

plained why, in the field-ion microscope, the image gas is now thought to be strongly bound to the metal tip. Two years ago E. W. Müller thought that field ionization occurred at a clean metal surface, but his development of the atom-probe field-ion microscope has changed all that.

PLANT PATHOLOGY

Systemic Fungicides

from a Correspondent

FOUR years ago there were no commercially available systemic fungicides, whereas today there are ten of these compounds in practical use. At a conference organized in London on January 5 and 6 by the Pesticides Group of the Society of Chemical Industry, there was general agreement among the participants that these compounds are here to stay for a long time to come.

Systemic fungicides are applied to the soil or are sprayed on the leaves to protect crop plants from fungal diseases. They are a great advance on the old established method of treating the plant after a disease has started to develop, but little, however, is so far known about their mode of action. In his discussion of the advantages to be obtained from the proper use of efficient systemic fungicides Dr E. Evans (Fison's Agrochemicals) pointed to the danger that disease organisms might develop resistance to these specialized compounds. This question of resistance arose many times during discussions and there is now no doubt that, though systemic fungicides are a welcome addition to the armoury against plant disease, they will have to be used with care if widespread resistance by pathogens to specific compounds is to be avoided.

Although systemic fungicides will probably find their greatest outlet in staple food production, they have a place in other branches of agriculture, and two contributions by Dr R. J. Byrde (Long Ashton Research Station) and Miss Pauline M. Smith (Glasshouse Crops Research Institute) dealt with the assessment of their value for use on top fruit and on glasshouse crops respectively. Dr Byrde showed that benomyl, the thiophanates and triarimol were usually better than the standard captan/binapacryl spray for the control of apple scab and mildew, though they did not seem to depend on systemicity for their effectiveness. The monoculture system in the protected environment of the glasshouse presents special problems which Dr Smith and Dr D. M. Spencer (Glasshouse Crops Research Institute) kept in mind when designing experiments to evaluate ten currently available compounds for use on tomato and cucumber crops.

On the second day Dr T. W. Tanton (University of Southampton) said that the systemic fungicides now being developed seem to follow the path of solutes and water in the transpiration stream. They are therefore translocated passively in the xylem and free space within the tissues of treated plants and he described an elegant technique using lead-EDTA as a tracer to study distribution within this system. When the lead chelate, which is relatively non-phytotoxic, is precipitated *in situ* with hydrogen sulphide, studies can be made of the route followed by a compound applied to the soil, from root hair to regions of water loss at the leaf surface.

Although it has long been expected that systemic fungicides applied to any part of the living plant would move freely to other parts of the plant and control disease whenever it appears, such compounds are not among the first generation systemic fungicides. They move only in the direction of the transpiration stream and are not satisfactorily systemic in woody plants. Ethirimol and dimethirimol are taken up and translocated more rapidly by cucumber than by apple as Dr Claire Shephard (Plant Protection Ltd) has found. Dr R. T. Mercer (May and Baker Ltd) dealt with three thiophanate compounds, one of which, thiophanate-methyl in water, gives rise to methyl benzimidazole-2-carbamate, a fungitoxic molecule which is also formed

from benomyl. The uptake and translocation in barley seedlings of 'Cela 524', a piperazine compound, have been studied by Dr V. von Bruckhausen (Boehringer Sohn) and his colleagues using inhibition of spore germination, the bioautography of thin layer chromatograms and the incorporation of the tritium labelled molecule into plant tissues as measures of uptake.

In a final discussion which ranged widely over such topics as the areas of need for systemic fungicides, their present usage and their mode of action, the phytoalexins, the naturally occurring antifungal agents, were mentioned as other possible systemic fungicidal molecules. There is an obvious need for much more research on the chemical basis of disease resistance.

CIRCADIAN RHYTHMS

Keeping in Time

from our

Experimental Psychology Correspondent

THOUGH light is the most important of the signals that synchronize circadian rhythms in animals, in man, under properly controlled conditions, the lighting cycle is relatively ineffectual. This conclusion (R. Wever, *Pflügers Arch.*, **321**, 133; 1970) is one of several interesting results on human diurnal rhythms

Revealing DNA in Chromatin

CHROMATIN—the complex of nucleic acid and protein which is obtained when DNA is extracted from the cells of higher organisms—is usually thought to have a structure in which the DNA is extensively, if not completely, covered by basic histone proteins. This idea is now shown to be incorrect by Clark and Felsenfeld who report in next week's *Nature New Biology* the application of three fairly straightforward analytical techniques to chromatin of calf thymus.

The saturation value reached when chromatin is titrated with polylysine indicates the amount of DNA which is free to react with the polypeptide. Measurement of the amount of DNA remaining after chromatin has been digested with staphylococcal nuclease shows how much DNA is protected from the enzyme. Both results suggest that roughly half of the DNA of chromatin is not protected by its associated proteins from reactions.

Another surprise has emerged from studies to find how tightly the proteins of chromatin are bound to DNA. The technique used by Clark and Felsenfeld was to mix chromatin with radioactively labelled free DNA and then to digest the mixture with nuclease. Any radioactivity which is not digested must have been

protected by proteins which were free to exchange between the free DNA and the DNA of chromatin.

The answer obtained depends on the conditions used to incubate the mixture of DNA and chromatin. At the ionic strengths used to measure the reaction of chromatin with polylysine or with nuclease, almost all the radioactivity is digested. But as the ionic strength is increased, more of the DNA is protected against digestion. This means that many of the chromatin proteins must in these conditions be in labile equilibrium with DNA, and not tightly attached as had been previously thought. Unfortunately, many experiments with chromatin have used these latter conditions, so that their conclusions must now be regarded as suspect.

When chromatin is transcribed by RNA polymerase, only 5–20 per cent of the DNA is transcribed into RNA, but much more of the DNA is transcribed when the histone proteins are removed. This has usually been interpreted to mean that histones function in some way as gene repressors which must be removed to enable genes to function. The implication of Clark and Felsenfeld's experiments is that, for much of the DNA at any rate, this type of model is probably irrelevant.