Answer to question below…

I am not sure what the second animation is, but there was one on the development of the membrane potential...
First, it showed a cell membrane without any potential. However, the Na K pump is on so that the K concentration is high in the cell, and Na concentration in the cell is very low.

Then a few potassium channels open so that K ion moves down its electrochemical gradient. The positive potassium moves outside the cell...this makes the inside of the cell slightly negative and the outside of the cell slightly positive. Sodium wants to move in the opposite direction (into the cell) but sodium is not able to cross the membrane as well as potassium (potassium is the most permeant ion).

So, the membrane potential develops as the K ion moves to the outside the cell.. at about -60 mV, the electrical gradient is equal and opposite of the chemical (concentration) gradient...then you reach an equilibrium. In the animation, the arrow for the chemical gradient is large at the start and is pointing out of the cell (as [K] is high inside), but then the electrical gradient grows from very small to larger and larger (this arrow points into the cell), until the two arrows are the same size (but still point in opposite directions). To do, this the electrical arrow grows in size (size of the force) and the chemical arrow decreases a bit, until the two arrows are equal in size but still pointing in the opposite directions. When these two forces are equal and opposite (arrows same size, pointing in opposite directions), then the ion is in equilibrium.

At equilibrium, the electrical force (arrow in the animation) is equal in size and opposite in direction to the chemical (concentration) force.

So, this equilibrium is an assumption for the Nernst equation...that the two forces are equal and opposite. To use the Nernst equation to estimate the membrane potential, you would simply plug in the concentrations for K (the most permeant ion).

Sent: Saturday, March 14, 2009 2:16 PM
To: Stith, Brad
Subject: membrane potential

Hi Dr. Stith,

I was studting for the upcoming exam and found that I am still a little confused on the membrane potential. I watched the second animation (the one involving the Nerst EQ and was wondering if you could clarify it for me. I think what I'm confused on is how the chemical and electrical gradients are equal and opposite. Any clarification would be helpful! Thanks.