strong argument for a silicon-cellulose in which silicon might or might not with equal physiological convenience play the part of one or more atoms of carbon. Fascinating as this hypothesis is, I am bound to say that the prolonged investigation which he devoted to the question is on the whole adverse to the idea of silicon playing any part of the kind.

It still remains then an unsolved problem why, when no adaptive end is involved, plants should take up such relatively enormous quantities of silica. The case of the frustules of *Diatomaceæ* is peculiar, as there the silicious wall is apparently a continuous plate of inorganic matter capable of resisting without impairment treatment by the most destructive and disintegrating agencies known Yet Castracane adduces evidence to show that such walls can grow; and as this can only be by interstitial growth, a molecular constitution is implied quite different from anything physical, and precisely similar to that of a cellulose membrane. He quotes, indeed, von Mohl for the opinion that the wall is not simply inorganic, "but only an organic membrane which is impregnated with silex."

Now, in the case of tabasheer, it is quite evident that the plant takes up an amount of silica beyond its powers to use, and so it is exuded into the hollow cavities of the bamboo stem. I do not mind confessing that, in so far as I had reflected on the matter at all, I had pictured to myself this as taking place by some process of secretion, so that the mass of tabasheer ultimately accumulated from successive portions of thrown-off silica. I was obliged, however, to give a little more serious thought to the matter when Prof. Cohn, of Breslau, wrote to me that he proposed to investigate the whole subject, and asked for help in the way of specimens and information. It then struck me what a very singular thing the phenomenon of the occurrence of tabasheer really was. I set to work to hunt up in the literature of Indian botany some rational account of the matter. The only ray of light I got was from the "Forest Flora of North-West and Central India," by Dr. Brandis, late Inspector-General of Forests to the Government of India. Everyone who knows Dr. Brandis knows that he gave to administration the energy he would more willingly have devoted to scientific pursuits. I was not at all surprised to find, therefore, modestly hidden in his book (p. 566) the key to the riddle. He says: It is not at all impossible that the well-known silicious deposit (*tabasheer*) which is found in the joints of this and other species [*Bambusa arundinacea*] may be the residuum of the fluid which often fills the joints." I communicated this to Prof. Cohn, and he was good enough to tell me that he quite agreed that this was the correct explanation. I at the same time wrote to Dr. King, the distinguished Superintendent of the Royal Botanic Garden, Calcutta, to know if it were possible to procure specimens of tabasheer *in situ*, as we possessed in our Museum nothing but broken fragments. I extract from several letters he has written me the following particulars:—"January 11. I have inquired of several old workers as to the situation tabasheer occupies. They all say it is found either on the *floor* of the joint, or if (as is so often the case in *B. Tulda*) the stem leans over, it is also found on the lower wall. It is never found on the roof of a joint. . . . . Tabasheer is not common in bamboo grown near Calcutta. And, besides, it is apt to be forced out of its natural position by the forced used in breaking a joint open. There is no external mark by which a tabasheer-bearing joint can be recognised prior to being opened." "January 18. I have got a specimen of tabasheer *in situ* for you. It concretes *as a jelly*, and is now being carefully dried off."

I think that these extracts (in which the italics are mine) fully confirm the explanation as far as I know first put out by Dr. Brandis. The rapidity of growth of a bamboo shoot is well known to be enormous. The root-pressure is probably equally great. The joints, at first solid, become hollow by the rending apart of the internal tissues, and water containing silica in solution is poured out into the cavities so formed. When the foliage is developed, transpiration is active: the water taken up from the ground is rapidly got rid of; not merely is the root-pressure compensated, but the water poured out into the joints is re-absorbed. It is not easy to see why the silica should not be always taken with it, as in the vast majority of cases it no doubt is. But in the cases in which it is left behind it has apparently simply undergone a process of dialysis. The determining causes of the occasional deposit of tabasheer are, I think, still obscure. But, as Prof. Cohn intends to investigate the subject, I think we may pretty confidently look forward to an exhaustive explanation.

It is a well-known fact that a large proportion of the ash-constituents of plants may have but little significance in their nutrition. The chemical constitution of plants, as far as their ash is concerned, to a large extent varies with the nature of the soil in which they are grown. It is quite certain that they will in consequence take up a vastly larger proportion of certain constituents than they can turn to any physiological account. Tabasheer is a striking instance of one such case. The calcareous masses found in the wood of many Indian trees mentioned in NATURE, vol. xxi. p. 376, affords another.

