subcutaneously is about 1 milligramme of dried substance, which proves lethal in about twelve hours. Twice this quantity injected into the veins kills a rabbit of about 1500 grammes in sixteen minutes. Five times as much introduced subcutaneously proves fatal in about three and a half hours. I may, however, give you the results of experiments devised to bring out the exact action of the anti-venomous serum, which experiments have been followed by those who are working in these laboratories.

To exhibit the efficiency of protective injections, at nine o'clock this morning four rabbits, weighing between 1450 and 1770 grammes, were injected intravenously in the lateral aural vein, each with 3 c.c. of the anti-venomous serum. This afternoon these rabbits have been injected intravenously with 2 milligrammes of dissolved dried venom sufficient to kill the animal in sixteen or seventeen minutes. None of these animals show any symptom of sleepiness, and it is evident that the venom will have little, if any, effect upon them. At the time that these animals were injected with the two lethal doses, two control rabbits, weighing 1340 and 1275 grammes respectively, were similarly injected intravenously with 2 milligrammes of the venom; these both succumbed to the symptoms above-mentioned, one in about sixteen minutes and the other in seventeen minutes. We have here, then, ample evidence of the great protective power that the serum exerts when injected into the body before the venom is introduced. In a second series of experiments, carried out to demonstrate the curative properties of this serum, six rabbits were similarly treated with 5 milligrammes of venom injected under the skin. Half an hour afterwards two of these animals received 3 c.c. of the serum intravenously; neither of them showed any symptoms of poisoning, and remained perfectly well. Two others of these poisoned animals, one hour after the venom had been introduced, were similarly injected intravenously with 3 c.c. of the serum; they also remained well. Two of the other rabbits should have been left for one and a half hours, but the dose of poison was so large that one of the animals succumbed at the end of an hour and twenty minutes; the other animal was immediately injected with the same dose of serum as above, with the result that it is now well, although the dose of venom was so large and had been allowed to act for so long a time—long enough, indeed, to kill the other animal injected at the same time. This is a very striking proof of the efficacy of the serum.

Although the anti-venomous serum does not act directly upon the toxin, but only through the cells, it begins to exert its influence immediately it is introduced into the body. This fact is well brought out by the following experiments:—Three c.c. of the serum were injected into the lateral vein of the left ear of a rabbit weighing 1280 grammes; fifteen minutes later this animal received into the lateral vein of the right ear 2 milligrammes of the venom, sufficient to kill it in less than twenty minutes had it not received the serum. The animal has remained perfectly well, and still shows no evidence of poisoning by snake venom. A more striking experiment still is one of which I give a description. A rabbit having received intravenously 2 milligrammes of venom, two minutes later is injected with 5 c.c. of the anti-venomous serum in the vein of the opposite ear. The animal has remained perfectly well.[1] Such an experiment shows that the venom does not destroy the cellular elements at once, and that even when the poison has already found its way to the circulation these cells may be rendered insensible to the action of the poison by means of the action of the serum.

[Dr. Calmette then gave extracts from the paper which he brought before the British Medical Association at Carlisle, and concluded by asking Dr. Woodhead to read the following.]

Gentlemen, the experiments that have been described to you concerning the efficacy of the "anti-venomous serum," the results of which you have before you, prove that the said serum really constitutes a specific remedy against venomous snake-bites. The use of this serum must necessarily become generalised at no distant date in all countries where venomous snakes are found, in order that both men and domestic animals may be protected. Is it not advisable, therefore, for the British or Colonial Governments, which are deeply interested in this matter, to take rigorous measures to prevent the sale in England and in its colonies of serums for which no absolute guarantee of efficacy and purity is given? I have the honour to propose that you will adopt the following propositions, and bring them in some way before the Government at as early a date as possible:—

(1) That there be instituted in London and in each British colony where there are found venomous snakes a sanitary committee, to be entrusted with the duty of testing the efficacy of anti-venomous serums offered for sale or sent out to be delivered gratuitously by druggists and others.

(2) That no bottle shall be sold or distributed unless bearing the mark of such control.

(3) That this control be effected according to the sole, simple, and rapid method which alone presents every guarantee of accuracy.

(4) The method proposed is the following:—A standard solution of venom will be placed at the disposal of the appointed experts. The toxic unit of this solution will be based on the quantity of venom necessary to kill a rabbit of 2 kilogrammes in twenty minutes by intravenous inoculation in the marginal vein of the ear, the above quantity corresponding on an average to 2 milligrammes of cobra venom (weighed dry) and to 4 milligrammes of rattlesnake venom. An anti-venomous serum, to be sufficiently active for therapeutic use, must be a preservative in a minimum dose of 2 c.c. on intravenous injection into a rabbit of 2 kilogrammes against an intravenous injection of the toxic unit of venom. The preventive inoculation must be made fifteen minutes only before the inoculation of the venom. The testing of the serum is thus effected in less than one half-hour.

