

## Learning goals for MCDB 1150-003: Biofundamentals

- To bring a recognition of the (uninterrupted) continuity of life (at the cellular, structural, dynamical, informational levels) from the origin of life to all current organisms. Students are encouraged to consider this basic biological fact in their descriptions and models of biological behaviors, traits, and scenarios.
- To be able to apply appropriate evolutionary mechanisms (mutation and genome dynamics, selection at both the individual and social levels, sexual selection, and stochastic (non-adaptive) mechanisms, such as genetic drift and gene linkage) to generate a plausible analysis of a particular behavior or trait. In particular we use social evolutionary concepts to consider (and interpret) the behavior of multicellular organisms.
- To generate plausible molecular level scenarios (molecular machines) to be applied to essentially all cellular behaviors (DNA regulation and repair, gene expression, polypeptide synthesis and protein assembly and turnover.
  - This requires that students develop and be able to accurately apply an understanding of the factors involved in molecular interactions (affinities, on-off rates, concentrations), knowledge upon which our analysis of membrane structure and properties is based, as well developing a working understanding of the features of the molecules and macromolecules from which molecular machines are built, and upon which these machines act to carry out specific functions, e.g. the repair of damaged DNA, the movement of molecules across membranes, the coupling of chemical reactions, etc.
  - Students need to develop the ability to use their biological knowledge to apply or (if necessary develop) plausible models for biological behaviors, such as quorum sensing, programmed cell death, and other social behaviors, the stochastic features of the lac operon and differentiation (e.g. in *Dictyostelium*). This year we hope to extend this emphasis to a consideration of a range of stochastic biological behaviors, including the bursting aspects of transcription and translation.

