ling these bales by hooking under the wires, since the breakage-resisting qualities of the weaker types of wire will be increased. The Association recently published a book entitled, *A Background Course in Radiological Safety*.

One of the most important research projects of the Timber Research and Development Association has been the development of timber shell roofs, while the development of steel connectors and glues by providing efficient systems of jointing wood has reduced the main restriction to its use for large-scale construction. New systems of house building are being developed to increase the rate of house building by using standardized mass-produced factory components in wood and the Association has co-operated with the London County Council in the design of 700 mobile homes for London's homeless.

A principal technical success of the earlier work of the Water Research Association was research into the mechanism of the chemical process by which turbid waters are clarified in water-treatment plant, and this has laid the basis for a proper understanding of the process. The loss of water by leakage from distribution mains represents a probable cost to the consumer of at least £7 million a year, and an operational research investigation is being made based on such factors as the cost of inspection, the manner in which leakage falls with more frequent inspections, rate of growth of an unrepaired leak, and the increasing damage done by leak with time. Efforts are also being made to improve the technique of detection, and instruments and techniques are also being developed for the more accurate calculation of the yield of water from catchment areas and underground sources.

MANAGEMENT EDUCATION AND TRAINING NEEDS OF INDUSTRY

THE report of the Working Party of the Federation of British Industries on *Management Education and Training Needs of Industry** does not seek to suggest the precise methods by which those existing needs should be met. It seeks rather to clarify the issues, removing the confusion of aims at various levels and defining more precisely the needs of industry itself. By implication it rejects the use of the term 'business' instead of management as suggested at the Home Universities Conference last year, although the report itself restricts the use of the term 'manager' to one who practises management and not to a rank or an appointment. It distinguishes in detail between management and supervision desiderating different qualities for the two functions, and, while critical of the present products of higher education, makes little suggestion as to how this basic education should be obtained. Perhaps the most useful feature of the report is its adoption of the term 'training' rather than education for the measures required to fit the manager for his job, whether at departmental level or in general or higher management.

Postulating that the term 'management' should not be used in the designating of any courses devoted largely to supervisory aspects and that the difference between management and supervision needs to be clearly recognized in the scope of the courses and the terminology used, the Working Party recommends that the curricula in schools and universities should devote much more attention to a knowledge and understanding of the social, economic and political influences of the present time and to the underlying purposes and objections. This, of course,

is a matter of the fundamental general education on which any training course for management must be built. However, in its next recommendation the Working Party loses sight of the distinction between education and training and calls for development of a progressive structure of management 'education' for the three clear stages of departmental, general and higher management, no course attempting to cover more than one stage. The first courses of approximately three months or the equivalent are recommended at post-graduate level with opportunities for experience in the practical problems and actual conditions of the chosen environment. The second residential courses of some three months are recommended at not more than one or two centres with the necessary outstanding staff and a specially designed syllabus. The needs of higher management should be met by weekend study conferences or at the most five-day seminars at a few centres where the necessary resources are concentrated. More research is recommended in specific management techniques by those universities and centres which provide management training courses. The courses themselves would benefit and a consultancy service could emerge; but this needs the full support of industry. Training for management must proceed side by side with education, and opportunities must be provided within the organization for progressive instruction and practice in responsibility through staging posts and under senior guidance. In all this there must be the closest link between educational institutions and industry. A critical review of the needs should be the basis of the courses provided and opportunities afforded for the demonstration of principles and observation of practice within industry itself.

* *Management Education and Training Needs of Industry: A Report by an F.B.I. Working Party*. Pp. v+27. (London: Federation of British Industries, 1963.) 6s.

VETERINARY SCIENCE AT BRISBANE

THE Colin Wright Tropical Preventive Medicine Laboratory at the Veterinary School Farm, Brisbane, was built with funds from a variety of sources, which included a donation from the Beneficiaries of the Wright Estate, Imperial Chemical Industries of Australia and New Zealand, Ltd., the Australian Cattle and Beef Research Fund, and the Wool Research Fund.

The nieces and nephews of Mr. Colin Wright of 'Waverley', St. Lawrence, intended the Laboratory "to be a memorial of his work, which illustrated that the introduction of Brahman blood into beef cattle herds in the Tropical Coast is a profitable commercial proposition". It is of interest that Waverley Station, which is some 160

miles north of Rockhampton, adjoins the Cattle Station on which Mr. Christian developed the formula of his arsenical dip for cattle ticks in 1895; this formula was used throughout the world with only minor modification for the next fifty years.

Work on the Farm over the past five or six years has shown that the presence of, say, forty engorged ticks on a young bovine will reduce its growth at the rate of approximately 40 lb per annum¹.

The herd of Droughtmaster cattle on the Farm has carried about ten times fewer ticks than British cattle grazed with them, and the Droughtmasters have never had to be dipped or sprayed². Droughtmasters are a

breed similar to the Santa Gertrudis produced by crossing Brahman and British beef cattle. They are approximately half Brahman compared with the three-eighths of the Santa Gertrudis. The importance of this is difficult to over-estimate: there are a few British cattle with quite high tick-resistance, but it would obviously take a long time to raise the overall tick-resistance to a high level. On the other hand, one cross with a Brahman bull raises tick-resistance about ten-fold, and we can still select for tick-resistance. These facts were well understood by Dr. R. B. Kelley, who contributed so much in this field, and they have, in fact, been well established, even if their importance has not been well or widely accepted, for at least forty years. Unfortunately, for a long time the subject of 'tick-resistance' seems to have caused considerable confusion in the minds of people regarded as

experts on ticks, or at least they have not appreciated its importance. However, a few people have had a clear understanding, and a paper published early in this century described how pastures grazed by tick-resistant cattle were steadily 'cleansed' of ticks. The Droughtmasters and Brahman-hybrid cattle are also considerably more resistant to babesiosis³ than European cattle.

