Using the 'network' hybridisation method, they show that it forms a DNA provirus which becomes integrated into the host genome.

Vanishing interstitial in semiconductors

from a Correspondent

RECENT work by a group of American workers (Weigel *et al., Phys Rev. B*, **8**, 2906; 1973) helps to clear up one of the current problems in solid state physics—the mystery of the vanishing interstitial in semiconductors.

When a crystal is irradiated with high energy electrons or other particles, atoms are knocked off their lattice sites. The simplest defects thereby created are the Frenkel pair—the vacant lattice site (the vacancy) and the ejected atom (the interstitial, so called because it occupies one of the interstices of the lattice rather than a normal substitutional site). Of the elemental semiconductors (diamond, germanium and silicon) the latter has received most attention experimentally and vacancies have been detected, both alone and in combination with other defects. The problem is that nobody has yet observed the interstitial, in spite of many attempts to do so. It seems that this defect is very mobile and can diffuse over long distances until it recombines with a vacancy or is trapped by a dislocation or reaches the surface of the crystal, thereby disappearing. But as everybody is aware these days, the ability to travel a long way depends on the availability of a supply of energy. In the normal atomic transport mechanism the energy is thermal; the transistors are made by diffusing in impurities at temperatures in the region of 1,000° C. But the silicon interstitial seems to be mobile at 4 K, making it unlikely to be a thermal process.

The calculations of Weigel *et al.* are for carbon (diamond) because the approximation used, Extended Hückel Theory, has been very successfully applied to organic molecules; but the results are expected to apply to silicon and germanium as well. The solution of the mystery has two aspects. First, one would expect that an interstitial atom would occupy the largest interstice available. In the silicon lattice this is the tetrahedral site, equidistant from four lattice atoms. But the calculations show that this is not the case. The interstitial combines with a lattice atom, pushing it slightly out of position. Neither of the atoms occupies the lattice site but are both symmetrically displaced from it along the ⟨100⟩ crystal direction (the 'split-⟨100⟩' interstitial), rather like two people trying to sit on one chair. This situation is of lower energy than one lattice atom plus an interstitial and hence is more stable. It also explains why previous calculations, which assumed a tetrahedral site, were not very successful.

The second aspect of the solution is that there is not one stable situation, but two, the other being the 'bond-centred' configuration, where the interstitial sits midway between two nearest neighbour lattice atoms which are symmetrically displaced from their sites, like three people sitting on a two-seater settee. Furthermore, which of these two 'interstitialcy' configurations has the lower energy depends on the charge state and this can change during irradiation due to the tremendous amount of ionisation created. Consequently the interstitial would switch from one configuration to the other and hence migrate through the lattice whatever the temperature. This mechanism, 'ionisation-enhanced diffusion', was suggested earlier by Bourgoin and Corbett (*Phys. Lett.*, **38**A, 135; 1972).

The authors are properly cautious about their results. For example, Extended Hückel Theory is of necessity a rather simple approximation because of the complicated nature of the calculations. And strictly speaking the extension to different charge states is not valid. It seems likely, however, that a more rigorous calculation would reach the same conclusions.

Nature of scrapie agent

from a Correspondent

WORK on the agent of scrapie, one of the spongioform encephalopathies, continues to be both intriguing and frustrating. At a meeting of the British Photobiology Society on January 16 at Imperial College, London the latest attempts to characterise the active macromolecules of this agent were discussed. Two introductory lectures by I. A. Pattison and D. A. Haig (both of the ARC Institute for Research on Animal Diseases, Compton) outlined the pathogenesis of scrapie and in particular how it differs from conventional virus diseases. Haig and his colleagues have found that the scrapie agent (SA) multiplies in cultured mouse brain cells but with one remarkable difference from normal viral proliferation—there is a strict correlation between the number of cells and SA activity. As the cells divide, the infectivity increases on a one for one basis. Approximately 100 cells are required to cause infection in a test animal.

G. D. Hunter, also from the Institute for Research on Animal Diseases, favours a structure for the SA which involves a small piece of RNA closely associated with plasma membrane. His conviction is based on his own work, which has shown conclusively that the plasma membranes are the sites of the SA, and on work by T. O. Diener in the United States on the very small host-dependent potato RNA viroids which exhibit some of the physicochemical properties of the SA. Some caution must be observed, however, when comparing the properties of the RNA potato viroids, which are extracted in a relatively pure form by classical nucleic acid techniques, with those of the SA which has proved difficult to isolate by such methods.

T. Alper (MRC Experimental Radiopathology Unit, Hammersmith Hospital) who, in collaboration with Haig, was responsible for early work in determining the size of the infective particle by the use of ionising radiation, reported that like some biologically important membrane systems the sensitivity of the SA to ionising radiation is much enhanced by the presence of oxygen when irradiated in aqueous suspension, whereas biologically active nucleic acids and proteins are typically no more sensitive.

Finally, R. Latarjet (Fondation Curie, Paris) suggested four possible structures for the SA which could explain why it is highly resistant to ultraviolent light. These were: a very small piece of nucleic acid: a larger piece of nucleic acid which suffers ultraviolet damage but is repaired in the host with high efficiency; nucleic acid protected by other constituents of a complex; and, lastly, a non-nucleic acid agent. Results of Latarjet's work in collaboration with Alper, Haig and Clarke, who attempted to characterise the SA by studying its response to various wavelengths of ultraviolet light, suggest that the SA may be non-nucleic acid in structure. Latarjet, however, could not at present rule out a combination of nucleic acid and glycoprotein where energy absorbed in the glycoprotein at wavelengths not characteristic for nucleic acids is transferred to the nucleic acid moiety.

Absorption of toxins by leaf surfaces

from our Plant Ecology Correspondent

IT is well known that vegetation acts as a filter for particulate and aerosol material carried in the atmosphere. The effects of both impaction upon solid surfaces and settlement in situations of low wind speeds lead to the accumulation of material on the surfaces of plant leaves and stems. Suspended matter in the atmosphere may originate from the oceans, from wind eroded soils, or from industrial activities; some matter can be re-