Watch Movie: Multiple Sclerosis
Answer the movie questions on the worksheet.

Complete Activities 1-3.

Activity #1:
- Go to the pathophysiology lab web page.
- Click on activity 1, “The Virtual Body”.
- Click on the English version.
- Click on “The Human Brain”.

Activity #2:
PhysioEx:
- Go to www.physioex.com, or click the link on the pathophysiology web page.
- Click on the PhysioEx 6.0 For Human Physiology graphic.
- Enter login name: healthsciences and password: wildcat05.
- Click on “proceed to PhysioEx 6.0” (bottom-right corner).

The page now appearing on the screen links a student to the “main menu” (for laboratory exercises) and “instructions and course materials”.

To download and print the lab activity instructions,
- Click on the “instructions and course materials” link.
- Click the “worksheets” tab (left side of screen). Note: for all PhysioEx lab exercises, use the “for human physiology” links.
- Click on lab 3, exercise 3 – Neurophysiology of Nerve Impulses.
- Print exercise 3.

Return to the PhysioEx page containing the “main menu” link by minimizing or closing the worksheet/instructions window.
- Click on “Main Menu”.
- Click on the “Neurophysiology and Nerve Impulses” exercise.
- Click on “experiment” (top of screen) and choose “Nerve Conduction Velocity”. The experiment analyzes the relationship between nerve size and conduction velocity and myelination and conduction velocity.
- Follow all instructions.
• Complete the activity by filling in the answers on the laboratory worksheet.

Activity #3:
Complete the case studies on the accompanying laboratory worksheet. Refer to the graphic links on the pathophysiology website for additional information.
Multiple Sclerosis Movie

1. Multiple sclerosis is a disorder of the _______________________.

2. Symptoms of multiple sclerosis include:

3. List the two main forms of multiple sclerosis.

4. The highest incidence of multiple sclerosis occurs in what geographic area of the world?

5. What gender is more frequently affected with multiple sclerosis?

6. In multiple sclerosis the _____________ are attacked by the body's immune system which destroys the ________________ of the nerve axons.

7. Destruction of the myelin sheath interrupts _____________________.

8. What is the hard scar tissue called that replaces the myelin sheath?


10. List 4 areas of multiple sclerosis research.

11. What radiography technique is used to observe patches of sclerosis?
Case Studies

Case 1
A 61 year-old man, who has a long history of alcohol abuse, was sitting on a bar stool when he was noted to suddenly fall to the floor. He was unable to arise and the paramedics were called. When they arrived, he was able to answer questions and he stated that he had a severe headache. Upon arrival to the hospital the admitting physical examination demonstrated a right hemiparesis (paralysis of the right side). The patient became increasingly somnolent (drowsy) after admission. In spite of supportive care, the patient became comatose and died two hours after admission.

Click on slide 1a to view a CT scan of the patient's head upon admission. The large white area shows a large hematoma (bleeding) in the deep basal ganglia on the left with a shift of the brain to the right. Click on slide 1b to view the brain during autopsy.

What could have caused the hematoma and subsequent death?

Case 2
An 81 year-old man was in good health until developing a cough with the production of yellow sputum. He complained to his relatives of a headache the day before admission. He was found stuporous by his son on the day of admission. In the emergency room, the physical examination demonstrated an elderly man who was not responding very well to questions. His temperature was 99.7 degrees F, respirations 16, pulse 100 and weak, and blood pressure 110/50. His neck was stiff. A lumbar puncture revealed cloudy cerebrospinal fluid with a marked pleocytosis with 1500 WBC's (90% of them PMN's), no RBC's, glucose of 31 mg/dL, and protein of 60 mg/dL. He did not respond to treatment and dies.

Click on slide 2a. This slide shows the gross pathology of the brain at autopsy. The white substance covering the brain is pus from neutrophils. The blood vessels are engorged with blood.
Click on slide 2b. This is the microscopic appearance of the brain showing numerous neutrophils.

What is your diagnosis?

Case 3
This 68 year-old man was noted by his family to have become forgetful in the months before being seen by his family physician. He was brought to his physician by his son because he had been found wandering in the streets. On physical examination, he was unable to remember any objects after five minutes and, although an avid football fan, he was unable to recount the previous Monday night's game which he had watched with his son. A CT scan was obtained and showed mild cerebral atrophy.

