Endoderm

By: MacCod, Keywords: endoderm

Endoderm is one of the germ layers—aggregates of cells that organize during early embryonic life and from which all organs and tissues develop. All animals, with the exception of sponges, form either two or three germ layers through a process known as gastrulation. During gastrulation, a ball of cells transforms into a two-layered embryo made of an inner layer endoderm and an outer layer of ectoderm. In more complex organisms, like vertebrates, these two primary germ layers interact to give rise to a third germ layer, called mesoderm. Regardless of the presence of two or three layers, endoderm is always the inner-most layer. Endoderm forms the epithelium—a type of tissue in which the cells are tightly linked together to form sheets—that lines the primitive gut. From this epiblastic lining of the primitive gut, all subsequent organs, tract, liver, pancreas, and lungs develop.

Throughout the early stages of gastrulation, a group of cells called mesendoderm expresses sets of both endoderm and mesoderm-specific genes. Cells in the mesendoderm have the ability to differentiate into either endoderm or ectoderm, depending upon their position among surrounding cells. Scientists have found mesendoderm is widespread among invertebrates, including the nematode Caenorhabditis elegans and the purple sea urchin Strongylocentrotus purpuratus. Within vertebrates, mesendoderm has been found in the zebrafish Danio rerio and has been indicated in mice, Mus musculus.

Endoderm, along with the two germ layers, was discovered in 1817 by Christian Pander, a doctoral student at the University of Würzburg, in Würzburg, Germany. In his dissertation, Beiträge zur Entwickelungsgeschichte des Hühnchens im Ei, Pander described how two layers give rise to a third in the chick. Pander's discovery was later confirmed by Edmund Beecher Wilson, in Jena, Germany, and Hilde Mangold, in Jena, Germany. These and other scientists then began to look for embryos to explain the phenomenon of endoderm formation.

Evolution of the Mechanisms and Molecular Control of Endoderm Formation.

The formation of the endoderm begins with the germ layers. In the early stages of gastrulation, the endoderm is formed by a group of cells called mesendoderm. In the late nineteenth century, scientists began to realize that the formation of the endoderm is not a simple process. It requires the interaction of several factors, such as the genes involved in the process, the environment, and the stage of development. In the early 1900s, researchers discovered that the formation of the endoderm is regulated by a group of genes called the homeobox genes.

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