

Grade Level: 9-12

Subjects:

Biology
Anatomy/Physiology
Personal Health
Critiquing Evidence
Gathering Data

Duration: 4-5 day(s) (45 min. per day)

Prerequisites: Basic knowledge of sensory receptors and nerve cells (neurons).

In this unit, students explore the sense of touch from the perspective of both anatomy and physiology. The unit utilizes online content resources, hands-on laboratory activities and interactive student activities. The resulting unit addresses both content and process objectives.

Description

The "Sense of Touch" is a guided inquiry, hands-on lesson that enables students to explore their sense of touch. The students will discover the adaptation rates of tactile receptors in the skin, the sensitivity of these receptors using a two-point discrimination test, and learn about diseases that can affect the sensory system. Students will design and conduct experiments relating to receptor density. Finally, students will read about the work of neurophysiologists and learn the correlation between sensory receptors and the functioning of the human body.

Credits

This project was co-authored by Charles Geach (El Paso I.S.D., El Paso, TX) and Lisa Bidelspach (Clear Creek High School, League City, TX). Special thanks to Karin Westlund High, Ph.D. (Professor, Anatomy & Neuroscience, University of Texas Medical Branch/Galveston, TX). Edited by Kathleen Kelly, APS K-12 Programs Coordinator.

Project History

This APS-WISE unit was created as part of the program, "Frontiers in Physiology," a national teacher professional development program sponsored by the American Physiological Society (APS) and the National Institutes of Health/National Center for Research Resources.

The Sense of Touch Unit Overview

Introduction

In this project, students explore the sense of touch starting with a discussion on how critical the sense of touch is to the survival of humans. Students will experience, read and comment on the phenomenon of adaptation within this sensory system. Written information and a cross-section of the skin will provide knowledge about the five primary types of receptors in dermal tissue. Students will also explore different types of research in the field of neuroscience. Then a question is posed concerning the density of sensory receptors in the human body. Students develop a hypothesis and design and conduct an experiment to test for receptor density. After graphing their data and comparing their findings, students will observe data collected using a more sophisticated test for sensitivity. Students can then brainstorm other ways to test for sensitivity and, if time permits, expand on their experiments. An article about diseases that affect the sensory systems provides an opportunity to return to the question of the importance of touch for our everyday activities. Students wrap up the unit by applying what they have learned to the design of a mechanical hand.

Curricular Context

This project was designed for high school level. The web sites selected for content materials have reading levels at the high school level. The laboratory activities, however, could easily be adapted to middle school level. Time requirements will vary on group sizes, number of computers, and whether components are assigned as homework.

Students will need a basic knowledge of:

- sensory receptors within the skin -primarily mechanoreceptors
- types of nerve endings: ex. Pacinian corpuscles, free nerve endings, etc.
- nerve cells (neurons) and their role as transducers
- sensory receptive fields

The unit consists of eight sequential activities:

Activity 1: "To Feel or Not to Feel" - Introductory and engage activity

Activity 2: Explore Mechanoreceptors - Content exploration

Activity 3: Skin Receptors - Content exploration & self-assessment

Activity 4: Meet Neuroscientists - Careers in science exploration

Activity 5: Join the Research Team - Inquiry-based, hands-on laboratory

Activity 6: More Tests for Receptor Density - Comparing data and extending experimental designs, optional hands-on laboratory

Activity 7: Touch Disorders - Content exploration and expansion

Activity 8: The Final Touch - Assessment (online quiz and journal activity)

Each activity includes authentic assessment components and, in the final activity, students utilize information from previous activities to complete an online quiz and to apply what they've learned in their exploration of the sense of touch.