W. T. THISELTON DYER

ON THE EARLIER TRIPOS OF THE UNIVERSITY OF CAMBRIDGE

I HAVE read with great interest the papers by Mr. Glaisher in NATURE of December 2, 18, and 30, 1886 (pp. 101, 153, and 199), entitled "The Mathematical Tripos." Through the period common to Mr. Glaisher's notes and my recollections, I believe that we are strictly in agreement. I am able, however, to supply some little histories (I wish these had been more numerous and more certain) relating to transactions several years earlier than those known, personally, to Mr. Glaisher, and I am desirous that their memory should not be totally lost. There are now few persons, perhaps none, whose recollections of the University of Cambridge and of Trinity College go so far back as my own.

I first advert to the official course of undergraduates' life.

Shortly after introduction to the College in the October Term of 1819, I attended, with all other freshmen, in the Senate House or in the College Hall (I believe the latter) to take the oaths of allegiance and supremacy. With great ardour I renounced the "damnable doctrine" that the Pope of Rome could absolve subjects from their allegiance, with several similar declarations; and I also disclaimed all connection with other Universities and Colleges, and in particular with Wolsey's College at Ipswich. I believe (but have no certain knowledge) that these puerilities terminated a few years afterwards.

The undergraduates were arranged in "sides," divided under the official tutors under whom they were entered in the College Lists. There were then two "sides"; subsequently there were three. The lectures on each side were held in the College rooms of the tutor or his assistant tutor. The lectures consisted, naturally, in proposals of theorems and problems (in writing) and oral discussion of the answers in a friendly style.

The annual College examinations of the undergraduates of all sides (collected), of each year of undergraduateship, were held in the College Hall at the practical termination of the May Term. The order of merit in each year, as determined by these examinations, was published by lists of names suspended in the College Hall. Small sums of money, to be expended in honorary prizes, were assigned to the First Class of each year.

In the third year of undergraduateship arrived the time

of "keeping Acts and Opponencies." These, as Mr. Glaisher has explained, were formerly the only public exhibitions of students' merits in the University; and, possibly, were still considered in the University as more important than would be gathered from Mr. Glaisher's account. The three Opponents met to take tea and to arrange their arguments; the Act also was invited, with an intimation that he was not to stop long. I have seen the "Schools," in which the disputations were held, quite filled with undergraduates of all Colleges, who came to listen to the disputations, or rather quibbles, held in the Latin language, of the argumentative quarrel. If my memory is correct, each of the undergraduates (selected, I believe, by the Moderators) appeared twice in the character of "Act" (asserting the correctness of some doctrine in the printed books), and twice or more in the character of "Opponent" (denying that correctness). The President of the School was one of the Moderators. The assertion of the Moderator that the argument failed was given by the words "Probes aliter." The discussion was usually closed by a complimentary address of the Moderator, as, for instance, "Magno ingenio argumenta tua et construxisti et defendisti." I do not think that the form lasted many years after this time.

At length came the October Term, the last term (the tenth) for undergraduates, of which I remember only one characteristic, namely, that in the College Hall a separate dinner-table was established for the "Questionists" (as those were called who were to proceed to the B.A. degree in January). To this table all Questionists were removed from whatever tables they previously occupied. Among others, the "Scholars" of the College (Trinity) were removed from their table, where they had formed agreeable acquaintances, to a collection of strangers, naturally disagreeable to the "Scholars." We much disliked this change. I think that in this term the character of the College lectures was changed almost entirely to problems and questions; some of them in the evening, in the College rooms of one of the Fellows.

At length arrived the Monday morning on which the examination for the B.A. degree was to begin. A breakfast was given by the "Father" of the College (one of the Fellows of the College) in the College Combination Room, and then we were all marched in a body to the Senate House and placed in the hands of the Moderators. How the "candidates for honours" were separated from the οἱ πολλοὶ I do not know. I presume that the Acts and Opponencies had something to do with it. The honour-candidates were divided into six groups; and of these Nos. 1 and 2 (united), Nos. 3 and 4 (united), and Nos. 5 and 6 (united), received the questions of one Moderator. No. 1, Nos. 2 and 3 (united), Nos. 4 and 5 (united), and No. 6, received those of the other Moderator. The Moderators were reversed on alternate days. There were no printed question-papers: each examiner had his bound manuscript papers of questions, and he read out his first question; each of the examinees who thought himself able proceeded to write out his answer, and then orally called out "Done." The Moderator, as soon as he thought proper, proceeded with another question. I think there was only one course of questions on each day (terminating before 3 o'clock, for the Hall dinner).

The examination continued to Friday mid-day. On Saturday morning, about 8 o'clock, the list of honours (manuscript) was nailed on the door of the Senate House.

