HISTORY OF BIOLOGY

A "Non-event"

from a Correspondent

IT is a truth of history and an aspect of human behaviour that momentous occasions recalled in later life by men who took part often gain in grandeur and importance with the passing of time. A study of contemporary documents by J. W. T. Moody (*J. Soc. Bibliog. Nat Hist.*, **5**, 474 ; 1971) shows that the presentation of the Darwin–Wallace papers on natural selection to the scientific world on July 1, 1858, was no exception to this general rule. As Moody points out the occasion has been said to represent the beginning of a new era in scientific thinking—the beginning of modern biology or the Darwinian Revolution—but at the time of its presentation it was something of a non-event.

In the first place, the meeting at the Linnean Society at the critical day had been specially called by the president for the election of a new council member, but the opportunity was taken to deal with other business. A list of donations to the society's library and museum was read and there followed the election of the new councillor by ballot and a lengthy eulogy of the recently deceased vice-president, Robert Brown. Then the secretary read the text of the Darwin and Wallace papers on the laws which affect the production of varieties, races and species with an introductory letter from Sir Charles Lyell and Dr J. D. Hooker, and he followed by reading five other papers on miscellaneous and unrelated subjects.

According to the account of the event recollected by Hooker at the jubilee celebrations in 1908, only Darwin, Lyell, and Hooker himself, had any knowledge of the papers to be presented and Darwin for domestic reasons did not attend the meeting. Gage has noted (*A History of the Linnean Society of London*, 54; 1938) that at that date agenda were not sent to members, so the fewer than thirty members who attended the meeting can hardly have expected a momentous meeting. Hooker seems to have been the source of the impression that the audience was awed by the revelations read to them; in a letter thirty years after the event he wrote "the interest excited was intense . . . it was talked over after the meeting 'with bated breath'. Lyell's approval, and perhaps in a small way mine . . . rather overawed those Fellows who would otherwise have flown out against the doctrine . . .". Moody, however, suggests that the audience were not so much stunned by new ideas as they were overwhelmed by the sheer volume of information loaded upon them. No formal discussion took place at the meeting, the audience was expected to switch its attention instantly from the Darwin–Wallace papers to "Notes on the organization of *Phoronis hippocrepis*", and it is suggested that boredom and bewilderment on a July afternoon, as much as Lyell and Hooker's advocacy, contributed to the overawed silence which greeted the unveiling of the concept of natural selection.

GALAXIES

Circular Polarization

from a Correspondent

DURING the past two years astronomers have discovered circular polarization in the radiation from a variety of objects. At Jodrell Bank, for example, Conway and Gilbert measured significant circular polarization at 49 cm wavelength from several compact sources (*Nature*, **227**, 585 ; 1970), and a series of reports from Kemp and his colleagues has described the circular polarization in the light from white dwarf stars and planets (*Nature*, **232**, 151; 1971). The range of possible observations is now expanded still further with a terse announcement in *IAU Circular 2343* that circular polarization has been successfully detected in the optical radiation from two extragalactic sources.

For many years observers have determined the magnetic fields in the Sun by measuring the circularly polarized components in spectral lines split by the Zeeman effect. At the Crimean Astrophysical Observatory, Severny, Nikulin and Kuvshinov hooked up a modified solar magnetograph to their 100-inch reflector telescope, and monitored the light from the radio galaxy M87, quasar 3C 273 and a Seyfert galaxy NGC 4151. The condensed, superluminous nuclei in the last two objects gave a positive result: the degrees of circular polarization are 1.2 ± 0.4 per cent for 3C 273 and 1.1 ± 0.3 per cent for NGC 4151. One X-ray source in the galaxy Sco X–1 was also investigated, but like M87 it gave a negative result.

