Massachusetts, of the isopod crustacean *Ancinus depressus* (=*Noesa depressa*, Say), of which only two examples were previously known.

To the third part of the *Bergens Museum Aarbog* for 1908 Mr. Alf Wollebœk contributes an important and lavishly illustrated article on the decapod crustaceans of the North Atlantic and the Norwegian fiords. The article commences with an elaborate account, illustrated by eight out of the thirteen plates, of *Caloxaris crassipes*, for which the new subgeneric term Calocarides is proposed. The rest of the article is devoted to various species of Macrura, with special reference to their distribution, both horizontal and vertical, and their habits and life-histories.

In the serial last quoted, No. 1658 (vol. xxxv., pp. 681–727), Prof. C. C. Nutting reviews the alcyonarians of the coast of California, the paper being based on the collections obtained during the cruise of the *Albatross* in 1904. Out of a total of thirty-eight species, twenty are referable to the pennatulid group. Many of these species are described for the first time, and the memoir is illustrated with a large number of figures. The writer saw only two kinds of alcyonarians in shallow water—both pennatulids; and as the coast appears to form an ideal habitat for such organisms, their rarity requires explanation.

No. 2 of vol. vi. of the Zoological Publications of the University of California is devoted to the Leptomedusæ of the San Diego region. Of eleven species of these jellyfish recognised by the author, Mr. H. B. Torrey, in the collection of the Marine Biological Association of San Diego, no fewer than ten are described as new, two of these indicating new generic types, namely Tiaropsidium and Phialopsis.

The last paper on our list is the first portion of a memoir by Mr. W. Gariaeff, of the Zoological Laboratory at Villafranca, on the histology of the central nervous system of the cephalopods, published in vol. cxii. of *Zeitschrift für wissenschaftliche Zoologie*. In this instance the author deals with *Octopus vulgaris*.

THE INFLUENCE OF MOISTURE ON CHEMICAL CHANGE.[1]

THE influence of a trace of water vapour on a chemical reaction was first noticed by Prof. H. B. Dixon in 1880. He found that it was possible to pass electric sparks in a mixture of carbon monoxide and oxygen without explosion if the mixture had been very carefully dried. Shortly afterwards Cowper proved that dried chlorine had little or no action on several metals. Further observations were made by Prof. Dixon's pupils, the author in 1884 showing that carbon could be heated red hot in dried oxygen, that sulphur, and even the very inflammable phosphorus, could be distilled in the same gas without burning. Later experiments proved that ammonia and hydrogen chloride gases could be mixed without uniting, and that the readily dissociated ammonium chloride could be converted into a true vapour, and sulphur trioxide could be crystallised on lime, provided always that moisture was, so far as possible, removed. In 1902 it was shown that tubes containing very dry and pure hydrogen and oxygen could be heated to redness without any explosion resulting, and in 1907 that nitrogen trioxide could exist in the gaseous state if carefully dried.

Taken altogether, some twenty-five simple chemical actions have been shown to be dependent on the presence of moisture, and a few only, the burning of cyanogen, carbon bisulphide, and some hydrocarbons, seem to take place as easily when dried as when moist. In 1893 Sir J. J. Thomson showed that a potential difference of 1200 volts was unable to cause the passage of electric sparks through very dry hydrogen, and in the same year the author was able to stop the passage of the discharge from an induction coil by carefully drying the gas between the platinum points.

The amount of water necessary for the bringing about of chemical action is extremely small, less, in all probability, than one part in three hundred thousand of the reacting gases. Many hypotheses have been suggested for the explanation of its action. Prof. Dixon believed, in the case of carbon monoxide and oxygen, that the water vapour acted as a carrier of oxygen by alternate reduction and reoxidation of the hydrogen. Traube imagined an alternate formation and decomposition of hydrogen peroxide. Dr. Armstrong in 1884 suggested a theory of "reversed electrolysis," the impurity of the water vapour rendering it a conductor. Sir J. J. Thomson in 1893 published a paper showing that if the forces holding the atoms of a molecule together were electrical in their nature, these forces would be very much weakened in presence of liquid drops of any substance of high specific inductive capacity such as water.

In 1895 it was shown that the newly discovered Röntgen rays were able to cause a gas to become a conductor of electricity, and it was thought, at that time, that the molecules of the gas were split up into atoms by this agency. If this were so, it seemed likely that in these circumstances chemical action would take place in absence of water, but a joint paper of Prof. Dixon and the author, in 1896, showed that the Röntgen rays, at the ordinary temperature, had no measurable effect on the combination of dried gases. Since that time, however, the researches of J. J. Thomson, Rutherford, Townsend, and others have proved that the ionisation of gases is of a different character.[1] The negative ions are extremely small particles of the mass of about 1/1000th part of the mass of an atom of hydrogen, the positive ion being the residue, but whether it is the residue of a molecule or of an atom seems to be still doubtful.

