

Mouth and Anus.

By

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With 1 Text-figure.

EMBRYOLOGISTS and more especially those zoologists who are engaged in teaching must long have felt that there is some confusion, or at least want of precision, in the use of the word mouth. Sometimes it is used to mean simply the anterior opening of the alimentary canal; at other times a more special morphological significance is attached to it, and the term is used to denote the anterior opening leading from the ectodermal stomodaeum into the endodermal cavity or enteron.

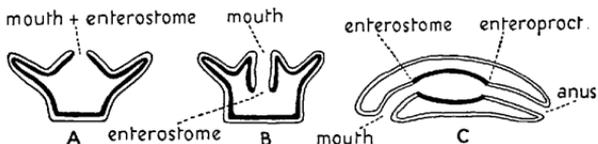
For instance, in the larval *Amphioxus* the aperture on the left side leading into the endodermal pharynx is called the mouth. At its margin ectoderm joins endoderm, and it is formed by the piercing of an opening at a point where the two layers meet and fuse. On the other hand, doubt arises as to what should be called mouth in the adult. The larval mouth becomes converted into the central aperture of the velum; hence this opening is often named 'true mouth' or 'mouth proper'. But other authors may prefer to give the name mouth to the larger more anterior opening situated between the right and left oral hoods, and leading into the buccal chamber lined by ectoderm. Clearly it is this latter opening which corresponds to the mouth, and the larval mouth which corresponds to the opening pierced in the 'oral membrane' of the craniate vertebrate.

Again, comparing *Hydra* with an actinian (Text-fig. 1), the mouth in the former leads directly into the enteron lined by endoderm, whereas in the actinian the mouth is the outer opening leading into an ectodermal stomodaeum, which itself opens into the endodermal cavity some way from the mouth.

From these two familiar examples it appears that the word mouth as at present used has no precise morphological meaning,

that it may be applied to an opening into an ectodermal stomodaeum or into an endodermal gut. Further, it follows that, since the anterior opening of the alimentary canal should always be called the mouth, some convenient term is needed to denote the aperture from the ectodermal surface or inpushing into the endodermal cavity. For this purpose I propose the word *enterostome*.

In *Hydra* and the larval *Amphioxus*, then, mouth and enterostome coincide in position, but in the actinian and the adult *Amphioxus* they come to lie some distance apart, the enterostome being carried inwards by ingrowth of ectoderm.



TEXT-FIG. 1.

Diagrams illustrating the position of mouth, anus, enterostome, and enteroproct in (A) Hydromedusae, (B) Anthozoa, and (C) Arthropoda.

We may call enterostome the anterior opening formed where endodermal gut meets ectoderm wherever it may occur, and however it may be developed. Even when it disappears as such in later stages, owing to the limit between the two germ-layers becoming indistinguishable (as, for instance, in *Gnathostomes*), it may be distinct in the embryo. It may here be noted that a better name for the so-called 'oral membrane' occurring in the embryo of all Craniata would be *velar membrane*, or more precisely *enterostomial membrane*, since in it is pierced not the mouth but the enterostome.

What has been said about the mouth applies with equal force to the posterior opening of the alimentary canal, or an *anus*. In the early embryo the anus may be situated at the point where ectoderm passes into endoderm; while, usually in later stages if not from the first, it may be the opening to the exterior of a proctodaeal ectodermal invagination. Thus may be carried inwards a long distance from the superficial anus the aperture

from the proctodaeum into the endodermal gut. For this posterior opening of the enteron I propose the name *enteroproct*.

It is, perhaps, in the Arthropods that both enterostome and enteroproct are most definite and conspicuous even in the adult (Text-fig. 1); and it is well known that in some they may nearly meet, reducing the enteron to a comparatively short region of the whole alimentary canal.

In most Invertebrates in which they occur both enteroproct and anus are easily recognizable in the embryo if not in the adult. But in the craniate vertebrates the conditions are still somewhat obscure, and require further elucidation.

The so-called 'anal membrane' (more precisely the enteroproctal membrane) of Craniates is formed where the endodermal gut meets the ectoderm, and in it is pierced the enteroproct. But, since some proctodaeal invagination usually takes place, the enteroproct becomes in later stages separated from the superficial anus. Moreover, there is formed at the posterior end of the gut an endodermal cloaca into which open the rectum and the urinogenital ducts. To this endodermal cloaca, after the piercing of the enteroproct, may be added a posterior region derived from the proctodaeum. Thus, the cloaca of the adult may be partly ectodermal in origin, and its external opening is then an anus and not an enteroproct.

How much proctodaeal invagination there may be in the various groups of Craniata seems to be doubtful since the exact position of the enteroproct often becomes obscured in later development, but in Reptilia and Aves its position appears to be indicated by the circular fold separating the 'urodaeum' from the most posterior division, the 'vestibule'.

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