content and is very attractive to honeybees. These results provide the first evidence that a minor constituent of nectar can significantly inhibit its collection by honeybees.

Much less is known about pollination in the tropics than in temperate regions, though an even higher proportion of tropical crops probably depend on insect pollination. S. E. McGregor (USDA Laboratory, Tucson) presented a list of 120 such crops, belonging to 39 botanical families. T. Chandler, a Canadian currently working at the Forestry Training Institute, Arusha, Tanzania, has studied pollination of lucerne by the African honeybee *Apis mellifera adansonii*, which has come in for much reprobation recently on account of its aggressive (or defensive) behaviour. This subspecies proves much more effective than the European ones at 'tripping' the flower, and thus pollinating it, largely because lucerne pollen is attractive to them, whereas other pollens are preferred by European honeybees. Also, the African honeybees are efficient at detecting which florets are at the right stage for tripping, and thus do not waste time visiting those that were too immature.

Work by Mackensen and Nye on breeding *Apis mellifera* specifically for collecting pollen from lucerne has now been successfully extended to red clover by H. Nørgaard Holm in Denmark (Højbakkegård, Tåstrup).

Since the second pollination symposium in London in 1964, commercial rearing of certain species of soil-nesting and stem-nesting bees has progressed beyond all expectation. Reports came of work in Canada, United States, France, Hungary, Czechoslovakia and other countries. From Poland L. Bornus and his colleagues (Beekeeping Institute, Pulawy) brought news of the highly successful rearing of bumblebees for pollination, achieved largely by careful determination of these bees' preferences at each stage of their seasonal cycle.

In an account of the first 25 years of the Bee Research Association at Chalfont St Peter, Buckinghamshire, Eva Crane reported that a 23-year index to research reported in its journal *Apicultural Abstracts* (1950-1972) has just been completed. The information is stored on magnetic tape, and it is hoped to publish it as author and subject catalogues, linked to abstracts in the journal. The 17,000 publications represented include many giving information on pollination, and a volume *Pollination of Seed Crops*, based on publications reported in *Apicultural Abstracts*, has already appeared. Estimates of the world value of crops resulting from insect pollination vary from £1,000M to £10,000M a year or more.

Gap junction between cells in contact

from a Correspondent

ALL cells in tissues and all but two of twenty-five cultured cell lines form junctions with one another and communicate through these junctions by transfer of electrical signals and chemical substances (the latter was originally termed metabolic cooperation). The junctions form extremely rapidly, within a minute certainly, and presumably break just as rapidly. Cells therefore are constantly forming and breaking contacts for metabolic cooperation and intercytoplasmic exchange. The relevance of such processes to inductive interactions during tissue differentiation and embryogenesis makes this one of the newest and perhaps most interesting areas in biology. The Cell Surfaces Discussion Group held a timely meeting on May 23 at the National Institute for Medical Research, Mill Hill on the structure and function of intercellular junctions.

The particular consideration of the meeting was the gap junction between cells in contact, permitting the flow of matter across the membranes between two cells. E. L. Benedetti (Institute of Molecular Biology, Paris) catalogued interesting similarities and differences between the propagation of an electric current between cells and passage of chemical tracers. Thus both electric coupling and chemical transfer are bidirectional and operate across the same junction. Some separation of these events is implied, however, since the former is present in most embryonic cells, excitable and non-excitable, and there may be some restraint of chemical transfer in embryonic tissues.

The inability to form gap junctions is also seen in some cell lines such as L fibroblasts, for example, and this is recessive in cell hybrids. Thus, heterokaryons with human fibroblasts can electrically and chemically couple and revertants that lack part of the complement of human chromosomes first lose competence for passage of chemical markers across the gap junction and subsequently the capacity for electrical coupling.

The types of chemicals transported across gap junctions is quite wide, but, as was emphasised by J. Pitts (University of Glasgow), there is an upper molecular weight limit of about 1,000. The flux of a metabolite, such as a purine nucleotide, is calculated to be about 10^5–10^6 molecules s^{-1} across the gap junction, that is about equivalent to the *Escherichia coli* chromosome. The capacity of mouse fibroblasts to form gap junctions may not be lost irretrievably and it is possible to select for 'revertant' cells that form junctions, but not as efficiently as say BHK cells.

E. Wright (Institute of Virology, University of Glasgow) described experiments that set out to isolate BHK cell mutants incapable of forming competent junctions. The basis of the selection is to cocultivate BHK wild type cells with a thymidine kinase negative mutant and BUdR and to isolate cells which survive ultraviolet irradiation. Interestingly, although these mutants (Mec^-) as expected are extremely poor recipients of thymidine from a BHK wild type cell population, metabolic cooperation can be established if a purine marker such as adenine is used so that there seems to be discrimination between the passage of two nucleosides across the gap junction.

As both Pitts and Wright agree, the idea that the many metabolites capable of passage across the gap junction may require independent transport processes is extremely difficult to reconcile with the evidence that purified gap junctions appear to contain relatively few proteins. For example, W. H. Evans (National Institute for Medical Research, Mill Hill) finds one major protein of molecular weight 29,000 in fractions of mouse liver plasma membrances enriched in gap junctions. Similar results were reported for synaptic junctional complexes by I. Morgan (Centre de Neurochemie, CNRS, Strasburg) and A. Matus (University College, London). The most common method of preparation, however, involves detergent solubilisation of the non-junctional areas of membrane and it may be that some dissolution of junctional membrane components may also take place.

The mechanism of formation of gap junctions remains obscure. Since junctions can form in the absence of protein synthesis, pre-existing membrane proteins are utilised. The junctional areas, however, are clearly differentiated from the rest of the membrane by the absence both of typical enzyme markers such as 5′-nucleotidase and leucyl napthylamidase and most of the plasma membrane proteins and glycoproteins. It must be assumed, therefore, that the initial events in junction formation requires the clustering of specific junctional proteins by lateral diffusion in the surface membrane.

The association of cytoplasmic contractile elements with gap junctions now seems established. One supportive result is the probable identity of an actin-like protein in preparations of mouse liver gap junctions. The role of these elements in formation maintenance and function of the gap junction, however, remains to be elucidated.

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