

Neuron Structure: What are the essential structures that make up a neuron?

Why?

Cells are specialized for different functions in multicellular organisms. In animals, one unique kind of cell helps organisms survive by collecting information and sending messages throughout the body. The shapes and features of neurons, which are the primary cells in the nervous system, enable animals to experience all of the five senses; find food, mates, and shelter; and to survive in their diverse environments.

Model 1 – Parts of a Neuron



1. Model 1 is an illustration of two neurons. Label one of the neurons in the diagram with the following structures:

Cell body or soma

Axon

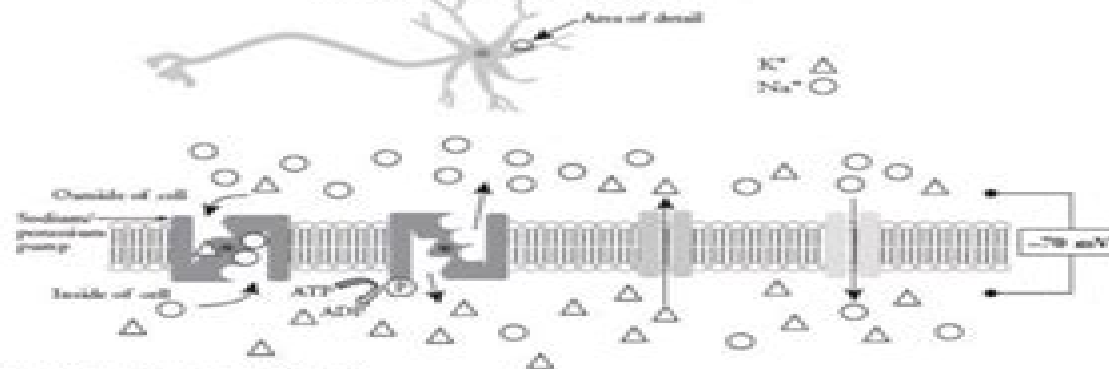
Cell nucleus

Synapse

Dendrites

2. Which structure(s) on the neuron in Model 1 would receive a signal from either a sensory cell (taste bud, touch receptor, retinal cell) or from another neuron?
3. Draw an arrow through the two cells in Model 1 to show the path of a nerve impulse if a message was being sent through the two neurons.

Model 2 – Membrane Potential



4. Describe the cellular structure shown in detail in Model 2.

5. Identify each of these symbols in Model 2.



6. Consider Model 2.

- a. Which side of the membrane has more sodium ions when the neuron is at rest?
- b. Briefly explain why sodium ions cannot cross the membrane without the use of a protein channel.
- c. Which direction should sodium ions flow naturally if a channel is provided?

Neuron Function Pogil Activities For Ap Biology

R Bogdan



Neuron Function Pogil Activities For Ap Biology:

Science Citation Index, 1992 Vols for 1964 have guides and journal lists **Basic Concepts of Neuronal Function**
Don L. Jewett, Martin D. Rayner, 1984 **Photochemical Control of Neuronal Activity** Ivan Tochitsky, 2013 Photochemical control of neuronal activity methods and clinical application by Ivan Tochitsky Doctor of Philosophy in Molecular and Cell Biology University of California Berkeley Professor Richard Kramer Chair Mammalian nervous systems are incredibly complex with almost 100 billion neurons making up the human brain Neurons in the brain primarily communicate with one another in one of two ways electrically via the flow of ions across the cell membrane or chemically by releasing and detecting a variety of signaling molecules In order to understand the function of the nervous system we need to be able to manipulate it with high spatial and temporal precision Conventional electrical or chemical stimuli do not allow for such precise control Thus a new and orthogonal stimulus modality had to be utilized in order to facilitate the study of the nervous system The emerging field of optogenetics uses light as such a stimulus since light can be delivered only to a small part of the nervous system or even a single neuron and the illumination can be controlled with millisecond time resolution Optogenetic techniques involve the expression of light sensitive proteins from microbes in genetically targeted populations of neurons rendering those neurons sensitive to light Recent advances in optogenetics have greatly advanced our understanding of the function of the nervous system both in healthy organisms and in the context of disease Optogenetics is a powerful technique for investigating neural networks but this approach primarily studies the function of the nervous system at a system rather than molecular level The vast complexity of the human brain is created not only by the large number of individual neurons and the intricate connections between them but also by the dizzying variety of proteins found in the cell membranes of these neurons These proteins sense and respond to the release of chemical signaling molecules from neighboring cells or changes in ion concentrations that alter the cell's membrane potential allowing for the generation and propagation of electrical signals We have combined the powers of synthetic chemistry and genetics to develop novel optopharmacological or optochemical genetic methods which enable precise optical control of neuronal function at the molecular level These strategies involve the generation of light sensitive photoswitch molecules that selectively target a population of either genetically engineered or endogenous membrane proteins including receptors sensing chemical stimuli or ion channels responding to electrical potential changes in the cell The addition of a photoswitch compound to a neuron expressing the target protein makes that protein and by extension the neuron sensitive to light We first applied this strategy to generate light regulated neuronal nicotinic acetylcholine receptors which are a group of proteins that respond to the chemical neurotransmitter acetylcholine These receptors modulate the activity of other neurons in different parts of the brain and are also sensitive to nicotine an addictive chemical found in tobacco products The function of acetylcholine receptors in the brain and their role in nicotine addiction neuropsychiatric and neurodegenerative disorders is not fully understood in large part

