Example of report on cell transport lab report

Sociology, Communication

Introduction

The neurophysiology of nerve pulses in the cell were the subject of the online laboratory experiment in order to better understand neuron communication from inside a cell to the outside of a cell. One of the incredible characteristics of the nervous system is its capability to communicate due to the existence of neurons. Neurons show a measurable response to their environment by producing an electrical signal. We can smell due to olfactory sensory neurons that can directly react to perfume, food or anything with an odor; these odors are the sensory stimuli. The function of the receptor potential is to trigger an action potential that is another electrical signal that will then be transported along the sensory neurons axon via the membrane to the brain.

Communication is possible because of the chemical synaptic transmission and release of neurotransmitters. The concentration and type of ions solution inside the cell and in the extracellular region influence the potentials (mV), the signal to communicate and then the transmission of the message. Action potential travels via the axon and is conducted to zero or many locations depending on the environmental conditions. The end of each axon branch is called the axon terminal where nanometer sized synaptic vesicles hold the chemical transmitters until signaled to release the transmitters.

Exocytose influences neuron communication, too. It is the term a cell process that consumes energy when vesicles are released (like hormones, soluble proteins, lipids, and other secretions) outside of the cell membrane of the vacuole which is the extracellular region. A transient vesicle fusion, rather

than a complete merger with the cell membrane, takes place during cell secretion that empties, at least partially the vacuole.

Hypothesis

Communication by neurotransmission for cells happens or is stopped depending on the type of chemical ions in solution.

Materials and Methods

Experiment 1: The Resting Membrane Potential

The materials used in the experiment included an in vitro neuron, three extracellular solutions were available (a) the control solution (mM K+ and 150 mM Na+), (b) high concentration of K+ (25 mM K+ and 130 mM Na+) solution and a low concentration of sodium solution, Na+ (5 mM K+ and 30 mM Na+ and and 120 mM TmA+). A microelectrode, the microelectrode manipulator control, the microelectrode amplifier and an oscilloscope were the instruments used.

A neuron that is in vitro is a big and cultured (or disassociated) neuron placed in a Petri dish. Changes in the neuron based on communication behaviors from the inside to the outside and vice versa were observed. The microelectrode is designed like other probes except the tip is exceptionally small, it is so small a manipulator is needed in real lab conditions to prick one neuron. The amplifier measured the reference voltage and the microelectrode voltage so the difference between the two is known. Finally, the oscilloscope is the instrument that measures and shows digitally the voltage changes. The simulated lab showed a magnified neuron so the behaviors could be seen.

Experiment 8: Neurotransmitter release

The online lab was used because seeing this in real-life takes special training and an electron microscope. An in vitro neuron, a Petri dish and four extracellular solutions were needed. The extracellular solutions consisted of a control solution containing only calcium ions, Ca2+. Three other solutions were available to add to the Petri dish holding the neuron for the experiment. The first solution contained no Ca2+. The second solution contained only a low concentration of CA2+. The last solution contained magnesium ions, Mg2+. The experiment simulated low to high intensity reactions based on introducing one of the four chemical solutions into the experiment. The two intensity settings were used for each solution to determine if neurotransmitters were released or not.

Experiment 9: Neurotransmitter release

Experiment 9 called for making predictions about the outcomes of the steps. A sensory neuron was stimulated, the response and the target of the response were noted and the predictions were tested.

The materials included the following.

In vitro sensory neuron

An in vitro interneuron

Microelectrodes

Hook electrodes

Oscilloscope

Stimulator

Most of the materials were described for an early lab but others such as the

hook electrodes are explained here. The hook electrodes allow the axon to be measured for extracellular voltage changes. The oscilloscope was used in an earlier experiment, but in this experiment the voltage changes observed on the oscilloscope monitor are across the interneuron and the neuron membrane. The stimulator is used in the same way as above, to produce pulses to the neuron at either a high or low intensity setting.

Results

The control calcium ion solution was introduced to fill the Petri dish and it was used as the control extracellular solution. The first simulation of the neuron was done at low intensity with only the Control. After activation only a few transmitters were released. The next simulation was done at high intensity. Strong bursts of stimulus allowed many channels to carry neurotransmitters and open so the neurotransmitters were released into the extracellular solution that was earlier used as the control. Table 1 shows the results from all the activities during the experiment. The discussion section below explains the meaning of the results.

