[Talk 17] Adaptive walks and record processes

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Adaptive walks are simple evolutionary dynamics defined on a discrete space of genotypes. In one step of the walk, the resident population is replaced by a fitter genotype chosen among the neighbors that can be reached by a single mutation. The walk terminates when no fitter neighbors exist, that is, when the current genotype is a local fitness maximum. If the fitness values assigned to genotypes are independent, identically distributed (i.i.d.) random variables and the choice among fitter neighbors is uniformly random, the problem is closely related to a standard record process. Here we consider such random adaptive walks on correlated fitness landscapes where the fitness is the sum of an i.i.d. random variable and a deterministically increasing profile. We show that this problem generalizes the delta-exceedance record process originally introduced in 1996 by Balakrishnan, Balasubramanian and Panchapakesan. Due to a subtle interplay between the tail properties of the distribution of the random fitness components and the shape of the deterministic profile, the model displays continuous and discontinuous phase transitions where the sample paths of the record process switch between an increasing and a stationary phase. In the context of the adaptive walks the transition manifests itself in a singular change in the dependence of the walk length on the number of genetic loci, or in the first-order case in a bimodality of the distribution of walk lengths.