workshop fitted with a circular saw, a planing machine, and a lathe for the instruction of students, rooms for the members of the staff, a students' room, and a library. Additional rooms for the museum and laboratory of the lecturer in forest zoology were also provided in the building. These various parts of the building are fitted up with valuable collections of specimens, serving as object-lessons for the training of the students.

This accommodation was just completed before the outbreak of war. The site and building cost 19,500*l.*, and at present prices it is easy to reckon that its value to-day is nearer 40,000*l.* than 20,000*l.* The equipment and fittings cost about 2000*l.*, and the same remark applies to them. It is difficult to make even a guess at the value of the specimens which fill the museums. Towards this outlay, which is exclusive of museum specimens, the University furnished 15,200*l.*, the Development Fund contributing 6300*l.* The other expenditure on the forestry department proper for the period of years 1910–11 to 1919–20, to which allusion is made, on salaries, etc., amounted to 8800*l.*, of which 6600*l.* was furnished from the University funds and 2200*l.* from State funds; so that out of a total outlay during the period of 30,300*l.* the University provided 21,800*l.* as against 8500*l.* received from the State. In addition, the University paid from its own funds the salaries of the lecturers conducting the applied science subjects, forest botany, and so forth. Last year a chair in forestry was instituted and endowed within the University with the help of a grant from the Development Fund.

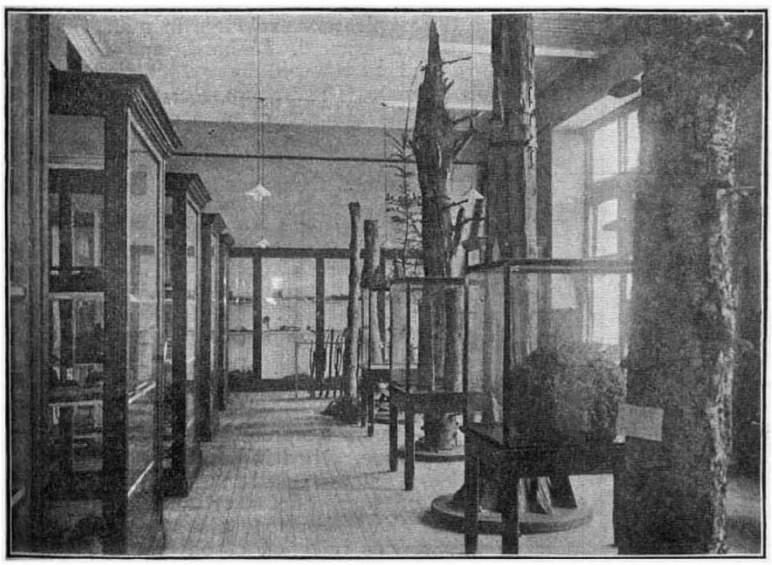

FIG. 2. - Protection Museum, Fore try Department, University of Edinburgh.

For the practical work, through the courtesy of their proprietors, Edinburgh University has had the use of the woods on the estates of the Duke of Atholl, Col. W. Steuart-Fothringham of Murthly, the Earl of Mansfield of Scone, and Viscount Novar of Novar and Raith, and of the Speyside Woods. The students are taken out to these areas and instructed in nursery work, in planting and felling, in sylviculture, and in the protection, utilisation, and scientific measurement of the woods. Arrangements have recently been made with the War Office by which a forest garden has been established on the War Office estate at Dreghorn, situated a few miles from Edinburgh, where a fine large nursery is being laid out; and the Stobs estate of several thousand acres, also belonging to the War Office, has been made available for practical work by the students, the University in return advising on the management of the woods of these estates. The Forest of Dean is used for advanced practical work, and the visits which were made to Continental forests before the war are now being resumed.

At the outbreak of war there were 50 students in the department; last year 168 students took forestry courses in the University, and this year the number has reached 170. The 40 students who have taken the forestry degree since 1911 are now serving in the Indian Forest Service and in the various Colonial Forest Services (South Africa, Canada, and New Zealand), in the Home Forestry Service, and in the Home universities. At the present moment there are in Edinburgh University sixteen Indian forestry, nine Colonial Office, and ten South African probationers—a total of thirty-five.

The University may thus be considered to have met a national need in placing itself in a position to give a full scientific training to the forest officers of the Empire.