(5) That stations provided with serum and all the necessary apparatus for its application be established in the principal centres of agriculture and in the mining and forest districts of the colonies infested with venomous snakes, such as Australia, Burmah, and India, so that every person bitten may be able to come at once and receive treatment.

[1] All these animals were still alive and in excellent health eight days later.

REPORT OF THE DEPARTMENT OF SCIENCE AND ART.

THE forty-third Report of the Department of Science and Art, dealing with the work of the Department during the past year, has just been issued in the form of a Blue-book. The report may be taken as a statement of the condition of elementary science teaching in this country; therefore, some of the facts and opinions contained in it are worth recording.

In the science division it is pointed out that in the decennial period, from 1886 to 1895, the number of schools has increased from 1682 to 2673, of classes from 5862 to 9545, and of students from 94,838 to 193,404. Of the 193,404 pupils under instruction in 1895, 188,380 come within the category of those on account of whose instruction payments on the results of examinations are made by the Department. Of the schools examined, 2139 were in England and Wales, 366 in Scotland, and 168 in Ireland. There were 113,398 individual students examined, and 52,079 were successful in passing in one or more subjects. The payments to Science Schools, exclusive of those made to Training Colleges on the results of the examinations for the year 1895, amounted to £142,543, an increase of more than £2000 on the preceding year.

Of the 2673 Departmental Science Schools in 1895, 115 were Organised Science Schools, that is to say, schools in which organised courses of instruction are followed. A new scheme of work for such schools came into force last year, and so far it appears to have worked satisfactorily. Practical physics was made obligatory in these schools by the new scheme, and the result is that while only a few years ago a physical laboratory was a rarity, one will shortly be found in every school in which science forms a proper place in the curriculum.

Mr. C. A. Buckmaster, one of the senior inspectors, places his finger upon a weak point in the education of teachers when he says, "the great failing of the elementary teacher as a science instructor is not want of knowledge, but want of ability to experiment." The reason is that few Training Colleges provide facilities for courses of experimental work, though such scientific practice should be an essential condition for the teaching of science subjects in the Elementary School Code.

Throughout the reports of the inspectors the welcome information is made known that experimental work in science is becoming more common, but there is still much room for improvement. The supply of apparatus is being largely increased, and *laboratory accommodation is being extended. The* chief difficulty to be contended with at the present time is the insufficient education of the students who join the evening classes. Especially is there a lack of knowledge of scientific principles, and there is a difficulty in getting students to take up subjects which lie at the bottom of all technical subjects. On this point Dr. H. H. Hoffert says: "It is much to be desired that as Technical Institutes multiply, and permanent staffs of well-qualified teachers become appointed, more encouragement may be given to students of evening classes to take up definite courses of study. Such students too frequently attempt the study of the more purely technical and applied subjects, without having the necessary knowledge of the underlying sciences, and in consequence of this the teaching is largely based on rule-of-thumb methods of practice, and is lacking in scientific generality and educational value. There is an undue disproportion in number between classes on such subjects as applied mechanics, steam, and mining, and those in theoretical mechanics, elementary physics, chemistry and geology."

In addition to the reports on instruction in science and art, the Blue-book just issued contains as appendices reports on the Royal College of Science, the South Kensington Museum, and other museums in connection with the Department of Science and Art, supported by the State. There is also in it the Report of the Director-General of the Geological Survey of the United Kingdom and the Museum of Practical Geology, and a Report to the Solar Physics Committee on the work done in the Solar Physics Observatory at South Kensington.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE appointments, recently advertised, at the Northampton Institute, Clerkenwell, have been filled as follows:—Mr. John Ashford, Lecturer on Engineering at the Birmingham Technical Schools, to be Head of the Mechanical Engineering and Metal Trades Department; Mr. John Williams to be Head of the Artistic Crafts Department; Mr. C. V. Drysdale to be Chief Assistant in the Applied Physics Department; and Miss Mary A. H. Gibbs to be Head Teacher in the Domestic Economy School.

THE Technical Education Board of the London County Council has addressed a letter to the Councils of University and King's Colleges on the subject of the financial assistance to these institutions during the forthcoming session. It is pointed out in this letter that the Board cannot undertake to ensure regular annual grants towards either of these colleges. It is further recommended that the Councils of the two colleges should confer together before making any application for assistance, with a view to coordinating the work now specially carried on in connection with Oriental languages. A question has been raised with regard to King's College, as to whether the Board can legally make a grant to an institution of a denominational character. But since the discussion of these questions will take some time, it is proposed to continue the grants of £1500 to University College and £1000 to King's College for next year, on the understanding that such a conference shall be held.

