special notice. Of the cheap stands, the American type microscope (F.) is undoubtedly of good design. The horse-shoe foot is replaced by one of a much more stable tripod form, and the arm carrying the tubes and adjustments is particularly well made, giving freedom all round the stage while securing a firm support for the body-tube. All the usual microscope accessories are listed, but there is nothing of such special design as to call for particular notice.

THE additions to the Zoological Society's Gardens during the past week include two Wild Swine (*Sus scrofa*, ♂ ♀), European, presented by H.M. the King; a Leopard (*Felis pardus*) from West Africa, presented by Captain Guy Burrows; an Eland (*Orias canna*, ♂) from South Africa, presented by the Duke of Bedford; two Grey-breasted Parrakeets (*Myopsittacus monachus*) from Monte Video, presented by Mrs. Brownrigg; two Ground Snakes (*Typhlops exocoeti*) from Christmas Island, presented by Sir John Murray, K.C.B., F.R.S.; a Grey-cheeked Mangabey (*Cercocebus albigena*) from West Africa, a Brazilian Tree Porcupine (*Sphingurus prehensilis*) from South America, two Black Tortoises (*Testudo nigra*) from the Galapagos Islands, three Dark Green Snakes (*Zamenis gemonensis*), two Smooth Snakes (*Coronella austriaca*), European, deposited; a Sambur Deer (*Cervus aristotelis*, ♂) from India, two Javan Peafowls (*Pavo spicifer*, ♂ ♀) from Java, two Peacock Pheasants (*Polyplectron chinquis*, ♂ ♀) from British Burmah, two Australian Sacred Ibises (*Ibis strictipennis*) from Australia, two Summer Ducks (*Æx sponsa* ♂ ♀) from North America, two Blood-breasted Pigeons (*Phlogaenas luzonica*) from the Philippine Islands, four Ruffs (*Machetes pugnax*, ♂ ♂, ♀ ♀), twelve Green Lizards (*Lacerta viridis*), European, purchased.

OUR ASTRONOMICAL COLUMN.

COMET *a* (1901).—The Sydney correspondent of the *Times* reports that a brilliant comet was seen early on Tuesday morning (April 23) at various stations throughout the Australian continent. It was stated to have been near the star Aldebaran (α Tauri).

On Friday, the 26th ult., a telegram received from Dr. Gill announced that the new comet had been observed from the Cape Observatory. It was very brilliant, having a compound triple tail about 10° long. The comet was observed on the eastern horizon some two hours before sunrise and was rapidly approaching the sun, so that it may be expected to become more brilliant as perihelion is passed. It was seen by the observers at the Yerkes Observatory at Wisconsin early on Saturday morning last, about 15° north of the sun. This indicated that it had made a very rapid north-westerly movement in relation to its position when seen at the Cape. It was visible for fully twenty minutes before sunrise and about fifteen minutes after, and is considered the brightest comet seen for the last nineteen years. No account has yet been received of the comet having been seen in this country.

THE APRIL METEORS OF 1901.

A SERIES of very clear nights enabled these objects to be looked for in favourable circumstances this year. Moreover, the moon was absent, so that the smaller class of meteors could be well seen projected on the dark blue of the cloudless sky. Meteors are usually very rare in April, and it is only the shower of Lyrids, occurring in past years on about the 20th, that has made the month interesting to meteoric observers. The display apparently returns annually, but it is often inconspicuous and rarely proves as rich as the August Perseids.

On April 13, 17, 18 and 19 I maintained a watch of the north-east region of sky, but found meteors scarce and there were very few Lyrids. The minor showers of the epoch gave little sign of their presence; in fact, meteoric apparitions were so few and far between that observers found their patience sorely tested. Prof. Herschel watched perseveringly at Slough on the nights of April 10, 13, 14, 15, 16 and 17, and, in the aggregate, only recorded twenty meteors in 8½ hours.

On April 20 at Bristol the sky was brilliantly clear, and I kept a look-out during about five hours of the period from 9h. 50m. to 15h. 30m, but observed only twenty-nine meteors. Not a single Lyrid was included amongst them, though several bright, swift-moving meteors fell from a bordering radiant at 261° + 36° in Hercules.

On April 21 the firmament was less favourable, but soon after commencing to watch at 9h. 45m. I found meteors extremely numerous. Several of the minor showers were very active, and the Lyrids formed a pretty rich display. During 3¼ hours' watching, up to 14h. (allowing for occasional interruptions by clouds), I counted fifty-two meteors, and of these there were twenty-five Lyrids from a radiant about 5 degrees in diameter with 270° + 33° as a centre. But while registering the observed paths of the meteors seen, many others must have eluded detection. The horary rate of meteoric apparitions for a continuous watch of the firmament by one observer would have been about 25 and the proportion of Lyrids 12. The figures represent rather an unusual display, though falling far short of the strength of the Perseids and some other periodical showers. It must be remembered, however, that at the epoch of the Lyrids meteors are generally very rare, and that the principal shower is itself sometimes very feeble, if not quite invisible.