Discussion

Experiment 1: The Resting Membrane Potential

The experiment showed that when a resting membrane potential is -70 mV then the inside of the cell is negatively charged by 70 more mV than the outside of the cell. The amount of voltage is a measure of the differences in ion concentrations inside the cell and outside the cell. Voltage measurements are essential in order to learn about the electric charge size that is integral to a neuron’s ability to transmit messages.

A change in the sodium or potassium ion conductance can results in one of two ways; either depolarization or hyperpolarized. Starting with 0 mV for potential indicates that the membrane is at rest and that the K+ and Na+ do have the same concentrations outside and inside the cell. When a nerve impulse takes place Na+ is able to move through the member into the cell and the result is depolarization. When the voltage increases to the peak charge, this is the time that K+ travel to inside the cell causing the environment to become hyperpolarized. The cell environment is dependent on the total charge; in other words it is dependent on the charge inside the cell plus the charge outside of the cell.

Experiment 8: Neurotransmitter release

During the laboratory it was found that if the extracellular potassium ion, K+, increases and then the amount of net K+ diffusion out of the neuron is reduced because of the large number of potassium leakage channels. Potassium leakage channels number more than the number of sodium leakage channels. Therefore the K+ diffuses to the extracellular region faster the sodium ion. When the extracellular K+ increases the membrane potential decreases because causes a higher negative voltage inside the cell, because as more cations are moving out of the cell, the extracellular concentration increases The experiment results did not agree, but the resting membrane (if the experiment had worked) would show 150mM K+ inside the cell and 5mM K+ . There are a larger number of potassium cations in the cell at resting potential but when activated the potassium cations have many channels to move out of the cell.

Low amounts of additional calcium ions did not cause neurotransmitter

release. Adding magnesium caused the neurotransmitter release to equal the amount of release in the control (none) because the axon terminal calcium channels were blocked. The amount of stimulus intensity influences the neurotransmitter release at the Axon terminal proportionally to the number of synaptic vesicles discharged in the synaptic cleft. If no calcium is present then no neurotransmitter release can take place because, and the experiment showed that exocytosis is calcium dependent.

The reason the sensory neuron and the interneuron are equal with a resting membrane potential is because the voltage equals zero.

Experiment 9: Neurotransmitter release

Increase in stimulus intensity causes the number of neurotransmitter per vesicle that transports neurotransmitters to increase. The neurotransmitters are released at the membrane surface. The stronger the stimulus, the more sensory neuron vesicles were released from the Axon Terminal. Sodium cations signaled the neurotransmitters to be release.

Many of the predictions were proved to be correct when compared to the experimental data as noted in the list below; the stronger the stimulus the larger the response.

A small but depolarizing response occurred at R1,

Action potentials occurred at R2, R3, and R4, and

a moderate stimulus to the sensory receptor causes a small depolarizing effect at R1 and R2, whereas action potentials occur at R3 and R4.

When no sodium cations are available there is no response,

With a weak sub-threshold, stimulus R1 did show a small and depolarizing response but the other locations showed no response at all.

The experiment offered the chance to identify the components of a two-neuron circuit: the axon, sensory endings and the postsynaptic membranes. The predictions made at the beginning the experiment matched the observations made of the response or non-response to a very weak, sub-threshold, moderate and intense stimulus. Since the predictions were good, I feel more confidence in carrying out experiments about neurons.

Final Thoughts

The laboratory experiments are great because they allow a student to visualize what is happening in a neuron and how nerves communicate by triggering signals that direct the vacuole with the transmitters so the transmitters can be released into the extra cellular region. The type of ions in solution inside and outside a cell influences the voltage that can be measured. High intensities correlated with higher responses. The distance from the axon terminal does matter. Calcium and Potassium ion concentrations are influential on the movement taking place between inside the cell to the extra-cellular region. The experiment showed that Magnesium stops neurotransmission and that exocytosis calcium dependent.

References

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