

*The Morphology of the Ungulate Placenta, particularly the Development of that Organ in the Sheep, and Notes upon the Placenta of the Elephant and Hyrax.*

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(Abstract.)

The formation of the placenta of the Ungulata vera is founded on a system of foldings of the subzonal membrane (or of the trophoblast only), which fit into corresponding grooves in the walls of the uterus, without thickening of the trophoblast layer of the blastocyst, and without destruction of maternal epithelium or other tissue (*Sus*). Certain parts of the crests of the ridges are produced by local amplification into true villi, into which the splanchnopleure of the allantois subsequently extends (*Equus*, *Bos*, etc.).

For this type of placentation, which is caused fundamentally by the folding of the trophoblast, the term plicate is used (placenta plicata), and to this type of placentation it is suggested that the Cetacea, Sirenia, and Proboscidea conform, as well as the Ungulata vera, and possibly the Edentata and Prosimia.

The term placenta cumulata is used for the type of placentation in which the placenta is formed by the heaping up or thickening of the trophoblast layer, among the cells of which accumulation extravasated maternal blood circulates. Destruction of the maternal epithelium probably always occurs. To this type belong the Rodentia, Insectivora, the Hyracoidea, Primates Chiroptera. The Carnivora are perhaps intermediate, but, according to Strahl's account, they would be distinctly plicate, while, according to the account of other authors, they are slightly cumulate.

The morphological position of the Sheep's placenta, a full account of the development of which is given in the paper, is at that end of the series of plicate forms which closely approximates to the cumulate type.

Though essentially plicate in mode of development, a slight tendency to a heaping up of the trophoblast occurs, in which a distinction into a plasmoditrophoblast and a cytotrophoblast can be detected. The uterine epithelium is destroyed over certain areas in an early stage of pregnancy, and the plasmoditrophoblast forms a layer of cells, which has been mistaken for a

degenerate uterine epithelium. A direct protoplasmic connection is effected between foetal and maternal cells.

Extravasated blood fills lacunæ between the mother and the foetus in the cotyledonary areas, in which the shorter villi and the bases of the longer villi lie bathed in maternal blood, thus leading up to a condition characteristic of the cumulate type.

The placental connection is restricted during the later period of pregnancy to the lower part of the uterus, while the upper parts of the horns become specially active in secretion, and even exhibit a general destruction of tissue to form pabulum. At birth, a large amount of foetal tissue is left within the uterus.

The anatomy of the Elephant's placenta at half term and at full term is shown to be closely comparable to that of the sheep. The placenta is essentially plicate, and its special peculiarities are easily derivable from those of the sheep. Its most obvious difference, the zonary as contrasted with the polycotyledonary form, is regarded as subsidiary in morphological importance to the anatomical and developmental characters. On the ground of placentation, the elephant may well be associated with the Ungulata.

*Procavia (Hyrax)*, which is sometimes classified with the Sub-Ungulata, is shown, on the other hand, by its placentation to be in no way associated with the Ungulata vera, or with the Proboscidea. It is typically cumulate.

The zonary form of placentation in this case (*Hyrax*) is not to be compared with any other form of zonary placenta. The placenta of *Hyrax*, some early stages of which are described, is remarkable for the highly diffuse and cumulate placentation prior to the assumption of the zonary form.

The terms cumulate and plicate are proposed as expressing fundamental differences in the behaviour of the trophoblast which give rise to two main types of placentation and correspond on the whole to the divisions deciduate and non-deciduate, although the Carnivora which have the most deciduate of all placentas are probably to be regarded as plicate rather than cumulate.

The placentation of the Ungulata shows that that order is more closely connected with the Proboscidea, and the Sirenia, and Carnivora, than with other groups of mammals, whilst the placentation of the Hyracoidea suggests no connection at all with those groups, but is of the cumulate type, and resembles more closely the form found in certain of the Insectivora.

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