The Farm, of some 700 acres, is only seven miles from the new Veterinary School at St. Lucia which was opened in August 1961 by the Hon. C. F. Adermann, Minister for Primary Industry. There are now almost 100 students in each of the first two years of this school, and 36 post-graduate students.

JOHN FRANCIS

¹ Little, D. A., *Austral. Vet. J.*, **39**, 6 (1963).

² Francis, J., and Little, D. A. (submitted to *Austral. Vet. J.*).

³ Francis, J. (submitted to *Austral. Vet. J.*).

AUSTRALIAN DEFENCE STANDARDS LABORATORIES

THE main sections of the illustrated annual report of the Department of Supply of the Australian Defence Standards Laboratories for the year ended June 30, 1962, deal with the work carried out in the fields of physics, metallurgy and chemistry.

The Physics Division consists of the metrology, electronics, electrical measurements, chemical physics and optics, and xerography groups and branches in New South Wales and in South Australia. The two items of special interest in the Division's activities during the year are the production of calibration tables for platinum resistance thermometers by means of an IBM 1620 digital computer and the acquisition of one of the highest precision Mueller resistance thermometer bridges yet built.

The bridge, which incorporates all the latest developments and modifications from the United States National Bureau of Standards, has nine dials covering the range 0-422 ohms in increments of microhms. The Division's 'Varian' wide-line nuclear magnetic resonance spectrometer was used in the study of a number of chemical and physical problems, including the determination of the separation between hydrogen atoms in the water of crystallization in calcium sulphate hemihydrate and the observation of some nitrogen, zinc and chromium resonances. The resonance of the tin-119 isotope, which is of low natural abundance and of relatively poor sensitivity, was recorded in a series of liquid tributyl tin compounds of particular interest in the development of plastics resistant to corrosion and to penetration by fungi. The shift of the tin resonance in each molecule relative to the resonance of the stannous ion was measured and explained on the basis of simplified models.

Mention was made in the 1961 annual report of investigations on the vaporization processes occurring on the surfaces of metal electrodes when subjected to low-current long-duration pulsed discharges. These have been continued. In the field of solid-state physics small-scale experimental work was started on hot carrier conduction in silicon. In the metrology group a method was devised for the use of the 'Talyrond' roundness measuring instrument for the accurate measurement of standard ring gauges, and an experimental mercury manometer of 5-cm bore was constructed for the measurement of pressures of 0-60 millibars to an accuracy of 10^{-2} millibar.

The Metallurgy Division was mainly concerned with the production of pure chromium and with the study of the properties of chromium and chromium alloys. In collaboration with Dr. P. A. Jacquet a new technique was developed for the preparation of chromium for microscopic examination with either the optical or electron microscope. Internal friction studies established that

the extent of magneto-mechanical damping and associated hysteresis in chromium is markedly dependent on grain size and on impurity content. Measurements of the dynamic shear modulus of chromium at 1 c/s over the temperature-range -100°C to 100°C showed that the modulus has a maximum value at the antiferromagnetic transition temperature (Néel temperature). The metallographic study during 1961 of abraded germanium surfaces led to the surprising result that the damaged layer consisted of cracks and not of large densities of dislocations. This work was extended during 1962 to the examination by microscopy and by taper-sectioning techniques of the extent to which the damage is removed by etching with 'CP-4' reagent. It was found that the reagent penetrated the cracks and opened them into broad crevices, but that at the same time the surface was smoothed out with the production of a characteristic cellular pattern. The damage in electric spark-machined surfaces was also studied.

Some interesting results were obtained from the structural studies and stereochemistry investigations in the Chemistry Division of the aliphatic cyanides and isocyanides which, despite identical molecular formulae, differ considerably in chemical and physiological activity. The contribution of the isocyanide bond to the molecular refraction is much greater than that of the cyanide bond, and the effects of hydrogen-bonding solvents on the infrared spectra of the two families of organic compounds and of carbonyl compounds differ markedly. Other activities in the Chemistry Division include the determination of gases in metals, in particular oxygen in chromium by the vacuum fusion and the Adecock chemical methods, and phosphorus in irons and steels using quinoline molybdate instead of the more usual ammonium molybdate, and X-ray fluorescence analysis of the ternary alloys Fe-Cr-Ni, Cu-Ni-Zn and Cu-Zn-Sn.

The annual report lists the various personnel of the Laboratories and their status, and gives details of the publications by members of the staff during the year under review. The staff numbered 724 on June 30, 1962—an increase of 37 during the year, reflecting the somewhat easier position in the recruitment to sub-professional positions. Nine members of the staff spent all or part of the year in the United Kingdom. Visitors to the Laboratories included the Australian Minister for Supply; Prof. K. H. Hunt of Monash University; Prof. S. Kikuchi of Tokyo University; Sir Leslie Martin, chairman of the Australian Defence Research and Development Policy Committee; Dr. P. Cheosakal of the National Research Council of Thailand; Dr. W. J. Youden of the United States National Bureau of Standards; and a party of sixty officers from the Australian Army Staff College.

S. WEINTROUB