its cortex, is essentially amphibian. This fact, taken in conjunction with the palaeontological evidence, suggests that the stegocephalian brain may have bridged the interval between those of Dipnoi and Reptilia. Perhaps both Amphibia and Reptilia have been derived from Stegocephalia. Recent research, especially on fossils from the Permian of Texas, has brought to light stegocephalians so closely resembling reptiles, and reptilian remains so stegocephalian, that there can no longer be any question as to the genetic relationship of the two groups.

Prof. Elliot Smith remarked that it is unfortunate that nothing is known of the brain in the Cynodontia, for he thought that the transformation of its cortex must have played a leading part in the evolution of the Mammalia. Broom states that the South African Theriodonts from which mammals were derived became distinguished from their American allies by the development of powerful limbs, and that "it was the lengthened limb that gave the start to the mammals." "When the Therapsidan took to walking with its feet underneath and its body off the ground it first became possible for it to become a warm-blooded animal. All the characters that distinguish a mammal from a reptile are the result of increased activity—the soft flexible skin with hair, the more freely movable jaws, the perfect four-chambered heart, and the warm blood." But Broom confesses his inability to explain how this fateful lengthening of the limbs was caused. Prof. Elliot Smith suggested that a realisation of the changes which took place in the brain in the transition from reptiles to mammals would seem to indicate an explanation of this and the acquisition of many other mammalian features.

The development of a definite neopallium (the cerebral cortex *sensu stricto*), the lengthening of the limbs, the increased activity, the freeing of the skin of its mail-like coat of scales and conversion of it into a highly developed tactile organ—all these events occurred at about the same time, and had a reciprocal influence one upon the other.

By the time the Reptilia were evolved the cerebral hemisphere had reached a stage of development which opened up vast possibilities of new developments. Though the cerebral cortex was still mainly olfactory in function, tactile, gustatory, visual, and perhaps auditory impulses were able to make their entry into it; but it exercised little direct control over the movements of the body, which were still regulated by the midbrain. The possession of this potential receptive organ in the cortex for receiving tactile impressions and bringing them into relation with impressions from the other sense organs gave an added importance to the tactile sensibility of the ridges of skin that intervened between the scales of the Hypotherian. Moreover, more precise movements of the limbs became possible, because more exact information was being provided of the positions of the limbs by these tactile impressions.

The enhanced importance of the skin as a tactile organ led to the atrophy of the scales, perhaps by a process of natural selection; and the greater perfection of the tactile sensibility of the skin, and of its receiving and recording apparatus in the cortex, reacted mutually one upon the other and gave birth to the neopallium. It is not without significance that from its earliest appearance the neopallium performed the function of regulating "skilled" movements of the whole body, i.e. such actions as are possible only when there is a highly developed tactile information bureau to render nicely adjusted movements possible. Moreover, quickness and increased activity are made possible by the neopallium, because it was put into direct connection *ab initio* with all the motor nuclei in the whole central nervous system by the pyramidal tract (which developed *pari passu* with the evolution of the neopallium), and also with the cerebellum (by the simultaneous development of the pons), which enabled the creature to coordinate the muscular activities of its whole body to perform quick, accurately adjusted, and skilled movements. It is such developments as these that made the mammals what we know them to be, that give them their dominant position and their plasticity, or power of rapid adjustment to varying environment.

It is only when such skilled movements are possible that long limbs, capable of supporting the body, can become useful appendages. The fact that such limbs were making

their appearance in the Therapsida in Triassic times is tangible evidence of the birth of the neopallium in these pro-mammals.

Prof. Arthur Keith, in maintaining that mammals arose not from reptiles, but from Amphibia, remarked that the divergence between his views and those of Prof. Elliot Smith was not really so great, as the question involved not the Amphibia and reptiles of the present, but extinct forms in regard to some of which it was difficult to say to which of these phyla they should be referred. The common stock from which reptiles, birds, and mammals had been derived possessed three characters:—(1) an egg giving rise during development to an amnion and allantois; (2) the beginning of a cerebral cortex; and (3) lungs filled and emptied by movements of the body wall. Prof. Keith regarded this common ancestor as more amphibian than otherwise. He devoted special attention to the third character above named, and pointed out there was not in any living reptile a trace of a diaphragm, and that the lungs of reptiles were essentially different in structure from those of mammals, and, further, the movements of the body wall were different in the two phyla. He believed that the evolution of a new type of respiration, in which the whole body wall became a means of expanding the body and filling the lungs, was a great step in advance, and he considered that this occurred in an amphibian stock not far removed from the Dipnoi, and conceived that there was a common type (amphibian) from which the three types of respiration—reptilian, avian, mammalian—had been evolved. He also referred to the presence of His's bundle, which is found only in the heart of mammals, and suggested that this arose in the Dipnoi, and was transmitted through an ancient amphibian. Prof. Keith thought that an early amphibian, arising near the beginning of the Permian, was the stock from which came the higher vertebrates.

