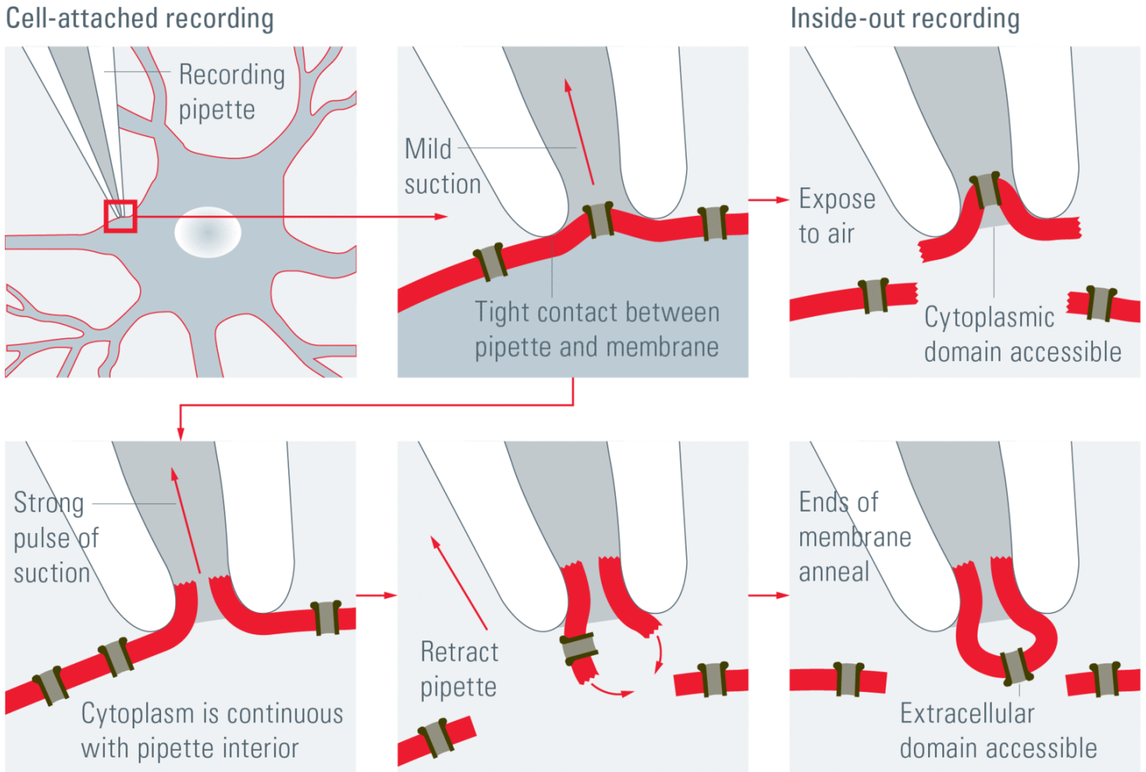
Biology 2201 Activity 4.6 Understanding the Sodium Potassium Pump Gillam Holy Heart Name: _____

Palytoxin is a deadly compound found in certain marine animals. When scientists first isolated palytoxin from sea corals in the 1970s, they did not know how it affected people exposed to it. In time, they began to suspect that the toxin was interfering with the sodium-potassium pump. Researchers have measured the effect of palytoxin on ion transport through the sodium potassium pump using the patch-clamp technique. This involves using a fine-tipped microelectrode to measure the electric current across pumps in the cell membrane. In this activity, you will examine some of the researchers' results and conclusions.



Read the following observations that researchers made after adding palytoxin to a membrane, and then answer the analysis questions.

- Observation 1: The current across a single pump increased from 0 picoamperes to 1 picoampere.
- Observation 2: When ATP was added to the cytoplasm facing side of the membrane, the current across a group of pumps increased by a factor of 8 times.
- Observation 3: A molecule 0.75 nm in diameter was able to pass through the pump. (For comparison purposes, a hydrogen atom measures 0.1 nm in diameter.)

1.) How does the patch-clamp technique help researchers study ion transport across cell membranes?

2.) In general, about 107–108 ions/s pass through an open ion channel. In contrast, only 102 ions/s pass through an ion pump. How would you expect the strength of an electric current across an ion channel to compare with the strength across an ion pump? Remember the stronger the charge the quicker the transport.

3.) What does Observation 1 suggest about ion flow through the sodium-potassium pump when palytoxin is added?

4.) Given that the sodium-potassium pump is a form of active transport, suggest an explanation for Observation 2.

5.) What does Observation 3 suggest about the size of the passage through the sodium-potassium pump?