

EVOLUTION OF POLYPHENISM: THE ROLE OF DENSITY AND
RELATIVE BODY SIZE ON MORPH DETERMINATION

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Questions: Why and how do relative body size and density influence the expression of polyphenism?

Background: Facultative paedomorphosis in salamanders is a polyphenism. There are two alternative adult phenotypes: paedomorph (remains in the aquatic environment and matures within the larval form) and metamorph (transforms and matures in the terrestrial environment)

Mathematical Methods: Evolutionary game model; ESS and CSS analysis justified by population genetics.

Key assumptions: The fitness of each morph is determined by density, relative body size, and the frequencies of phenotypes. Individual body size is environmentally determined. Each strategy is denoted by the probability of becoming paedomorphic as a function of body size.

Conclusions: Large animals become paedomorphic when density is low, small animals become paedomorphic when density is high, and the frequency of paedomorphosis is minimized when density is intermediate. These results are consistent with current empirical studies, and make testable predictions for future research on this and other polyphenisms.