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Genomic regulation: Experiments, computational modeling and philosophy

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The prominent role of the genome in the regulation of basic biological phenomena has been the subject of extensive experimental and theoretical studies since the mid-20th century. Jacob and Monod's operon model for gene regulation in bacteria and the Britten-Davidson theory of genomic regulation in higher organisms are two well-known examples.

While mathematical modeling has a long history in biology, in particular connected to evolutionary theory and population genetics, models related to complex characteristics such as development originated more recently. Following Turing, the biochemistry of the morphogen concept was modeled using differential equations. Discrete-state models aiming at causal relationships, such as the Boolean and Bayesian models are used among others, to explain and predict embryonic genomic states, i.e. the spatial and temporal distribution of the interrelation of regulatory genes through gene products.

The workshop provides an in-depth examination of the association of the concepts of genome and regulation, while at the same time giving an historical and philosophical analysis which includes major methodology, in particular experimentation and computational modeling. The focus will be on topics such as cell cycle regulation, development, immunology, and evolution. The following topics are among those that will be discussed: The relationship between experimentation and modeling; the scope, explanatory power and practical values of different approaches; the underlying philosophy; the connection between computational models and biological reality; genomic regulation and evolutionary theory.