See slide 3a to note the cerebral atrophy. Slide 3b is a microscopic section of the brain showing neurofibrillary tangles. Slide 3c is a microscopic section of the brain showing a senile plaque.

What is your most likely diagnosis?

Case 4
A 37 year-old female presented with sudden loss of vision in one eye, partial right leg paralysis and tingling in the extremities. She had noticed dizziness and blurred vision 5 years previously after the birth of her last child. She seemed to recall other episodes of weakness and tingling in her extremities. At the time of her initial evaluation, a spinal tap revealed a normal CSF pressure, 6 cells (all lymphocytes), an elevated protein, and a normal glucose. Protein electrophoresis revealed an elevation in IgG. An MRI showed several plaques in the white matter of the cerebral hemispheres.
Case 5

A 55 year-old man presented with the acute onset of left sided headache and mild right leg paresis. MRI scan showed a large cerebral mass lesion.

What is your diagnosis? Prognosis?

On questioning, the patient admitted to noting some blood-tinged urine in the weeks prior to his admission. He did not have any dysuria or urgency. A CT scan of the abdomen revealed a large mass in the right kidney.

What is your diagnosis? Prognosis?
Measuring Nerve Conduction

As you do the experiments, fill in the data on the chart below:

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Earthworm (small nerve)</th>
<th>Frog (medium nerve, myelinated)</th>
<th>Rat nerve 1 (medium nerve, unmyelinated)</th>
<th>Rat nerve 2 (large nerve, myelinated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elapsed time from stimulation to action potential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduction velocity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What nerve in the group has the slowest conduction velocity?

Which nerve in the group has the fastest conduction velocity?

What is the relationship between nerve size and conduction velocity?

How does nerve myelination affect conduction velocity?

What is the major reason for the differences seen in conduction velocity between the myelinated and unmyelinated nerves?

Based on this experiment, do you think the size of a nerve affects the amount of pain we feel?

Multiple sclerosis is an autoimmune disease affecting the myelin sheath of the nerve cells. If the myelin sheath is destroyed, how would nerve conduction be affected?

http://chpweb.weber.edu/hthsci/labpages/
ANSWERS TO MULTIPLE SCLEROSIS
MOVIE WORKSHEET

1. Multiple sclerosis is a disorder of the ___ CENTRAL NERVOUS SYSTEM __.

2. Symptoms of multiple sclerosis include: WEAKNESS, MUSCLE TREMORS, DIZZINESS, SIGHT DISTURBANCES, SPEECH IMPAIRMENT, LOSS OF BALANCE, WEAKNESS IN LIMBS.

3. List the two main forms of multiple sclerosis. RECURRENT, CONTINUOUS

4. The highest incidence of multiple sclerosis occurs in what geographic area of the world? NORTHERN EUROPE

5. What gender is more frequently affected with multiple sclerosis? FEMALES

6. In multiple sclerosis the _____________ are attacked by the body's immune system which destroys the _____________

7. ________________ of the nerve axons. OLIGODENDROCYTES, MYELIN SHEATH

7. Destruction of the myelin sheath interrupts ___NERVE IMPULSES __.

8. What is the hard scar tissue called that replaces the myelin sheath? SCLEROSIS


10. List 4 areas of multiple sclerosis research. ORIGINS, IMMUNE SYSTEM, MYELIN SHEATH, GENETICS

11. What radiography technique is used to observe patches of sclerosis? MRI
ANSWERS TO CASE STUDIES WORKSHEET

Case 1
A 61 year-old man, who has a long history of alcohol abuse, was sitting on a bar stool when he was noted to suddenly fall to the floor. He was unable to arise and the paramedics were called. When they arrived, he was able to answer questions and he stated that he had a severe headache. Upon arrival to the hospital the admitting physical examination demonstrated a right hemiparesis (paralysis of the right side). The patient became increasingly somnolent (drowsy) after admission. In spite of supportive care, the patient became comatose and died two hours after admission.

Click on Slide 1a to view a CT scan of the patient’s head upon admission. The large white area shows a large hematoma (bleeding) in the deep basal ganglia on the left with a shift of the brain to the right. Click on slide 1b to view the brain during autopsy.