The fact of the maximum being so definitely marked on April 21, while there was a comparative absence of Lyrids on April 19 and 20, shows that for some time in future we must expect these meteors on the former date. This is, no doubt, owing to 1900 not having been a leap year. And the shower appears to be a very fugitive, short-lived one, or it must have exhibited more decided traces on April 19 and 20. Though I saw no Lyrids whatever at Bristol on April 20, Prof. Herschel informs me that he observed 5 during the night.

Nearly all the Lyrids seen this year were accompanied with streaks; this feature was, indeed, as well shown as it usually is in the case of the Perseids, Orionids and Leonids. When the radiant was rather low on April 21, the apparent motions were estimated as slow and slowish; but in the later hours of the night, with increasing altitude of the radiant, the velocity appeared much swifter.

Some of the meteors from Lyra and other constellations were very interesting, and in the following list I have made a few selections in the hope that the objects may have been observed elsewhere, and that the requisite data may be obtained for computing their real paths in the air.

				From		To		
	h.	m.	Mag.	°	°	°	°	
April 21 ...	10	9	1	278½	+52	304	+70	Lyrid
	10	41	3	202	+40	213½	+ 7	α-β Perseid
	10	50	2	210	+50	171	+40	Lyrid
	10	59	2	218	+52	255	+75	Virginid
	11	23	1	70	+57	88	+50	Cassiopeid
	12	47	2	269	+46	305	+49	Virginid
	13	7	1	242	+74	130	+74	Lyrid

On April 20, at 10h. 35m., I noticed a brilliant double flash, caused probably by a large meteor at a low altitude, and hidden from my view by houses in this locality.

Two meteors appearing on April 18 were mutually observed at Slough and Bristol. The first was seen at 13h. 19m., and it fell from an altitude of 83 to 55 miles over Oxfordshire. The radiant was at 266°+33°, so the meteor was an early Lyrid, and it having been well seen at both stations, the direction of its flight was recorded with considerable accuracy. The position of its radiant at 266°+33°, as compared with the general Lyrid centre at 270°+33° three nights later, on April 21, proves that this shower, like that of the August Perseids, exhibits a radiant moving eastwards at the rate of about one degree per day. The second meteor doubly observed was registered at 14h. 47m., and it descended from 58 to 44 miles over the borders of Gloucestershire and Oxfordshire. The radiant was at 247°± 0°, so the meteor belonged to one of the minor showers of the epoch.

Since writing the above I have learnt that two bright meteors, the 1st and 5th in the above list, were observed by Mr. C. L. Brook at Meltham, near Huddersfield, as well as at Bristol. The first was a Lyrid with radiant at 268°+30°, and it fell from 79 to 54 miles in height over the Midlands. Its length of path was 60 miles and velocity 40 miles per second. The other meteor was a Cassiopeid belonging to a radiant at 21°+59°,

and falling from 66 to 44 miles over Merioneth and Cardigan, Wales. Its observed length of path was 55 miles and velocity 14 miles per second. It is remarkable that though few, if any, of the smaller class of shooting stars diverge from this radiant near δ Cassiopeiæ in the spring months it yet furnishes many fireballs. In the General Catalogue of Radiants, No. xv. p. 228, the radiants of five fireballs appearing in April and May give a mean centre at 20° + 57°, which is almost identical with that of the bolide of April 21 last. W. F. DENNING.

CHEMISTRY IN ITS RELATIONS TO ENGINEERING.[1]

THE engineer of fifty years ago can hardly be said to have received any special educational training; he forced himself to the front in virtue of his qualities and industry alone. But the youth who to-day intends to become an engineer feels it wise, if not necessary, to decide where he shall receive, not only his general, but also his engineering education. While he was at school he will have learnt much about the simpler and more general laws and facts of mechanics and natural science, both by description and by practical work in the laboratory and in the workshop; he will also have attained to some proficiency in mathematics, in one or more of the modern languages, in drawing and in other usual school subjects. When he passes on to his college career his knowledge of these subjects will undergo expansion in the class-room and especially in the laboratory and workshop. It is satisfactory to find that many of our leading schools for training engineers exist in connection with institutions in which pure and applied mathematics, natural science and modern languages are efficiently taught even in their higher stages. The engineering student is thus afforded the opportunity of following up the higher study of any one of these subjects, if his taste and energy lead him to wish him to do so. But even his ordinary course of instruction always includes the opportunity of obtaining lecture and laboratory instruction in chemistry.

Chemistry in Engineering Education.

It appears to be the general feeling of those who have had experience in teaching chemistry to engineering students that it is useless to attempt very much in the small amount of time which can be allotted to the subject in the regular curriculum; it is evidently felt, however, that a student who wishes to attain to any considerable proficiency in the subject should be encouraged to join certain additional courses which are included in the ordinary chemical curriculum.