There are several ways of obtaining circularly polarized radiation, but theorists will understandably want to see a more detailed report before any firm conclusions can be drawn from this new discovery. It is important in that it adds another method for investigating physical processes inside remote compact objects. It is already well established that the synchrotron mechanism may be responsible for the continuum radiation at optical wavelengths, and with certain geometries for the magnetic field a circular component is also introduced into the radiation. An encouraging step in this direction is given by the 49 cm results, where the synchrotron theory seems to satisfy the observations.

SEAFLOOR SPREADING

Chemical Rates?

from our Geomagnetism Correspondent

SEAFLOOR spreading rates vary from ridge to ridge at any given time and probably even vary with time for any given ridge. The first of these propositions is easy to prove because the patterns of magnetic anomalies close to oceanic ridges may be compared directly with the well-dated geomagnetic polarity-time scale derived from continental rocks of the past 4 to 5 million years. When this is done it clearly emerges that average spreading rates for the past few million years are different for different ridges ; and thus it is safe to say that current spreading rates are also different. Direct evidence for the

Dybbuks and Tachyons

A FEW years ago a suggestion was made that there might exist particles that travelled with a velocity greater than light. These particles, named tachyons, satisfy the fundamental equation of special relativity:

$$E^2 - P^2 = M^2$$

where E. P and M are the energy, momentum and mass of the particle. They differ, however, from ordinary particles in that their mass is imaginary but they have a real energy and momentum. In next Monday's *Nature Physical Science*, Raymond Fox of Haifa, Israel, points out that particles with imaginary mass, imaginary momentum and imaginary energy are also solutions of the fundamental equation, and Fox names such particles "dybbuks". The one important difference between tachyons and dybbuks is that whereas it has been argued that the concept of tachyons violates causality there is no likelihood of such a problem with dybbuks.

Fox gives a description of the possible interactions of these particles and applies the results to an evaluation of the gravitational interaction of a very dense star. An interesting prediction is that the gravitational radiation from a pulsar is very much less than presently estimated. Such a prediction is bound to arouse interest in astronomy circles and the basis of Fox's theory will no doubt be subject to intensive study.

second proposition is more tenuous, however, because it is difficult to assign ages beyond about 5 million years to either the continental reversal pattern or the series of oceanic magnetic anomalies. Nevertheless, although the uniform spreading rate is sometimes used as a working hypothesis in geophysics, there is now quite convincing evidence that spreading rates do vary with time.

The need to determine spreading rates as a function of time has led Bass (*Earth Planet. Sci. Lett.*, **11**, 18 ; 1971) to take the first steps in a novel approach to the problem. The point of his argument is that if it can be shown that the chemical composition of the basalt extruded at ridge crests varies systematically with spreading rate at the present time, then it might be possible to determine the relative spreading rates for older oceanic crust by chemical analysis. He has thus tried to demonstrate that such variations exist.

The first thing to be said about this approach is that there are known to be practical difficulties both in demonstrating composition–spreading rate correlations and, supposing such correlations exist, in extrapolating them to older rocks. It is an experimental fact, for example, that any dredge haul of basalt from the ocean floor is likely to contain more than one type of basalt. It thus becomes difficult to assign a particular chemical characteristic to any area, or even site, of the ocean floor. But even if this problem can be overcome by the selection and use of suitable criteria, the application of those criteria to older crustal basalts is likely to be invalidated by the possibility of secondary alteration. It is too soon to say whether or not alteration will ultimately prove to be an insurmountable objection to Bass's method; but Bass has, at least, been able to show that there are systematic relations between chemical composition and spreading rate although he admits that the data are "too sparse to establish a statistically compelling argument" for strong correlations.

The ridges Bass has chosen to examine are the rapidly spreading East Pacific Rise and Juan de Fuca Ridge, the moderately slowly spreading Gorda Ridge and the slowly spreading Mid-Atlantic Ridge. Not all samples from these ridges were accepted in defining the chemical characteristic for each ridge—several classes of rock which would have led to ambiguities in interpretation were excluded. But when the compositions of the rocks selected by Bass are plotted on the normative AN-OL-HY ternary diagram, systematic variations in the positions of the fields for the various ridges became apparent. Thus the fields for the ridges of lower spreading rate move progressively towards higher AN and OL values and the ends of the fields poorer in HY move progressively towards the AN corner. In short, the lower the spreading rate the richer in Al_2O_3 and the more undersaturated are the basalts.

