

Atlantic Coast States were transported there by tanker. Now the "Big Inch" pipe-line is delivering more than 300,000 barrels of crude oil daily to refineries on the Atlantic seaboard, while the "Little Big Inch" delivers domestic fuel oil to the New York Harbour area. The "Big-Inch" main line is 1,254 miles long and the "Little Big-Inch" 1,475 miles.

SOUTH AFRICAN INSTITUTE FOR MEDICAL RESEARCH

THE annual report for 1943 of the South African Institute for Medical Research, Johannesburg, is a record of valuable war and other work. The work of the South African Medical Corps Establishment is directed from the Institute and is organized into eight sections. Their work includes the supply and administration of the seven large and fifteen small laboratories situated at military hospitals all over the Union and the two mobile laboratories based on the Institute; training of personnel in tropical medicine and laboratory work, which has been extended to naval medical officers; a military blood transfusion service, which has developed considerably; the supply of glucose saline and other fluids for intravenous use; a snake-catching unit, which caught an average of 50-75 cobras and puff-adders a month to provide venom for the manufacture of antivenene by the Institute (a larger and more permanent snake farm at Barberton is being planned and a valuable agreement has been made with the director of the Pasteur Institute, Brazzaville, French Equatorial Africa; for the supply of venoms from equatorial snakes); and a unit for catching gerbils for the use of the typhus-vaccine department, which catches about 1,000 gerbils a month. Assays of vitaminized foodstuffs have been done by the biochemical department for the Director of Supplies, the Red Cross Prisoner-of-War Parcels Section, and other authorities. The Institute is at present the only laboratory in South Africa able to undertake the assay of vitamins in foods. An important part of the war effort has been the continued production of typhus and yellow fever vaccines and other curative and protective sera for military use, and also the building up of a reserve of anti-gas-gangrene serum.

Research work has been done on pneumonia, meningitis, diphtheria, tuberculosis endotoxoid vaccine, tetanus, whooping cough, dysentery, plague, syphilis and other diseases. The enzyme purification and concentration of tetanus and diphtheria antitoxin, anti-gas-gangrene serum and polyvalent antivenene has made such progress that it is possible to plan large-scale manufacture of various antitoxins by this process. The susceptibility of various South African rodents to vole acid-fast mycobacterium of tuberculosis has been studied. Gerbils dying after a dose of 0.0001 mgm. had lesions with a histological appearance between those of tuberculosis and leprosy. Much work has been done on anti-typhus vaccines. It is claimed that experiments with the intradermal injection of typhoid vaccine have given satisfactory results; with this method less vaccine is required and there are no local or general reactions.

Considerable research work has been done on gas gangrene, one interesting result of which has been that, among eleven samples of sera of wild animals

examined, the sera of two zebras, one inyala, four impala and four kudu contained *Cl. welchii* anti-toxin.

It has been shown for the first time that epidemic typhus in the Transkei Territory is transmitted by lice. Murine typhus and tick-bite fever also occur in this territory. By serological tests, using pure Rickettsial suspensions, it has been found possible to differentiate between epidemic typhus, murine typhus and tickbite fever.

Entomological work has included a study of the distribution of sandflies; species which transmit kala-azar have been found in Southern Rhodesia; this discovery is important because troops returning from areas in which kala-azar is endemic may bring home this disease. A survey of the fleas of the South African Union is also being made. Other subjects of study have been rat-mite dermatitis, due to *Liponyssus bacoti*, which is very common on rats in Johannesburg, intestinal myiasis due to Dipterous larvae, the toxin found in the eggs of ticks which causes tick-paralysis and the fungal and nematode parasites of mosquito larvae.

The Biochemical Department has done work on human nutrition, the nutrition of mosquito larvae, carbohydrate metabolism and the mechanism of the sulphonamide methæmoglobinæmias.

The routine work of the Institute has again increased, although the military laboratories have taken over some of this. Further expansion of the Serum Production Department has been necessary. The large-scale serum-drying and freezing plant, the cost of which was borne by Sir Ernest Oppenheimer, has been completed and is in use. Very large quantities of vaccines have been produced. Typhoid endotoxin immunization in the Witwatersrand mines has reduced the annual incidence of typhoid since 1934 from 5.26 to 0.25 per 1,000 and the annual mortality from 1.18 to 0.05 per 1,000.

The reports of the branch laboratories at Port Elizabeth and Bloemfontein indicate that these also are vigorously developing the work of the parent Institute.

G. LAPAGE.

AERIAL SYSTEMS FOR SHORT RADIO WAVES

A RECENT meeting of the Radio Section of the Institution of Electrical Engineers was devoted to the presentation of two papers dealing with the theory and experimental performance of special aerial array systems for short and ultra-short radio waves.

The first paper was by E. B. Moullin and was entitled "Theory and Performance of Corner Reflectors for Aerials". For wave-lengths of about one metre, a convenient arrangement comprises a pair of reflecting sheets inclined to one another to form a V, with a single aerial on the bisector. Dr. Moullin shows that the field from such a system can be calculated by image treatment and that an algebraic formula can be found when the angle of the V or corner reflector is a proper fraction of 180°. A numerical example given in the paper illustrates the convenience of the Fourier series for evaluating the radiation pattern when the aerial is sufficiently distant from the apex to make the main beam much sharper than a sinusoid, and concurrently to produce side-lobes.

