Prof. Wilhelm Münch, professor of pedagogy in the University of Berlin, in the Report of the U.S. Commissioner of Education for the year ended June 30, 1911, vol. 1., just received from Washington.

The whole system is, in fact, capable of much development; for younger lecturers and for older and proved students, a field of useful labour is here opened.

The absence of all unifying personal guidance of the student's course of study is not infrequently felt to be a weakness in German university life, yet few people wish for definite or printed curricula, even if these should be only for the sake of suggestion. Full "academic freedom" proves, as a matter of fact, a benefit only to students of much intelligence and firm character. It is, in fact, only the more distinguished who rise; the ordinary individuals fall back. Some now declare that the lecture system has lived its day and that a method in which dialogue should predominate ought to take its place; others—and such a conspicuous thinker as the late Friedrich Paulsen was among their number—regard the lecture system as the most effective, to be surpassed and replaced by no other.

On the whole it is not strange that the demand should at intervals have arisen for a special "academic pedagogy" as a new science. In an age when all questions of pre-university education are carefully considered and measures taken in accordance, indifference ought not to prevail toward the succeeding years and their educational claims. The academic chair also claims its principles and regulations. There should be no shrinking from a discussion of the problem, for the psychology of the student period deserves an exhaustive observation which it has not yet received.

If it was already hard enough for the freshman to gain a footing in the new mental atmosphere, to understand the abstract language, and to follow the closer line of thought; and if it was at the same time not exactly easy for the professor to find the right way of fascinating the cleverer spirits without repelling the weaker, the difficulty has become still greater for both parties, because pupils have been admitted to the university, not only from the classical schools (humanistischen Gymnasien), but also indiscriminately from the various schools which have a nine years' curriculum.

Now, it had never been intended that the modern and mixed schools should regard themselves thenceforward chiefly as preliminary stages to the university. It was expected that only those few pupils from them who felt a special call to higher scientific studies would take advantage of the new privilege, while the majority would devote themselves as before to more everyday ends. It is, however, undeniable that a much greater percentage of the students in these more practical institutions is streaming into the university than is desirable; and, what is worse, they enter, not for the sake of working in those subjects for which they had been chiefly trained (which were already free to them in the university), but in almost all other subjects as well, with the exception perhaps of theology. The allurements of the new liberty has clearly taken effect here, but just as clearly also the idea of social distinction which accompanies the academic calling. For in Germany, particular industrial districts excepted, university men are still regarded socially as an upper class, to which, in the eyes of the public, only the nobility, the official class, and perhaps the most distinguished artists are superior.

Convincing statistics of the result of the university work of students from modern schools in comparison with that of students from classical schools are at present not attainable. Great importance is not laid on figures and average results; the examinations, which must, after all, be the chief means of information, are affected by many different factors which cannot be weighed and measured, the addiction of the examiners to the method in which they themselves

were schooled being possibly one of them. On the whole, however, judging from a number of personal opinions, the results certainly do not seem to denote a triumph for the modern schools. From the classical schools, also, it is true, the number of those is not small whose mental capacity does not mark them for scientific study; and on the other side there are always to be found among the students from the modern schools individuals of conspicuous talent and the highest aspirations who do creditable work in each subject.

The increase in the number of foreigners at the German universities steadily continues, but has recently had to be checked. Too many individuals of doubtful education, and frequently also leading very questionable lives, forced themselves in, particularly from the eastern European countries, and took up the space and the best seats at the practical exercises, crowding aside the German students. Visitors from America or England will scarcely be likely to find the recent measures of restriction an obstacle; their previous education is often excellent. It is, of course, the natural and desirable thing that only those students of a nation should be sent abroad who have distinguished themselves above the average. The dark sides of the German university system above mentioned apply but little to such; the lectures of the most distinguished professors are precisely what they have come for, and the arrangement of their studies can be confidently left to themselves.

As is only natural, the various branches of learning differentiate themselves more and more from one another, and thus, through the splitting up of departments already existing and through the extension of study over quite new fields, new chairs become needed.

