

The tunicate nervous system: insights into the origin of vertebrate-specific traits

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Basic organization of the central nervous system (CNS) is conserved among all vertebrates. For example, the CNS can be divided from anterior to posterior into the forebrain, the midbrain, the hindbrain, and the spinal cord. The forebrain can be further divided into the telencephalon and the diencephalon. The diencephalon contains or is associated with important structures, such as the hypothalamus, the pituitary gland, and the pineal gland. The eyes also develop from the diencephalic region of the neural tube. While all these structures are highly conserved among vertebrates, they are absent in tunicates, the closest living relative of vertebrates. The adult CNS of ascidians, sessile tunicates, is a simple ganglion, while its larva contains a tripartite CNS derived from a neural plate that rolls up to form a hollow neural tube. In this talk, we compare structure, development, and function of the nervous system between vertebrates and lower chordates. Recent studies on the ascidian nervous system by using genome information, transgenic animals, and imaging technologies have revealed a number of novel similarities to vertebrates as well as highly derived features. Based on these new findings, we discuss the origin and evolution of the vertebrate-specific features of the nervous system.