This paper also describes an experimental investigation at a wave-length of about 1.25 m. of the radiation pattern produced by a half-wave-length aerial in a corner reflector with angles of 90°, 60° or 45°. Using sheets one and a half wave-lengths high and two wave-lengths wide, it was found that the radiation distribution is not appreciably modified if the apex of the reflector is amputated and the resulting hole closed by a flat sheet. Such a modified reflector affords a saving in space and also shows that the pattern is insensitive to the shape of the back of the reflector. Other experiments showed that the performance of this type of aerial system was inappreciably affected if the continuous reflecting sheets were replaced either by wire netting with a mesh about one fortieth of a wave-length inside, or by a comb of open rods about half a wave-length long.

In the course of the second paper, H. Page described some measurements of the performance of various horizontal dipole arrays operating on wave-lengths in the region of 15–20 metres as used at stations of the British Broadcasting Corporation. The main method of measurement adopted consisted in elevating a calibrated frame receiving aerial by means of a captive balloon; by varying the height and position of the balloon, the field strengths in different directions from the transmitting array were determined. In a second method, a frame aerial at ground-level was used; this gave only relative values of field strength and was used mainly to determine variations in the performance of the aerial array as the radio frequency in use was altered over a small band.

It was found that for an aerial array radiating over a flat site free from obstacles, there was good agreement between the theoretical and measured performance: the maximum field strength was of the order of 0.8–0.9 of the theoretical value. A sloping site or the existence of other nearby arrays may, however, cause appreciable departures from the theoretical characteristics. In particular, it was found that the loss of power in radiating through other aerial array systems may be as much as 40 per cent in some cases; and this loss is not necessarily associated with a resonant condition in the obstructing array.

It is concluded from this work that, in order to obtain the best efficiency in short-wave transmitting aerial arrays, these should be erected on as flat a site as possible and should be arranged to avoid radiation through other arrays; distant obstructions which intercept part of the main lobe of radiation should also be avoided.

'MINOR' ELEMENTS IN PLANT NUTRITION

OUR knowledge of the precise physiological functions of the so-called 'minor' elements in plant nutrition has not kept pace with the growing realization of their importance in agricultural and horticultural practice. A number of papers in the *Proceedings of the American Society of Horticultural Science* report the effects of certain minor elements on crop growth and behaviour. R. D. Dickey and M. Drosschoff (42, 74; 1943) show that 2 lb. of manganese sulphate per tree applied to the soil cured freckling of the leaves of the tung (*Aleurites fordii*), due to manganese deficiency. The same authors

(42, 79; 1943) describe a 'cupping' of the terminal leaves of the tung, which are reduced in size and show an interveinal chlorosis and sometimes an apical and marginal browning. This may be followed by leaf abscission and shoot die-back; the condition can be cured by applying copper sulphate (1/16 oz. per tree) to the soil. That the disease is due to copper deficiency and the ameliorative effects of the soil dressings of copper sulphate are not due to any indirect effect, is shown by the fact that spraying with copper sulphate is equally effective in curing the disease.

J. G. Maclean, W. C. Sparks and A. M. Binkley (44, 362; 1944) in a manurial experiment with potatoes in an alkaline soil (pH 8.5) supplied the sulphates of iron, copper, zinc and manganese (25 lb. per acre) alone and in all possible combinations, in addition to adequate dressings of nitrogen, potash and phosphate. Besides noticeable effects on crop yields due generally to effects on tuber size rather than the number of tubers, all the treatments, except copper + iron + zinc, copper + zinc + manganese, iron + zinc, copper + manganese, and zinc + manganese, increased the thickness of the periderm of the tuber significantly. Whether or not a thickened periderm will reduce tuber damage during harvest and marketing remains to be seen, but the possibilities in this direction need no stressing. Effects of minor elements on skin colour of tuber of Red McLure potatoes are reported by W. C. Sparks (44, 369; 1944), who found that all combinations of minor elements tried increased tuber colour in the field, but the effect was greatest when iron, alone or in combination with copper or copper and manganese, was supplied.

Significant effects on carrots and turnips of application of borax, copper sulphate, manganese sulphate and zinc sulphate, to soils in which the crop showed no deficiency symptoms, are described by G. H. Harris (43, 219; 1943). The effect varied on the different soils (but copper always increased root yield) and yield, sugar content and keeping qualities of the roots were all affected by the treatment.

CYTOPLASM, VACUOLE AND CELL-WALL MAGNITUDES IN DIPLOID AND TETRAPLOID BARLEY

IN the larger cells of a 'gigas' or 'semi-gigas' allo-tetraploid, is the increase due to proportionate increases in the cytoplasm, the vacuoles and the cell-walls, or is it mainly due to an increase in one alone or in two of these? By careful analyses of the water, ash, sugar, 'protein', nitrogen, etc., contents of diploid and tetraploid plants of a single variety of barley, *Hordeum vulgare*, grown under constant nutrient conditions in photothermostats, I. Ekdahl (*Arkiv för Botanik* (Stockholm), 31, No. 5, 1; 1944) is able to draw some interesting conclusions. Tetraploid leaves assimilate more slowly but have a higher proportion of their dry weight as sugar and ash than diploid leaves, but if this extra sugar and ash is deducted from the total dry weight, a 'residual' dry weight for 'protein', cell-wall, etc., is obtained which is the same in both tetraploid and diploid leaves. Calculated on the residual dry weight, fresh tetra-