UNIT – 3

BIOPOTENTIAL ELECTRODES & CONFIGURATION

Nernst equation

Cell Potential under Nonstandard Conditions

$$\Delta G = \Delta G^\circ + RT \ln Q$$

$$-nFE_{cell} = -nFE^\circ_{cell} + RT \ln Q$$

$$E_{cell} = E^\circ_{cell} - \frac{RT}{nF} \ln Q$$

$$E_{cell} = E^\circ_{cell} - \frac{0.0592\ \text{V}}{n} \log Q$$

This equation, known as the **Nernst equation**, helps us determine the cell potential at nonstandard conditions.

Concentration Cells

- It is possible to get a spontaneous reaction when the oxidation and reduction reactions are the same, as long as the electrolyte concentrations are different. The concentration gradient drives the reaction.

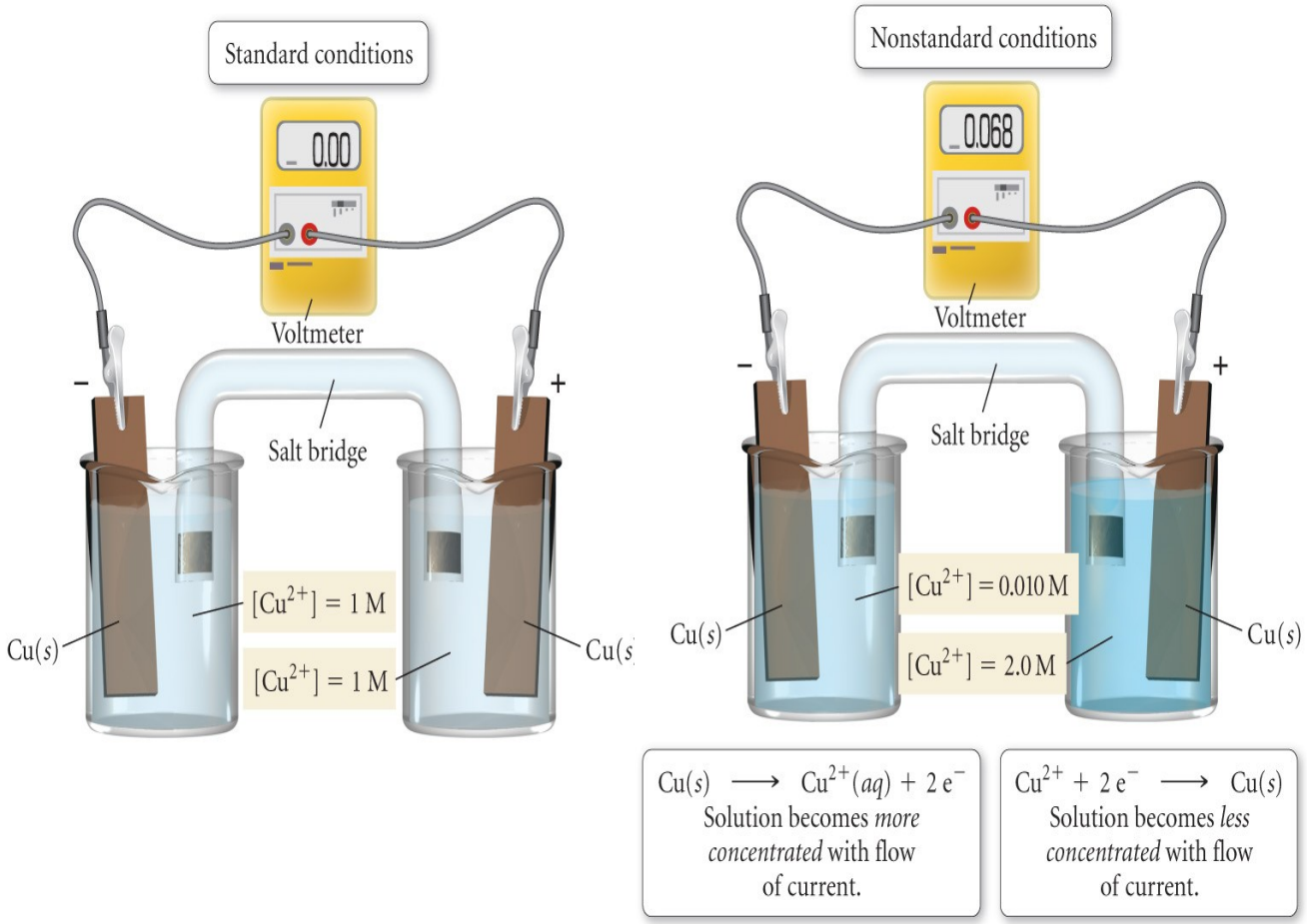
- Calculating cell potential using the Nernst equation helps us determine the direction of spontaneity in the cell.

