

# **Evolutionary Processes on Fitness Landscapes**

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Fitness landscapes underlie the dynamics of evolutionary processes and are a key concept of evolutionary theory. Recent research on molecular folding and on evolutionary algorithms has demonstrated that such landscapes are also important for understanding problems of chemistry and of combinatorial optimization. In these cases free energy or cost functions are used instead of biological fitness functions defined on genotypes. However, the image of a three dimensional landscape with many peaks and valleys turns out to be wrong. Genotypes differ in numerous characteristics and the properties of the resulting multidimensional fitness landscape are very different from those of low dimensions. In particular, landscapes derived from problems like folding RNA sequences into their secondary and third structures, or optimization tasks like the Travelling Salesman Problem (TSP) are supposed to share a number of characteristics. To investigate the main features of fitness landscapes I focused primarily on the TSP, which amounts to finding the shortest tour visiting a given set of locations. Comparing theoretical results concerning the waiting times for evolution from one cluster to another, based on percolation and correlation approaches, to the actual features of the analyzed fitness landscape shows the need for extending those approaches. To enhance predictive accuracy I will have to incorporate suitable statistical properties of cluster topologies.