

# #9398

## WIRED

LANDMARK MEDIA  
1997  
Grade Levels: 7-12  
20 minutes



### DESCRIPTION

As millions of receptors in the human nervous system respond automatically to light, sound, touch, and smell, and send information to the brain, the body acts. Explores a condition amputees experience known as "phantom pain" or "phantom limb." Also explains how the blind "see" words with the receptors in their hands.

### ACADEMIC STANDARDS

#### Subject Area: Science

- Standard: Understands the structure and function of cells and organisms
  - Benchmark: Knows that multicellular organisms have a variety of specialized cells, tissues, organs, and organ systems that perform specialized functions (e.g., digestion, respiration, reproduction, circulation, excretion, movement, control and coordination, protection from disease)
  - Benchmark: Knows that organisms can react to internal and environmental stimuli through behavioral response (e.g., plants have tissues and organs that react to light, water, and other stimuli; animals have nervous systems that process and store information from the environment), which may be determined by heredity or from past experience
  - Benchmark: Understands the structure and functions of nervous systems in multicellular animals (e.g., nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves; nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules)

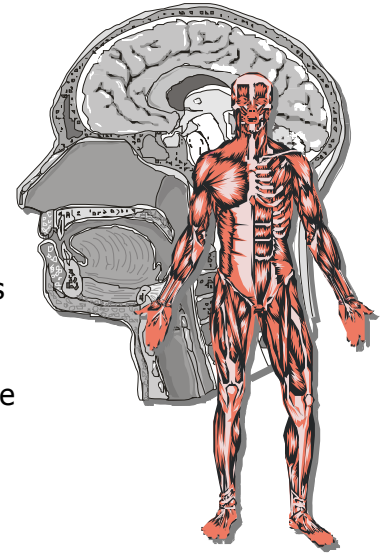
### INSTRUCTIONAL GOALS

1. To depict how receptor cells detect energy and form nerve impulses.
2. To trace the path of a neuron impulse during a reflex action.
3. To describe *phantom pain* and explain what causes it.
4. To examine how a visually impaired person is able to learn Braille.

### VOCABULARY

1. all-or-none effect
2. electrical impulse
3. motor neuron
4. neurotransmitter

5. phantom pain
6. receptor
7. reflex action
8. sensory cortex
9. sensory neuron
10. stimulus
11. synapse



### BEFORE SHOWING

1. Discuss the title of the video. What are some possible interpretations of the title? (Electricity, hyperactivity, wearing a wire undercover, nervous system.)
2. Display pictures of optical illusions. Discuss why different people have different perceptions of the pictures.
3. Explain that the video is divided into three parts:
  - a. Nerve impulses
  - b. Phantom pain
  - c. Braille

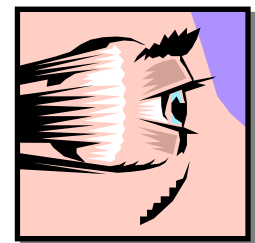
### DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at the section showing the images from the thermal-imaging camera. Point out the color code on the left side of the screen.
3. Pause at the scene showing the synapse. Point out the chemical bridge that is formed, allowing the nerve impulse to cross over the gap.
4. Pause at the scene showing the sensory cortex of the brain.
  - a. Point out the yellow area that controls sensations of the missing limb.
  - b. Discuss how it is possible for the nerves to become cross-wired.
5. Pause at the section showing the dominoes lined up. Discuss how this explains the all-or-none effect.

### AFTER SHOWING

#### Discussion Items and Questions

1. Where are receptor cells located?
2. What is the function of the receptor cells?
3. How is a nerve impulse formed?
4. How fast does a nerve impulse travel?
5. How does a reflex action occur?
6. Why does Emma cry out in pain after she jerks her hand back?
7. What is *phantom pain*?
8. How far do neurons travel from head to toe?
9. What is the gap between two neurons called?
10. How do the neurons travel over this gap?
11. What is a possible explanation for phantom pain?
12. Why does a visually impaired person seem to have an easier time learning Braille than a sighted person?



## Applications and Activities

1. Create a model of a neuron using fruit, jellybeans, licorice and other foods.
2. Trace the path of a neuron impulse during a reflex action on a large-sized poster board. Use flashing Christmas tree lights for special effects.
3. List other examples of reflex actions (blinking of an eye, knee jerk, sneeze, papillary response).
4. The reflex action shown in the video is an example of a survival mechanism. List other reflexes that serve as survival mechanisms.
5. Convert these metric units to English units:
  - a. a neuron travels 120 meters a second (feet per second)
  - b. a neuron travels 1.5 meters from head to toe (inches or feet)
  - c. a certain color represents 65°C on the thermal-imaging camera picture (°F)
  - d. a certain color represents -10°C on the thermal-imaging camera picture (°F)
  - e. the touch receptors in the fingertips can detect pinpricks 1.3 millimeters apart (inches)
6. Research historical and literacy references to phantom limb.
7. List other famous terms in which the word "phantom" appears (the comic Phantom character, The Phantom of the Opera, Phantom Planet).
8. Report on famous amputees and how they cope with phantom limb pain.
9. Create a slide presentation on Louis Braille and the history of Braille.
10. Obtain samples of books written in Braille from the local library or a school for the visually impaired. Rate the difficulty in identifying the dots.
11. Visually impaired individuals seem to have better tactile skills than others. Discuss how deaf and hard of hearing individuals compensate for their loss of hearing.

## RELATED RESOURCES



### Captioned Media Program

- Bill Nye the Science Guy: Brought to You by the Brain #9042
- Nervous System (Second Edition) #2575
- People You'd Like to Know: Amputee #7270



### World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

### • EXPERIMENTS AND ACTIVITIES

<http://faculty.washington.edu/chudler/experi.html>

Contains ideas for hands-on activities for grades K-12 related to the nervous system. Some examples are: modeling the nervous system, brain games, reflexes, brain worksheets and lessons, and brain songs.





- **FANTASTIC OPTICAL ILLUSIONS**

<http://www.ads-online.on.ca/illusion/directory.html>

Contains examples of optical illusions that can be used to show how people perceive pictures differently. Examples of illusions shown are: young girl/old woman, impossible triangle, rabbit/duck, and Necker cube.

- **PHANTOM LIMB: FROM MEDICINE TO FOLK WISDOM AND BACK**

<http://www.acponline.org/journals/annals/01jan98/phantom.ntm>

Focuses on the medical debate concerning phantom limb phenomena suffered by amputees, from its earliest known recognition to present-day beliefs.

- **THE MOST POPULAR AMPUTEE ORIENTED SITE ON THE NET**

<http://amputee-online.com/>

Serves as resource for amputees, their families, and health professionals. Includes a section on remedies for phantom sensation and pain.

- **BRaille SYSTEM**

<http://kids.infoplease.lycos.com/ipka/A0775274.html>

Contains cards showing the alphabet in Braille and numbers and punctuation marks in Braille.