molecules—can be split into two components. One of these is the enzyme itself and the other is a factor which adapts the enzyme to specific template DNA. This discovery is almost certainly the vanguard of an avalanche. No doubt the phosphocellulose salesmen are already rushing to those laboratories known to be working on RNA polymerase, for their product will be in great demand in the months ahead. The truth is that the discovery of this factor suggests an explanation of many of the outstanding problems of the control of gene expression.

Experiments with the drug rifamycin, reported last year in *Nature* (**220**, 275; 1968) by Tochini-Valentini *et al.*, suggested that there is only one species of RNA polymerase in the cell. At the same time, however, there are countless examples of the independent and uncoordinated control of the synthesis of the ribosomal RNA, transfer RNA and messenger RNA, the last of which is made in several different species. Taken together, this evidence rules out the possibility that different classes of RNA polymerase may synthesize the different classes of RNA. What then determines the character of the RNA actually synthesized in a cell? The elegant work of the groups at Harvard and Rutgers offers an answer.

To begin with, their result makes it highly probable that the RNA polymerase enzyme alone can only initiate and continue the transcription of certain genes and that a whole series of specific factors, similar to the factor they have described, must also exist. It follows that in order to transcribe a particular gene or operon, it may be necessary not merely to have RNA polymerase but a specific factor as well. One obvious mechanism for such a positive control of the separate synthesis of the several classes of RNA might be that the RNA polymerase cannot bind to the promoter regions of certain genes and start the transcription of RNA except in the presence of a specific factor which binds to the enzyme molecules in such a way that the complex can then bind to the otherwise inaccessible promoter region of a gene and thus start RNA synthesis.

As Burgess *et al.* note somewhat cryptically, factors like the one they have discovered could be involved in regulating production of bacteriophage RNA during phage infection of bacteria. One obvious example, of course, is phage λ. A whole group of late functions—that is to say, λ genes which are normally expressed only in the later stages of the replicative cycle of the phage—are never expressed if two early genes are not expressed, as, for example, when the two early genes contain amber mutations. These two genes, which apparently regulate the expression of the late genes, may well be specifying two RNA polymerase factors which confer on the enzyme the ability to bind to and to transcribe the late function genes. The same line of argument may obviously be equally applicable to any phage in which expression of late functions depends on the expression of earlier genes. It will be interesting to see whether the groups at Harvard and Rutgers have a sufficient start on their competitors to be able to test these ideas first.

PLANT BIOCHEMISTRY

Where is the Hydroxyproline?

from our Cytogenetics Correspondent

OVER the years, evidence has accumulated suggesting that when proline is provided to actively growing plant cells it is incorporated into protein where it may be subsequently hydroxylated to give hydroxyproline. Proteins rich in hydroxyproline are uncommon and the hydroxyproline-containing protein of plant cells has been likened to collagen. Work by Lamport and by Cleland, working with cultured cells of *Acer* and *Avena* coleoptiles, has led them to the conclusion that the hydroxyproline-rich protein was a constituent of growing cell walls and in some way regulated wall growth (see *Nature*, **216**, 430; 1967). In 1967, Steward and his co-workers, however, challenged the view that hydroxyproline was associated with a protein in the plant cell wall. In that paper (*Proc. US Nat. Acad. Sci.*, **58**, 541; 1967) and in a more recent one, Israel, Salpeter and Steward (*J. Cell Biol.*, **39**, 698; 1968) set out to examine the intracellular localization of the hydroxyproline-containing protein using electron microscopy in conjunction with autoradiography.

They fed actively growing carrot explants with radioactive proline, labelled with ^{3}H in the 3 and 4 position or uniformly labelled with ^{14}C. Both labelled proline molecules were converted to hydroxyproline in the carrot tissue. The intracellular localization of radioactivity was determined from electron micrographs. Interpretation of autoradiographs at the electron microscope level is subject to some uncertainty, but nevertheless it is quite clear that a radioactive proline or hydroxyproline-containing moiety is absent from the cell walls both immediately after the incubation period with labelled proline and after further growth of the cells in culture medium free of radioactive proline. On the other hand, radioactivity appears immediately in the nucleus and nucleolus but subsequently declines in these compartments as the radioactivity migrates into the cytoplasm, which itself shows an appreciable amount of labelling.

These observations clearly cast doubt on the validity of the claim that the hydroxyproline is contained in a protein associated with the cell wall. Steward and colleagues believe that the methods employed to isolate pure cell wall fractions are imperfect and have led to misleading results and invalid conclusions.

The role of hydroxyproline-rich protein still remains a very open question, but they suggest that in view of its association with the nucleolus it may be involved with nucleic acids and ribosomes. Steward's group admit that ribosomal protein does not contain hydroxyproline, so they speculate that the hydroxyproline-rich protein may play a part in the function or assemblage of polysomes. Unfortunately neither electron microscope autoradiography nor the present methods of cell fractionation are likely to have sufficient resolution to test this suggestion.

MUSCLE PROTEIN

Myosin Reassembled

from our Molecular Biology Correspondent

THE gross features of the myosin molecule are now generally agreed on, but published studies of the finer