

Focus: Understanding How the Brain Works

Riddle: What's the size of a grapefruit, weighs 3 pounds, and contains 10 to 50 billion cells, each of which sends 50,000 messages per minute? Answer: Read on...

If you think the answer is a computer, you're close. Actually, it's the computer you carry around with you every day: your brain. Experts see many similarities between the "command center" in your head and the digital box you may have in your home. But nothing can beat the brain for its blockbuster powers. It may be only the size of a grapefruit and look like a wrinkled blob of pinkish-gray jelly. But the brain has amazing abilities. If you give it proper care, it can often achieve great things.

What's on Your Mind?

The brain is constantly remaking itself. For instance, when the brain analyzes new information, it compares it with what has been learned. The process forms new connections or new pathways in the brain.

Memory and Learning. There are about 500 trillion possible connections among the neurons of the brain! Two processes are responsible for using these connections: memory and learning. For example, when you learned the multiplication tables, you created certain connections in your nervous system. The more you practiced multiplying, the faster and smoother those connections became. The *hippocampus* (part of the brain stem) also helps you learn or remember. It changes short-term memories--something that happened two minutes ago--into long-term memories that are kept for years. That's why you still remember the day you got your first bicycle.

Emotions. The brain also files away learned emotions, such as anger and pleasure. Parts of the temporal and frontal lobes help us recognize danger and experience fear. When this happens, the brain sends out a "fight or flight" message to the body, and stress hormones start preparing you for action.

Pain. The brain takes charge of pain, too, but not in just one area. That's because pain is a complicated sensation. It depends on a combination of memories, attitudes, and emotions. And these important files are located in different parts of the brain.

Scientists don't completely understand how the brain handles pain signals. They do know that the "ouch" effect varies from person to person. In other words, your reaction to pain may differ from that of your best friend. This is true even though your bodies release the same pain-relieving chemicals called *endorphins* (en-DOR-fins). This may partially explain why some athletes continue to perform even though they may sprain an ankle or break a bone.

Photos and Faces

Even after you're fully grown, your brain will continue remaking itself. Scientists know the brain is a work-in-progress.

They know this thanks to high-tech imaging techniques, such as magnetic resonance imagery (MRI) and positron emission tomography (PET). The MRI snaps detailed pictures of the brain. The PET scan reflects brain activity.

Recently, experts at the National Institute of Mental Health discovered that the age of 11 to 12 is a good time to learn loads of new skills, in areas such as language, math, and music.

Being able to handle math doesn't mean the maturing brain can handle everything. The brain has to "prune" or throw out certain useless connections. So it's not always able to interpret situations correctly and make "good calls." And the pruning process is not complete until early adulthood. That means teenagers and younger kids may have some problems making decisions and coping with certain emotions, such as anger.

Look Into My Eyes

When people get angry, scared, or feel other strong emotions, their faces usually reveal their feelings. For instance, when you feel sad, your face may frown and your eyes may lose their sparkle.

But looks can be deceiving, particularly to kids and teens. Their brains are sometimes not mature enough to interpret all the facial signals correctly. So they jump to the wrong conclusions.

Have your classmates make faces indicating a particular emotion. How do they feel?

Tired?

Ashamed?

Guilty?

Fearful?
Timid?
Angry?

Make up your own mind. Then discuss your conclusions with your friends and classmates. Do they agree or disagree? What does your teacher think?

Even reading facial expressions can be hard for many teens. A study of Massachusetts teens showed this. The teens could not tell if someone's face showed anger or fear. And recognizing the difference is crucial information when you're trying to react properly to someone.

It takes time and lots of work for young brains to mature. Some of that work is accomplished during sleep. The brain eliminates certain information stored in its short-term memory. Without enough sleep, the brain can't do this job. That's why younger kids and teens should not shortchange themselves on sleep.

Problems and Progress

As with every other part of the body, the brain can develop problems. These include tumors, strokes, mental retardation, headaches, and Alzheimer's disease.

Fortunately, science is finding ways to help more people prevent or recover from brain diseases. Experts now know people can help to create and recreate the shape of their brain. A recent study showed that kids with reading problems can often retrain their brains through special word games. And people who suffer strokes can often relearn to walk. Other parts of their brain can take over the functions the damaged parts used to perform. Different physical and surgical therapies help to make this possible.