Probably all that can be expected of the average engineering student is that he shall become generally conversant, during his college course, with chemical language, with chemical principles and laws, and with the chemical nature of the materials with which he has to deal; and that he should obtain such an insight into chemical analysis as to be able to confer with the trained chemist, and to understand the meaning of a general statement of the results of chemical analyses bearing on metals, alloys, fuel, lubricants, cements and other materials which are frequently used by the engineer.

It is beyond question that the engineer has too many calls upon his time and energy, both in his training and in his subsequent career, to allow of his becoming a chemist or a chemical analyst; but he should at least be sufficiently conversant with the science to enable him to appreciate the important bearings of chemistry on his varied requirements, and to enable him to avail himself intelligently of the results of chemical investigation and analysis. He should be able to watch and to appreciate any chemical inquiry and investigation, even if he is not qualified to suggest its methods of procedure or to carry it out himself.

It has been stated to me by a German manager of large English works, who has frequently occasion to call in the professional advice and assistance of both engineers and chemists, and who is himself well educated in both departments, that he has to lament in this country the "absence of useful engineering knowledge among chemists, and of useful chemical knowledge among engineers." Another informant states that Germany employs many more trained chemists working in conjunction with her engineers than England does.

Applications of Chemistry to Engineering.

In order to illustrate some of the advantages which engineers have derived from chemical coadjutors, one or two instances may be selected from different fields of engineering activity and enterprise.

In the matter of supplying the engineer with suitable constructive materials, the most striking case is that of the introduction of cheap steel of varying qualities in substitution for costly steel and other less suitable forms of iron.

The Bessemer process owed its original suggestion, as well as its salvation from failure, to the chemical knowledge which was supplied to those who were interested in the procedure. It further owed the extension of its application to all the commonest, cheapest and most abundant kinds of impure English cast iron to the further utilisation of chemical knowledge and suggestion.

At the present time the metallurgical chemist and the chemical metallurgist are engaged in furnishing metals and alloys, new to commerce, which can rank in importance with cheap steel, only in a somewhat minor degree; and the engineer in every department of his activity is now continually having placed at his disposal alloys which are more suitable for his various designs than any which he has hitherto employed.

It is scarcely necessary to point out the absolute necessity of chemical knowledge and chemical advice to the gas engineer. In the matter of water supply, also, both the engineer and the chemist find their respective but closely connected spheres of duty.

There is another direction in which the constant relation of chemistry to engineering, and in which the association of the chemist with the engineer must be maintained, if success is to be secured and expensive failures are to be avoided.

In no application of chemical and engineering principles is the co-operation of chemist and engineer more necessary for the attainment of success than in securing the suitable purification of our town sewage. Such co-operation has enabled London, Manchester and other large centres of population in recent years to carry out on an experimental scale most important trials of the natural or bacterial treatment of sewage, and has led to reports on this method being published which will probably become classical. This experimental work has led to considerable and valuable development and improvement of the bacterial method. There is now no doubt that this process can inexpensively dispose of a large proportion of the putrescible sediment or sewage-sludge, and can render the effluent, not only non-putrescible and suitable for maintaining the life of fish, but even pure if necessary. The process is therefore destined to effect great reforms in our sewage-disposal problem and considerable improvements in the condition of our watercourses.

[1] Abstract of the "James Forrest" lecture delivered at the Institution of Civil Engineers on April 25 by Prof. Frank Clowes.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Rede Lecturer for the present year is Dr. F. W. Maitland, Downing professor of law. Dr. Haddon, F.R.S., gives this term a course of lectures on studies in Papuan ethnology and the races of Oceania, on Mondays and Fridays at 2.30 p.m.

The Medical School Buildings Syndicate recommend the acceptance of tenders for the erection of the Downing Street wing and the Humphry Museum, amounting to more than 26,000*l.*

The Frank Smart studentship in botany at Caius College, of the annual value of 100*l.*, will be vacant at Michaelmas. Candidates must have taken honours in Part i. of the Natural Sciences Tripos. Further information may be had from the senior tutor of the College.

A meeting was held in St. John's College on April 27 for the purpose of procuring a portrait of Prof. Liveing, F.R.S., as a memorial of his lifelong services to the University. The meeting was largely attended by members of the Senate, and a warm tribute was paid to the professor, who began his teaching of chemistry fifty years ago, and who during that time has in many ways, public and private, benefited the University, town, and county of Cambridge. A strong committee was formed to carry out the purpose of the meeting.

Prof. Newton announces that there are vacancies for workers at the University tables in the Plymouth and the Naples zoological stations. Applications are to be sent to him by May 23.

Twenty-one candidates have passed the half-yearly examination in sanitary science for the diploma in Public Health, held in April.