PROTEIN SYNTHESIS

Vitamins, Hormones and Proteins

from our Cell Biology Correspondent

In higher organisms, vitamins and hormones are able to regulate the synthesis of many proteins, but the precise mechanism of this regulation is something of a mystery. Usually both hormones and vitamins stimulate their target cells to synthesize RNA, although in some cases they inhibit RNA synthesis, but this still does not indicate the site of action of the vitamin or hormone. They could act at the level of the chromatin, unmasking DNA templates, or they could affect transcription in some other way.

At least one vitamin, vitamin D, apparently acts directly on the chromatin. Haussler and Norman (*Proc. US Nat. Acad. Sci.*, **62**, 155; 1969) claim to have isolated from chromatin an acidic protein or proteinaceous complex which has a high affinity for binding, non-covalently, a biologically active metabolite of vitamin D. This vitamin is essential for the absorption of Ca^{++} by the intestinal mucosa. The vitamin stimulates RNA synthesis in the mucosal cells, and actinomycin *D* blocks completely the response of the tissue to the vitamin, all of which suggests that it acts directly on the chromatin derepressing specific genes. The isolation of a receptor macromolecule in chromatin strongly supports this notion.

The receptor fraction contains significant amounts of RNA as well as protein but, although RNase digestion leaves its affinity for vitamin D unaltered, pronase digestion destroys vitamin binding. The RNA is not, therefore, the binding site. It could be contamination or, perhaps more likely, it could serve as a link joining receptor molecules in a complex. So far Haussler and Norman have only achieved about 170-fold purification of the receptor, which may account for the wide range of molecular weights (50,000 to 200,000), but there may be more than one species of binding complex. These questions will only be answered when the receptor has been further purified, but results so far suggest that the vitamin acts directly on the chromatin derepressing specific genes.

In the same journal (*ibid.*, 112) Hahn *et al.* report that the species of RNA induced in fowls by the hormone oestrogen are in part organ specific. Oestrogens induce synthesis of yolk proteins in fowl liver and ovalbumins in the oviduct. Hybridization studies indicate that within 105 min of receiving the hormone, pullets have most, if not all, of the RNA species characteristic of the liver of laying hens. Hybridization also shows that the RNAs induced by oestrogens in the liver and oviduct are not homologous. Oestrogen itself is too simple a chemical to carry much specificity; presumably the specificity of action resides not in the hormone but in its receptors in the target cells. The problem now is to identify the receptors and to discover whether the hormone acts indirectly or, like vitamin D, directly on a component of the chromatin.

TREE PHYSIOLOGY

Trees or Fruit?

from a Correspondent

The competition for metabolites between vegetative and reproductive growth, of prime concern to foresters and fruit growers alike, formed a central theme at the symposium on physiology of tree crops held on March 25–28 at Long Ashton Research Station. This led to the intriguing question whether trees, as such, are essential for producing many of the crops they bear.

Professor P. F. Wareing's inaugural lecture, on coordination of growth in the whole tree, emphasized the need to break down the present barriers between those who study the productivity of growth for wood, for fruit or for the various products grouped as plantation crops.

Rapidly changing market requirements and methods of harvesting have a profound influence on the physiological problems that have to be solved. Several contributors saw the tree as a nuisance that encumbered the rational production of fruit or seeds (for example, apples or coffee), while some foresters even foresee that the extensive use of chipboard and reinforced timber could radically alter the requirements of forestry production, where large trees have been necessary in the past to give sawn timber its requisite size and strength. Dr J. V. Possingham (Horticultural Research Station, CSIRO, South Australia), speaking of the 600,000 tons of grapes produced annually in Australia, said that mechanical harvesting would necessitate a complete review of the methods used for growing vines.

A major function of the tree is to store reserves, and a more detailed study of partition of assimilates could provide advances in knowledge, which is still in much the same state as when Askenasy discussed these factors in relation to sweet cherry more than a century ago, although much more is known about the structure of the compounds concerned. In fact, as several speakers pointed out, fashions in scientific studies, based on the availability of techniques and equipment, largely determine the attention paid to particular compounds or aspects of plant growth. Dr G. Tromp (Wilhelminadorp Research Station, Holland), who spoke about the translocation of nitrogen compounds and the economic importance of knowing how and why nitrogen supplies wax and wane, thought that physiologists might well think again about carbohydrate/nitrogen relations. The discussions emphasized the importance of morphological studies, which have recently been less fashionable in schools of botany, because a more detailed knowledge of the structure of plants could lead to a better understanding of the effects of environmental factors. This was seen in the numerous references to the importance of pollination or fertilization in tree productivity, for example, on the yields of apple and pear trees and oil palms, and in the possibility that control of seed production in forest trees could lead to enhanced timber supplies.

The range of products that trees produce was reflected by papers on tea (leaf), coffee (seed), apples (fruit), rubber (latex), and forest trees (timber). Special attention was given to tropical crops because research stations in Britain are increasingly interested in extending their studies to the problems which such crops present. In contrasting the stages of development of various crops, the point was made that Neanderthal man would feel at home in a modern forest but would not even recognize the crops in a modern orchard or plantation, thanks to the benefits of selection and breeding that have produced the modern cultivars. Forestry had not been under the same economic pressure in the past, but similar fundamental developments were forecast for the future if adequate resources are devoted to forestry research.