The International Physiological Congress, 1920.

SUMMARY OF PAPERS.

SINCE more than two hundred papers and demonstrations were given at the above congress, which was held in Paris in July, a mere mention of the more outstanding communications is all that is possible in this summary. For a general account of the congress Prof. Fraser Harris's article in NATURE of September 16 may be consulted.

Of new apparatus, those described by Hess (Zürich) and Wilson (Cairo) may be specially mentioned. The former demonstrated a cardio-phonograph, a viscosimeter, and stereoscopic photographs. The latter exhibited a stethograph, a portable ergograph, a micro-nitrometer, a colorimeter, and a chronograph with electro-magnetic signal. The pursuit-meter described by Miles (Boston) for detecting the influence of nutrition, fatigue, industrial conditions, etc., on neuro-muscular co-ordination, and the demonstration (without the aid of the microscope) by Fredericq (Liége) of cilia, spermatozoa, etc., in motion, by means of intense illumination, were of particular interest. Philippson (Brussels) demonstrated an apparatus for showing the precise moment of coagulation of an organic liquid; another for recording modifications in the viscosity of fluids; and

a method for measuring the electrical resistance of cells and tissues. The crescograph shown by Bose (Calcutta), which is claimed to magnify growth and other movements ten million times, was closely examined and much criticised. Mention may also be made of the display of well-made physiological apparatus by several French and Swiss firms.

Morpurgo (Turin) showed a number of artificially united rat-pairs (so-called Siamese twins). He finds that when two animals of different size are united the weaker dies from inanition, as a result of failure to hold its own in the joint distribution of nutritive substances. Rochon-Duvigneaud (Paris) finds that the foveæ in the retina of birds may be central, excentral, or double; since complete decussation occurs at the optic chiasma, each has a unilateral connection. A communication by Minkowski (Zürich) dealt with the course of the optic fibres in man and other mammals.

Botazzi (Naples), by very slowly varying its temperature, finds that mammalian striated muscle (diaphragm) shows a distinct shortening at 0° C. (cold-contracture) and another, already well known, at 45° (heat-contracture). He believes that these changes, which are reversible, are due to the sarcoplasm. Heat rigor (63° C.), which is irreversible, he regards as due to contraction of the connective-tissue. Parnas (Warsaw), in his communications on muscle physiology, supported a view which is opposed to that of A. V. Hill on the question of the fate of lactic acid during the relaxation phase, favouring the combustion theory. Langley (Cambridge) suggested that muscle atrophy after denervation is due to fatigue (fibrillation), resulting from the irritation set up in the neural region of the muscle. He also spoke upon nerve suture and regeneration. The conditions of industrial fatigue were dealt with in a paper by Lee (New York).

The question of fat metabolism in its broadest aspect was the subject of a communication by Halliburton (London), the vitamine problem being specially considered. Gosset, Camus, and Monod (Paris) described a method for obtaining permanent biliary fistulæ in the dog. Both Foa (Parma) and Lombroso (Messina) dealt with the metabolism of fats in the liver; they showed that their destruction is much greater during digestion than during fasting. Lombroso also discussed the action of enterokinase upon the proteolytic activity of pancreatic juice. Brinkman (Groningen) showed that the cholesterol-phosphatide quotient controls the permeability of cell-membranes, those of erythrocytes in particular, and pointed out that this factor is all-important in the pathology of anæmias. The question of intermediary metabolites and their relation to heat production was dealt with by Graham Lusk (New York), who found that in the dog 58 grams of glucose increased heat production by 4·3 Calories, while 50 grams of glucose *plus* 8 grams of lactic acid caused an increase of 4·8 Calories. When lactic acid was replaced by 3 grams of acetic acid, the increase observed was 7·3 Calories. This last result is similar to that obtained when fat and glucose are metabolised together, and suggests that acetic acid may be an intermediary metabolite of fat, but not of glucose. E. and May Mellanby (London) showed that the cause of rickets is probably want of fat-soluble A vitamine in the diet. When this is lacking the development of bones and teeth is defective.

With intact kidneys a small dose of uræmic blood causes intense diuresis, while a large dose arrests the flow of urine. After denervation no result is obtained. This was demonstrated by Pi Suner and Bellido (Barcelona).

