

The aim of this thesis is to understand the factors that have shaped several complex biological systems. Our main tool is the optimization framework. This consists of making a hypothesis about the most relevant factors that have influenced the evolution of a particular system, finding its optimal configuration according to that hypothesis, and comparing the actual system with the optimal configuration.

Here we present applications of this method to the anatomy of the nervous system, to bacterial metabolism and to the rules that govern collective behavior. We also present a tracking method for the study of the behavior of animal groups.

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Optimization Principles in Neurobiology and Collective Animal Behavior

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