ties have remained about the underlying genetic control, and further attempts must be made to square the facts of palaeontology with the new knowledge and insights gained from molecular biology. Evolutionary genetics has been primarily concerned with structural genes, those genes which are transcribed into RNA, leading to the synthesis of particular proteins and enzymes. It turns out however that there are striking similarities in the basic proteins and enzyme activities throughout the organic world, from primitive prokaryotes to mammals, which vastly outweigh the differences. The enormous differences within the animal and plant kingdoms are much more a matter of organisation and structure. This suggests to Valentine and Campbell (*Am. Sci.*, **63**, 673; 1975) that the evolutionary divergence of major and perhaps even minor taxa has been effected mainly by changing patterns of gene regulation rather than the mere substitution of amino acid sequences in proteins.

The regulatory model proposed for prokaryotes (bacteria and blue-green algae) by Jacob and Monod, involving operator and repressor genes, has been verified in many particulars, but gene regulation in the much more complex eukaryotes (the rest of the organic world) is far less well understood. Valentine and Campbell favour the general regulatory model for higher organisms put forward by Britten and Davidson (*Q. Rev. Biol.*, **46**, 111; 1971). 'Sensor' genes receive a stimulus, probably hormonal, and cause 'integrator' genes to transcribe. The transcription product, activator RNA, is detected by 'receptor' genes, which in turn cause structural genes to transcribe. Whole batteries of receptors, which need not be mutually exclusive, operate under the control of a single integrator, and a hierarchy of sets could be controlled by a series of master sensors. It is evident that mutations affecting regulatory genes, together with chromosomal rearrangements, could create in a geologically short time a wide variety of novel patterns involving large numbers of structural genes.

In broad outline evolution can be envisaged to have proceeded in a number of major steps, each involving a repatterning of genes in new combinations and expansion of the regulatory apparatus, as cell types differentiated and complex body-layer and organ systems progressively developed. Thus for the animal kingdom the sequence is: protozoans; diploblastic metazoans (sponges, jellyfish); triploblastic metazoans (flatworms); primitive burrowing coelomates (many worms); advanced coelomates, often with skeletons. Each successive step involved significant addition of new information to the regulatory apparatus and creation of batteries of structural genes in new combinations. The fossil record indicates that all the steps were accomplished by the end of the Cambrian, some 500 million years ago, when all but two of the living phyla that are well skeletonised had already appeared. This does not mean that most palaeontologists are necessarily only concerned with the equivalent of philosophy's 'footnotes to Plato', because there is still a vast amount to be discovered about the detailed patterns of evolution as revealed by fossil distributions in time and space. The Valentine and Campbell paper is valuable not so much in prediction as in providing a satisfying interpretive framework for further research. □

A hundred years ago

OUR readers no doubt know that we have a younger French sister who appears under the name of *La Nature*. We have just received from Germany a specimen of another of the family, rejoicing in the name of *Die Natur*. This seems, however, to be a new series of an old-established journal, but whether it has always appeared under its present name we cannot make out. It is conducted by Dr. Otto Ule and Dr. Karl Müller, of Halle, is mainly devoted to natural history, and the number sent us contains several interesting articles; among these is one on the African Steppes, by Dr. Ule.

from *Nature*, **13**, January 27, 256; 1876

Rapid quenching: second harvest

from Robert W. Cahn

The Second International Conference on Rapidly Quenched Metals was held at the Massachusetts Institute of Technology on November 17–19, 1975. It was organised by Professor N. J. Grant, of MIT, and Professor B. C. Giessen, of Northeastern University.

WHEN a canny farmer ploughs a new field, the first harvest will as likely as not be bounteous; but the second harvest defines the long-term value of the land. The Conference was dedicated to Pol Duwez, the American metallurgist who first opened up the field of rapidly quenched metals 15 years ago; a rich first harvest was reaped in 1970 during the First Conference, and now the second has proved that he made a sound investment.

The Conference was immediately followed by a Workshop (held at Northeastern University, Boston) devoted to the applications of amorphous alloys. These materials—also known as metallic glasses—are merely one subcategory of rapidly quenched metals, but the fact that two days were entirely devoted to them reflects the organisers' judgment, vindicated by the Conference and Workshop, that the corn now grows tallest in this corner of the field.

The first Conference, in 1970, was largely concerned with extended solid solubility and with anomalous intermetallic phases resulting from splat-quenching of alloy melts. Fewer papers this year dealt with these concerns than one would have foretold then. Some of these were concerned with steels: groups at Cambridge (UK), Tohoku University (Japan), and the University of Pennsylvania (USA) examined the behaviour of splat-quenched steels, both in their initial state and after subsequent transformation: crystallography, morphology and kinetics were all investigated. The Cambridge group concentrated on familiar steels such as Fe-Mo-C steels, and observed solubility extension in ferrite, retained austenite and a number of unfamiliar carbides: the steels were at all stages crystalline. The others examined Fe-P-C, one of the transition metal/metalloid combinations which become amorphous on quenching, and investigated the details of subsequent crystallisation. This is an area where much more research is now needed, with good prospects of industrial applications.

Aluminium alloys continue to be the favourites among those who prefer to investigate crystalline forms of metastability. Some of these have reached the verge of industrial use. A group at the Battelle Institute in Frankfurt (Germany) have scaled up a technique for splat-quenching and compaction of Al-Fe alloys (for some years now the preferred alloys for practical application), further alloyed with Mg, Mn and Cr. The product is not only very strong, even at 300 °C, but—like a number of other chromium-bearing splat-quenched alloys—extremely resistant to corrosion: there was no detectable attack by superheated seawater at 150 °C. Some applications are immediately apparent. A group from the University of Sussex (UK) showed how a plasma-spraying gun, with improvements to help keep the deposit cool, can be used to spray highly supersaturated and thus extremely strong Al-Cu alloy sheets.

An impressive paper from Battelle