Experimental Physics. Apart from biophysics, there are several distinct physics research groups in the Wheatstone Laboratory.

One group is studying effects produced by nuclear radiations and light on various crystalline insulators such as diamond. Variations in the texture of diamonds have been shown to cause wide changes in some of their physical properties. This work has the dual purpose of developing radiation detectors which utilize such effects, and of increasing knowledge of how energy is transported and converted in insulators and semi-conductors.

Another group is concerned with the temporary distortions produced in the earth's electric field due to thundercloud disturbances. The relation of the propagation of this field distortion, the wave-form, and its frequency analysis are studied by means of multi-tube cathode-ray wave-form recorders and radio spectrometers installed on the roof of the College.

An electronics group is concerned with the development of high-speed electronic-analogue computing techniques and their applications to a variety of physical and biophysical problems. Two high-speed computing instruments have been built. Techniques are also being developed for the study of the central nervous system from the point of view of information theory.

In connexion with biophysical applications of spectroscopy, investigations of the fundamental relation of optical properties to molecular structure are being made by a spectroscopic group. The ultra-violet and infra-red absorption of small molecules and crystals of known structure is being measured by means of high-dispersion equipment using polarizers, reflecting microscopes and automatic recorders. Fundamental studies in the vacuum-ultra-violet are also in progress. M. H. F. WILKINS

LONG ASHTON RESEARCH STATION

OPEN DAY

AT the University of Bristol Agricultural and Horticultural Research Station's Open Day on July 15, several items of particular scientific interest were demonstrated. In the Pomology Section, Dr. L. C. Luckwill dealt with fruit-thinning sprays containing α-naphthalene acetic acid. These, applied to apples within three or four weeks of petal-fall, induce seed abortion, and consequently an increased drop of young fruits. The concentration required to give satisfactory thinning is affected by the variety, the initial set of fruitlets and the stage of development at the time of spraying. The method, therefore, cannot yet be safely recommended in commercial apple growing.

Paper chromatography is being employed at Long Ashton in the study of the natural auxins controlling fruit development. An exhibit showed some of the biol gical tests employed for locating the position of the auxins on the chromatograms. These include a modification of the coleoptile cylinder test and the *Coleus* petiole abscission test.

In the plant nutrient investigations under the direction of Dr. E. J. Hewitt, specific visual symptoms on the cauliflower plant were used to demonstrate its molybdenum requirements in the presence of nitrogen applied respectively as nitrate, nitrite, ammonium or urea. Nitrate consistently induced a characteristic mottling, absent from plants given the other treatments.

A survey of the copper, zinc and molybdenum requirements of large-seeded legumes demonstrated that the seed reserves in dwarf, runner and broad beans and in peas could provide sufficient molybdenum for one year's growth but rarely for two. Seed reserves of these crops also mitigated the effects of copper and zinc deficiencies. In comparative trials of water purification methods in the study of molybdenum, copper and zinc requirements, the behaviour of test crops showed that rainwater demineralized by a suitable ion-exchange resin was similar to glass-distilled water.

Iron deficiency was induced in sugar-beet by excess of copper, zinc or manganese. The degree of chlorosis produced was increased by extra molybdenum and, outstandingly, by copper.

The exhibits dealing with insecticides included a demonstration by Mr. S. H. Bennett (working in collaboration with Dr. W. D. E. Thomas) of biological methods using chrysanthemum plants infested with *Macrosiphoniella sanborni* for tracing the movement of octamethyl pyrophosphoramide (schradan) through the plant. This method used in conjunction with radioactive tracer techniques permitted accurate study of the translocation of the insecticide.

Dr. R. J. W. Byrde, of the Mycology Section, demonstrated the effect of winter spray treatments in inhibiting sporulation by *Nectria galligena* (causing apple canker) and *Sclerotinia fructigena*, the brown rot fungus. The effect on *Nectria galligena* was sufficient to reduce subsequent leaf scar infections; but in *S. fructigena* the supply of spore inoculum could be built up sufficiently quickly to outweigh the effect of the winter treatment.

In an exhibit illustrating improvements in spray nozzles, Mr. N. G. Morgan and Dr. H. G. H. Kearns showed two standardized designs. The first was a light-weight all-purpose ¼-in. B.S.P. nozzle, with interchangeable parts for high- or low-volume spraying at low pressures (30–75 lb./sq. in.), suitable for light lances, ground-crop booms or air-flow machines. The second was a ¾-in. B.S.P. nozzle intended mainly for high-pressure (200–400 lb./sq. in.) spraying of fruit trees by means of hand lances or spray masts.

The exhibits of the Cider and Fruit Juices Section (under the direction of Dr. A. Pollard) were concerned both with the practical aspects and with some of the more fundamental work at present being undertaken on cider and apple juice production. In an exhibit emphasizing the microbiology of cider making, photomicrographs illustrated the yeasts and bacteria capable of giving rise to disorders of cider. The latter included 'sickness' bacteria and lactic rods responsible for the condition known as 'ropiness'. The use of acetic bacteria in the production of cider vinegar was the subject of a practical demonstration.

An exhibit of unfermented apple juices illustrated oxidation phenomena during processing and storage. The addition of small amounts of sulphur dioxide at the time of milling the fruit was shown to inhibit the initial rapid oxidation of polyphenolic components which normally occur, the amount required exhibiting wide variation according to fruit variety. Adequate exclusion of oxygen from the bottled and pasteurized product was shown to inhibit the slower oxidative changes which occur on storage.

