1972), who include both the herbivorous tritylodonts and the carnivorous tri-theledonts ("ictidosaur") as end members of the group. Within the cynodonts, mammalian ancestry seems to have lain within the Brazilian family Chiniquodontidae, and Romer (*Breviora*, 344, 1; 1970) has described the skull of a genus, *Probainognathus*, which may lie on the direct line of mammalian evolution. The postcranial skeleton of cynodonts, and the evolution of that of mammals, has recently been thoroughly described by Jenkins (*Bull. Peabody Mus. Nat. Hist.*, 36, 1; 1971).

Though much work remains to be done, particularly in elucidating the relationship between the theriocephalian and cynodont stock and the Russian earlier forms, the principal lines of evolution of the mammal-like reptiles, and the adaptive reasons for their structural divergences, are now becoming steadily clearer.

PSYCHOLINGUISTICS

Learning Syntax

from our Experimental Psychology Correspondent

THE view of language acquisition that one derives from Chomsky's emphasis on syntax is that of a child acquiring a working theory of grammar, by being equipped initially with a set of hypotheses between which he has to choose on the basis of the rather small set of utterances he hears. In this sense, as Chomsky points out, the child's task is not logically different from that of the linguist constructing a theory of grammar. A quite different view would be that children do not discover the syntactic rules of a language by finding the underlying regularities of strings of sounds, but that they use their understanding of the semantic setting in which utterances are made to understand words and the significance of their grammatical relationships.

This second view seems a good deal more plausible, but there is the difficulty of describing exactly what kinds of semantic arrangement give rise to grammatical rules. It is in this context that two recent articles by Moeser and Bregman (*J. Verb. Learn. Verb. Behav.*, 11, 759; 1972; and 12, 91; 1973) are of interest. In their experiments Moeser and Bregman taught first college students, and then school-age children a miniature artificial language, which had a simple underlying grammar consisting of a small set of rewrite rules. The language was taught by exposing subjects successively to well formed sentences in that language, or by exposing them to this same set of sentences plus pictures of possible

referents for the language. The words in the language were nonsense syllables, and the syntactic rewrite rules were of the form $S \rightarrow AP + BP$; $AP \rightarrow (D) + A$ and so on: meaning that a sentence S can be rewritten as an A phrase followed by a B phrase; an A phrase is a D followed by an A and so on. After exposure to each block of eighty well-formed examples, subjects were asked to make judgments of which of a pair of test sentences (without pictures) were grammatically correct, where neither of the test sentences had previously been seen.

In their first experiment Moeser and Bregman compared performance among four groups of subjects shown (1) words only, (2) words plus a row of arbitrary pictorial figures, with each one always corresponding uniquely to a word, (3) words plus a row of figures each displaying a property referred to by the word, and (4) composite figures using these same reference classes as (3), but made up in such a way that the logical constraints of the pictures were mirrored by the syntax rules. Thus a two-word A phrase YOW FET would have as the pictorial referent in its (3) condition a dotted line and, separately, a green rectangle, but in its (4) condition it would have these reference classes combined to form a green rectangle bounded by dotted lines. In their first experiment they found increasing ease of learning the syntactic rules across the conditions (1) to (4).

In their second experiment Moeser and Bregman gave much longer practice with a total of 3,200 presentations of well-formed sentences, and compared simply the equivalent of conditions (1) and (4) in six subjects who were somewhat younger (aged 12 to 18) than those of the first experiment. Here the results were much more clear cut. Whereas the three subjects trained only with words performed at or near chance with the pairs of test sentences, those trained with words and semantic referents approached completely correct judgments on the grammaticality of the test sentences. The subjects who had successfully learned the syntactic rules with the help of semantic referents were furthermore able to learn the syntactic categories of new words each presented in just three novel sentences without pictures. Subjects trained in the words-only condition did not learn the syntactic categories of the new words.

This sort of experiment does not, of course, show that syntax is learned by appreciating the semantic constraints of referents, but it does show that grammar can be learned much more easily when this is possible. It would be surprising if this were not made use of in a child's initial acquisition of language.

MARS

Up Hill Down Dale

from our Soviet Correspondent

PHOTOMETRIC data from the Mars 2 and Mars 3 probes have provided new estimates of the heights of surface features on the planet. The method is based on the measurement of reflected solar radiation in the CO_2 bands at 2.06 μm and 2.01 μm , and in the continuous spectrum around 2.25 μm . The pressure of CO_2 on the surface is determined from the intensity of the bands, and hence the height of the surface at that point may be calculated from a barometric formula.

The method has already been used in observations from Earth, but a resolution of only 500 to 1,000 km was obtained. Results of this kind for individual areas of the Martian surface, with considerably better resolution, were obtained by Mariners 6 and 7. The Mars 2 and 3 experiments were intended to give a continuous scan of the planet's surface using a field of vision of 0.01 rad (15 km from a distance of 1,500 km), although some averaging of results was carried out before data transmission so that each averaged reading corresponded to some 50 km of flight of the spacecraft.

Reporting their data (*Doklady Akad. Nauk SSSR*, 208, 1048; 1973), the team from the Institute of Space Research of the Soviet Academy of Sciences stress that the results are "preliminary".

Working with the 6 mbar isobar as an arbitrary baseline, they quote data for the Mars 3 trajectory of February 16, 1972, which passed over the northern extremity of Hellespontus, the north-west edge of Hellas, the dark regions Iapigia and Syrtis Major, and also Meroe and Umbra and the north polar cap. They report a maximum height for Syrtis Major (+3.5 km) and minimum heights for Hellas (−1 km) and the region to the north of Syrtis Major (0 to +1 km). North of 50° N the presence of the polar cap introduces considerable anomalies in the equivalent band width of CO_2 . Comparison of these data with those of the similar trajectory of December 27, 1971, shows that on the earlier date, during the dust storm, a considerable decrease in the band width was observed, confirming earlier observations from Earth made by one of the present team (Moroz) and by Parkinson and Hunten (*Science*, 175, 323; 1972).

The Mars 3 trajectory of February 28, 1972, passed over Nereidum Fretum, Mare Erythraeum, Margaritifer Sinus, Chryse and Mare Acidaliu, and also gave an anomalous reading for the north polar cap. In the equatorial zone, altitudes were considerably less than those recorded on February 16, 1972,