

Learning goals Systems Biology Lecture

1. You know the dynamic features of the following network motifs:
 - a. Simple regulation
 - b. Negative auto regulation
 - c. Positive autoregulation
 - d. Mutual inhibition (toggle switch)
 - e. Relaxation oscillator
 - f. Coherent feed-forward loop
 - g. Incoherent feed-forward loop
2. You are familiar with the Hill equation as a model for promoter binding and understand the significance of the parameters in this equation
3. You can predict how the dynamics upon ON or OFF switch change in the above mentioned motifs upon changes of parameters (e.g. binding constants, rates, etc.)
4. You can write down simple models given a wiring diagram of a network
5. You can deduce the wiring diagram from a simple model
6. You understand how you can distinguish regulation of protein production vs. protein removal/degradation rates in a model.
7. You are familiar with the following terms:
 - a. Steady-state
 - b. Response time
 - c. Nullcline
 - d. Bifurcation
 - e. Hill-Equation
 - f. Stable (unstable) fixpoint
 - g. Bi-stability
8. You can calculate / know the effects of parameters on:
 - a. Steady-state level of simple regulation
 - b. Response time of simple regulation
 - c. Fraction of promoter binding using the Hill equation
9. You can graphically derive the dynamic behavior of the coherent and incoherent feed-forward loop and can explain how parameter changes and logic gates at the z promoter affects its qualitative behaviour.
10. You can interpret phase-planes and one-dimensional flow diagrams, e.g. distinguish stable and unstable fixpoints
11. You can calculate exponential growth and competition between two exponentially growing strains
12. You have an intuition on how the timing of reproduction and rate of reproduction affect the rate of population growth.