Macleod (Toronto) showed that in decerebrate cats the respiratory centre can be stimulated during slight anoxæmia without any decided change in the CO_2 tension or the H-ion concentration of the arterial blood; greater degrees of anoxæmia cause paralysis of the centre. Krogh (Copenhagen) demonstrated that the respiration of aquatic animals is not influenced by CO_2, but only by the amount of oxygen. The same author, employing the frog's tongue, finds that capillaries can be caused to dilate independently of the influence of the arterioles supplying the part. Waller (London) described a ready method of deterining the CO_2 output under varying conditions of work; he also demonstrated the electrical emotive response in man. The effect of different kinds of exercise on the respiratory exchange in man was also dealt with by Liljestrand, Linhard, and Stenstrom (Stockholm), and as affected by gymnastic exercises by Langlois (Paris). The transport of CO_2 by hæmoglobin formed the subject of a communication by Buckmaster (Bristol). The crystallisation of hæmoglobin of the bat was described by Amantea and Kryszkowsky (Rome); these authors also dealt with the physiology of spermatozoa.

The glycogen-content of leucocytes and the nature of amœboid movement were discussed by de Haan (Groningen); amœboid movement is stated to be dependent partly on viscosity (colloid) and partly on HCO_3 ($NaHCO_3$). De Haan and Feringa produced evidence of the apparent formation of eosinophil leucocytes from lymphocytes. Doyon (Lyons) demonstrated that incoagulability of the blood after peptone injections is due to an antithrombic substance of nuclear origin—a nucleo-protein—containing 3 per cent. of phosphorus. Nucleinate of soda was also shown to be a strong anti-coagulant. Gautrelet (Paris) found no fatal effects or any alteration in the viscosity or the H-ion concentration of the blood after an intravenous injection of oil (1 c.c. per kilo. body-weight).

Sharpey Schafer (Edinburgh) proved that the pulmonary blood-vessels are supplied by vaso-motor nerves by showing that stimulation of the depressor nerve causes a fall in pulmonary pressure independently of the aortic system. He also exhibited cats in which both cervical sympathetics had been cut at an interval of a few weeks, showing paradoxical contraction of the pupil and dilatation of arterioles on the side of the first section. The mechanism of paradoxical dilatation of the pupil following cocainising of the cervical sympathetic was also discussed in a communication sent by Byrne (New York).

Feenstra (Utrecht) confirms the work of Zwaardemaker on the inter-availability of potassium and other radio-active salts in Ringer's solution. Dubois and Duvillier (Lille) showed that after section of the cervical cord double vagotomy may still produce cardiac acceleration provided the blood-pressure is sufficiently high. Wertheimer and Boulet (Lille) showed tracings to demonstrate that in frogs poisoned by $BaCl_2$ it is possible either to provoke or to arrest heart-block by an induction shock, according to the phase of the normal rhythm at which the heart is stimulated. Barry (Cork) showed in the toad's heart that reversal of action may take place (ventricle beating before auricle) during recovery from the effect of nicotine. Einthoven (Leyden) described experiments which appeared to show that the positive electrical change during vagal stimulation described by Gaskell in the tortoise auricle is due to mechanical stretching by contraction of the lung. De Boer (Amsterdam) reported the results of his study of the effects of varying rates of conduction on the form of the ventricular electrogram. He also described a

method for obtaining delirium cordis in the frog-ventricle. Danielopolu (Bucharest) records observations upon the effects of various conditions—clinical and experimental—upon the human electro-cardiogram.

In a communication by Heger (Brussels) the cause of the relative hypertrophy of the right ventricle which occurs in man and animals acclimatised to residence at a high altitude is ascribed to a persistent pulmonary hyperæmia.

Anaphylaxis was the subject of communications by Kopaczewski (Paris) and Pesci (Turin).

Communications dealing with the central nervous system were few in number. Among them was one by Amantea (Rome) on the effect of application of strychnine to the sensori-motor region of the cerebral cortex on experimentally excited epilepsy; one by Camus and Roussy (Paris) on polyuria produced by lesions at the base of the brain; and one by Lafora (Madrid) on the functions of the corpus callosum.

