The Endostyle and the Vertebrate Thyroid Gland

Neither the structure nor the function of the urochordate or cephalochordate endostyle gives any clue to its fate in the vertebrates. Similarly, examinations of adult vertebrates never show a ciliated groove that once functioned to produce a sticky, mucous trap for filter-feeding ancestors. The study of the development of one group of vertebrates, the lampreys, has provided insight into the endostyle's evolutionary fate.

An endostyle is present in larval lampreys, where it produces a mucous filter, just as in the invertebrate chordates. In addition, it binds iodine to the amino acid tyrosine. The significance of this second function is revealed when the larval lamprey metamorphoses to the adult and becomes a predator. Mucus-secreting functions of the endostyle become secondary, and the secretion of iodine-bound tyrosine derivatives becomes the endostyle's primary function. During larval metamorphosis, the endostyle transforms into an endocrine gland common to all vertebrates, the thyroid gland. The iodine-containing secretions of the vertebrate thyroid gland regulate metamorphosis and metabolic rate.

The development of the thyroid gland of lampreys may reflect evolutionary events leading to the vertebrate thyroid gland. The endostyle of vertebrate ancestors may have had both mucus-secreting and endocrine functions. With the evolution of jaws and a more active, predatory lifestyle, endocrine functions were probably favored.