

Publication

Along the speciation continuum in sticklebacks

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Speciation can be viewed as a continuum, potentially divisible into several states: (1) continuous variation within panmictic populations, (2) partially discontinuous variation with minor reproductive isolation, (3) strongly discontinuous variation with strong but reversible reproductive isolation and (4) complete and irreversible reproductive isolation. Research on sticklebacks (*Gasterosteidae*) reveals factors that influence progress back and forth along this continuum, as well as transitions between the states. Most populations exist in state 1, even though some of these show evidence of disruptive selection and positive assortative mating. Transitions to state 2 seem to usually involve strong divergent selection coupled with at least a bit of geographic separation, such as parapatry (e.g. lake and stream pairs and mud and lava pairs) or allopatry (e.g. different lakes). Transitions to state 3 can occur when allopatric or parapatric populations that evolved under strong divergent selection come into secondary contact (most obviously the sympatric benthic and limnetic pairs), but might also occur between populations that remained in parapatry or allopatry. Transitions to state 4 might be decoupled from these selective processes, because the known situations of complete, or nearly complete, reproductive isolation (Japan Sea and Pacific Ocean pair and the recognized *gasterosteid* species) are always associated with chromosomal rearrangements and environment-independent genetic incompatibilities. Research on sticklebacks has thus revealed complex and shifting interactions between selection, adaptation, mutation and geography during the course of speciation.

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