**HW 5 (IQB w18)**

Due date: 19/2/18

1. Open and closed states of an ion channel is a prominent example of two state biological systems. Suppose $P_o$ and $P_c$ denote the probability of finding a given channel in open and closed states, respectively. Master equations describing open to close transitions in this two state system can be given by

$$\frac{dP_o}{dt} = -k_{-1}P_o + k_1 P_c \quad and \quad \frac{dP_c}{dt} = k_{-1}P_o - k_1 P_c$$

(a) (1 pt) Show that in the steady state (equilibrium) ratio of probabilities are given by:

$$\frac{P_o}{P_c} = \frac{k_1}{k_{-1}}$$

(b) (1 pt) Analyze the single channel recording data provided in the next page and estimate $P_O/P_c$.

(c) (1 pt) Suppose $P_{Open \rightarrow Close} = 2/5$ and $P_{Close \rightarrow Open} = 1/5$ using time-step of $\Delta t = 1$ msec. Use computer simulation (kinetic Monte Carlo) to capture dynamics of openning / closing of a single ion channel; show 2 plots of current ~ time (as shown in the graph next page) between t=0 to t=100 msec. (assume fixed / constant current when a channel is open).

Challenge question: Estimate $P_O/P_c$ from current ~ time graphs generated in part 1(c) and verify the relation proved in part 1(a).

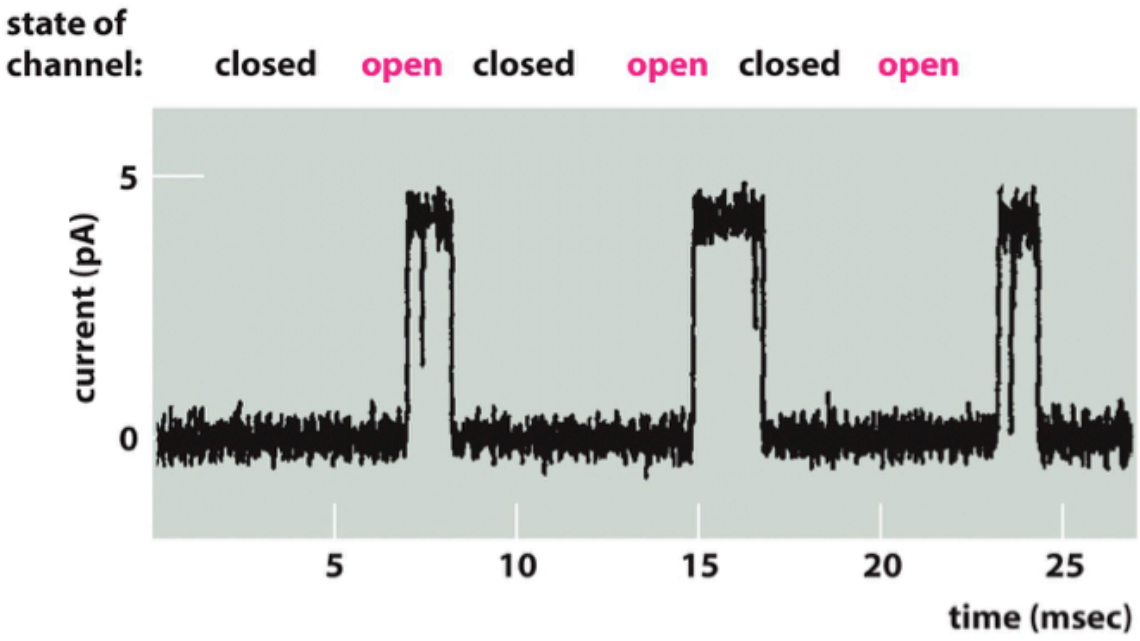


Figure 12-25 Essential Cell Biology, 4th ed. (© Garland Science 2014)

Ref:
Essential Cell Biology (by Alberts et al)
Physical Biology of the Cell (by Philips et al)