States to Japan; the time delay will be approximately 0·6 s. Airborne units, because of their greater band width, will suffer more from off-frequency signals than shipboard units. From this aspect, an Omega transmitter in the New Zealand–Australia area would be better located north of a line through Brisbane and the Kermadec Islands rather than in New Zealand. Such a location would have a sufficiently low geomagnetic latitude to avoid significant whistler mode reception in the North Pacific. The proposed stations in South America, Reunion Island and the Far East all seem unlikely to generate undue whistler mode signals.

PLANT GROWTH

Movement of Auxin in Roots

from a Correspondent

THE four classes of substance believed to be the major natural factors in the control and integration of plant growth and development are the auxins, gibberellins, cytokinins and dormins. Forty years of intensive research have passed since the first of these, auxin (β-indolyl acetic acid), was discovered, but little is yet known of their mode of action at the molecular level. All except the last class of growth substance are known to behave in the manner typical of animal hormones. They are synthesized at a site remote from the place where they exert their controlling influence, and are transported through the plant.

Auxin—the hormone responsible for the control of extension growth in cells—is produced in the shoot apex and transported towards the base. The polarity of this transport is dependent on metabolic energy, but independent of the orientation of the shoot with respect to gravity. Furthermore, it can proceed against an unfavourable concentration gradient of auxin in the tissues. It is clearly important that the manner in which the root transports auxin should be understood as thoroughly as the equivalent process in the shoot, but reports of investigations into this mechanism have been equivocal or contradictory. Recent papers by Kirk and Jacobs (*Plant Physiology*, **43**, 675; 1968), Wilkins and Scott (*Nature*, **219**, 1388; 1968) and Scott and Wilkins (*Planta*, in the press) have shed new light on this aspect of plant growth control.

Sections of shoot incubated in auxin solution show a maximal increase in length when the auxin concentration is of the order of 10^{-6} M. Roots, however, show a maximal growth response when the concentration of auxin is approximately 10^{-11} M. Higher concentrations cause inhibition of growth and eventual injury to the root tissue. A major problem in looking at auxin movement in roots is therefore to find a concentration of auxin that will neither overload the transport system nor damage the tissue, but which can be reliably measured. In the recent work short sections of root, cut just below the apex, were placed in 'Perspex' holders, and auxin labelled with carbon-14, of specific activity 33 Ci/mole, more than twice that used by earlier investigators, was applied to one end of the section in a block of agar gel. The overall transport of auxin through the tissue was estimated by the amount of radioactivity reaching another block of agar applied to the opposite end of the segment. It was established chromatographically that the radioactivity in the receiving block was still incorporated in the auxin molecule.

Results indicate that transport of auxin in the roots of some six species examined occurs in a strictly polar fashion. This polarity of movement is directed along the long axis of the root towards the apex, in direct contrast to shoots, in which the direction of movement is away from the apex. Polarity was well marked in almost all species studied. Wilkins and Scott found that more than thirty times as much radioactivity moved towards the apex as towards the base in corn (*Zea mays*) roots. Pea roots, in which Wilkins and Scott found little evidence for movement of auxin in either direction, possess a very active mechanism for the destruction of auxin. With the auxin analogue 2,4-dichlorophenoxy acetic acid, which is less easily destroyed, Wilkins and Wilkins (unpublished report) have found evidence for polarity of transport towards the apex.

A second interesting observation was the amount of auxin that the root sections would tolerate and transport; the concentration in the donor block was many orders of magnitude greater than that believed to inhibit root growth and cause positive injury to the root.

These recent papers have established some important basic facts about the transport of auxin in roots. We still do not know, however, what part, if any, auxin plays in the control of root growth in the intact plant. It does seem possible that the growth of the root may be controlled by auxin derived from the shoot, although other centres of auxin production in the plant may not have been located yet. Information gained from investigation of these problems should enable us to understand a great deal more about the mechanism of control of root growth and development.

MOLECULAR BIOLOGY

The Elusive Ribosome

from our Molecular Biology Correspondent

THE relation between the two subunits of bacterial ribosomes, and in particular the circumstances and manner of their association and dissociation, occupied until recently a murky corner of the ribosome literature. It now appears that the ribosomal subunits, when not actually engaged in protein synthesis, exist independently of one another, and go through a cycle, involving association and re-dissociation from the time at which the messenger is bound to the release of the polypeptide chain. It has now been found (Subramanian *et al.*, *Proc. US Nat. Acad. Sci.*, **61**, 761; 1968) that the dissociation step appears to require a protein factor, associated with the 30*S* particle.

Washing with 1 M ammonium chloride leads to a supernatant which contains the dissociation factor. When this is added to a preparation of 70*S* ribosomes, a substantial dissociation ensues (though some 70*S* particles always remain). The stoichiometry of the process indicates that the factor is not catalytic in function. Moreover, it is opposed by magnesium ions. It seems most likely that the factor operates by binding to the 30*S* subunit, and this attachment is weakened by high magnesium concentrations. That the factor is a protein is shown by its lability to trypsin.

A slightly disappointing feature of these results is