The ceremonies and customs of conferring degrees in the middle of the day, I believe, have not been altered. The Vice-Chancellor was seated in the centre of the Senate House. The Father of that College of which the Senior Wrangler was a member led him to the Vice-Chancellor. The roar of acclamation from the undergraduates in the galleries of the Senate House, to welcome a favourite Senior Wrangler, will not be forgotten by one who has heard it. The Father presented him with the words: "Dignissime Domine, Domine Procancellarie, et tota Universitas, præsento vobis hunc juvenem, quem scio tam moribus quam doctrinâ esse idoneum ad respondendum Quæstioni; idque tibi fide meâ præsto, totique Universitati." The candidate knelt before the Vice-Chancellor, who pressed the candidate's hands between his own, and answered: "Auctoritate mihi commissâ, admitto te ad respondendum Quæstioni, in nomine Patris, et Filii, et Spiritûs Sancti." I am not able to say how much of this was repeated for each candidate. Then followed some petty quibbles with some Master of Arts concerning questions which nobody professed to understand, but which were inessential. The undergraduate gown was then changed for a B.A. gown.

On a certain day following, at a Congregation of the Senate, the list of names of those who were thus admitted was read to the Vice-Chancellor, who (as I understood) solemnly recognised the rights of the first to the privileges of Bachelor of Arts, and to each of those following only repeated the words "et ei," finally declaring that they were "actualiter in Artibus Baccalaureos."

It is evident that there must have been some relation between the various ranks which no longer exists; and, in particular, that the *Quæstio* was once important, and is now totally lost. And connections existed between the Colleges and the University which can scarcely be traced at the present day.

I now advert to the mathematical subjects of study and examination.

In the October Term, 1819, the only books on pure mathematics were: Euclid generally; "Algebra," by Dr. Wood (formerly Tutor, but, in 1819, Master, of St. John's College), Vince's "Fluxions" and Dealtry's "Fluxions," Woodhouse's and other Trigonometries. Not a whisper passed through the University generally on the subject of differential calculus, although some papers (subsequently much valued) on that subject had been written by Mr. Woodhouse, Fellow of Caius College; but their style was repulsive, and they never took hold of the University. Whewell's "Mechanics" (1819) contains a few and easy applications of the differential calculus. The books on applied mathematics were: Wood's "Mechanics," Whewell's "Mechanics," Wood's "Optics," Vince's "Hydrostatics," Vince's "Astronomy," Woodhouse's "Plane Astronomy" (perhaps rather later); the first book of Newton's "Principia." I do not remember any others. These works were undoubtedly able; and I do not conceal my opinion that for the great proportion of University students going into active life books constructed on the principles of those which I have cited were more useful than those exclusively founded on the more modern system. For those students who aimed at the mastery of results—more difficult and (in the intellectual sense) more important—the older books were quite insufficient.

More aspiring students read, and generally with much care, several parts of Newton's "Principia," Book I. and also Book III. (perhaps the noblest example of the geometrical form of cosmical theory that the world has seen). I remember some questions from Book III. proposed in the Senate House Examination, 1823.

In the October Term, 1819, I went up to the University. The works of Wood and Vince, which I have mentioned, still occupied the lecture-rooms. But a great change was in preparation for the University course of mathematics. During the great Continental war, the intercourse between men of science in England and in France had been most insignificant. But in the autumn of 1819 three members of the Senate (John Herschel, George Peacock, and Charles Babbage) had entered into the mathematical society of Paris, and brought away some of the works on pure mathematics (especially those of Lacroix) and on

mechanics (principally Poisson's). In 1820 they made a translation of Lacroix's "Differential Calculus," and they prepared a volume of "Examples of the Differential and Integral Calculus." These were extensively studied; but the form of the College examinations or the University examinations was not, I think, influenced by them in the winter 1820-21 or the two following terms. But in the winter 1821-22 Peacock was one of the Moderators; and in the Senate-House Examination, January 1822, he boldly proposed a paper of important questions entirely in the differential calculus. This was considered as establishing the new system in the University. In January 1823 I think the two systems were mingled. Though I was myself subject to that examination, I grieve to say that I have forgotten many of the details, except that I well remember that some of the questions referred to Newton, Book III., on the lunar theory. To these I have already alluded.

No other work occurs to me as worthy of mention, except Woodhouse's "Lunar Theory," entirely founded on the differential calculus. The style of this book was not attractive, and it was very little read.

From this time to the times of which Mr. Glaisher treats, there were successive books on the new system, but none, I think, which can be cited as producing a marked effect in the University. G. B. AIRY

NOTES

THE University of Bologna has decided to celebrate its eight hundredth anniversary in the spring of 1888. The exact date of its foundation cannot, indeed, be determined, but all authorities on the subject agree that an important school was established at Bologna in the eleventh century. Afterwards the University took a great place as the chief centre for the study of jurisprudence, and there also anatomy was for the first time scientifically studied. The foremost Universities of Europe and America will no doubt be glad to take this opportunity of testifying their respect for so ancient and famous an institution.

