uBEATS Teacher's Guide:

Specialized Cells: Sensory Pathways

(Grades 6-8)

This teacher guide is a supplementary text to support the use of the uBEATS "Specialized Cells: Sensory Pathways" module for grades 6-8.

To help students develop the knowledge necessary for an incredible future in health care, we created UNMC Building Excellence in Academics Through STEM (uBEATS), an online health science resource for Nebraska students.

UNMC uBEATS modules are short (15 minutes or less), interactive online health science modules to supplement curriculum taught in grades 6 – 12. These do not replace curriculum but are a supplement for teachers and students incorporating evidence-based information and UNMC expert guided material. Each module is chunked into sections with formative and summative assessments with immediate feedback provided.

Tips on how to utilize uBEATS modules:

- Internet access is required to view uBEATS modules.
- For those who have access to one-to-one technology, modules can be used in or outside of the classroom as a topic introduction, extension, or review.
- For classrooms without individual student devices modules can be used in whole group instruction. Formative assessment questions can use the teacher's preferred call and response method and summative assessment questions can be displayed on the board and answered individually by students or printed and distributed to students after viewing the module.

Objectives

- Describe the sensory pathway: 1) Stimulus, 2) Receptor cell, 3) Nerve transmission, 4) Brain processing
- Recognize that a problem anywhere along the pathway could cause loss of a particular sense.
- Discuss treatment options for various types of disorders related to your senses.

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Introduction

So, what are your senses? Well, simply put, our senses are what help us gather information about the outside world. We have five main senses that contribute to everyday life. They are our senses of sight, hearing, smell, taste, and touch. All these senses are converted into electrical impulses and are carried to the brain for processing.

Prior Knowledge

Before beginning this module, the student should understand the Grade Band Endpoints for Core Idea LS1.D. A Framework for K-12 Science Education

- ***By the end of grade 2*** Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).
- ***By the end of grade 5.*** Different sense receptors are specialized for kinds of information, which may then be processed and integrated by an animal's brain, with some information stored as memories. Animals can use their perceptions and memories to guide their actions. Some responses to information are instinctive—that is, animals' brains are organized so that they do not have to think about how to respond to certain stimuli.

Key Terms/Vocabulary

Senses, sight, hearing, taste, smell, touch, electrical impulses, sensory pathway, stimulus, receptor cell, nerve transmission, brain processing, visual perception, cornea, lens, retina, photons, photo receptor, rods, cones, optic nerve, thalamus, brain stem, occipital lobe of brain, blindness, diabetes, macular degeneration, traumatic injury, glaucoma, eye infection, intraocular lens, corrective lens, eye surgery, sound vibrations, pinna, tympanic membrane (eardrum), outer ear, middle ear, inner ear, cochlea, auditory nerve, deafness, viral infection, meningitis, olfactory chemoreceptor, aerosolized molecules, olfactory sensory neurons, olfactory nerve, olfactory cortex, temporal lobe of brain, anosmia, congenital, hyposmia, brain tumor, allergies, decongestants, antihistamines, antibiotics, gustatory cortex, taste buds, umami taste, sour taste, sweet taste, bitter taste, salty taste, cranial nerve, pain receptor, pressure receptor, tension receptor, temperature receptor, texture receptor, shape receptor.

Science Standards

Nebraska's College and Career Ready Standards for Science 2017 Nebraska Science Standards

- Structure and Function in Living Things: SC.6.6.2.D

Next Generation Science Standards (NGSS) featuring Three-Dimensional Learning

Core Idea LS1.D: Information Processing A Framework for K-12 Science Education

- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.

Science and Engineering Practices **NGSS**

- Developing and using models

Crosscutting Concepts **NGSS**

- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Structure and function

Extensions of the lesson

- To help students become more familiar with the Key Terms of this module, the teacher can use the vocabulary list for a classroom Word Wall or integrate the vocabulary into classroom word games during review sessions.
- For personal relevance, encourage students to think about a time in their own life when they experienced a "malfunction" of one of their senses. Which sense was having a problem? What may have caused that problem? How was the problem resolved?
- The teacher may need to address student misconceptions about these important concepts:
    - There is a complex pathway that gives an organism the ability to monitor various changes in its environment.
    - Each of the five senses involves its own specific stimulus, receptor cells, transmission signals, and areas of brain perception.
    - Loss of sensation can be the result of disruption anywhere along that pathway.
    - Certain disruptions may be congenital, while others may be brought about by disease, trauma, etc.

- Medical intervention for loss of sensation can vary from the simple (such as removal of excess wax in the outer ear canal) to the complex (such as the implantation of newly engineered devices to assist detection of stimuli).

Enrichment

- For information about career opportunities, see UNMC's Careers in Healthcare.
- To make connections in your community, contact local hospitals, healthcare clinics, nurses, doctors.
- Encourage students to follow current news events regarding loss of normal sensing abilities (for example, reports that coronavirus may interfere with the sense of smell).
- A classroom activity that can promote an understanding of how a blind person uses the touch pathway in place of the sight pathway can be found at "Blindness Awareness" for the Class.
- Classroom activities to understand and protect the hearing pathway can be found at Noise Induced Hearing Loss.
- Causes of the loss of sense of smell can be studied at What is Anosmia?
- The sense of taste can be explored at Impaired Taste: Diagnosis, Causes, and Treatment.
- Information about the sense of touch is offered at Why Have I Lost Sensation?