Dr. C. W. Andrews remarked that the agreement of the skeleton of Cynodonts with that of mammals is so remarkable that it is impossible to believe it accidental. Possibly in Middle Permian times lived some small animal of this group from which the mammals arose. The shoulder girdle, atlas, and lower jaw of some Theriodonts represented transitions from reptilian to mammalian conditions. The dentary became greatly enlarged, owing to the differentiation of the teeth, especially grinding teeth, extended backwards, and acquired articulation with the squamosal, leaving the quadrate and articular on the inner side. Some of the South African Therapsida present so close an approach to mammalian characters that it seems impossible to believe that the Mammalia can have arisen from any other group.

Dr. Marett Tims pointed out that if the dentitions of the monotremes and of the Metatheria and Eutheria be considered, the monophyletic derivation of the mammals does not appear to be fully established. In the marsupials and Eutheria generally (leaving the Rodentia out of account for the moment) the dentition is of the *type* which may be referred to as trituberculate, though not of the trituberculate pattern, while the dentition of the monotremes is of an entirely different nature, being referable to that of the fossil Multituberculata. Dr. Tims said that his investigations on the tooth germs of the Caviidae lend support to the view that, as already urged by Dr. Forsyth Major, the dentition of these rodents has a multituberculate character. On these and other grounds Dr. Tims was disposed to suggest the possibility of the diphyletic origin of mammals, and to believe that monotremes, and possibly rodents (though with much greater doubt), may have sprung from a different stock than that from which the marsupials and remaining Eutheria have arisen.

J. H. A.

VERTICAL CURRENTS IN THE ATMOSPHERE.

IN a paper entitled "Die Messung vertikalen Luftströmungen," Dr. Paul Ludewig, of the University of Königsberg, describes some experiments made in three balloon ascents, for the purpose of determining the vertical currents in the atmosphere. The lack of information on this important point is made painfully evident at intervals in the inquiries into aeronautical disasters. The problem is

being attacked in this country partly by observations of pilot balloons and partly by observations near the earth's surface of the angle of elevation of a balloon, which in a horizontal wind floats very nearly at the same level as the point to which it is attached. Special difficulties arise owing to the rapid increase of the errors of observation in the first method as the balloon travels away from the observers, and to the influence of the instability of the wake in the second method. Dr. Ludewig's contribution will therefore be of special interest. He uses the principle that the barometer in the balloon shows the height above sea-level, and therefore the rate at which the balloon is rising relative to the earth, while a vertical anemometer carried by the balloon shows the rate at which the balloon rises relative to the air. The difference between the two rates gives the rate at which the air is rising relative to the earth or the strength of the vertical current.

The construction of a suitable anemometer is the principal difficulty. Dr. Ludewig uses a fan in a small cylinder, which hangs from the balloon in a vertical position; the revolutions of the fan are recorded photographically by an ingenious device, so that the inertia and friction are reduced to a minimum. When the anemometer was suspended in a horizontal current of air, the fan did not rotate, so that effects arising from variations in the horizontal velocity were practically eliminated. In addition to a barograph, a Bestelmeyer variometer was used. The instrument is a form of eye-reading microbarograph, which permitted of great accuracy in determining the small variations in altitude as the balloon travelled across the country. In the first ascent, made on January 22, 1911, the results obtained from the variometer and the anemometer agreed so closely that it was evident that no vertical currents were present. In the third ascent, on February 18th, when there was a steep gradient for westerly winds over central Europe, strong vertical currents were experienced, and the instrumental measurements showed that the motion was mainly upwards, and reached at times a speed of 3 metres per second at altitudes slightly less than one kilometre. A curve, showing in profile the country passed over by the balloon during the period for which the diagram of vertical motion is drawn, would add interest to the latter and possibly suggest the causes of the rapid variations in the upward current.

E. GOLD.

BEACH-LA-MAR, THE JARGON OF THE WESTERN PACIFIC.