With the view of illustrating the influence of ionisation of gases on chemical change, the author devised a new experiment. It is known that mercury vapour, in ordinary circumstances, contains only atoms of mercury, which exhibit little tendency to combine with oxygen. The vapour, however, is ionised in the mercury vapour lamp, and when the current is cut off and oxygen is admitted shortly afterwards, the mercury becomes covered with a layer of mercuric oxide. Since the temperature of the lamp is much below that at which ordinary mercury vapour combines with oxygen, it is evident that in this case ionisation can bring about chemical action.

It is probable that this ionisation of mercury is different from the ordinary ionisation of gases. It may be regarded as the splitting off of an electron from the atom as distinct from a molecule, and the charged atom of mercury can then enter into union with oxygen. The cases mentioned above of combustions in oxygen which are apparently unaffected by the absence of moisture are perhaps to be explained in the same way. The gases are readily broken up into their elements, and it has been shown that carbon bisulphide breaks up at a lower temperature than that required for its burning. When these gases are heated charged atoms are probably formed, capable of direct union with oxygen.

To test further the question as to whether the ionisation of molecules, as distinct from atoms, as in the case of mercury vapour, can bring about chemical change, some recent experiments have been performed in which radium bromide was used as the ionising agent. Small quantities of this salt, contained in open silica tubes, were sealed up in tubes containing mixtures of hydrogen and oxygen and carbon monoxide and oxygen, the gases being very dry in some cases and moist in others. In no case was any chemical action observed, although the tubes were allowed to stand at 20° for more than two months. By means of a vacuum gauge the combination of 1/10,000th of the whole could have been detected. Another experiment showed that radium bromide was able to produce ionisation in very dry air, so that the want of chemical action in the above experiments must have been due to the fact that ionisation cannot of itself produce chemical action. There remained, however, the possibility of ionisation increasing the rate of union of two gases which were otherwise under conditions which would produce a slow chemical action between them. The reaction between nitrous oxide and hydrogen was found to be a suitable one for investigation, since it takes place

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[1] Abstract of the Wilde lecture, delivered before the Manchester Literary and Philosophical Society on March 9, by Dr. H. Brereton Baker, F.R.S.

[1] The author finds that liquid water invariably collects in tubes containing salts of radium, though these salts are not at all deliquescent. In one experiment 10 mg. of radium bromide increased in weight by 1·5 mg. when allowed to stand for two days in an atmosphere saturated with moisture at 0° C. Examination of the crystals under the microscope showed that their edges were quite sharp, showing that the absorption of water was not due to deliquescence.

slowly and uniformly at 530°. It is known that many substances will, when heated, ionise gases. Lime is fairly effective in this respect, thoria to a much greater extent, and radium bromide is the most effective of all. Accordingly, tubes containing the mixture of not very dry hydrogen and nitrous oxide were prepared. One contained a little lime, a second some thoria, and a third some radium bromide. These tubes were heated in an electric resistance furnace side by side with comparative tubes containing the same gases in which was a small quantity of powdered Jena glass to make the conditions as similar as possible. It was found that the rate of combination was much quickened by the presence of lime, much more by the presence of thoria, while the gases in contact with radium bromide, directly the combining temperature was reached, combined with explosion.

When a tube containing thoria and the same mixture was dried for ten days by phosphorus pentoxide, the gases showed no measurable combination when heated for five minutes to 530°.

Hence increasing the ionisation in presence of moisture increases the rate of chemical change, while in absence of moisture it apparently has no effect.

An experiment of rather different type was shown which illustrates the way in which the ionisation of gases may exert its influence. A mixture of sulphur dioxide and sulphuretted hydrogen can be kept unchanged although water vapour is present in some quantity. If, however, liquid water is introduced, separation of sulphur is immediate. A small open tube of radium bromide was placed in such a mixture, and after standing some time the whole of the gases condensed in the small tube of radium bromide in the form of sulphur and water. There is little doubt as to what happens in this case; the water vapour condenses in liquid drops on the ionised particles in the radium tube, and in these drops the reaction between the two gases is completed.[1] In the other chemical changes at high temperatures it is conceivable that condensation to some form approaching the liquid state might take place, in which case Sir J. J. Thomson's theory would apply.