The result of field trials with selected varieties of cider apples grown as bush trees was illustrated by

Dr. Luckwill and Mr. R. R. Williams. Average annual yields over a period of three years have ranged from less than one to over thirteen tons per acre, depending chiefly on the variety. These intensive methods of cider fruit production have brought their problems of pollination, and work is in progress to determine the self- and cross-fertility of the recommended varieties. A provisional list of the triploid varieties of cider apples was displayed. R. W. Marsh

STRUCTURE OF ELASTIC TISSUE

By Dr. D. A. Hall, Dr. R. Reed* and Prof. R. E. Tunbridge, O.B.E.

Departments of Medicine and of Leather Industries, University of Leeds

Elastic fibres are described in standard histological texts as being yellow in colour, highly refractile and as exhibiting considerable elasticity[1]. The fibres run singly, branch freely and anastomose with one another and can be differentiated by selective stains such as acid orcein and resorcinol fuchsin. They form the major component of the elastic tissue of aortic media and ox ligamentum nuchæ. It has been shown[2] that the apparent increase in elastic staining in certain pathological conditions of the skin may not necessarily be associated with similar increases of elastic fibres, as identified under the electron microscope, but may be due to the presence of altered collagen. Such anomalies in the basic criteria for the identification of elastic fibres and elastin led us to study the morphological and chemical characterization of elastic fibres, and the present communication summarizes our observations of human aortæ and ox ligamentum nuchæ.

Histological examination has confirmed the findings of Benninghoff[3] that there are in the media of human aorta two components, fibrils and lamellæ, to which the name elastin could be given on the basis of their staining properties. By contrast ox ligamentum nuchæ consists solely of large fibrils running parallel to the long axis of the fibres. Morphological differences are also evident under the electron microscope. Disregarding the fibrils of collagen which are a characteristic and easily definable component of all elastic tissue, the aortic media contains ill-defined branching fibres, some of which are apparently made up of still smaller fibres embedded in an amorphous matrix. The large lamellæ observed under the light microscope contain similar elements. On the other hand, ox ligamentum nuchæ consists solely of dense broad fibres of circular cross-section arranged in parallel formation and exhibiting no branching.

Both tissues react similarly when treated with pancreatic elastase. Some of the cementing matrix is first digested, the fibres becoming less opaque and collapsing, revealing an array of fine fibrils, lying roughly parallel to the long axis. These fibrils are quickly broken down into small particulate material. Thus the action of elastase points to a morphological similarity between the two tissues, although under the light microscope considerable differences are apparent.

The chemical evidence is similarly confusing. The majority of data previously available had been obtained from studies on ox ligament and had shown that elastin differed from most albuminoids in that it was remarkably insoluble in the normal solvents for proteins, while those reagents capable of dissolving it apparently did so only with considerable degradation. Total analyses have been made by Richard and Gies[4], and amino-acid analyses of preparations believed to be pure elastin have also been made by Stein and Miller[5] and by Neuman[6]. Stein and Miller[5] used either boiling 40 per cent urea solution for protracted periods or short treatment with water to remove associated proteins, and reported that the analyses of the materials remaining were identical. Later workers have used the simpler method of preparation to minimize degradation of the protein, but it has recently been reported by one of us (Hall[7]) that treatment of human elastic tissue with hot water or acetic acid, although previously presumed adequate for the removal of collagen, does not free the preparation from all proteins other than the elastin of Stein and Miller. A fraction remains resembling collagen on analysis, having both basic amino-acids and hydroxyproline in excess of the accepted values for ox ligament elastin, but having neither the striated structure nor the solubility properties of collagen. Hence all analyses of tissue for elastin content based on the separation of elastin as a fraction insoluble in water or acetic acid[8,9] will give erroneously high values in tissues such as human aorta where the extra component appears to be present. The acetic-acid-resistant protein can be removed from elastin by prolonged treatment with dilute solutions of urea, hence the method of Neuman and Logan[10] should give more reliable results with human tissue. The material remaining after the removal of collagen and the extra component has an amino-acid analysis identical with elastin preparations obtained from ox ligament by the action of acetic acid alone. This is further evidence of the complexity of human elastic tissue as compared with that from ox ligamentum nuchæ and, at the same time, of the possible existence of a common component.

The insolubility of elastin in boiling 40 per cent urea solutions, as claimed by Stein and Miller[5], has been shown by Hall[7] to be relative and dependent only on the ratio of urea to elastin. The product of such a reaction with urea is a soluble protein which from preliminary ultracentrifuge and osmometry observations appears to be of low molecular weight and which from electrophoretic data migrates as a single peak over a *p*H range of 2–10. Further, no free amino-acids have been identified in the dialysate; but, most significantly, polysaccharide and acid are released during solution. This protein species is also reversibly denatured by heat, the temperature at which this is brought about varying with *p*H and ionic strength of the environment and being lowest (14° C.) at *p*H 2·8 and at an ionic strength of μ–0·2. This soluble protein, therefore, is similar in some respects to that reported by Adair, Davis and Partridge[11] as being produced from elastin by the action of 0·25 *M* oxalic acid. Their protein was a mixture of two fractions, one with a molecular weight of 84,000 showing thermal denaturation and the other of much lower molecular weight and not denatured by heat. A further significant difference is the short duration of the oxalic acid reaction and the reported presence of acidic amino-acids in the dialysate, phenomena which Adair *et al.* attribute to incipient hydrolysis of the elastin molecule. Recently, Wood[12] has demonstrated that other methods, such as prolonged boiling with 0·1 *N* sodium hydroxide or

* The electron microscopic studies were carried out while Dr. Reed was on the staff of the Department of Biomolecular Structure of this University, and the authors would like to thank Prof. W. T. Astbury for the facilities provided.