rate (B. J. Kilbey, University of Edinburgh, for *Neurospora*). The host-mediated assay—that is the scoring of mutations in microorganisms that were exposed transitorily to an environment inside chemically-treated host rodents—has been the object of much scrutiny. R. Fahrig (University of Freiburg) scored gene conversion in yeast, injected into the peritoneum of either rats or mice, or into the testis of rats. Efficacy of the technique varied with the chemical used, but in general rats were superior to mice and the testis was the more relevant environment.

The finding of E. Zeiger (Food and Drugs Administration) that diet of the host may affect the efficacy of the host-mediated assay highlights the disturbing complexities of the test. Because of this, attempts are now being made to short circuit it by adding liver microsomes from rodents to the medium of *in vitro* tests on, for example, bacteria. Sobels quoted results indicating that at least some of the activations of potential mutagens that are carried out in mammalian liver occur also in *Drosophila*. Tests on mammalian cell cultures, including human ones, are constantly being perfected. One of the main problems here is to decide whether transmitted changes are caused by gene mutations. R. J. Albertini and R. de Mars (University of Wisconsin, Madison) and J. W. and J. M. Simons (State University of Leiden) gave reasons for inferring that this is true for their systems (human cells, Chinese hamster cells). New systems are constantly being developed and tested. Even if some of them should never become obligatory or even recommended for routine testing, all are likely to contribute results of general importance. No good system is yet available for tests on non-disjunction, although this is one of the most serious hazards. *Drosophila* (Sobels), soy beans (B. K. Vig, University of Nevada), human cell lines (de Mars) have all been suggested as promising in this regard.

Among the environmental hazards studied specifically are mercury (S. Nakai, Chiba University; C. Ramel, University of Stockholm), mercaptopurine (V. A. Ray, Pfizer, Groton), pesticides (W. F. Grant, McGill University), hycanthone (Clive; W. L. Russell, Oak Ridge National Laboratory; M. Shahin and de Serres, NIEHS), aflatoxin (A. Velasquez *et al.*, University of Mexico), tritiated water (A. L. Carsten *et al.*, Brookhaven National Laboratory), caffeine (Sobels; F. Palitti *et al.*, University of Rome), food additives (R. Valencia, University of Wisconsin, Madison), isoniazide (E. Röhrborn, University of Heidelberg) and bisulphite (R. Shapiro, University of New York).

The only possible direct approach to the estimation of human hazards is the monitoring of human populations for chromosome damage or genetic variation. This was discussed by J. Neel (University of Michigan), who is engaged in a screening programme of South American Indians, with the surprising result that these tribes carry more genetic damage than does civilised man in his polluted environment, possibly as a result of natural hazards from, for example, viruses.

The relation between mutagenesis and carcinogenesis is not yet understood and not even established beyond doubt. There is, however, increasing evidence for the dual effects of many chemicals in producing both gene mutations and cancer. The use of genetic systems for the early detection of carcinogens was advocated by Ames and by O. G. and M. J. Fahmy (Institute for Cancer Research, London).

ORIGIN OF LIFE

Optical Asymmetry

from a Correspondent

THE Earth is 4.7×10^9 yr old and life is known to have existed for at least 3.5×10^9 yr; perhaps 500 million yr was available for the 'chemical evolution' believed to have preceded life. The proteins of living organisms are built exclusively from one set of optical isomers, the L-amino acids, although non-enzymatic syntheses always yield equal quantities of the two isomers. Was the choice of L-amino acids a matter of chance, or was it determined by some basic asymmetry in the environment? The first international conference on this subject was held at the Nuclear Reactor Centre, Jülich, Germany, on September 24–26, and was organised by Professor K. Wagener and Dr W. Thiemann.

F. Vester (Studiengruppe für Biologie und Umwelt, Munich) appropriately opened the meeting. He gave an entertaining account of how the idea of a relationship between parity non-conservation and optical activity was born, beginning with the discussion in Ulbricht's laboratory at Yale on the day after the report in the *New York Times* in January 1957 of the discovery of parity violation in β decay by Lee, Yang and Wu. The mechanisms Vester and Ulbricht considered (*Q. Rev.*, **13**, 48; 1959) were: (1) direct energetic interaction between β rays and molecules (regarded as negligible because of the large difference in energy levels); (2) longitudinally polarised β rays $\rightarrow$ circularity polarised bremsstrahlung, interaction with matter $\rightarrow$ optical asymmetry (this has a solid theoretical foundation); (3) direct non-energetic interaction (for example, by entropy exchange; considered heretical).

Vester's personal account dealt with the psychology of discovery, opposition from older scientists, frustration in the face of experimental difficulties and so on. T. L. V. Ulbricht (Agricultural Research Council, London) commented that, in Kuhnian terms, there had never been a paradigm concerning the origin of optical asymmetry on Earth, but perhaps one had now reached the critical point. The early experiments were inconclusive; hope revived with Garay's results (*Nature*, **219**, 338; 1968) and the presence of research workers from eleven countries at the conference testified to the continuing interest in the field.

Recent work at CERN has confirmed the presence of parity-violating interactions even in strong interactions (discovery of the neutral current). D. Rein (Technische Hochschule, Aachen) presented the first theoretical study of the magnitude of the direct energetic interaction and confirmed that it is indeed small, at best 10^{-10} of the binding energy. The task of detecting such a small effect is formidable, but there have been a number of studies on the amplification of small deviations from racemic conditions, including two by the organisers, K. Wagener and W. Thiemann (Jülich) on cascade processes, such as precipitation from saturated racemic solutions, with some positive results.

L. Keszthely (Biological Research Centre, Szeged) has measured the lifetime spectra of positron annihilation in crystalline L and D-amino acids, and has found that the triplet intensity in D-amino acids is higher than in their L-isomers and that the triplet lifetime shows differences between the enantiomers. The helicity of electrons in chiral molecules, postulated by A. S. Garay (also Szeged) in his 1968 paper, was developed by him as the helical electron gas model. The coupling of the magnetic transition moment and electron spin in chiral molecules leads to small energetic differences between optical isomers.

Another group of contributions were concerned with statistical fluctuations from the racemic state in small and large numbers of molecules, a return to the idea that the selection of one series of isomers was a matter of chance. In a different category, E. Gil-Av (Weizmann Institute, Rehovot) described his beautiful work on enantiomeric micro-analysis by gas chromatography. C. Ponnamperuma (University of Maryland) gave a brief survey of present thinking about the origin of life and its time scale, presented results of meteorite analysis for amino acids, and at the end reviewed the significance of the conference papers, concluding that a bias in the basic asymmetry of matter, as revealed by parity non-conservation, might have been amplified and so determined the choice of one set of optical isomers. More experiments, please.