1033-37-4 **Sergey Gavrilets***, University of Tennessee. *Mathematical models of speciation.*

I first show why the classical theories of speciation by peak shifts across adaptive valleys driven by random genetic drift run into troubles (and into what kind of troubles). Then I describe the Bateson-Dobzhansky-Muller (BDM) model of speciation that does not require overcoming selection. I describe exactly how the probability of speciation, the average waiting time to speciation, and the average duration of speciation depend on the mutation and migration rates, population size, and selection for local adaptation. The BDM model postulates a rather specific genetic architecture of reproductive isolation. I then show exactly why the genetic architecture required by the BDM model should be common in general. Next I consider the multilocus generalizations of the BDM model again concentrating on the qualitative characteristics of speciation such as the average waiting time to speciation and the average duration of speciation. Finally, I consider two models of sympatric speciation where the conditions for sympatric speciation were found analytically.

A number of important conclusions have emerged from analytical studies. Unless the population size is small and the adaptive valley is shallow, the waiting time to a stochastic transition between the adaptive peaks is extremely long. However, if transition does happen, it is very quick. Speciation can occur by mutation and random drift alone with no contribution from selection as different populations accumulate incompatible genes. The importance of mutations and drift in speciation is augmented by the general structure of adaptive landscapes. Speciation can be understood as the divergence along nearly neutral networks and holey adaptive landscapes (driven by mutation, drift, and selection for adaptation to a local biotic and/or abiotic environment) accompanied by the accumulation of reproductive isolation as a by-product. The waiting time to speciation driven by mutation and drift is typically very long. Selection for local adaptation (either acting directly on the loci underlying reproductive isolation via their pleiotropic effects or acting indirectly via establishing a genetic barrier to gene flow) can significantly decrease the waiting time to speciation. In the parapatric case the average actual duration of speciation is much shorter than the average waiting time to speciation.

Speciation is expected to be triggered by changes in the environment. Once genetic changes underlying speciation start, they go to completion very rapidly. Sympatric speciation is possible if disruptive selection and/or assortativeness in mating are strong enough. Sympatric speciation is promoted if costs of being choosy are small (or absent) and if linkage between the loci experiencing disruptive selection and those controlling assortative mating is strong. (Received November 15, 2006)