Géza Meszéna
Department of Biological Physics, Eötvös University, Budapest
e-mail: geza.meszena@elte.hu
András Szilágyi
Department of Plant taxonomy and Ecology, Eötvös University, Budapest
Liz Pásztor
Department of Genatics, Eötvös University, Budapest

Darwinian speciation on a regulated landscape

Darwin envisioned speciation as a gradual transformation from within-species diversity to between species one, driven by the fitness-advantage of reduced competition via niche-segregation. We identify three issues why Darwins suggestion has been considered problematic since the New Synthesis: I: The notions of niche and reduced competition have no meaning in the context of a rigid adaptive landscape. Instead, one has to consider the landscape (i.e. the fitness function) as a function of the phenotype-distribution in a functional analytic context. The functional derivative of this map is the competition function with the correct biological meaning. The adaptive dynamics phenomenology, including evolutionary branching, can be derived from this setup. II: The observed often-allopatric nature of speciation seems to exclude a role for competition. However, the theory of structured populations allows considering spatially distributed populations as a single population with an over-all fitness value. Therefore, we can define the adaptive landscape on the large spatial scale and apply the considerations above for allopatric and parapatric speciation modes analogously to the sympatric case. III: Biological species concept declared reproductive isolation as the defining issue of speciation. In our picture emergence of isolation is secondary to ecological segregation on the regulated/changing landscape. As selection for ecological divergence is caused by a fitness minimum, it is always accompanied by a selection pressure for isolation. Whether this pressure results in an evolutionary buildup of reproductive isolation depends on the availability and genetic organization of the possible isolating mechanisms. Considering these three issues together leads us to conclude that Darwins original idea is still the most parsimonious theory of speciation. Species diversity is necessarily based on competition-reducing niche segregation, i.e. segregation with respect to the way of being regulated. This structure translates to the concept of regulated adaptive landscape, providing selection pressure for competition-reducing branching evolution, which may, or may not be related to spatial segregation.