quantity of either of these substances, placed in a bulb a cubic inch in volume, warmed, and exposed to the intermittent beam, emits a sound of extraordinary power.

I also tried to extract sounds from perfumes, which I had proved in 1861 to be absorbers of radiant heat. I limit myself here to the vapours of pachouli and cassia, the former exercising a measured absorption of 30, and the latter an absorption of 109. Placed in dried flasks, and slightly warmed, sounds were obtained from both these substances, but the sound of cassia was much louder than that of pachouli.

Many years ago I had proved tetrachloride of carbon to be highly diathermanous. Its sounding power is as feeble as its absorbent power.

In relation to colliery explosions, the deportment of marsh-gas was of special interest. Prof. Dewar was good enough to furnish me with a pure sample of this gas. The sounds produced by it, when exposed to the intermittent beam, were very powerful.

Chloride of methyl, a liquid which boils at the ordinary temperature of the air, was poured into a small flask, and permitted to displace the air within it. Exposed to the intermittent beam, its sound was similar in power to that of marsh-gas.

The specific gravity of marsh-gas being about half that of air, it might be expected that the flask containing it, when left open and erect, would soon get rid of its contents. This however is not the case. After a considerable interval the film of this gas clinging to the interior surface of the flask was able to produce sounds of great power.

A small quantity of liquid bromine being poured into a well-dried flask, the brown vapour rapidly diffused itself in the air above the liquid. Placed in the intermittent beam, a somewhat forcible sound was produced. This might seem to militate against my former experiments, which assigned a very low absorptive power to bromine vapour. But my former experiments on this vapour were conducted with obscure heat; whereas in the present instance I had to deal with the radiation from incandescent lime, whose heat is in part luminous. Now the colour of the bromine vapour proves it to be an energetic absorber of the luminous rays; and to them, when suddenly converted into thermometric heat in the body of the vapour, I thought the sounds might be due.

Between the flask containing the bromine and the rotating disk I therefore placed an empty glass cell: the sounds continued. I then filled the cell with transparent bisulphide of carbon: the sounds still continued. For the transparent bisulphide I then substituted the same liquid saturated with dissolved iodine. This solution cut off the light, while allowing the rays of heat free transmission: the sounds were immediately stilled.

Iodine vaporised by heat in a small flask yielded a forcible sound, which was not sensibly affected by the interposition of transparent bisulphide of carbon, but which was completely quelled by the iodine solution. It might indeed have been foreseen that the rays transmitted by the iodine as a liquid would also be transmitted by its vapour, and thus fail to be converted into sound.[1]

To complete the argument:—While the flask containing the bromine vapour was sounding in the intermittent beam, a strong solution of alum was interposed between it and the rotating disk. There was no sensible abatement of the sounds with either bromine or iodine vapour.

In these experiments the rays from the lime-light were converged to a point a little beyond the rotating disk. In the next experiment they were rendered parallel by the mirror, and afterwards rendered convergent by a lens of ice. At the focus of the ice-lens the sounds were extracted from both bromine and iodine vapour. Sounds were also produced after the beam had been sent through the alum solution and the ice-lens conjointly.

With a very rude arrangement I have been able to hear the sounds of the more active vapours at a distance of 100 feet from the source of rays.

Several vapours other than those mentioned in this abstract have been examined, and sounds obtained from all of them. The vapours of all compound liquids will, I doubt not, be found sonorous in the intermittent beam. And, as I question whether there is an absolutely diathermanous substance in nature, I think it probable that even the vapours of elementary bodies, including the elementary gases, when more strictly examined, will be found capable of producing sounds.

[1] I intentionally use this phraseology.