Take "Brandi," a young girl with severe epilepsy (brain seizures). Doctors removed a large part of Brandi's brain to reduce the number of seizures. And they did this without Brandi losing important abilities. Her brain created other nerve paths as she relearned how to eat, speak, and move like other kids.

Brain Boosters

To make the best use of your brain cells, here are some tips on taking care of your command center:

- **Eat a healthy, well-balanced diet** based on the Food Guide Pyramid. A recent study of English girls found that dieting lowered their IQs. The teens did not get enough iron-rich foods, such as nuts, lean meat, and leafy green vegetables.
- **Exercise regularly.** You need to refresh and reenergize your brain with enough oxygen. Swim, bike, play team sports, or just go for a walk in your neighborhood.
- **Sleep 8 to 10 hours every night.** Your brain needs this down time to carry out its tasks.
- **Do not use drugs or alcohol.** New studies say that kids and teens who abuse alcohol or use other drugs may damage their brains. This damage can lead to memory loss when they're older.
- **Drink fewer caffeine-containing beverages** such as colas. They can cause you to feel anxious and irritable. They also are addictive.
- **Listen to music you enjoy.** It relaxes the nerves. Now experts say it also may increase your math abilities. Researchers recently found that second-graders who received piano lessons did better on a math test than kids who didn't get music lessons.
- **Keep learning new things.** Reading a lot today can improve your memory as you grow older. Find interesting hobbies, join school and community clubs, and reach out to people and places.
- **Work at staying emotionally healthy.** Depression, anger, and anxiety can harm your brain. So can the stress hormones your body releases.
- **Protect yourself from head injuries.** Wear a helmet that fits properly during sports activities such as rollerblading and bicycling. (The helmet should be approved by a national agency such as the American National Standards Institute.) Also, wear your seat belt in the car. Car crashes account for 44 percent of all brain injuries, says the Brain Injury Association. Dive only in the deep ends of pools. And stay away from guns.
- **Make time for relaxation.** Close your eyes and do nothing a few minutes each day.
- **Avoid pesticides and other harsh chemicals.** Wash fruits and veggies well before eating them, or buy organic foods. Take precautions when getting rid of dangerous chemicals such as household cleaners. Poisonous fumes can harm the brain.
- **Cut back on TV** so your brain won't become a "couch potato."
- **Learn how to prevent brain injuries.** Suggest to your principal that your school become a HeadSmart School. You and your classmates will get a one-day program on how to prevent brain injuries. For more information, check out www.biausa.org, or write to The Brain Injury Association, 105 North Alfred Street, Alexandria, VA 22314. You may also call the Brain Injury Association's Family Helpline at 1-800-444-6443.

The brain is constantly developing and maturing. Your brain will continue to steer you in the right direction if you respect it and its ability to grow and change.

Name: _____

Date: _____

1. According to the passage, how many possible connections are there among the neurons of the brain?
 - A 50 trillion
 - B 5 billion
 - C 500 trillion
 - D 500 million

2. Which of the following is a tip the passage recommends for taking care of the brain?
 - A watch more TV
 - B drink more caffeinated soda
 - C sleep only five hours a night
 - D protect yourself from brain injuries

3. Based on the passage, what may happen if a person has damaged the temporal and frontal lobes of his brain?
 - A He may have trouble learning multiplication.
 - B He may have trouble recognizing danger or experiencing fear.
 - C He may have trouble remembering people's names.
 - D He may have trouble feeling pain.

4. Read the following sentence: "It takes time and lots of work for young brains to mature."

As used in the passage, **mature** means

 - A create
 - B develop
 - C shrink
 - D recover

5. This passage is mostly about
 - A how the brain learns new things and remembers them
 - B understanding the types of brain disorders
 - C understanding how the brain works and how to take care of it
 - D tips for protecting your brain while doing outdoor activities

6. What does the passage recommend including in a diet to keep the brain healthy?

7. Based on the passage, what would be the best age to learn how to play a musical instrument?

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

Younger kids and teens need lots of sleep at night _____ that their brains can mature.

- A after
- B but
- C though
- D so

9. Answer the following questions based on the sentence below.

A few years ago, researchers found that reading can improve your memory by studying people who read a lot.

Who? researchers

(did) What? _____

When? _____

How? _____

Directions: Read the vocabulary word and definition below to complete questions 10a, 10b, and 11.