AT their meeting on February 3 the President and Council of the Royal Society adopted the following resolutions concerning the publication of the Philosophical Transactions:—That the Transactions be published in two independent series, one (*a*) containing those papers which are of a mathematical or physical character, the other (*b*) those of a biological character; that the papers in each series form a yearly volume, paged continuously (though issued in parts if the Secretaries find it convenient), but that each paper be also published separately in paper covers as soon as it is ready for publication; and that Fellows have the option of receiving one or both of the yearly volumes, or, should they prefer it, each separate paper of either or both series, or the whole of one series and any separate paper of the other series, immediately on publication. These resolutions are to take effect with the volume for the present year.

A COMMITTEE, lately appointed by the College of Physicians of Edinburgh, has reported in favour of the establishment and maintenance, by the College, of a laboratory for the prosecution of original research. The Committee proposes that the College shall vote from its capital 1000*l.* for the establishment of this laboratory, and, year by year, a sum not exceeding a third of the clear surplus of annual income over annual expenditure for its maintenance, including the payment of salaries The superintendent, it is thought, should devote his time wholly to the direction and prosecution of scientific research in the laboratory; and it is suggested that an assistant experienced in microscopic work should be engaged to reside on the premises. The Committee is of opinion that the laboratory should be open without fee to Fellows of the College, to members, and to any licentiate, medical man, or investigator who may, by testimonial or otherwise, be able to show that he is a fit person to use the laboratory for purposes of scientific research. Moreover, the Committee recommends that, if there should be sufficient funds after payment of expenses, a medal and money-prize (not exceeding twenty guineas) should be offered for original work. It is understood that this admirable scheme will be adopted, and we may hope that the example set by the Edinburgh College will soon be followed by the English College of Surgeons and College of Physicians.

A CORRESPONDENT writes to us from Tashkend that on November 29 last, at 9.12 a.m, a violent shock of earthquake was felt there, accompanied by a great noise like thunder. The people were much frightened, and the majority of the buildings were more or less injured. Light shocks were felt also on December 3, and on January 9 and 16.

ON the 15th of January last there was in some parts of Japan the most severe earthquake that has been experienced there since February 22, 1880. It fetched down a number of chimneys and parts of roofs in Yokohama, but in Tokio (eighteen miles distant) it only broke a few vases and created alarm. The important and peculiar feature of the disturbance was that it had a long period and large amplitude. At the Imperial Observatory at Tokio, where a number of "Gray-Milne seismographs" are employed, the pointers of the instrument were seen to move for nearly ten minutes. We learn from the *Japan Gazette* that the disturbance was felt at Tokio at 6h. 51m. 59s. p.m., commencing in a series of small waves. The greatest horizontal movement was 19·2 mm. (about $\frac{3}{4}$ inch). The time taken to describe the largest wave was 2·3 seconds. The vertical motion had a range of 5·5 mm. (about $\frac{1}{4}$ inch), and its period was ·8 seconds. Altogether there were 60 distinct waves, and the maximum velocity with which the earth moved to and fro was 26 mm., or about 1 inch per second. At Tokio people felt the motion as if they had been on a slowly-moving floating pier, and in many cases it provoked a sensation of nausea. The general distribution of destruction at Yokohama was similar to that which took place in 1880. The *Japan Gazette*, however, points out that many chimneys standing on ground which in 1880 suffered severely were this time uninjured. This "anomaly," it thinks, may be explained by the fact that the owners of these chimneys took advantage of the experience they gained in 1880, and rebuilt their chimneys with a special view to their safety.

THE Right Hon. G. Sclater Booth, M.P., has accepted the Presidentship of the Congress of the Sanitary Institute of Great Britain, to be held at Bolton in September next.

ON March 6 a century will have elapsed since the birth of the celebrated optician, Joseph von Fraunhofer, at Straubing, in Lower Bavaria. Preparations are being made in Munich for the due celebration of the day.

IN the eleventh annual Report of the President of the Johns Hopkins University, Baltimore, Dr. Gilman is able to give a very satisfactory account of the progress made by the institution since its establishment in 1876. Much of its success, he thinks, is due to the system of Fellowships. Every year twenty young men who have given evidence of their attainments and of intellectual promise are selected by the authorities as Fellows, and are encouraged to devote all their time to the study of some branch of knowledge in which they have already shown proficiency. During the first ten years this honour has been bestowed upon 130 persons. Their names and the stations to which they have been called have been frequently printed, and Dr. Gilman says a scrutiny of the list will show that it contains the names of many excellent scholars. While resident at the University, the Fellows are