THE following complaint, which has been made by *The Local Government Journal*, is not, we think, borne out by the reports of the technical education committees of those County Councils which administer the affairs of the agricultural counties, and which have been sent to us from time to time. The paragraph runs thus: "If technical education committees would bestir themselves and give lessons in thatching, hedging, ditching, sheep-shearing, and so on to the men, instead of providing an afternoon's amusement for labourers' wives in showing them how to make butter without having a cow to produce the milk, and similar instruction for farmers' wives and daughters when the ladies of the farm have no intention of making butter, or of bending their backs to skim the milk, much more good would be done than is accomplished at present, and a great waste of treasure would be obviated." More than one committee in charge of technical instruction would be grateful to our contemporary for some successful method of getting farm-labourers together for the purpose of agricultural instruction, though we have our opinion of the wisdom of teaching the subjects named, *even if these arts are not included in the well-known restriction* of the Technical Instruction Act.

SCIENTIFIC SERIALS.

American Journal of Science, August.—Molluscan archetype considered as a *veliger*-like form, by A. E. Verrill. In the form of molluscan larva known as *veliger*, and in its slightly younger stages, we have organisms that swim free, often seek their own food, and seem to have claims to be considered the nearest living representatives of the ancestral molluscan archetype, or archetypes, for it is quite probable that the different classes of Mollusca have descended from distinctly differentiated *veliger*-like organisms. In general, it may be stated that nearly all Gastropoda, except certain terrestrial and fresh-water forms, pass through *veliger* stages. The same may be said of Bivalvia, Scaphopoda, and Pteropoda. Cephalopoda, on the other hand, seem to have an abbreviated development, like terrestrial Gastropoda, and leave the egg with the general structure of the adult. It is probable that each of these great classes were originally small, free-swimming forms, furnished with a ciliated locomotive organ similar to the velum of modern veligers. The primitive Cephalopoda had probably a similar origin from a *proveliger* like that of some pteropods and gastropods. On the other hand, it seems impossible to derive a cephalopod or a bivalve from a creeping chiton-like archetype such as Lankester has proposed.—An apparatus for the rapid determination of the surface tensions of liquids, by C. E. Linebarger. The apparatus is based upon Jäger's method of employing two capillary tubes of different bore immersed in the liquid, and measuring the difference of the depths to which they were plunged when air bubbles forced out of them at the bottom required the same air pressure. The tubes employed had bores ranging from 0·1 to 1·5 mm. Two tubes were mounted in clamps in a stand over a test tube containing the liquid, and immersed in a water or glycerine bath. Air pressure was applied, and the orifices were shifted until the liquid was pushed down to the orifices, and there the heights were carefully adjusted until equal streams of bubbles issued from both orifices. The surface tensions were found by the formula

$$\gamma = chs + s^2$$

when γ is the surface tension in dynes per cm., c the apparatus constant, h the distance between the ends of the tubes, and s the specific gravity.—Wardite, a new hydrous basic phosphate of alumina, by J. M. Davison. Mr. Packard's "variscite" from Utah occasionally leaves on decomposition some cavities in the nodules, and encrusting these cavities is a hydrous basic phosphate of alumina, which appears to be a new mineral. It is a light green or bluish green, with vitreous lustre, concretionary structure, hardness about 5, and density 2·77. Its formula is $Al_2(OH)_3PO_4$, and it forms a series with Peganite and Turquois.—On the existence of selenium monoxide, by A. W. Peirce. The author has been unable to find evidence of the existence of the monoxide, either gaseous or solid, and his experiments go to show that the peculiar smell of decayed cabbage, attributed by Berzelius to the monoxide, is only developed when selenium is heated in presence of moisture, if only a mere trace, and is probably due to selenium hydride.

Bulletin of the American Mathematical Society, vol. ii. No. 9, June.—The motions of the atmosphere, and especially its waves, is a translation, by Prof. Cleveland Abbe, of an address by Dr. E. Hermann, which was delivered before the Meteorological Section of the Association of German Naturalists at the annual meeting held in Vienna, September 25, 1894. The author states that the inadvisability of the views according to which the motions of the atmosphere consist in the development of independent cyclones and anticyclones is, of late years, more and more plainly recognised. This conclusion has been arrived at, not so much through a severe criticism of the fundamental basis upon which these erroneous views had been established, as by the power of the facts that resisted introduction into this artificial system. He traces this change of view