



The **Lorry I. Lokey** Interdisciplinary Center  
for Life Sciences and Engineering

המרכז הבין תחומי למדעי החיים  
וההנדסה ע"ש לורי לוקיי

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## Multiple timescale inheritance in a population dynamic model

### *Introduction*

Traditional models of population dynamics describe genetic mutations by transitions with a characteristic timescale. The combination of these mutations with growth and selection provides the basis of evolutionary dynamics models. However, recent accumulating experimental data in many biological systems indicate that genetic and epigenetic mutations in fact occur over an extremely broad range of timescales spanning many orders of magnitude. How this property of inheritance affects population dynamics and evolution is poorly understood.

### *Project description*

In this project the question of multiple timescales of inheritance will be investigated in the framework of a simple mathematical model. Transitions between different states (representing either genetic or epigenetic mutations) will be modeled by non-Markovian kinetics with non-exponential residence-time-distributions. The outcome of competition between different species will be computed in various external environments. A cybernetic approach, utilizing optimization concepts, will be taken to understand the possible advantage of such transition kinetics in time-variable environments.

### *Project Requirements*

- Constructing a Matlab simulation for describing a simple two-state model with non-exponential transitions between the states (this involves either solving an integro-differential equation or performing Monte-Carlo simulations).
- Running and analyzing the model results for various time-dependent environments.
- Using the numerical results to explain the relation between multiple timescale properties of individual organisms and temporal characteristics of the environment.

### *Project duration*

One semester, with optional extension

### *Contact*

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