the folding intermediates may be susceptible to more detailed analysis.

The generality of the overall scheme is supported by a similar study by Tsong and Baldwin (*J. Mol. Biol.*, **69**, 145; 1972) on chymotrypsinogen A, also previously held to display a simple two-state denaturation equilibrium to a first approximation. Again a fast and a slow phase are resolved, which are the same in *p*H-jump and temperature-jump experiments, and it seems that here too a slow nucleation process co-exists with a rapid folding-unfolding reaction.

COSMOCHEMISTRY

Abundance Discussed

from a Correspondent

MUCH of the discussion at the Cosmochemistry Symposium held in Cambridge, Massachusetts, from August 14 to 16 was related to the cosmological implications of the studies of the abundances of particular nuclei in various astronomical objects. In particular, Dr H. Reeves (CNRS-Saclay) pointed out that nuclear astrophysicists believe that deuterium could only have been synthesized in the big-bang, the amount of deuterium produced being dependent on the density of the universe (independent of Hubble's constant) and the assumed lepton number of the universe. It was also felt that ^{4}He and possibly some ^{3}He and ^{7}Li were produced in the big-bang. Dr Reeves showed that the conditions necessary to do all the required nucleosynthesis implied that the density of the universe now is $\sim 2\times 10^{-30}$ g cm^{-3} and that the lepton number is possibly non-zero and slightly negative. These conclusions depend strongly on the D/H ratio for various objects.

Another cosmological use for measurements of isotopic abundance is in nucleocosmochronology where the relative abundances of radioactive nuclei are used to determine information about events near the time of formation of the solar system as well as time scales related to the total duration of nucleosynthesis and thus the age of the Galaxy.

In a review paper, Dr D. N. Schramm (University of Texas, Austin, Texas) emphasized that the relative abundance of ^{244}Pu was the factor determining whether any exceptionally large nucleosynthetic event occurred just before the solar system formed. It was mentioned that current chronologies are based on ^{244}Pu numbers from only one meteorite, the chondrite St Severin. Dr G. Crozaz (Brussels University, Belgium), Dr D. Burnett (Caltech, Pasadena, California), and Dr. R. Walker (Washington University, St Louis, Missouri) presented results of fission track measurements which showed that U and Th are chemically fractionated in many meteorites. It is reasonable that Pu would also be fractionated and therefore it is extremely dangerous to base nucleochronologies on the ^{244}Pu measurements from a single meteorite. In conjunction with nucleochronology, new interpretations were given for the time interval of 10^{8} yr between the last nucleosynthetic event and the formation of the solar system. This time interval was once thought of as the time taken to form the solar system. The possibility that this time might better be related to the density wave theory of the galaxy was, however, given strong support by Professor A. G. W. Cameron (Yeshiva University), Dr D. N. Schramm, and Dr H. Reeves. According to this theory the interval of 10^{8} yr represents the time between formation and when the protosolar gas was last being mixed with the gas in a spiral arm.

Apart from the application of abundance measurements to cosmology, an important area of cosmochemistry is its application to the special problems of the formation of the solar system. An exciting discussion, principally involving Dr. P. Gast (NASA Manned Space Flight Center, Houston) and Dr D. L. Anderson (Caltech), centred on the formation and composition of the Moon. Dr Anderson showed that it was possible for the whole Moon to be formed from a single high temperature condensate with a composition similar to that of the inclusions in the Allende meteorite. This proposal greatly pleased people such as Professor Cameron, who felt that a high temperature condensate made for a more probable theory of the formation of the solar system.

Also of interest was the almost heretical proposal by Dr P. B. Price (University of California, Berkeley) that cosmic rays might possibly yield a more representative sample of the galactic material than does the solar system. This, of course, depends on the unscrambling of the propagation problem as well as a more accurate determination of charges and abundances.

Regulation of RNA Synthesis in Embryos

DURING embryonic development, the pattern of RNA synthesis changes markedly, indicating control of gene expression at the level of transcription. Ribosomal and transfer RNAs are specific molecules whose transcription can be studied directly, but the question of whether their synthesis is regulated during early embryogenesis remains controversial.

In next Wednesday's issue of *Nature New Biology* (September 13), O'Melia and Villee report results that will renew the argument. They present evidence showing that 5s RNA and tRNA are synthesized by embryos of sea urchins at the cleavage stage.

Until recently, it was generally accepted that, in several embryonic systems, synthesis of rRNA and tRNA did not occur during cleavage and became activated at about the time of gastrulation. This conclusion was based on the fact that when embryos incorporate radioactive nucleic acid precursors during cleavage, the RNA which they make is heterogeneous in size and has DNA-like base composition (dRNA). It consists predominantly of heterogeneous nuclear RNA and messenger RNAs. Synthesis of rRNA cannot be detected even with long labelling periods, and 4s RNA labelling is largely CCA turnover (for example, Gross, Kraemer, and Malkin, *Biochem. Biophys. Res. Commun.*, **18**, 569; 1965). By contrast, when gastrula or later stages are labelled, newly synthesized rRNA and tRNA are readily detected. Synthesis of dRNA continues, but at a reduced rate per nucleus. It has, however, been pointed out that the rapid synthesis of dRNA during cleavage could obscure rRNA synthesis even if this occurred at the rate seen in older embryos (Emerson and Humphreys, *Dev. Biol.*, **23**, 86; 1970). This, of course, does not prove that rRNA synthesis does occur early. Only circumstantial evidence has been presented, and most of the evidence argues against this interpretation (Sconzo and Giudice, *Biochim. Biophys. Acta*, **254**, 447; 1971, for example).

What O'Melia and Villee have done is to concentrate on tRNA and 5s RNA, which they purified by precipitating larger RNAs with 2 M LiCl. Also, by using guanosine as a precursor, they avoided CCA end-labelling, as guanosine is not converted to other nucleotides. In this way, they detected *de novo* synthesis of tRNA and of 5s RNA during cleavage. The two RNAs were identified by polyacrylamide gel electrophoresis and, using an exonuclease, they showed that the label was internal. The tRNA, but not the 5s RNA, also became methylated.

Thus synthesis of tRNA and 5s RNA is not completely switched off during cleavage. What then of the other rRNA species whose synthesis is generally coordinated with that of 5s RNA? Either they are also synthesized or this system is an exception and coordinate synthesis does not occur. Unfortunately, O'Melia and Villee present no data on the fraction of total RNA synthesis which is represented by tRNA plus 5s RNA, so it is not clear whether there is a low level of synthesis or one equivalent to that seen later in development.