Toward an Evolutionary-Developmental Explanation of Alternative Reproductive Strategies: The Central Role of Switch-Controlled Modular Systems

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A full understanding of the development and evolution through natural selection of alternative reproductive strategies requires two levels of explanation. First is proximal causation. How do alternative reproductive strategies develop over individual lifetimes? This question involves specifying how gene × environment × phenotype interactions structure the development of major patterns of individual differences. On the one hand, developmental experiences capture information that enables individuals to match reproductive strategies to environmental conditions encountered in their own lifetime. On the other hand, many allelic variations are maintained within populations, biasing development in given directions and increasing phenotypic diversity. While the critical role of both genes and environments is widely acknowledged, much less is known about how genetic and environmental influences are actually integrated in development to produce systematic adaptive variation. To address this issue, the first part of this chapter describes the concept of switch-controlled modular systems and their critical role in development and maintenance of alternative reproductive strategies. Second is ultimate causation. At an evolutionary level, how has the process of natural selection organized these modular systems? The second part of this chapter discusses the conditions under which natural selection favors regulation of alternative reproductive strategies through adaptive genetic variation versus conditional responsivity to developmental conditions.