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Does developmental plasticity facilitate or inhibit speciation?

Abstract

Environmental cues affect phenotypic traits at the life stage when they occur, but can also canalise later development in particular directions. There is often more flexibility in early life than later. Drawing data from experiments on planktonic foraminifera and developing feature extraction software for x-ray computed tomography, I'll use an integral projection model (IPM) to motivate studies of how developmental plasticity evolved in free living populations. IPMs are increasingly common in population ecology for studying the evolution of a continuously structured trait (such as size) that regulates rates of survival and fertility. According to the IPM, the strongest influence on foraminiferal population growth rate is somatic growth rate, which is morphologically visible in diverse fossil systems. The IPM also predicts that greater plasticity later in development increases population mean fitness. These results might therefore be taken to infer that greater plasticity should facilitate speciation, but this conclusion would contradict von Baer's Laws of Embryology, which state that divergence among species occurs at the earliest life stages. I'll introduce the first morphological and geochemical data of a new project seeking to resolve this apparent contradiction in free-living populations. The fossil record documents individuals that were once free-living and is surprisingly promising source material with organisms as diverse as zooplankton, bivalves, trilobites and trees containing records of their dynamic ontogenetic development that are extractable via modern imaging technology. Ecologically dominant species should be more labile in their growth rates, but we expect to see the clearest differences among species from the earliest life stages. The fossil record can make a strong contribution, especially empirically, to contemporary arguments into the evolution of size-structured populations spanning micro- and macroevolution.