

Obligatoriske oppgaver i INF-5610

Frist: 24. October, kl 14.00

- Red blood cells have a passive exchanger that exchanges a single Cl^- ion for a bicarbonate (HCO_3^-) ion. Develop a model for this exchanger and find the flux.

Hint: What sort of transport is this an example of?

- Consider the model of the Na^+ channel shown in Fig. 3.14 on page 79(107) in the kompendium. Show that if α and β are large compared to γ and δ , then x_{21} is given (approximately) by

$$x_{21} = \left(\frac{\alpha}{\alpha + \beta} \right)^2 h, \quad (1)$$

$$\frac{dh}{dt} = \gamma(1 - h) - \delta h, \quad (2)$$

while conversely, if γ and δ are large compared to α and β , then (approximately)

$$x_{21} = m^2 \left(\frac{\gamma}{\gamma + \delta} \right), \quad (3)$$

$$\frac{dm}{dt} = \alpha(1 - m) - \beta m. \quad (4)$$

Hint: Use the assumption of equilibrium.

- Explain why replacing the extracellular sodium with choline has little effect on the resting potential of an axon. Why is the same not true if potassium is replaced?

- The Hodgkin-Huxley equations are for the squid axon at 6.3°C . The absolute temperature enters the equations through the Nernst equation. Simulate the equations at 0°C and 30°C to determine whether the equations become more or less excitable with an increase in temperature. Use the Matlab code from <http://folk.uio.no/glennli/INF-5610/oblig.m>. The figure below shows a phase-plot for the reduced system. Trajectories for different temperatures are shown. Relate this plot to your conclusions from the simulations.

