

Public Abstract

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Title: Differential Roles for Hedgehog Signaling in Motor Neuron Development

We all take for granted the relatively simple jaw movements associated with eating a meal. But what if at this precise moment, you suddenly lost this control, as well as all other muscles of volition? This state is a reality, existing for those afflicted with neurodegenerative disorders, such as amyotrophic lateral sclerosis (commonly known as Lou Gehrig's disease). As many as 30,000 Americans have Lou Gehrig's disease and approximately 5,000 new cases are diagnosed in the United States each year (www.wiki.com). Amyotrophic lateral sclerosis is one of many neurodegenerative disorders which illustrate the importance of the motor neuron, a cell that forms the basic biological wiring pattern for the nervous system. A motor neuron consists primarily of three parts: a soma containing the DNA, or life's genetic blueprint, an axon which is a cellular protrusion akin to a wire connecting the soma to the target muscle, and a synapse where the axon communicates to the muscle through chemical packets of information, or neurotransmitters. To contract your jaw muscle, say while eating your lunch, your body's nervous system relays electrical messages to ultimately activate the motor neurons that are connected to your jaw muscle. At the muscular synapse, your activated motor neurons then release a neurotransmitter called acetylcholine, which causes muscular contraction in your jaw. This basic neural mechanism of muscle control is a tenet for all motor neurons, from muscles of the jaw to those of the big toe.

We are examining the basic question about how these motor neurons form in the developing nervous systems of zebrafish embryos. In our investigations, we employ genetic, pharmacological, and molecular biology techniques to unravel the function of genes participating in motor neuron formation, and also the timing by when these genes function. Our work specifically reveals that the genetic code for motor neuron formation differs in the head versus the spinal cord. By understanding which gene products contribute to the formation of motor neurons, and at what times these genes contribute, this research might one day provide the mechanistic foundation for the ambitious and laudable goal of re-specifying motor neurons in patients afflicted with neurodegenerative disorders.