

Excitable Tissues Learning Outcomes

As a result of study the theory and related practical class on excitable tissues you should be able to:

1. Explain what an excitable tissue is and name the major excitable tissue types.
2. Describe how to record the membrane potential in a single cell.
3. Understand what the resting membrane potential is and that at rest the membrane is polarised.
4. Define the terms depolarisation, repolarisation and hyperpolarisation and understand how these relate to the magnitude of the membrane potential.
5. Appreciate that graded potentials are caused by stimuli and be familiar with the general characteristics of these potentials.
6. Describe the difference between a depolarising and hyperpolarising graded potential.
7. Understand the general features of an action potential.
8. Describe the three characteristic phases of an action potential and appreciate that these are named according to the direction that the membrane potential is moving during that phase.
9. Recall the typical membrane values at threshold and the peak of the action potential.
10. Explain the key differences between action potentials and graded potentials.
11. Understand the terms '*all or none principle*', *action potential propagation* and *conduction velocity*.
12. Explain frequency encoding and be able to describe how you could demonstrate this concept experimentally.
13. Recall the normal intracellular and extracellular ion concentrations for the major anions and cations in mammals.
14. Understand the functional significance of ion selective channels, resting channels and gated ion channels.
15. Explain the difference between voltage-gated, ligand-gated and stretch-gated ion channels and be able to provide an example where each of these has a physiologically-important role.
16. Describe the ionic-basis of the resting membrane potential.
17. Explain why the resting membrane potential is slightly less negative than the equilibrium potential for K^+ .
18. Understand the ionic-basis of the action potential with particular reference to the changes in membrane permeability that occur at threshold, the peak of the action potential and during the hyperpolarising phase.
19. Use semi-logarithmic graph paper to plot experimental data with a wide range of values.
20. Describe an experiment that could do to demonstrate that K^+ is responsible for the resting membrane potential.
21. Describe an experimental approach that you could use to demonstrate that Na^+ influx is responsible for the depolarising phase of the action potential.
22. Describe the relationship between ion concentration and membrane potential from the graphical representation of experimental data and be able to interpret the significance of the relationship.
23. Understand what the Goldman-Hodgkin-Katz equation is and how to use it to predict the membrane potential if you know the relative permeability of the membrane to K^+ and Na^+ .
24. Explain why the Goldman-Hodgkin-Katz equation provides a more accurate prediction of membrane potential than the Nernst equation.
25. Be able to explain how the mechanisms of action potential propagation differ between myelinated and unmyelinated axons and the implication that this has for conduction velocity.
26. Understand the difference between the absolute refractory period and the relative refractory period and the ionic-basis of each.