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Ecological Developmental Biology

Ecological developmental biology ("eco-devo") is a truly integrative biology, detailing the interactions between developing organisms and their environmental contexts. Eco-devo is a new science, studying development in the "real world" of predators, pathogens, competitors, symbionts, toxic compounds, temperature changes, and nutritional differences. These environmental agents are often necessary for normal development, often implemented when signals from the environment elicit epigenetic changes in gene expression. Ecological developmental biology also provides a systems approach to the study of pathology, integrating the studies of diabetes, cancers, obesity, and the aging syndrome into the framework of an ecologically sensitive developmental biology. Ecological developmental looks at examples where the environment provides expected cues for normal development and where the organism develops improperly without such cues. The study of epigenetics--changes in gene expression that are not the result of changes in a gene's DNA sequence--has recently provided startling insights not only into mechanisms of development, but also into the mechanisms and processes of evolution. The notion that epialleles (changes in chromosome structure that alter gene expression) can be induced by environmental agents and transmitted across generations has altered our notions of evolution, as have new experiments documenting the genetic fixation of environmentally induced changes in development. The widespread use of symbiosis in development provides new targets for natural selection. Ecological developmental biology integrates these new ideas into an extended evolutionary synthesis that retains and enriches the notion of evolution by natural selection.