

Biochem., **11**, 148; 1969) have reported what may prove to be specific initiation factors in rabbit reticulocytes.

RNA virus RNAs are, of course, far more readily characterized than cellular mRNAs, and Baltimore and Huang have described recently (*J. Mol. Biol.*, **47**, 263, 275; 1970) the fate of polio virus RNA made in HeLa cells. Apparently progeny RNA molecules do not associate with ribosomes until they have left the replication complex but the RNA is bound non-specifically to a heterogeneous collection of cell protein. This RNP has a buoyant density of 1.40 g/cm³ and it passes sequentially through forms with densities of 1.44 and 1.47 which are precursors to polyribosomes. According to Baltimore and Huang these two forms may well be respectively polio RNP associated with a 40S subunit and an 80S ribosome.

Unequivocal rather than suggestive analysis of eukaryote protein synthesis, however, depends on the future exploitation of cell free systems such as that described by Smith *et al.* (*Nature*, **225**, 184; 1970). With such a system it should be possible, for example, to test critically the claim (Tiboni *et al.*, *J. Mol. Biol.*, **47**, 467; 1970) that the G and probably T chain elongation factors from eukaryotes are specific for 80S ribosomes while the factors from prokaryotes and plastids are specific for 70S ribosomes.

AMPHIBIA

Origins of the Frog

from our Vertebrate Palaeontology Correspondent

SOME newly described fossil material from Oklahoma may help to settle the puzzle of the origin of the Amphibia. The common frog is one of the most aberrant vertebrates ever evolved. Most notably the whole skeleton is profoundly modified for jumping, but there are many other curious anatomical and physiological features. Prominent among these is the use of the whole surface of the skin for respiration. This latter character is not unique to the Anura, the group comprising the frogs and the toads, but is shared with the Urodela, or newts and salamanders, which have a shape more like a conventional primitive tetrapod. The anurans and urodeles together with the rare worm-like Apoda (caecilians) comprise the living representatives of the class Amphibia.

The record of fossil Amphibia is very full, but there is little to connect them with the living groups. The first fossil frog is a Triassic form, the first urodeles occur much later and there are no known fossil apodans. The other members of the class Amphibia are fossil forms ranging from the Devonian-Carboniferous boundary to the top of the Triassic. Two groups were present, the labyrinthodonts and the lepospondyls, but neither is obviously related to the living forms.

Attempts to relate the living Amphibia to labyrinthodonts or lepospondyls have been numerous and generally unconvincing. D. M. S. Watson in 1941 suggested that several small Upper Carboniferous labyrinthodonts had the reduction in the number of bones of the skull roof and in the number and nature of the vertebrae which would be expected in a frog ancestor. But the urodeles and the apodans were left without putative forefathers. The balance was re-

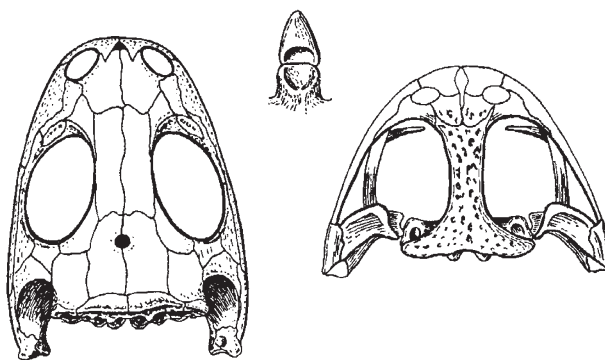
stored by Romer in 1945 when he assigned the urodeles to the lepospondyls.

The Swedish tradition has been to give frogs on one hand and newts on the other an even longer separate ancestry. In the 1930s Holmgren and Säve-Söderbergh derived the urodeles from the Dipnoi or lungfish, and more recently Jarvik has developed the idea that the Anura and Urodela are derived from separate groups within the Devonian rhipidistian fishes. Unfortunately the Swedish philosophy does not require the tracing of any lineage of intermediate forms to bridge the 350 million year gap. Also later work by Gregory showed that the apparent frog-like character of the skulls of Watson's postulated anuran ancestor was largely due to the misinterpretation of difficult material.

In the past decade interest in the origin of living Amphibia has revived, largely because of the work of Parsons and Williams. In 1962 they cited a unique and unifying character of the three living orders in the structure of their teeth and in the following year discussed the characters to be expected in an ancestor for all three.

Recent speculation has thus tended to be on the ancestry of the Lissamphibia, an old term revived by Parsons and Williams to embrace all living forms. Cox has argued for the lepospondyl ancestry of Lissamphibia, largely because the latter do not use costal respiration to ventilate their lungs, whereas the labyrinthodonts, with well developed ribs, almost certainly did. It seems probable, however, that his favoured ancestors among the lepospondyls also used their ribs to breathe.

Bolt (*Science*, **166**, 888; 1969) has recently proffered the most likely Lissamphibian ancestor yet. He describes a small labyrinthodont from the Lower Permian of Oklahoma which has Parsons and Williams's tooth character. Instead of the characteristic (and diagnostic) labyrinthodont teeth *Doleserpeton*, as the animal is called, has pedicellate teeth (see figure) with a bicuspid crown separate from the root portion by connective tissue. The vertebrae also are unusual for the group of labyrinthodonts to which *Doleserpeton* belongs, and show a possible pre-Lissamphibian condition.



On the left is the skull of *Doleserpeton* (redrawn, after Bolt); in the middle, a pedicellate tooth of *Doleserpeton* (highly magnified, after Bolt). On the right is the skull of the earlier frog-like form, *Triadobatrachus* (redrawn, after Watson).

Thus *Doleserpeton* could be a proto-Lissamphibian anatomically while stratigraphically it appears at about the right geological horizon. Ironically, it is a member of the same family of labyrinthodonts as Watson's original frog ancestors.