According to Abelous (Toulouse), cholesterol is manufactured in the spleen, which organ may be stimulated to increased production in this direction by secretin. A paper by Rothlin (Zürich) was devoted to the effects of adrenalin and β-iminazolethylamine (active principle of secretin) on gastric secretion; the former inhibits, and the latter, if injected subcutaneously or intramuscularly, stimulates. Quantitative studies on the adrenalin output of the adrenal glands was the subject of a communication by Stewart (Cleveland). Bazett (Oxford), as the result of cross-circulation experiments, finds that adrenalin is of little importance as regards pressor reflexes, but that it functions by maintaining a normal tone in the arterioles or capillaries. Negrin y Lopez finds that after "piqûre" and double vagotomy the blood-pressure always rises, but if the animal has been adrenalectomised a fall occurs. Gayda (Turin) finds that tadpoles fed with thyroid give off more heat than normal ones.

Pézard (Paris) confirmed the experience of others that castration leads to the appearance of the opposite sex-characters in fowls. Athias (Lisbon) showed that after total castration pituitrin always contracts the uterus, while adrenalin does so only in the rabbit and hedgehog; it inhibits contraction of the uterus of the dog and cat.

There were also presented many communications dealing with problems of chemical physiology and with the action of particular drugs the contents of which do not lend themselves to a short summary.

R. K. S. LIM.

Liquid Fuel from Coal.

By PROF. JOHN W. COBB.

A PAPER entitled "Coal as a Future Source of Oil-fuel Supply," which has a very special interest at the present time, was read by Sir Arthur Duckham at a meeting of the Institution of Petroleum Technologists held at the Royal Society of Arts on October 19, 1920. It marks the recognition of a new state of affairs which is rising out of the enormous increase, actual and contemplated, in the use of liquid fuel and the by no means unlimited supply of natural petroleum. America is already concerned with the conservation of its own supplies of the latter, and there is every necessity for a careful and extended examination of any method which appears to be practicable for producing liquid fuel from solid deposits.

The demands that have to be met are of various kinds, and require products differing widely in the degree of their refinement. One extreme is encountered in providing for the delicate mechanism of the motor-car engine, and the other in meeting the grosser requirements of a steam boiler, particularly in the raising of steam for the propulsion of battleships and other sea-going vessels.

The Scottish shale industry is old-established, and an example of the practicability of obtaining oils by retorting, but the proved quantities of suitable oil-producing shale in this country are not very great. Sir Arthur Duckham has addressed himself to a discussion of what may be done by way of treating coal so as to obtain the best value in oils and tars. In reviewing possible lines of development he expresses the belief that the industrial future of this country lies in the conversion of the coal at the pit's mouth into liquid and gaseous fuels. "Liquid fuels will be recognised as the medium for providing energy for all transport by land, sea, or air with the exception of electrical transport for congested areas, while gaseous fuels will be used direct for the great majority of heating purposes and for the generation of electricity." He points out that "full experience has been gained in America of the transmission of gas over long distances," and then that "there is no question that, starting in the big industrial districts which lie near the coalfields, gas can be supplied in sufficient quantities and can economically replace solid fuel." In this way the author emphasises the production of gas, oil, and tar together from coal as being the right direction in which to go, and proceeds to discuss the various technical and commercial considerations which should influence the choice of process and plant for the purpose.

In this Sir Arthur Duckham is completely at home, and, although primarily a gas engineer of assured reputation, he displays no reverence for traditional and accepted methods when these appear to him to be only second best. He is, however, compelled to lament at an early stage the impossibility of supplying financial or thermal balance-sheets with any degree of confidence. This difficulty is inevitable at any time with unproved processes, and at the present time there are peculiar difficulties on the financial side which are not confined to the problem he is discussing, but apply to all schemes involving extensive reconstruction.

In order to deal in turn with established methods, the author reviews the position of gasworks, coke-ovens, and gas-producers. He describes the evolution of gas-making as it is conducted for the purpose of public supply, pointing out how "it started as a low-temperature process, and gradually became, with the improvement of materials of construction and advanced knowledge, a high-temperature process." He indicates the extent to which gas undertakings have been hampered by "antiquated and restrictive legislation," based upon the conditions of the past, and indicates quite rightly that the recent removal of these restrictions should make for rapid development.

The form of gasworks plant which meets with Sir Arthur's approval is evidently the continuous vertical retort with steaming, increasing the temperature about the bottom of the retorts and highly superheating the steam before it enters. The hot waste gases from the plant are to go through waste-heat boilers, so raising the quantity of steam required for steaming