



uBEATS Teacher's Guide:

Specialized Cells: Receptors & Responses

(Grades 6-8)

This teacher guide is a supplementary text to support the use of the uBEATS Specialized Cells: Senses 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

- Compare the inputs (electromagnetic, mechanical, chemical) that each type of special receptor responds to.
 - Categorize the specialized cell with the sense it provides for us.
 - Predict the response an organism would display to a certain perception.
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Introduction

How do organisms detect, process, and use information about the environment?

Why do some people like the **taste** of cilantro while other do not?

How can I **hear** loud and soft sounds?

Can I tell the difference between two animals by **touch** alone?

Does my **sight** work better during the day than at night?

How can I **smell** fresh baked bread?

Let's explore these questions and others as we get to know about the specialized cells that give us our five senses!

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 particular kinds of information, which may then be processed and integrated by an animal's brain, with some information stored as memories. Animals are able to 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

Specialized cell, molecule, receptor, stimulus, electromagnetic, mechanical, chemical, perception, response, chemoreceptor, mechanoreceptor, photoreceptor, olfactory receptor, odorant, action potential, cochlea.



Science Standards

Nebraska's College and Career Ready Standards for Science 2024 [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

Nebraska Health Science Standards HS.HS.8.1.a.

- Identify basic structures and functions of human body systems

Nebraska Health Science Standards HS.HS.11.4.a.

- Describe the basic structural and functional organization of the human body and the systems of the body, including the integumentary, cardiovascular, musculoskeletal, immune, respiratory, digestive, urinary, reproductive, nervous, and endocrine systems.

Nebraska Health Science Standards HS.HS.11.4.c

- Describe common diseases and disorders of each body system.

National Health Science Standards (NCHSE)

- 1.1.1. Describe the organization of the human body and directional terms.
 - a. Identify levels of organization.
- 1.1.2 Identify basic structures and describe functions of human body systems
 - c. Integumentary
- 1.2.1. Describe etiology, pathology, diagnosis, treatment, and prevention of common diseases and disorders, including, but not limited to the following:



- Anxiety
- Arthritis
- Asthma
- Bipolar disorder
- Cancer
- Cataracts
- Concussion / Traumatic Brain Injury (TBI)
- Cystic fibrosis
- Dementia
- Depression
- Diabetes
- Gastric ulcer
- Hepatitis
- Hypertension
- Melanoma
- Muscular dystrophy
- Myocardial infarction
- Sexually Transmitted Infection (STI)
- Stroke / Cerebrovascular Accident (CVA)
- Tuberculosis
- Urinary Tract Infection (UTI) Arthritis

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.
- To help the students see personal relevance, give them a 30-second silent “sense check” for each of the senses:
 - “What do you smell right now? Where are those chemoreceptor cells located? How does your brain know about what you are smelling?”
 - “What do you taste right now? Where are those chemoreceptor cells located? How does your brain know about what you are tasting?”
 - “What do you see right now? Where are those photoreceptor cells located?”



- How does your brain know about what you are seeing?”
- “What do you hear right now? Where are those mechanoreceptor cells located? How does your brain know about what you are hearing?”
- “What do you feel right now? Where are those mechanoreceptor cells located? How does your brain know about what you are touching?”
- The teacher may need to address student misconceptions by emphasizing these important concepts:
 - Genetic instructions on DNA determine how specialized cells are formed.
 - Receptor cells are specialized cells designed to react to certain stimuli.
 - Chemoreceptors detect chemical molecules.
 - Mechanoreceptors detect energy changes involved in movement, vibration, pressure, stretch, pain, and temperature.
 - Photoreceptors perceive changes in light energy.
 - All of these receptors send electrical signals through nerves to the brain for processing into information.

Enrichment

- For information about career opportunities, see UNMC’s [Careers in Healthcare](#).
- To learn more about the five senses, see [How Stuff Works](#).
- To make connections in your community, contact local hospitals, healthcare clinics, nurses, doctors.
- For a lab activity with the sense of smell, see [Smell Experiments - How Sweet It Is](#).
- To experiment with the sense of taste, see [Jelly Bean Taste Test](#).
- To investigate the five senses, see [Experiments to Try](#).