was Huxley’s great merit to emphasize by the term *Sauropsida* the close and direct relationship between the classes of reptiles and birds, it was an unfortunate innovation to brigade the Amphibia and fishes as *Ichthyopsida,* thereby separating the Amphibia much more from the reptiles than is justifiable, more than perhaps he himself intended. The great gulf within the recent Vertebrata lies between fishes, absolutely aquatic creatures with internal gills and “ fins ’’ on the one side, and on the other side all the other, tetrapodous creatures with lungs and fingers and toes, for which H. Credner has found the excellent term of *Tetrapoda.* Another drawback of Huxley’s divisions resulted in the tendency of alienating the Mammalia, the third division, from the reptiles whilst trying to connect their ancestry with the Amphibia, a view which even now has some vigorous advocates.

The characters which distinguish the *Sauropsida,* that is, which are common to birds and reptiles, and not found combined in the other classes, have been thus summarized by Huxley: no branchiae at any period of existence; a well-developed amnion and allantois present in the embryo; a mandible composed of many bones and articulated to the skull by a quadrate bone; nucleated blood- corpuscles; no separate paraspnenoid bone in the skull; and a single occipital condyle. In addition to these principal characters others exist which are found in all birds and reptiles, but are not exclusively confined to them. The oviduct is always a Müllerian duct separate from the ovary and opening from the body cavity. The adult kidney is a metanephros with separate ureter; the mesonephros and mesonephric duct become in the adult male the efferent duct of the testis. The intestine and the reproductive and urinary ducts open into a common cloaca. There is usually an exoskeleton in the form of scales; in the birds the scales take the form of feathers. There are two aortic arches in reptiles, in birds only one—the right. The heart is usually trilocular, becoming quadrilocular in crocodiles and birds. In all the eggs are meroblastic and large, possessing a large quantity of yolk; in all the egg is provided in the oviduct with a layer of albumen and outside this with a horny or calcareous shell. In a few cases the egg is hatched in the oviduct, but in these cases there is no intimate connexion between the embryo and the walls of the duct. Fertilization takes place internally, occurring at the upper end of the oviduct previously to the deposition of the albuminous layer and egg shell.

Comparative anatomy clearly shows that birds arc closely allied to reptiles; enthusiasts even spoke of them as “ glorified reptiles,” and this view seemed to receive its proof by the discoveries of Archaeopteryx (*q.v.*), and the numerous bipedal Dinosaurs. But Archaeopteryx was after all a bird, although still somewhat primitive, and the question, what group of reptiles has given rise to the birds? is still unanswered. By irony of fate, mere lack of the fossil material, it has come to pass that the bridges between Amphibia and reptiles and from them to Mammals are in a fairer way of re­construction than is that between reptiles and birds, the very two classes of which we know that they “ belong together.” (H. F. G.)

SAUSSURE, HORACE BÉNÉDICT DE (1740-1799), Swiss physicist and Alpine traveller, was born at Geneva on the 17th of February 1740.@@1 Under the influence of his father and his maternal uncle, Charles Bonnet, he devoted himself to botany. In 1758 he made the acquaintance of Albrecht von Haller, and in 1762 he published his first work, *Observations sur l'écorce des feuilles et des pétales.* The same year he was chosen professor of philosophy at the academy of Geneva, and retained this chair till 1786. His health began to fail in 1791, when too he suffered great pecuniary losses. But he was able to complete his great work in 1796, before his death on the 22nd of January 1799. He became a F.R.S. after his visit to England (autumn of 1768), and in 1772 founded the Société pour l’Avancement des Arts at Geneva. His early devotion to botanical studies naturally led him to undertake journeys among the Alps, and from 1773 on­wards he directed his attention to the geology and physics of that great chain. Incidentally, he did much to clear up the topography of the snowy portions of the Alps, and to attract the attention of pleasure travellers towards spots like Chamonix and Zermatt. In 1760 he first visited Chamonix, and offered a reward to the man who should first succeed in reaching the summit of Mont Blanc (then unsealed). He made an unsuccessful

@@@l His father, Nicolas de Saussure (1709 1790), an agriculturist of unusually liberal opinions, resided all his life at his farm of Conches, on the Arve, near Geneva. As a member of the council of Two Hundred he took part in public affairs. Most of his writings bear on the growth and diseases of grain and other farm produce. His last work *Le Feu, principe de la fécondité des plantes et de la fertilité de la*

*terre* (1782), was more speculative in its nature.