In support of this view must be mentioned some very recent experiments of Prof. J. S. Townsend, which show that a very great diminution in mobility of negative ions is produced when a mere trace of water vapour is added to a dried gas ionised by Röntgen rays. If there is any truth in this provisional working hypothesis, it should be found that ions and water vapour (or some similar substance) must both be present in a mixture of gases if action is to take place. Experiments already in progress seem to show that this is the case, but they have not been sufficiently often repeated for it to be desirable to publish the results at this stage.

The lecture was illustrated by experiments showing the influence of small quantities of moisture on chemical actions.

FUNCTIONS OF A UNIVERSITY.[2]

I AM often asked, What will the University of Bristol be, and what will it do? The obvious, if not very enlightening answer is, It will, in large measure, be and do that which the citizens of Bristol shall, in their wisdom, determine that it shall be and do. Bristol will have to show the educational stuff of which it is made. It must rise to the great occasion, and prove itself equal to the responsibilities of a city of the first rank.

A university is not primarily a place, or a group of buildings, or a board of examiners. A university is first of all a corporate body of men, and with us of women too, associated together for a definite purpose, and united by a common aim. A university is, or should be, I take it, a guild of learners. Mark you, I do not say a guild of so-called learned folk. I trust there will be learned folk in our guild, and I trust there will be those rarer folk, men of wisdom and character; but though learned men, and wise men, and men of character, help to make a university, they do not constitute the university which, as a guild of learners, is founded on a broader basis. Nor do the teachers constitute a university, though they too help to make a university of the first rank. The learners constitute the university, and when the teachers cease to be learners they ought also to cease to be teachers. If then the university, as a corporate body, is a guild of learners, and its buildings a temple of learning, all should be welcome in the university who desire to learn, and who have given evidence of adequate breadth of previous education, and the requisite ability to learn at the relatively high level which ought to characterise university work. That is the real and only value of the matriculation test. Each stage of a degree should guarantee not only a higher level of attainment, but also a further ability to learn, and to utilise what has already been learnt.

A university, then, is a guild of learners united together in a corporation in which, as Huxley put it, "thought is free from all fetters, and in which all sources of knowledge, and all aids to learning, should be accessible to all comers without distinction of creed or country, riches or poverty."

The university is not, and cannot be, a place for all; it must be a place for the *selected few*, those only who are capable and willing to do university work. What we have to secure is that there shall be equal opportunities for all, without distinction of riches or poverty. Like the polishing of gems, the higher education is a costly and a lengthy process. It is worth while to spend two years in fashioning a Cullinan diamond, and its value is thus enormously enhanced. To expend this time and labour on mere glass or paste would be a grave economic blunder. In the university we must select the material on which the time and labour of our educational lapidaries is to be bestowed; and it is worth while to take the most anxious care to find your precious stones if only they are true gems. If, say, within the next ten years the University of Bristol can find and fashion but one lad of real genius, who would otherwise be cut off from the highest training, Mr. Wills's investment of 100 000*l*. in the University will be economically justified. That is not merely an opinion of mine. Some of you may remember what Huxley said:—"I weigh my words when I say that if the nation could purchase a potential Watt or Davy, or Faraday at the cost of a hundred thousand pounds down, he would be dirt cheap at the money. It is a mere commonplace and everyday piece of knowledge that what these three men did has produced untold millions of wealth, in the narrowest economical sense of the word." This is a point on which I feel strongly. As a matter of economic policy, from the national standpoint, I am convinced that 1000*l*. spent by a local education authority on the highest training of the best student will bear far higher interest to the community than the same sum spent in giving a smattering of education to a thousand evening students. Do not, however, misunderstand me. I am not denying that the latter expenditure is of value to the community. All I say is, this ought ye to do, and not to leave the other undone; but I do venture to add that we are not wise in the way in which we manage our national investment in education. As a nation we invest annually between thirteen and fourteen millions in elementary and secondary education in England and Wales. What is the amount of the Treasury grant to university education? About 142,000*l*., a little more than 1 per cent.

The chief thing that should be learnt in a university is how the problems which arise in all serious work are to be approached, to be grappled with, and, if possible, to be solved. That is really the first and foremost thing to be learnt. A leading man of business, whom I met some years ago in the United States, told me that most of the younger men employed in responsible positions in his office held a university degree. I asked wherein lay the practical value of the degree for his purposes. He replied that such men had been trained to face and tackle problems, and he added that it did not much matter in what faculty they had been trained, or, in other words, what line of investigation they had followed during their university career. He contended that the university degree was the

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[1] Since the phenomenon in gases is admittedly different from that in electrolysis, it is much to be regretted that the same term, ionisation, is retained for both.

[2] From a speech on the University of Bristol delivered by Prof. C. Lloyd Morgan, F.R.S., at the tenth annual dinner of the University College Colston Society, Bristol, January 14.