Vocabulary Word: **crucial** (cru · cial): very important.

10a. Read the sentences below and underline all forms of the word **crucial**.

1. When you're riding a bike, it is crucial to wear a helmet because if you hit your head, you may damage your brain.
2. He is a very important person in the company, so his opinion is crucial in deciding what we should do next.
3. Policemen will tell you it is crucial to wear a seatbelt in the car in case of an accident.
4. We are missing a crucial screw, so we can't finish building the table.
5. Chicken is a crucial ingredient in this soup, so we can't make it if we don't have any chicken in the fridge.

10b. In which location is it crucial that you have a life vest?



11. When driving a truck, is fuel crucial? Why or why not?

Teacher Guide and Answers

Passage Reading Level: Lexile 870

Featured Text Structure: Enumerative – the writer includes a list, giving examples of something. This text structure is often combined with cause/effect or problem/solution.

Passage Summary: This passage lists the characteristics of the brain, what the different parts of the brain are responsible for, and how it develops. The passage also provides a list of tips for keeping a brain in good health.

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 - D tips for protecting your brain while doing outdoor activities
6. What does the passage recommend including in a diet to keep the brain healthy?

Suggested answer: The passage recommends iron-rich foods, such as nuts, lean meat, and leafy green vegetables. [paragraph 17]

7. Based on the passage, what would be the best age to learn how to play a musical instrument?

Suggested answer: The best age would be 11-12. The passage states that experts at the National Institute of Mental Health found that 11-12 is a good age to learn new skills in areas of language, math, and music. [paragraph 9]

8. The question below is an incomplete sentence. Choose the word that best completes the sentence.

Younger kids and teens need lots of sleep at night _____ that their brains can mature.

- A after
- B but
- C though
- D so

9. Answer the following questions based on the sentence below.

A few years ago, researchers found that reading can improve your memory by studying people who read a lot.

Who? researchers

(did) What? **found that reading can improve your memory**

When? **a few years ago**

How? **by studying people who read a lot**

To the Teacher: ReadWorks recommends that you teach this vocabulary word to the whole class out loud using the four steps listed below.

Vocabulary Word: **crucial** (cru · cial): very important.

Step 1: Introduce the word

- a. Teacher writes the word on the board and divides it into syllables: (cru · cial)
- b. Teacher says: "This word is crucial. What is the word?" [All students reply together out loud: "crucial."]

Step 2: Provide a child-friendly definition

- a. Teacher says: "Crucial means very important."
- b. Teacher says: "The passage describes how the brain helps us to understand crucial, or very important, information."
- c. Teacher says: "What is the word?" [All students reply together out loud: "crucial."]

Step 3: Practice the word

Teacher provides examples and additional opportunities to repeat the word. Read the first sentence out loud to your students. Begin reading it again and when you come to the vocabulary word, prompt students to say the vocabulary word out loud. Then, finish reading the sentence out loud to your students.

Directions: Read the vocabulary word and definition below to complete questions 10a, 10b, and 11.

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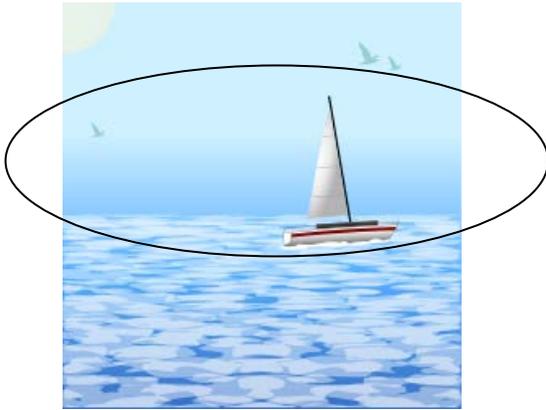
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4. We are missing a crucial screw, so we can't finish building the table.
5. Chicken is a crucial ingredient in this soup, so we can't make it if we don't have any chicken in the fridge.

Step 4: Check for student understanding

To the Teacher: This step can be completed as a whole class activity or as an independent practice.

10b. In which location is it crucial that you have a life vest?



11. When driving a truck, is fuel crucial? Why or why not?

Suggested answer: When driving a truck, fuel is crucial because without it, the truck will not run.

Suggested Additional Vocabulary: reaction, emission, interpret, mature, functions, addictive, precaution