social habits and ceremonies, witchcraft and beliefs, with particular reference to the worship of the god Kungwe.

More than 7,000 ft. of 16-mm. ciné film was exposed during the field work of the expedition and on aspects of the village life of the Waholoholo. Songs, musical instruments, drumming, dances and conversation of the Waholoholo, bird song and animal

noises were recorded on tape by A. Roggenkämper.

A second expedition to the same area with a different emphasis is being planned for 1959. It will include a zoologist to work on the freshwater fauna and another zoologist, three geologists, one botanist, and probably a medical man and a soil scientist.

B. E. JUNIPER

RADIO TRANSMISSION BY WAVE-GUIDE

THE continually increasing demand for radio frequencies for new and expanding services makes it necessary to review periodically the possibilities of any alternatives to free-space radio circuits. The installation of the trans-Atlantic coaxial cable carrying a large number of telephone circuits has been an outstanding success; and wide-band coaxial cables are in use as alternatives to radio links for conveying television signals over shorter distances. But coaxial cables, using the materials and techniques at present available, are limited to an upper working frequency of about 25 Mc./s., beyond which the attenuation and phase characteristics become unacceptable. With the development in recent years of the technique of generation and reception of ever higher radio-frequencies, corresponding to wave-lengths down to a few millimetres, the hollow tubular wave-guide has become a serious competitor of the coaxial cable. It was therefore very timely that a well-attended convention on "Long-distance Transmission by Wave-guide" was held on January 29 and 30 by the Radio and Telecommunication Section of the Institution of Electrical Engineers.

At the opening session of the convention, Prof. H. E. M. Barlow gave a most interesting and lucid introductory survey of the present technique of guiding radio waves along the outside surface of a single wire and along the inside of a hollow tube. His presentation included demonstrations of the configuration of the electric field both along a wire and inside a tube using a neon gas discharge, of the effect of a dielectric coating on a wire to counteract the radiation from it, and of the manner in which transducers can be arranged to connect cables to wave-guides. One of the great advantages of a copper tubular guide, about 2 in. in diameter, is that its attenuation for circular electric modes decreases with increase of frequency of the radio waves. For

example, at a frequency of 40 Gc./s., corresponding to a wave-length of about 7 mm., the attenuation of the guide is about 6 decibels per mile.

At the remaining five sessions of the Convention more than thirty papers were presented; many of these were of a detailed technical nature and they illustrated the advance which is being made in this field in Great Britain and other countries. Some of these papers dealt with both theoretical and practical aspects of avoiding spurious modes of transmission of radio waves in the tube, and the need to discriminate carefully in the conduct of measurements on the characteristics of the guide. Special microwave equipment is being developed to generate the very short waves involved, and particularly to couple the source to the guide, so that waves of the desired mode may be launched with the minimum loss of energy. The last session was devoted to a discussion of the practical possibilities of wave-guides for long-distance transmission, including the economic aspects of such communication systems. The speakers here stressed the fact that not only must such systems have a high degree of stability, but that, so far as possible, they must also be compatible with existing signalling networks as regards facilities for the insertion and extraction of signals at terminals and intermediate points.

On January 31, demonstrations were given of a variety of experiments using millimetre waves associated with tubular wave-guides in the Electrical Engineering Department of University College, London, and at the premises of Standard Telecommunication Laboratories, Ltd., at Watton-at-Stone, near Stevenage.

The text of all papers presented at the convention, together with the associated discussion, will be published in a Supplement to Part B of the *Proceedings of the Institution of Electrical Engineers*.

R. L. SMITH-ROSE

HILL FARMING RESEARCH ORGANIZATION

REPORT FOR 1954-58

THE scientific investigation of the problems of hill farming remained largely sporadic and unco-ordinated until it became recognized that this sector of the British agricultural industry is a distinctive form of land-use, based on complex and varying interactions of plant and animal communities which in themselves merit concerted programmes of research to define them more clearly and to attack their major problems. This concept provides the background to the establishment in

1954 of a central research organization and to its objectives and activities; these are clearly and succinctly described in the first report of the Hill Farming Research Organization*.

The extensive distribution of the hill farming areas in Great Britain, and the great ranges in environmental conditions and husbandry systems offer wide scope for study; three factors have tended to restrict,

* Hill Farming Research Organization. First Report, 1954-58. Pp. 88. (Edinburgh: Hill Farming Research Organization, 1958.)

as yet, development of the Organization's work. In the first place, any investigations of such a complex must be on a long-term basis; a small, though full-time, staff can only encompass narrow segments of the field, and in some four years their work can only be preliminary. Secondly, the work must be biased towards 'field' studies, with the niceties and precision of replicated experimentation largely sacrificed. Thirdly, the Organization's three research stations, to the resources of which much of the programme has had to be geared, were inherited from an earlier régime of separate interests in hill farming problems as presented in the areas of the three Scottish agricultural colleges.