INTERESTING NEW CRINOIDS

IN the *Memoirs* of the Swiss Palæontological Society for 1880 Prof. P. de Loriol has recently described a remarkable new Crinoid which he refers to the little known genus *Thiollericrinus*, Étallon, under the name of *T. ribeiroi*. It occurs in the Upper Jurassic beds of Engenheiro, in Portugal. The calyx, like that of most Jurassic *Comatulæ*, has five small prismatic basals attached to the under surface of the radials. But the centrodorsal piece on which the calyx rests is not entirely separated from the lower part of the stem, as is the case in the *Comatulæ*, though it resembles that of a *Comatula* in bearing cirrhi.

Thiollericrinus was a stalked Crinoid that never developed beyond the stage at which cirrhi appear on the enlarged uppermost stem-joint of the stalked larva of *Comatula*. The underface of the centrodorsal and the terminal faces of the other stem-joints resemble those of the *Comatula* larva and also of *Bourgueticrinus* and *Rhizocrinus* in their oval shape and in the presence of transverse ridges which are in different planes at the two ends of each joint. *Thiollericrinus* therefore is a permanent larval form, and furnishes an intermediate stage between the stalked *Bourgueticrinus* and the free *Comatula*. The top stem-joint of the former bears no cirrhi, as it does in *Thiollericrinus* and in *Comatula*; while in the latter it develops cirrhi, and unites closely with the calyx, separating from the rest of the larval stem on which it was previously fixed.

Another form of considerable morphological interest, from its occupying an intermediate position between two well-defined genera, has been lately described by Mr. P. H. Carpenter under the name of *Mesocrinus*. The stem-joints are of the type already mentioned as characteristic of *Bourgueticrinus*, having oval faces marked by transverse ridges in different planes. But the upper stem-joint is not enlarged as it is in *Bourgueticrinus* and in the *Apiocrinidæ* generally, while the form of the calyx recalls that of the *Pentacrinidæ*. It consists of five radials with well-developed articular faces, resting on five basals which form a complete ring as in the recent *Pentacrinus Wyville-Thomsoni*, from 800 fathoms in the Atlantic off the coast of Portugal.

Broadly speaking, therefore, *Mesocrinus* combines the stem of *Bourgueticrinus* with the calyx of *Pentacrinus*, or rather of *Cainocrinus*, as Prof. de Loriol prefers to call that section of the *Pentacrinus* type in which the basal ring is closed. *Mesocrinus* is an Upper Cretaceous genus, one species occurring in the "Plänerkalk" of Streben in Saxony, while another and larger one was found in the "Mucronaten Kreide" of Southern Sweden.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—In consequence of the unsatisfactory state of many of the lodging-houses in Oxford, in respect of their sanitary arrangements, a proposal will be brought before Congregation on March 1 "to make better provision for the supervision of lodging-houses." One of the delegates for licensing lodgings will be stipendiary, and it will be his duty to inspect every dwelling-house proposed for this use and to satisfy himself of its sanitary fitness. He shall have the assistance of a sanitary inspector, and shall have proctorial authority over members of the University in his character of inspector.

A special statute will also be proposed authorising the present delegates of lodging-houses to spend whatever sum they may think necessary on a general inspection of lodging-houses during the present year.

There will be holden at Christ Church on Saturday, March 12, an election to at least one Mathematical Junior Studentship, and at least one in Natural Science, tenable for five years from the day of election. They will be of the annual value either (1) of 100*l*. (including an allowance for room rent) if the Governing Body shall so determine; or (2) of 85*l*. (also including an allowance for room rent), which may be raised to the larger sum above named after the completion of one year's residence, if the Governing Body shall so determine. Candidates for the Mathematical Studentships and candidates for the Natural Science Studentships who offer mathematics will call upon the Dean on Monday, February 28, between 12.30 and 1.30 p.m.; candidates for the Natural Science Studentships who do not offer mathematics, on March 2, between 12.30 and 1.30 p.m. All must produce certificates both of the day of their birth and of good character. The examinations will follow in each case at

2 p.m. Candidates for either the Classical or the Mathematical Studentships must not have exceeded the age of nineteen on January 1, 1881; candidates for the Natural Science Studentships must not have exceeded the age of twenty on the same day.

