volume to all the rest, and in *Chlamydophorus* (dwarf armadillo) the frontals are raised “ into a pair of domes ” by sinuses in them com­municating with the large olfactory cavity. In most armadillos the external nose is strengthened by small bones. The air sinuses in the sloth extend upwards into the frontals and downwards into the sphenoid bone. No *Cetaceans* have olfactory organs, except the baleen or whalebone whales, and thus are devoid of the sense of smell. In the manatee (*Sirenia)* the nasal openings are placed far forwards and have movable cartilages, and the bony walls of the nasal passages are not extensive in proportion to the size of the rest of the skull. The elephants (*Proboscidea)* have the part of the nasal cavity concerned in smell contracted and narrow, but the cavity is prolonged into the trunk, at the end of which are the nostrils ; the nasal cavity communicates with sinuses permeating every bone of the cranium. The tapirs have a shorter but very mobile proboscis, and the development of the nasal passages is ex­tensive. The horse has the power of dilating and contracting each nostril, and the cribriform plates transmit very numerous olfactory nerves from the olfactory bulbs, which are large in proportion to the size of the rest of the brain. The *Suidæ* (swine) have a large and complex olfactory region ; the accessory sinuses or spaces attain a great development ; the nose is prolonged and truncate, the cartilages forming a complete tube, which is a continuation of the bony nostrils, and these tubes open on a naked disk. In the ox and sheep the olfactory region is large, but not so large as in the horse. The external, glandular, and moist part of the nose is a linear tract running from the mid-furrow of the upper lip to the oblique nostril in the sheep, and this portion passes through many gradations in size, as seen in the roebuck, fallow-deer, red-deer, and the ox. The *Carnivora* have the ethmo-turbinal and maxillo- turbinal regions even more largely developed than in *Herbivora,* and the latter portion reaches its maximum in the seals, where “these turbinals seem to block up the entry of the nasal respi­ratory passages, and must warm the air in arctic latitudes as well as arrest every indication from the effluvia of alimentary substances or prey ” (Owen). In *Quadrumana* the nasal chamber becomes shorter and gains in depth, but not proportionally. In the platyrhine monkeys the cartilage forming the septum becomes flattened anteriorly, pushing the nostrils outwards. In the catarrhines this flattening is much less, so that the nostrils are approximated. In both groups the nostrils are not terminal. In *Man* the chief characteristic is the prominence of the fore part of the chambers, with the nostrils on the lower surface, and the nose is supported by eleven pieces of cartilage, of which one is medial, the others lateral, in five pairs. The size and form of the septal or medial cartilage mainly determine the shape and prominence of the nose. It is least developed but thickest in the Negro and Papuan races. (For a description of the muscles of the nose in man, see Anatomy, vol. i. p. 837.)

The interior of the nose is divided physiologically into two portions,—(1) the upper *(regio olfactoria),* which embraces the upper part of the septum, the upper turbinated bone, and a portion of the middle turbinated bone ; and (2) the lower portion of the cavity *(regio respiratoria).* The olfactory region proper has a thicker mucous membrane than the respiratory; it is covered by a single layer of

epithelial cells, often branched at their lower ends and containing a yellow or brownish red pigment ; and it con­tains peculiar tubular glands named “ Bowman’s glands.”

The respiratory portion contains ordinary serous glands. In the olfactory region also are the terminal organs of smell. These are long narrow cells passing to the surface between the columnar epithelium covering the surface. (See Ana­tomy, vol. i. p. 885, fig. 76.) The body of the cell is spindle-shaped and it sends up to the surface a delicate rod-like filament, whilst the deeper part is continuous with varicose nerve-filaments, the ends of the olfactory nerve. In the frog the free end terminates in fine hairs.

*Physical Causes of Smell.—*Electrical or thermal stimuli do not usually give rise to olfactory sensations. Althaus states that electrical stimulation caused a sensation of the smell of phosphorus. To excite smell it is usually sup­posed that substances must be present in the atmosphere in a state of fine subdivision, or existing as vapours or gases. The fineness of the particles is remarkable, because if the air conveying an odour be filtered through a tube packed with cotton wool and inserted into the nose a smell is still discernible. This proceeding completely removes from the air organisms less than the 1/100000th of an inch in diameter which are the causes of putrefaction and fermentation. A grain or two of musk will scent an apart­ment for years and at the end of the time no appreciable loss of weight can be detected. Substances exciting smell are no doubt usually gases or vapours. Only a few ten­tative efforts have been made to connect the sense with the chemical constitution of the substance. One of the most important of these is in an *Essay on Smell,* by Dr. William Ramsay of University College, Bristol. The following gases have no smell :—hydrogen, oxygen, nitrogen, water gas, marsh gas, olefiant gas, carbon monoxide, hydro­chloric acid, formic acid vapour, nitrous oxide, and ammonia. (It is necessary, of course, to distinguish between the sensa­tion of smell and the irritant action of such a gas as ammonia.) The gases exciting smell are chlorine, bromine, iodine, the compounds of the first two with oxygen and water, nitric peroxide, vapours of phosphorus and sulphur, arsenic, antimony, sulphurous acid, carbonic acid, almost all the volatile compounds of carbon except those already mentioned, some compounds of selenium and tellurium, the compounds of chlorine, bromine, and iodine with the above-named elements, and some metals. Chlorine, bromine, iodine, sulphur, selenium, and tellurium, which are volatile and give off vapour at ordinary temperatures, have each a characteristic smell. Ramsay points out that as a general rule substances having a low molecular weight have either no smell or simply cause irritation of the nostrils. He also shows that in the carbon compounds increase of specific gravity as a gas is associated to a certain point with a sensation of smell. Take the marsh gas or methane series commonly called the paraffins. The first two have no smell ; ethane (fifteen times as heavy as hydrogen) has a faint smell ; and it is not till butane (thirty times heavier than hydrogen) that a distinct sensation of smell is noticed. Again, a similar relation exists among the alcohols. Methyl alcohol has no smell. Ethyl, or ordinary alcohol free from ethers and water, has a faint smell; “and the odour rapidly becomes more marked as we rise in the series, till the limit of volatility is reached, and we arrive at solids with such a low vapour tension that they give off no appreciable amount of vapour at the ordinary temperature.” Acids gain in odour with increase in density in the form of gas. Thus formic acid is devoid of smell ; acetic acid has a characteristic smell ; and the higher acids of the series—propionic, butyric, valerianic—increase in odour. It would appear also that “ the character of a smell is a property of the element or group which enters into the body producing the smell, and tends to make it generic.” Many compounds of chlorine, hydrogen, compounds of sulphur, selenium, and tellurium, the paraffins, the alcohols, the acids, the nitrites