According to Bass, the important conclusion to be drawn from these properties is that the lower the spreading rate for a ridge the greater is the depth from which magma can be derived. Thus if the maximum depth from which magma may be derived is, in effect, the maximum depth at which brittle fracture may occur, slowly spreading ridges must be underlain by thicker lithosphere. In other words, magma type or the chemical characteristics of the basalts may in principle be used as an alternative to seismic methods to determine the relative lithospheric thickness.

The correlation of lithospheric thickness with spreading rate then leads to conclusions about the processes which determine the maximum depth of brittle fracture. Whether the ridge is produced by stresses involved in the upwelling mantle material or by stresses imposed by the lithosphere sinking into trenches, the depth of brittle fracture (which determines the apparent thickness of the lithosphere) will increase with an increase in the rate of application of stress and thus with an increase in spreading rate. But working in the opposite sense is the effect of the geothermal gradient. The greater the spreading rate the greater will be the quantity of mantle material entering the ridge region from below and so the greater will be the heat flow. The higher geothermal gradient will effectively reduce the depth of brittle fracture. Although it is not possible to predict which of these processes will take precedence, Bass's correlation of the thickness-spreading rate in the lithosphere enables the relative effects of the two processes to be determined. Thus because increased spreading rates lead to thinner lithosphere it means that the geothermal gradient effect dominates.

HAEMOGLOBIN

Structural Variants

from our Molecular Biology Correspondent

SINCE Pauling's discovery rather more than twenty years ago of sickle-cell haemoglobin—the manifestation of what with unerring flair he dubbed a molecular disease—well over a hundred human haemoglobin variants have been documented. Some, but by no means all of these, are associated with pathological conditions, and a comparison of the stereochemical features of such species in the crystal with those of the normal protein should, one might hope, lead to a precise explanation of how a single-base mutation can encompass such dire physiological consequences. With the biochemical world still digesting the implications of his results on the relation between the structures of oxy- and deoxyhaemoglobin, Perutz, together with Greer, has recently embarked on

Uniaxially Reinforced Nylon Composites

IMPROVING the mechanical properties of polymers by inclusion of comparatively high strength and modulus fibres, such as glass or carbon, is well known. Unfortunately not all polymers are amenable to this method of reinforcement for, to utilize to the maximum the good mechanical properties of the fibres, the composite needs to contain long lengths of fibre. Any method of moulding such as by injection or extrusion, where there is drastic deformation and movement, will thus cause damage to induced fibres and so reduce their reinforcing effect.

The reinforced polymers which have had the greatest impact in engineering have therefore been constructed with thermosetting materials, such as epoxy and polyester resins, which require only simple "static" moulding conditions. The reinforcing fibres are placed in the mould with the desired orientation. Liquid resin is then added in the form of monomer or oligomer containing catalyst and the mould is heated. Polymerization then occurs and a solid moulding is formed. It is essential that no gaseous byproducts are produced during polymerization, for this causes disruption of the composite. Nylon is a well established engineering material which would benefit from fibre reinforcement. Some success has already been achieved by the incorporation of fibres before injection moulding, but fibre lengths in the composite are usually less than 1 mm and are almost randomly oriented.

Attempts to produce composites by this method of reinforcement fail because charging the mould with molten polymer is impracticable, and if normal monomers are used, water is evolved as steam during polymerization. But T. Bessell, D. Hull and J. B. Shortall report in next Monday's *Nature Physical Science* that this problem has been overcome by using caprolactam as the monomer and by inducing the ring opening type polymerization with anionic catalysts, so that the problem of gaseous byproducts is almost eliminated.