ELT 72106 Cellular Interactions

28 10. 2015

1. Explain briefly:
   a. Cellar automata
   b. Micro electrode array (MEA)
   c. Gap-junction in cells
   d. Patch Clamp measurement

2. Mechanisms of mechanosensing in cells

3. Describe an example how to make mathematical model of a single ion channel or myocardial action potential?

4. a) A cell in 37°C temperature has the following ionic concentrations and membrane permeabilities:

<table>
<thead>
<tr>
<th></th>
<th>Intracellular concentration (mM)</th>
<th>Extracellular concentration (mM)</th>
<th>Relative permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>K⁺</td>
<td>135</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Na⁺</td>
<td>15</td>
<td>140</td>
<td>0.05</td>
</tr>
<tr>
<td>Cl⁻</td>
<td>5</td>
<td>110</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Calculate the resting membrane potential of the cell using the Goldman-Hodgkin-Katz equation.

Constants:

\[ R = 8.3145 \frac{J}{K \text{mol}}, F = 96485 \frac{C}{\text{mol}}, k_B = 1.3807 \times 10^{-23} \frac{J}{K}, e = 1.602 \times 10^{-19} \text{C} \]

b) Describe the meaning and purpose of the Goldman-Hodgkin-Katz equation – compare it to Nernst equation?