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FOCUS

PROJECT

The Evolution of Phenotypic Determination and the Principles of Adaptive Developmental Plasticity

The overall aim of the project is to develop new theory about the evolution of phenotype determination, with an emphasis on variability in complex phenotypes. Important examples of phenotypic variation range from so-called personality types in humans and other animals, through alternative reproductive strategies in many animals and plants, to ecological specialization of organisms in varied environments. There will be an emphasis on behavior as a complex phenotype of crucial importance when theorizing about the superorganism as a conceptual model of phenotypic integration. The project will be guided by the unifying idea that different mechanisms of phenotype determination can be viewed as generalized forms of phenotypic plasticity. From this perspective, adaptive phenotypic plasticity, adaptive genetic polymorphism, maternal effects, and bet hedging in fluctuating environments fall under a common conceptual heading. Specifically, the project will address the following problem areas: 1) determination of multi-trait syndromes, exemplified by animal personalities, and their role in the emergence of a superorganism; 2) genetic conflict in the evolution of phenotype determination; 3) determination of alternative reproductive strategies; and 4) the impact of developmental mechanisms on polymorphic canalization.

Recommended Reading

Leimar, O. and P. Hammerstein. 2001. "Evolution of cooperation through indirect reciprocity." Proceedings of the Royal Society of London B 268: 745-753.
Leimar, O., P. Hammerstein, and T. J. M. Van Dooren. 2006. "A new perspective on developmental plasticity and the principles of adaptive morph determination." American Naturalist 167: 367-376.
Wolf, M., G. S. van Doorn, O. Leimar, and F. J. Weissing. 2007. "Life-history trade-offs favour the evolution of animal personalities." Nature 447: 581-584.

TUESDAY COLLOQUIUM, 25.05.2010

Novelty and Saltation in Evolution

Evolutionary change is the modification of already existing properties of organisms. For this reason it is a matter of judgement whether a certain modification should be regarded as a novel property. Nevertheless, it is worth asking how never-before-seen traits - like the flowers of the flowering plants - come into existence, and whether the evolutionary processes giving rise to such novel traits are special in some way. The perspective I will argue for is that novelty evolves through a confluence of developmental changes in the organism and a new relation between the organism and its environment.

Throughout the history of evolutionary thinking, the question has been debated whether change is always gradual or if, at least sometimes, it is saltational. One idea is that novelty arises through saltation, as a 'hopeful monster' that initiates a new lineage of organisms. A drastic reorganization of an organism in a single step seems unlikely to succeed, but less dramatic saltational change could well be important in bringing about new developmental trajectories. In addition to saltation in development, there can be abrupt changes in the relation of the organism to its environment, and these may be crucial by breaking new paths for evolution.

I will mention influential ideas about the nature of transformations - such as the concept of a sea-change from Shakespeare's The Tempest - and compare these with the major points made in the historical debate about change and novelty in biological evolution. As an example of novelty in evolution, I discuss the appearance of flowering plants some 200 million years ago, at which time a new relation between these plants and their pollinating insects emerged. We now know that a flower is made up of modified leaves, vindicating the hypothesis Goethe formulated in 1787, and we have some understanding of the gene-regulatory changes responsible for the developmental novelty. I also discuss the evolution of mimicry, in which one organisms mimics the appearance and behaviour of another. Mimicry was debated in the early 20'th century as an example in which saltational change could contribute to evolution.

Leimar, Olof (Amsterdam,2013)

Limiting similarity, species packing, and the shape of competition kernels

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1045332429

Leimar, Olof (2013)

Transgenerational effects and the cost of ant tending in aphids

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1043723870

Leimar, Olof (Hoboken, NJ,2012)

Feature saltation and the evolution of mimicry

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1687458596

Leimar, Olof (2012)

Development and evolution of caste dimorphism in honeybees – a modeling approach

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1045334596

Leimar, Olof (2011)

A simple fitness proxy for structured populations with continuous traits, with case studies on the evolution of haplo-diploids and genetic dimorphisms

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1045605565

Leimar, Olof (2011)

Ant–aphid mutualism : the influence of ants on the aphid summer cycle

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1045333123

Leimar, Olof (2011)

Genes as leaders and followers in evolution

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1029331901

Leimar, Olof (London,2010)

Cooperation for direct fitness benefits

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1029333777

Leimar, Olof (London,2010)

Variation and the response to variation as a basis for successful cooperation

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=757419240

Leimar, Olof (2009)

Feature theory and the two-step hypothesis of Müllerian mimicry evolution

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1029332789