Of greater interest for foreign readers are perhaps the movements which are going on in the German student world. To put it briefly, the students' clubs (Corps, Landsmannschaften, &c.) of the older form are losing ground to those which are founded on newer principles. The essential basis of the older corporations was, and is, the firm formation of a powerful community for the cultivation of boldness and courage, steadfast friendship, social and light-hearted enjoyment of youth; in practice, however, this is combined with considerable love of fighting and drinking, preservation of outworn ceremonies, and thoughtless pursuit of pleasure. Many of these bodies have at present but few members. At the same time the spirit which inspired them is by no means dead, and in certain universities, chiefly smaller ones, their characteristic way of life remains to this day. More prosperous, however, are the scientific societies, the athletic organisations, and those based on national, ethical, or Christian principles. And it is in keeping with the spirit of the time as well as with the academic tradition that the societies of similar aims at the various universities bind themselves together into united bodies.

[An addendum to the article shows the distribution of students among the German universities, and from it are taken the numbers given below for the year

1910-11:—

Universities	1910-11	Universities	1910-11
Berlin ... ..	9686	Kiel ... ..	1439
Ronn ... ..	3846	Königsberg ... ..	1387
Breslau ... ..	2454	Leipzig ... ..	4900
Erlangen ... ..	1011	Marburg ... ..	1981
Freiburg ... ..	2246	Munich ... ..	6905
Giessen ... ..	1243	Münster ... ..	2047
Göttingen ... ..	2237	Rostock ... ..	816
Greifswald ... ..	048	Strassburg ... ..	2067
Halle ... ..	2661	Tübingen ... ..	1883
Heidelberg ... ..	2008	Würzburg ... ..	1425
Jena ... ..	1637		

54,823

During this year 26,123 students of the total number took the philosophical faculty, which, in addition to mathematics and natural sciences, also includes philosophy, philology, and history.]

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

**BIRMINGHAM.**—Prof. Malins, on resigning the professorship of midwifery, which position he has held since 1894, has presented the sum of 100*l.* to the University, "with a profound sense of the many important advantages it [the University] offers to the advancement of knowledge, and the great capabilities it opens to the future in the highest interests of intellectual and material progress in our midst."

**CAMBRIDGE.**—The degree of doctor of science *honoris causâ* is to be conferred to-morrow upon the following:—Prof. E. B. Frost, director of the Yerkes Observatory; the Marchese Emanuele Paternò di Sessa, professor of chemistry in the University of Rome; Prof. Pavlov, St. Petersburg University; Prof. Picard, University of Paris; Geheimer Regierungsrat Rubens, University of Berlin; and Dr. Warming, formerly professor of botany at Copenhagen.

**LIVERPOOL.**—Prof. J. M. Beattie, at present professor of pathology and dean of the medical faculty in the University of Sheffield, has been appointed to the professorship of bacteriology. He has also been appointed bacteriologist for Liverpool. Dr. J. Reynolds Green, F.R.S., has been appointed to the Hartley lectureship in vegetable physiology, and Dr. C. Rundle to the assistant lectureship in infectious diseases. The following elections have also taken place:—Mr. H. C. W. Nuttall to the Holt fellowship in pathology; Messrs. R. Kennon and R. Gee to the Holt fellowship in physiology; Messrs. J. H. Rawlinson and T. Thomas to the fellowship in anatomy; and Mr. A. A. Rees to a fellowship in surgical pathology.

**LONDON.**—At the meeting of the Senate on July 10, the following appointments were made to professorships with funds provided by the new grant from the London County Council:—Dr. J. A. Fleming, F.R.S., professor of electrical engineering (to teach at University College); Dr. Arthur Dendy, F.R.S., professor of zoology (to teach at King's College); and Mr. A. J. Sargent, professor of commerce (to teach at the London School of Economics).

Dr. A. N. Whitehead, F.R.S., has been appointed reader in geometry (to teach at University College).