CAMBRIDGE.—There was a meeting of the members of the Senate on February 11, for the purpose of discussing the report of the Syndicate appointed last June to consider certain memorials as to the higher education of women. The Syndicate recommend that, subject to certain conditions of residence at Girton and Newnham Colleges, female students may be admitted to the Tripos Examinations, and certificates issued to them as to the result of the examination.—The Master of Emmanuel, in opening the discussion, remarked that he had never sat on any Syndicate before where so little difficulty had been experienced in agreeing to a report. Personally he wished the Syndicate had arrived at a different conclusion, and had recommended the admission of women to all the University examinations. He claimed for the recommendations of the Syndicate, however, that they closely followed the views of an influential number of residents who had signed a memorial on the subject, and wished for an official sanction to that which had been done for ten years without authority. He contended that it was the imperative duty of the University to give all possible access to its educational advantages, and that the proposed scheme was only a step in that direction.—Dr. Campion contended that the public opinion of the University had been carefully excluded in the constitution of the Syndicate. He charged the report with being both illiberal and harsh. It was illiberal, because the Syndicate had restricted the examinations to inmates of particular colleges, and was not for the encouragement of the higher education of women all over the country. Why was the advantage given only to Newnham and Girton Colleges? The report was harsh, for when they admitted women to test their scientific powers, it was unfair to do so after the conclusion of a time race with the men. Why not let the women study as long as they liked? He did not object to their being compelled to pass the previous examination, but to compel them to go step by step with undergraduates was placing them, by reason of their defect of physical power, in a false position.—Prof. Kennedy said, it was proposed to limit the competition to those within their reach; if the experiment succeeded, it would be a matter for future consideration what extensions should be made. As to the harshness, that surely might be left to the better judgment of the friends, relations, and guardians of these women who asked for these concessions. Women were mentally men's equals, but physically not. To urge their want of physical power as an objection to their admission to the same intellectual pursuits and pleasures as men was more for the Brahmin than the believer in the Bible; it was a fitter argument for the Turk than the Saxon.—Prof. Liveing defended the Syndicate from the attack of Dr. Campion, and asserted that the matter was discussed fully and fairly, without any bias of previously formed opinions.—Prof. Westcott, who did not concur in the whole of the report, expressed his great regret that the Syndicate before reporting had not collected further information on a problem so difficult and obscure.—Mr. Prothero, King's, was of opinion that the same course of training which was good for male students was equally good for women.—Mr. Sidgwick, Trinity, draw attention to the remarkable fact that no objection had been raised to the main proposal of the Syndicate.—The discussion lasted upwards of two hours.

KIEFF.—The number of students at the University of Kieff was, on January 1, 1881, as much as 1041, with fifty-eight professors.

SCIENTIFIC SERIALS

THE *Quarterly Journal of Microscopical Science* for January contains notes on a peculiar form of Polyzoa closely allied to Bugula (Kinetoskias, Kor. and Dan.), by George Busk, F.R.S., with plates 1 and 2.—On the germination and histology of the seedling of *Welwitschia mirabilis*, by F. Orpen Bower, B.A., with plates 3 and 4.—Notes on some of the Reticularian Rhizopoda of the *Challenger*, by Henry B. Brady, F.R.S.—On the head-cavities and associated nerves of Elasmobranchs, by Prof. A. M. Marshall, M.A., with plates 5 and 6.—Contributions to the minute anatomy of the nasal mucous membrane, by Dr. E. Klein, F.R.S., with plate 7.—Histological notes, by Dr. E. Klein, F.R.S.—On the intra-cellular digestion and endoderm of Limnocodium, by E. R. Lankester, M.A., F.R.S., with plates 8 to 10.—On the micrometric numeration of the blood-corpuscles, and the estimation of their hæmoglobin, by Mrs. Ernest Hart.—Preliminary account of the development of the lampreys, by W. B. Scott, M.A.—On some appearances of the red blood-corpuscles of men and other vertebrata, by G. F. Dowdeswell, B.A.