because it is quite difficult to chemically manipulate individual receptors without affecting others. Making light sensitive genetically targeted acetylcholine receptors should thus greatly advance our understanding of those receptors' function. The main rationale for making proteins or neurons light sensitive is to facilitate the study of the healthy nervous system as well as its malfunction in disease. There are however several human diseases where optical methods for controlling neuronal activity could directly provide a clinical benefit. Degenerative blinding diseases such as retinitis pigmentosa or age related macular degeneration leave the retinas of affected patients either partly or completely insensitive to light by causing the death of light detecting photoreceptor cells in the eye. Light responses can be restored to a blind retina by making some or all of the remaining retinal neurons sensitive to light. This can be achieved via the expression of light sensitive microbial opsins or engineered receptors in retinal neurons that are not normally light sensitive. Both of these approaches have restored some visual perception to blind mice suffering from retinitis pigmentosa. However in order to use either optogenetic or optochemical genetic tools in the clinic the mutant proteins must be artificially expressed in the patient's retina which requires the use of viral gene therapy. Gene therapy has potential health risks so we decided to develop a treatment for blinding diseases that would only involve a light sensitive chemical without the need for gene therapy or invasive surgery. To that end we have developed an optopharmacological therapy for vision restoration by creating photoswitch molecules that block and unblock endogenous voltage gated ion channels in a light dependent manner allowing us to control almost any neuron with light. The first photoswitch tested called AAQ restored electrical retinal light responses, the pupillary light reflex as well as other simple visual behaviors in blind mice. In order to optimize this treatment for clinical use we generated a compound called DENAQ with improved light sensitivity and persistence in the eye which responds to broad spectrum white light similar to what people encounter in natural visual scenes. Furthermore DENAQ acts selectively on retinas suffering from photoreceptor cell death but leaves healthy retinas unaffected. This selectivity raises the possibility that we may be able to treat not only patients who are completely blind but also those suffering from partial vision loss by restoring light sensitivity only to the parts of the retina experiencing photoreceptor degeneration. The promising preliminary results from animal studies suggest that our optopharmacological strategy for vision restoration may eventually be used in the clinic in addition to helping researchers understand the function of the nervous system in its normal state and in disease.

Basic Concepts of Neuronal Function Don L. Jewett, 1984 **Building Brains** David J. Price, Andrew P. Jarman, John O. Mason, Peter C. Kind, 2017-09-25 Provides a highly visual readily accessible introduction to the main events that occur during neural development and their mechanisms. **Building Brains: An Introduction to Neural Development** 2nd Edition describes how brains construct themselves from simple beginnings in the early embryo to become the most complex living structures on the planet. It explains how cells first become neural, how their proliferation is controlled, what regulates the types of neural cells they become, how neurons connect to each other, how these connections are later refined under the influence of neural activity and

why some neurons normally die This student friendly guide stresses and justifies the generally held belief that a greater knowledge of how nervous systems construct themselves will help us find new ways of treating diseases of the nervous system that are thought to originate from faulty development such as autism spectrum disorders epilepsy and schizophrenia A concise illustrated guide focusing on core elements and emphasizing common principles of developmental mechanisms supplemented by suggestions for further reading Text boxes provide detail on major advances issues of particular uncertainty or controversy and examples of human diseases that result from abnormal development Introduces the methods for studying neural development allowing the reader to understand the main evidence underlying research advances Offers a balanced mammalian non mammalian perspective and emphasizes mechanisms that are conserved across species drawing on examples from model organisms like the fruit fly nematode worm frog zebrafish chick mouse and human Associated Website includes all the figures from the textbook and explanatory movies Filled with full color artwork that reinforces important concepts an extensive glossary and definitions that help readers from different backgrounds and chapter summaries that stress important points and aid revision Building Brains An Introduction to Neural Development 2nd Edition is perfect for undergraduate students and postgraduates who may not have a background in neuroscience and or molecular genetics This elegant book ranges with ease and authority over the vast field of developmental neuroscience This excellent textbook should be on the shelf of every neuroscientist as well as on the reading list of every neuroscience student Sir Colin Blakemore Oxford University With an extensive use of clear and colorful illustrations this book makes accessible to undergraduates the beauty and complexity of neural development The book fills a void in undergraduate neuroscience curricula Professor Mark Bear Picower Institute MIT Highly Commended British Medical Association Medical Book Awards 2012 Published with the New York Academy of Sciences

The Molecules Behind Neuronal Function Mario Mikula, 2003

Trophic Function of the Neuron, Function and Mechanism of Polarized Targeting of Neuronal Membrane Proteins Joshua A. Barry, 2013

Abstract The ability of a neuron to survive and function properly requires many factors including a multitude of proteins Membrane proteins are a specific class that are expressed within the plasma membrane and function in a variety of roles from action potential firing to neurotransmitter reuptake To perform this variety of functions requires proper localization of these proteins however the exact functional relevance and underlying mechanisms that regulates this targeting is still an area of intense research In this thesis I examined the functional role that NgCAM had on inducing bundling of axons or dendrites via regulation by domain deletion or phosphorylation I also examined how the polarized targeting of the splice variants of Kv3 1 could affect the maximal spiking frequency of neurons Then I explored how Kv3 1 could induce clustering and activation of its motor kinesin 1 KIF5 Finally I looked at the role that metal binding sites specifically zinc plays on the localization and activity of Kv3 1 My various areas of research are all linked by the shared idea that the proper localization of membrane proteins can regulate the function of a neuron

Trophic Function of the Neuron Daniel B. Drachman, 1974

Protein Synthesis and Neuronal Function in Single, Identified Neurons of Aplysia Californica Yoke Peng
Loh, 1973

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