omy as it would be wasteful for two male strains to mate with each other.

The mode of action of CIA is itself intriguing. It will be necessary to determine the precise nature of the macromolecules induced in donors by CIA and how these could engineer the clumping response. It is possible that CIA may have an additional function in initiating the mobilisation of DNA for transfer in conjugation. The discovery of CIA in *S. faecalis* should stimulate further research to determine whether sex pheromones are a more general phenomenon amongst bacteria. □

Cosmochemistry and evolution

from A. H. Olavesen and N. C. Wickramasinghe

An international workshop on Cosmochemistry and the Origins of Life, organised by University College, Cardiff, was recently held at Gregynog Hall, Wales. A broad overview of the conventional ideas of chemical evolution was provided by C. Ponnamperuma (University of Maryland), who pointed to numerous laboratory experiments which showed the production of biochemical monomers from suitably energised mixtures of CH_4, NH_3 and H_2O. Such conditions are usually postulated to have occurred on the primitive Earth. A. W. Schwartz (University of Nijmegen, Netherlands) provided further evidence for the laboratory production of biochemicals from simpler chemicals. A wide range of biochemicals could be synthesised from 70% utectic mixtures of HCN in water. For instance all the purines were formed spontaneously in such systems, but pyrimidine synthesis required further ultraviolet-catalysed rearrangements. Phosphorylation reactions were envisaged as being derived from active phosphorylating agents arising from the interaction of apatite with certain other products of the HCN reactions. Reactions involving HCN were thought to have occurred most probably over primitive land masses whilst condensations of formaldehyde occurred in the primitive oceans. The two chemical systems are considered to have come together at the land-water interface.

H. Noda (University of Tokyo) discussed the probability of the appearance of a living system from a mixture of present-day biochemical monomers. It was concluded that random molecular combinations could not have led to the emergence of life with any reasonable probability. A. G. Cairns-Smith (University of Glasgow) pointed out that it was unreasonable to expect the most primitive genetic material to involve such a complex organic polymer as a nucleic acid. He considered it more likely that the crystal structure of simpler inorganic materials, such as clay minerals, might have served as some kind of primitive gene. Clay particles might also have served to concentrate organic materials necessary for the origin of life by surface absorption processes.

M. Paecht-Horowitz (Hebrew University of Jerusalem) demonstrated that certain well-directed polypeptide synthesis could be achieved in the presence of some clay minerals. A degree of polymerisation of up to about 24 amino acids was shown to be possible in this way, and the process was thought to be related to the persistent occurrence of blocks of amino acids in present-day proteins. P. Decker (Chemical Institute, Hanover) discussed the role of autocatalytic systems in the early development of biochemistry. Feedback loops in such systems could achieve steady-state concentrations of certain biochemicals without the necessary participation of enzyme catalysts.

J. T. Wimpenny (University College, Cardiff) traced the evolution of microbes from anaerobic prokaryotes to eukaryotic structures. Evolutionary pressures are thought to have forced primitive prokaryotes to develop increasingly sophisticated systems for the utilisation and conservation of essential ingredients. He stated that further biochemical evolution was effectively predetermined at the stage at which the first eukaryotic systems emerged.

The question of the site for the origin of life pervaded the entire meeting. Most participants preferred a terrestrial origin, but a radically different proposal by F. Hoyle and N. C. Wickramasinghe (University College, Cardiff) was the subject of much discussion. Hoyle and Wickramasinghe argued that the set of biochemical monomers necessary for the origin of life is produced in mass flows from stars and is abundant in interstellar molecular clouds. Such biochemicals were mopped up into comets when the Solar System formed and high aqueous concentrations of these materials are maintained for long periods in cometary interiors were they propose that life began. Hoyle and Wickramasinghe suggested that comets still continue to shed living systems onto the Earth in the form of bacteria and viruses. They then discussed an analysis of influenza attack rates in boarding schools (during the 1978 epidemic) which they claim provides evidence against normal explanations for the spread of this virus.

P. M. Solomon (State University of New York, Stony Brook) reviewed astronomical data relating to galactic molecular clouds. Over 40 molecular species have been detected so far and include HCN and formaldehyde which are also the most ubiquitous of the simpler organic molecules in the Galaxy. It is of interest that laboratory synthesis of biochemicals have mainly involved these two cosmically abundant species.

W. M. Irvine (University of Massachusetts) discussed radioastronomical observations of molecules in comets. Molecules detected so far include HCN, CH_3CN, H_2O and several radicals and ions. There are several radio lines in comets which are as yet unidentified. S. Yabushita (Kyoto University, Japan) discussed theories of cometary origin. K. Nandy and D. H. Morgan (Royal Observatory, Edinburgh) reviewed astronomical observations relating to an ultraviolet interstellar absorption feature centred on $\lambda = 2200$ Å. The most likely contributors to this band are thought to be small graphite spheres of radii less than 200 Å. N. Nakagawa and A. Sakata (University of Electro-Communication, Tokyo) considered the role of organic molecules with conjugated double bonds in producing the $\lambda 2200$ Å band. They also discussed mechanisms for the formation of such molecules by grain surface reactions in interstellar space, and described laboratory experiments which synthesised such molecules as HC_3N, HC_5N, HC_7N and HC_9N from HCN. □

European geophysics

from Geoffrey M. Brown

Of all the branches of science which attempt to operate under omnibus umbrellas, possibly the most nebulous is geophysics. The spectrum of interest extends from what is curiously referred to as 'solid earth' to the outermost extremities of the terrestrial environment. It is evident that in any assembly of geophysicists in conference there will be no uniting theme. The recent meeting of the European Geophysical Society* was no exception. If one had to select a single phrase to summarise the conclusions from the wide coverage of subjects it would be to emphasise progress in techniques. Repeatedly there were references to recent advances in measuring techniques and instrumentation, the development of

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