

Abstract

The left-right asymmetry of the internal organization of an individual occurs across the animal kingdom and represents a deeply conserved trait. This internal asymmetry involves various organ systems, including the brain. Left-right asymmetry in the brains of vertebrates can be found in the size, shape, or neural lateralization of brain regions. The developmental process governing these asymmetries involves complex interactions between genetic, epigenetic, and environmental factors. Understanding these mechanisms and their interrelationships is crucial for further studying this phenomenon. The zebrafish (*Danio rerio*) serves as a fundamental model organism for investigating brain asymmetry, demonstrating morphological asymmetry of the epithalamus and the development of its establishment from initial symmetry disruption in the body to functional asymmetry in the brain, with an emphasis on the role of the Nodal signaling pathway in regulating this asymmetry. Understanding the development of brain asymmetry and its regulation in vertebrates may provide insight into neurological disorders associated with this phenomenon and contribute to uncovering the evolutionary history of the brain, its adaptive capabilities, and responses to different environments.