What could have caused the hematoma and subsequent death? THE HEMATOMA COULD BE CAUSED FROM A SKULL FRACTURE FROM AN ALCOHOL INDUCED FALL. IT COULD ALSO BE CAUSED FROM HIGH BLOOD PRESSURE CAUSING A HYPERTENSIVE BLEED, WHICH IS A MAJOR CAUSE OF STROKE AND DEATH.

Case 2
An 81 year-old man was in good health until developing a cough with the production of yellow sputum. He complained to his relatives of a headache the day before admission. He was found stuporous by his son on the day of admission. In the emergency room, the physical examination demonstrated an elderly man who was not responding very well to questions. His temperature was 99.7 degrees F, respirations 16, pulse 100 and weak, and blood pressure 110/50. His neck was stiff. A lumbar puncture revealed cloudy cerebrospinal fluid with a marked pleocytosis with 1500 WBC’s (90% of them PMN’s), no RBC’s, glucose of 31 mg/dL, and protein of 60 mg/dL. He did not respond to treatment and dies.
Click on slide 2a. This slide shows the gross pathology of the brain at autopsy. The white substance covering the brain is pus from neutrophils. The blood vessels are engorged with blood.

Click on slide 2b. This is the microscopic appearance of the brain showing numerous neutrophils.

What is your diagnosis? **ACUTE BACTERIAL MENINGITIS.**

Case 3

This 68 year-old man was noted by his family to have become forgetful in the months before being seen by his family physician. He was brought to his physician by his son because he had been found wandering in the streets. On physical examination, he was unable to remember any objects after five minutes and, although an avid football fan, he was unable to recount the previous Monday night's game which he had watched with his son. A CT scan was obtained and showed mild cerebral atrophy.

See slide 3a to note the cerebral atrophy.
Slide 3b is a microscopic section of the brain showing neurofibrillary tangles.
Slide 3c is a microscopic section of the brain showing a senile plaque.

What is your most likely diagnosis? **DEMENTIA MOST LIKELY CAUSED BY ALZHEIMER'S DISEASE. NEUROFIBRILLARY TANGLES AND SENILE PLAQUES ARE FOUND IN ALZHEIMER'S DISEASE. THE GREATER THE NUMBER OF PLAQUES FOUND, THE MORE LIKELY THE CAUSE IS ALZHEIMER'S DISEASE.**

Case 4

A 37 year-old female presented with sudden loss of vision in one eye, partial right leg paralysis and tingling in the extremities. She had noticed dizziness and blurred vision 5 years previously after the birth of her last child. She seemed to recall other episodes of weakness and tingling in her extremities. At the time of her initial evaluation, a spinal tap revealed a normal CSF pressure, 6 cells (all lymphocytes), an elevated protein, and a normal glucose. Protein electrophoresis revealed an elevation in IgG. An MRI showed several plaques in the white matter of the cerebral hemispheres.
What is your diagnosis? How would you treat this patient? **MULTIPLE SCLEROSIS.** THE PATIENT SHOWS CLASSIC TRANSIENT SYMPTOMS WITH PERIODS OF REMISSION. THE PLAQUES ON THE MRI ARE DIAGNOSTIC. STEROIDS OR ANTIINFLAMMATORY DRUGS ARE USED TO SHORTEN THE DURATION OF ACUTE ATTACKS. BETA INTERFERONS ARE USED TO SUPPRESS THE BODY’S IMMUNE RESPONSE TO DECREASE THE ATTACK AGAINST MYELIN. SUPPORTIVE THERAPY FOR INDIVIDUAL SYMPTOMS IS GIVEN AS NEEDED.

Case 5

A 55 year-old man presented with the acute onset of left sided headache and mild right leg paresis. MRI scan showed a large cerebral mass lesion.

On questioning, the patient admitted to noting some blood-tinged urine in the weeks prior to his admission. He did not have any dysuria or urgency. A CT scan of the abdomen revealed a large mass in the right kidney.

What is your diagnosis? Prognosis? **RENAL CELL CARCINOMA WITH METASTASES TO THE BRAIN.** LUNG CARCINOMA, BREAST CARCINOMA, RENAL CELL CARCINOMA, AND MELANOMAS ARE THE MOST COMMON CANCERS TO METASTASIZE TO THE BRAIN.