THE *Journal of Anatomy and Physiology, Normal and Pathological*, vol. xv., part 2, January, 1881, contains—Dr. John Struthers, the bones, articulations, and muscles of the rudimentary hind-limb of the Greenland right-whale (*Balæna mysticetus*), (with four plates).—Dr. Creighton, on an infective form of tuberculosis in man identical with bovine tuberculosis.—Dr. W. Osler, medullary neuroma of the brain (plate 18).—A. Doran, case of fissure of the abdominal walls (plate 19).—Dr. D. Newman, description of a polygraph (with woodcut).—Dr. O. H. Jones, on the mechanism of the secretion of sweat.—Dr. P. S. Abraham, anomalous pilose growth in the pharynx of a woman (woodcut).—Dr. R. Saundby, histology of granular kidney (woodcut).—Dr. J. Oliver, two cases of cerebellar disease.—Prof. M'Kendrick, on the colouring-matter of jelly-fishes.—Dr. Cunningham, nerves of hind-limb of the Thylacine and Cuscus.—Dr. W. J. Fleming, pulse dicrotism.

THE *American Naturalist* for January, 1881, contains: Prof. A. Geikie, the ancient glaciers of the Rocky Mountains.—Fred. W. Simonds, the discovery of iron implements in an ancient mine in North Carolina.—William Trelease, on the fertilisation of *Calamintha nepeta* (woodcuts).—S. V. Clevenger, comparative neurology.—E. L. Greene, botanising on the Colorado desert.—W. J. Beal, on a method of distinguishing species of poplars and walnuts by their young leafless branches (woodcuts).—James L. Lippincott, an address to the fossil bones in a private museum.—The Editor's table: Recent Literature.—General Notes [this portion of the journal has been very considerably enlarged with this number. The Botanical, Zoological, Entomological, Anthropological, Geological, Geographical, and Microscopical Sections are each under the charge of a special editor as formerly].—Scientific News.—Proceedings of Scientific Societies.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 27.—"The Refraction Equivalents of Carbon, Hydrogen, Oxygen, and Nitrogen in Organic Compounds." By J. H. Gladstone, Ph.D., F.R.S.

Since the communication which I had the honour to read before this Society in 1869, "On the Refraction Equivalents of the Elements," very little has been done on the subject.

Of late however its importance in regard to theories of chemical structure has been recognised by Dr. Thorpe and other chemists in this country, and attention has been recalled to it in Germany by the papers of Brühl, who, following closely in the footsteps of Landolt, has endeavoured to explain the results in the language of modern organic chemistry.

At this juncture it may be of service to put on record my present views in regard to the refraction equivalents of the four principal constituents of organic bodies—carbon, hydrogen, oxygen, and nitrogen.

Carbon.—Carbon in its compounds has at least three equivalents of refraction, 5·0, 6·0, or 6·1, and about 8·8.

Whether its refraction should be one or other of these appears to depend on the way in which the atoms are combined.

When a single carbon atom has each of its four units of atomicity satisfied by some other element, it has a value not exceeding 5·0.

When a carbon atom has one of its units of atomicity satisfied by another carbon atom and the remainder by some other element, it has the value of 5·0. This is also the case if two of its units of atomicity are satisfied by carbon atoms.

When a carbon atom has three of its units of atomicity satisfied by other carbon atoms, its value is 6·0. The most striking instance is that of benzol, C_6H_6 (refraction equivalent 43·7).

There are other organic compounds in which only some of the atoms of carbon have the higher value. It has been especially the work of Brühl to point this out, and to show that where they occur (as in amylene or the allyl compounds) the carbon atom is in a condition similar to those in the phenyl nucleus, that condition in fact which is generally represented in our