At Glensaugh, in Kincardineshire, the basic Blackface sheep stock, on predominantly heather vegetation, is managed according to the custom of the north-eastern counties of Scotland; studies on the dentition and on winter feeding of sheep are in progress, as well as on different breeds and crosses of beef cattle in relation to prolificacy and growth of calves. Lephinmore, in the Cowal peninsula of Argyllshire, provides a varied hill ground in an area of high rainfall, relict from afforestation of plantable land, and thus having peculiar management problems for its Blackface sheep stocks. Sourhope, in Roxburghshire, is the main station for work on Cheviot sheep under conditions reasonably typical of the Cheviot hill areas; investigations on mixed grazing with cattle and sheep had begun in 1951, and others on controlled grazing and on the treatment of cobalt deficiency have since been added.

Animal studies are in two main groups, related respectively to breeding and nutrition. In the

former, comparisons of breed and strain are being made with the Blackface and Cheviot breed types, while in respect of the latter, the principal emphasis has been on problems of the nutritional status of hill sheep in winter; various methods and forms of supplementary winter feeding are being examined, responses in the mortality and growth of lambs observed, and differences in feeding habits noted. Particular attention is being given to the plane of nutrition, and methods of 'wintering', of flock replacements during their first winter.

The botanical work is described in more detail. Studies on management involve the effects of burning, drainage, surface seeding and cultivations, sod-seeding, heather grazing, fertilizer treatments, and bracken control. The great significance of the ecological aspects of the hill vegetation influences the investigations on plant communities and their species components and ecotypes; investigations in these fields are being conducted in a wider range of localities and environments beyond those presented in the Organization's own farms. Exploratory studies on the sheep grazing behaviour and preferences in relation to plant communities are being made at Sourhope.

A list of publications is given, and almost by way of appendixes, there are three occasional papers comprising reports on surveys of management systems in Blackface sheep in the north-east of Scotland (with special reference to the incidence of breakdown of incisor teeth with age), and of Border Cheviot sheep, and a short note on the effects of August treatments of a pasture sward on its subsequent yields in autumn, winter and spring.

J. E. NICHOLS

ULTRA-VIOLET CARCINOGENESIS IN ALBINO AND PIGMENTED MICE RECEIVING FUROCUMARINS: PSORALEN AND 8-METHOXYPSORALEN

By M. A. PATHAK, PROFS. F. DANIELS, jun., C. E. HOPKINS and T. B. FITZPATRICK

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EPIDEMIOLOGICAL evidence clearly implicates solar radiation as a factor in the induction of human skin cancer^{1,2}. A factor which appears to protect man from carcinoma induced by exposure to solar radiation is melanin pigment, the darkly pigmented peoples having a markedly reduced incidence of carcinoma of the exposed areas³⁻⁵. The generalized human albino living in the tropics almost invariably develops squamous and basal cell carcinoma of the exposed surfaces⁴. Similarly, the fair-skinned Caucasians who easily become sunburnt and have a tendency for freckling have a higher incidence of carcinoma of the exposed areas than persons who tan readily^{6,7}. The carcinogenicity of ultra-violet irradiation in albino mice has been established by many investigators⁸⁻¹² and has therefore provided an excellent experimental tool for studying the process of skin carcinogenesis.

Naturally occurring furocoumarins (psoralen, 8-methoxypsoralen or methoxsalen) have recently been

used for augmenting pigmentation of human skin following irradiation with long-wave ultra-violet light. This raised the question whether these photoactive compounds might alter the incidence of ultra-violet carcinogenesis. O'Neal and Griffin¹³ initiated studies on 8-methoxypsoralen and its effect on ultra-violet carcinogenesis in albino mice. Their initial report indicated that the final incidence of ear tumours induced by ultra-violet irradiation (15.2 to 17.5×10^8 ergs/cm.² of short and medium range up to 3200 Å.) in mice receiving 8-methoxypsoralen orally (0.5 gm./kgm. diet) was considerably less than that of control mice, evidence suggesting that this photoactive agent had a 'protective' effect against ultra-violet carcinogenesis. The extent of protection afforded by this compound appeared to be proportional to its concentration in diet up to an optimal level of 0.5 gm./kgm. diet. They found, however, in the same experiment that intraperitoneal administration of 8-methoxypsoralen (0.4 mgm./mouse/day)