Concentration Cells

- Electrons will flow from the electrode in the less concentrated solution to the electrode in the more concentrated solution.

  - Oxidation of the electrode in the less concentrated solution will increase the ion concentration in the solution; the less concentrated solution has the anode.
  - Reduction of the solution ions at the electrode in the more concentrated solution reduces the ion concentration; the more concentrated solution has the cathode.

Concentration Cell

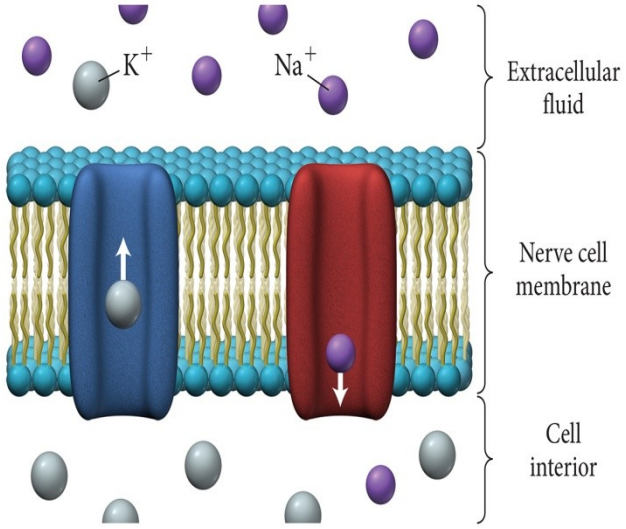


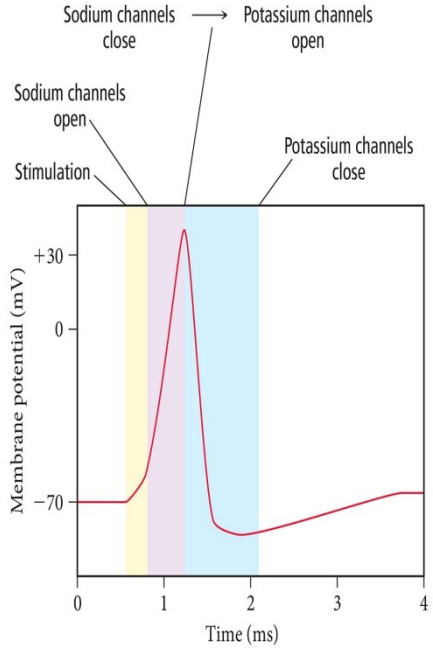
$$Cu(s) \mid Cu^{2+}_{(aq)}\,(0.010\ M) \mid\mid Cu^{2+}_{(aq)}\,(2.0\ M) \mid Cu(s)$$

Applications of concentration cells

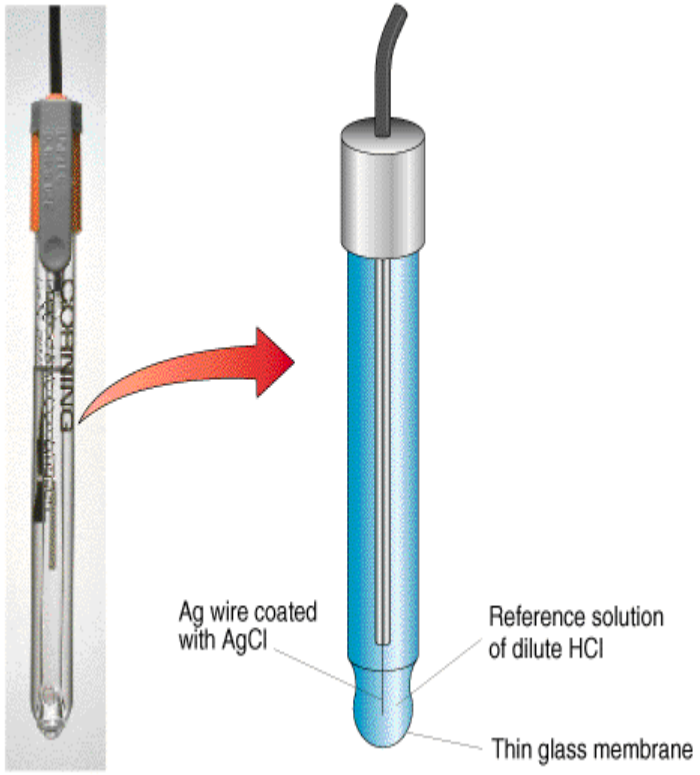
Neuron Potential

Nerve cells create a concentration gradient across the cellular membrane. To transmit a signal, the sodium and potassium channels open creating a spike in the membrane potential which is transferred down the nerve cell.





The pH Electrode



pH electrodes are able to determine the pH because they contain a solution of dilute HCl separated by a thin glass membrane from the test solution. The potential difference between the two different concentrations of H^+ is proportional to the pH.