attempt himself in 1785, by the Aiguille du Goûter route. Two Chamonix men attained the summit in 1786, by way of the Grands Mulets, and in 1787 Saussure himself had the delight of gaining the summit (the third ascent). In 1788 he spent 17 days in making observations on the crest of the Col du Géant (11,060 ft.). In 1774 he mounted the Crammont, and again in 1778, in which year he also explored the Valsorey glacier, near the Great St Bernard. In 1776 he had ascended the Buet (10,201 ft.). In 1789 he visited the Pizzo Bianco (near Macugnaga) and made the first traveller’s passage of the St Théodule Pass (10,899 ft.) to Zermatt, which he was the first traveller to visit. On that occasion he climbed from the pass up the Klein Matterhorn (12,750 ft.), while in 1792 he spent three days on the same pass (not descending to Zermatt), making observations, and then visited the Theodulhom (11,392 ft.). In 1780 he climbed the Roche Michel, above the Mont Cenis Pass. The descriptions of seven of his Alpine journeys (by no means all), with his scientific observations gathered *en roule, were* published by him in four quarto volumes, under the general title of *Voyages dans les Alpes* (1779-1796; there was an octavo issue in eight volumes, issued 1780-1796, while the non-scientific portions of the work were first published in 1834, and often since, under the title of *Partie pittoresque des ouvrages de M. de Saussure).*

The Alps formed the centre of Saussure's investigations. They forced themselves on his attention as the grand key to the true theory of the earth, and among them he found opportunity for studying geology in a manner never previously attempted. The inclination of the strata, the nature of the rocks, the fossils and the minerals received his closest attention. He acquired a thorough knowledge of the chemistry of the day; and he applied it to the study of minerals, water and air. Saussure's geological observations made him a firm believer in the Neptunian theory: he regarded all rocks and minerals as deposited from aqueous solution or suspension, and in view of this he attached much importance to the study of meteoro­logical conditions. He carried barometers and boiling-point ther- mometers to the summits of the highest mountains, and estimated the relative humidity of the atmosphere at different heights, its temperature, the strength of solar radiation, the composition of air and its transparency. Then, following the precipitated moisture, he investigated the temperature of the earth at all depths to which he could drive his thermometer staves, the course, conditions and temperature of streams, rivers, glaciers and lakes, even of the sea. The most beautiful and complete of his subsidiary researches is described in the *Essai sur l'hygrométrie,* published in 1783. In it he records experiments made with various forms of hygrometer in all climates and at all temperatures, and supports the claims of his hair- hygrometer against all others. He invented and improved many kinds of apparatus, including the magneto-meter, the cyanometer for estimating the blueness of the sky, the diaphanometer for judging of the clearness of the atmosphere, the anemometer and the mountain eudiometer. His modifications of the thermometer adapted that instrument to many purposes: for ascertaining the temperature of the air he used one with a fine bulb hung in the shade or whirled by a string, the latter form being converted into an evaporometer by inserting its bulb into a piece of wet sponge and making it revolve in a circle of known radius at a known rate ; for experiments on the earth and in deep water he employed large thermometers wrapped in non-conducting coatings so as to render them extremely sluggish, and capable of long retaining the temperature once they had attained it. By the use of these instruments he showed that the bottom water of deep lakes is uniformly cold at all seasons, and that the annual heat wave takes six months to penetrate to a depth of 30 ft. in the earth. He recognized the immense advantages to meteorology of high-level observing stations, and whenever it was practicable he arranged for simultaneous observations being made at different altitudes for as long periods as possible. It is perhaps as a geologist (it is said that he was the first to use the term “geology"—see the “ Discours préliminaire” to vol. i. of his *Voyages,* publ. in 1779) that Saussure worked most; and although his ideas on matters of theory were in many cases very erroneous he was instrumental in greatly advancing that science.

See Lives by J. Senebier (Geneva, 1801), by Cuvier in the *Bio­graphie universelle,* and by Candolle in *Décade philosophique.* No. xv. (trans, in the *Philosophical Magazine,* iv. p. 96); articles by E. Naville in the *Bibliothèque universelle* (March, April, May 1883), and chaps. v.-viii. of Ch. Durier's *Le Mont-Blanc* (Paris, various editions between 1877 and 1897). (W. A. B. C.)

SAUSSURE, NICOLAS THÉODORE DE (1767-1845), eldest son of Horace Bénédict de Saussure, was bom on the 14th of October 1767, at Geneva, and is known chiefly for his work on the chemistry of vegetable physiology. He lived quietly and avoided society; yet like his ancestors he was a member of the