The Dixon Fund for 1912–13 has been allocated as to 150*l.* to the Brown Institution for researches into leprosy, Jöhne's disease, and toxins and antitoxins by the superintendent (Mr. F. W. Twort); and as to 125*l.* to Dr. J. F. Spencer, of Bedford College, for researches on cerium and its compounds.

Dr. J. S. Bolton has been granted the D.Sc. degree in physiology for a thesis entitled, "The Beginnings of the Localisation of Cerebral Function based on the Clinico-Pathological Study of Mental Disease."

**OXFORD.**—Mr. G. E. Beaumont, University College, has been elected Theodore Williams scholar in pathology for 1912, and Mr. R. P. Pinsent, of Marlborough College, has been elected to a Williams exhibition in natural science at Balliol College.

MR. R. W. BAILEY has been appointed principal of the Crewe Technical School.

PROF. C. A. M. SMITH, of the East London College, has been appointed professor of mechanical and civil engineering at the newly created University of Hong Kong.

It is announced that the donor of 10,500*l.* towards the medical school of University College of South Wales and Monmouthshire and the King Edward VII. Hospital, Cardiff, is Mr. W. J. Thomas.

PROF. THEODOR KOCHER has presented to the University of Berne the sum of 200,000 francs for the purposes of research, in celebration of the holding by him for the period of forty years of the chair of surgery in the University.

GRANTS have been promised to the South-Eastern Agricultural College, Wye, by the Board of Agriculture of 262*l.* 10*s.* for research work in hops, parasitic worms, and "struck" sheep; 1000*l.* for advisory work undertaken by the college in entomology and mycology; and an offer of 500*l.* a year is made for a research fruit and hops plantation in the south-eastern district, provided an equal sum be raised locally.

At the meeting of the Council of the Royal College of Surgeons held on Thursday last the following elections and re-elections took place:—*President*, Sir Rickman J. Godlee; *Vice-Presidents*, Messrs. Clinton T. Dent and G. H. Makins, C.B.; *Hunterian Professors*, Mr. J. E. Adams, Dr. A. Keith, Dr. W. B. L. Trotter, Mr. K. M. Walker, and Mr. W. Wright; *Arris and Gale Lecturers*, Mr. W. B. Bell and Dr. C. G. Seligmann; *Erasmus Wilson Lecturer*, Mr. S. G. Shattock; *Arnott Demonstrator*, Dr. A. Keith.

MR. C. A. BALLANCE, M.V.O., was appointed to represent the college on the occasion of the ninth International Otolological Congress, to be held in August at Harvard University.

THE Imperial Conference of Teachers' Associations, promoted by the League of the Empire, was opened at Caxton Hall, Westminster, on July 13, and has continued its meetings this week. The delegates, who represented every part of the Empire, were welcomed on behalf of the Government by the President of the Board of Education. Mr. Pease, after eulogising the work done for the Empire by the teaching profession, went on to say that experts whom the Board of Education sent to the Continent report that we in this country have very little to learn from the European Powers. Even from Germany, with all its scientific advance so far as education in the elementary schools is concerned, we have not much to learn. In regard to the condition of our schools, hygiene, and medical inspection and treatment, we are ahead of other nations on the Continent of Europe.

WE learn from *The Pioneer Mail*, Allahabad, that a special meeting of the Senate of the University of Calcutta was recently held to consider, among other matters, the endowment made by Mr. Tarak Nath Palit for the founding of chairs in chemistry and physics, and for the establishment of a university laboratory. Mr. Palit's gift is of the value of more than seven lakhs of rupees. This sum is to be supplemented by two and a half lakhs from the reserve fund of the University. The Senate is therefore in a position to take the first step towards the foundation of a University College of Science and Technology. The founder stipulates in the trust deed that as his object is the promotion and diffusion of scientific technical education and the cultivation and advancement of science, pure and applied, amongst his countrymen by and through indigenous agency, the chairs founded by him shall always be filled by Indians, but the professor-elect may in the discretion of the governing body be required to receive special training abroad before he enters upon the discharge of the duties of his office. He will during this period be in receipt of suitable allowance and travelling expenses, which will be deemed part of the cost of