BEACH-LA-MAR is that peculiar variety of English speech which has arisen from the contact of uncivilised civilisation with the savage or semi-civilised peoples of the western Pacific. It is a language born of the necessity of comprehension between primitive traders, and is thus, in its nature and purpose, akin to the Lingua Franca of the Levant, the Pidgin of the China Seas, the Chinook of the American fur trade, the Negro-English of the Guiana plantations, and the Krooboy talk of the African coast. Its name suggests but one of its origins, for Beach-la-mar is the sailor's mispronunciation of *Bêche-de-mer*, a name of the Trepang or *Holothuria*, which was prepared on the island shores for the markets of the East Indies. But the language began with the American whalers and the sandalwood gatherers of the early nineteenth century, who preceded the *bêche-de-mer* fishers of the 'forties and 'fifties. On the decay of the trepang industry the talk passed to the copra-collectors and the beach-combers, and was finally settled as the jargon of the Pacific by the "blackbirding" (more delicately described as the "recruiting of Polynesian labour") in the 'sixties, when it became the common speech of the natives on the Queensland plantations.

Few have recorded the speech, and in an entertaining little volume Mr. Churchill has noted all that is to be found relating to it, with some chapters by way of introduction.¹

Mr. Churchill discusses the art of breaking English into jargon. It is delightfully simple, for "the proper way to make a foreigner understand what you would say is to use broken English." Politeness may give way to emphasis.

¹ "Beach-la-mar, the Jargon or Trade Speech of the Western Pacific." By William Churchill. Pp. 54. (Published by the Carnegie Institution of Washington, 1911.)

Grammar and the elegances of speech do not matter. The want of these will not shock the native, for in no native language is it possible to be ungrammatical. In them intelligible speech consists in the placing of the vocables in the right order. Inaccurate arrangement is unintelligible nonsense. The native subjects the broken English to the rules of his own speech. As to this, Mr. Churchill, premising that a single parent for the many and diverse languages of Melanesia is as yet unproved, recognises that all the languages of that region are practically on the same plane of development, and so uses the designation "Melanesian speech" to indicate a composite of the knowledge of the languages there spoken. He regards them as isolating languages, and rejects the Malayo-Polynesian theory of Bopp, as well as the application to them of the term "agglutinative." He believes the words may be separated into monosyllabic elements, and these even may be susceptible of ultimate reduction to vowels, to which may be prefixed or suffixed a consonant with a definite power of qualifying or fixing a special meaning to the stem.

The rules of isolating speech applied to the Broken English formed the Beach-la-mar.

The vocabulary is nearly all English, and the marine element is strong. Mr. Churchill says, "There can be no hesitation in ascribing to fore-castle English such exotics as *pickaninny*, *calaboose*, and *savvy*—longshore sweepings from the Spanish Main. The *squareface*, sole landward hope of the sailor, is scarcely known ashore. The sailor dialect has kept alive, and has given to these remote savages the special sense of *sing out* and *look out*, of *capsise* along with *copper*, of *slew*, of *look alive*, of *adrift* and *fashion*. Of certain elements of low, cant, vulgar English the sailors may have been the carriers." The Kanakas in the Queensland plantations enriched the vocabulary with Austral English, and to this "we must ascribe in the greater measure the inclusion of such terms as *tumble down* and *blackfellow*, of *flash* and *trash*, of *hook it* and *clear out*, of *hump* and *wire in*, of *gammon* and *bloody*." Such words as *kaikai*, food, *likelik*, little, *tambo* or *tabu* come from the island tongues, and one word, *rauss* (? clear out) is German.

Mr. Churchill has given a bibliography of the subject in fifteen entries. He has produced a most instructive and interesting book. It illustrates a simple language in the making, and records a form of speech which will disappear with colonisation and mission schools. It is to the presence of these in the Torres Straits that a decadence in jargon noted by Mr. Churchill is due.

SIDNEY H. RAY.

THE FRACTURE OF FLINT BY NATURE AND BY MAN.

AT a meeting of the Prehistoric Society of East Anglia, held at Norwich on November 4, the natural fracture of flint and its bearing on rudimentary flint implements was discussed by Mr. J. Reid-Moir.

Subjoined is a summary of the main points described:—

(1) Experiments were shown in natural percussion produced by placing a number of flint nodules in a sack and shaking them violently together. The following results were obtained:—

First, some of the flints were flaked on the edge by blows which had impinged at all angles, as would be expected from fortuitous blows.

Secondly, nearly all the blows had impinged obliquely, thereby blunting the edge and showing prominent ripple-marks.

On the other hand, human blows are always delivered at a constant angle to the edge of the flint, and are delivered vertically to the edge, as it is much easier to remove flakes thus than by oblique blows, which is nature's method.

Nature must of necessity detach flakes obliquely, because out of the 180 angles at which it is possible to edge-flake a flint, there is only one which gives a true vertical flake.

These vertical flakes do not show ripple marks, as the force of the blow does not pass through the body of the flint.

It was also seen that fortuitous blows produced a large number of truncated flakes on the edge of the flints, which are not seen to anything like such a large extent on human