Reflexes

Pupil to Pupil

For grades 3-12

Methods

Make the lights in the room dim. After a few minutes, look at the eyes of another person and note the size of the pupil (the black center spot in the middle of the eye). Turn on the bright room lights. Check the size of the pupil again. The pupils should now be smaller. This is the pupillary response: it "automatically" keeps out excessive light that may damage the eye.

Materials

- Just a room you can make dim

Jump to It!

For grades K-12

Methods

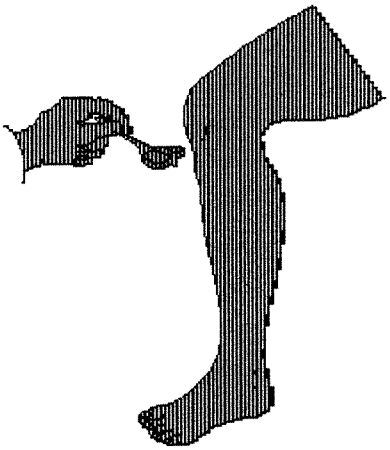
Here's a quick demonstration of reflexes...first talk about how the brain and the rest of the nervous system controls movement. Then, suddenly slam a book on a table to create a loud noise. Ask the class and count the number of students who:

1. Twitched
2. Moved their heads
3. Blinked their eyes
4. Put their hands up
5. Screamed

Reflexes are used to protect the body without us having to think about what is happening...reflexes get us away from objects that might hurt us, before they hurt us. For example, if you put your hand on a hot stove, your immediately remove your hand BEFORE the message, "Hey, my hand is on a hot, burning stove", gets to your brain.

Materials

- A large book or other heavy object to make a noise



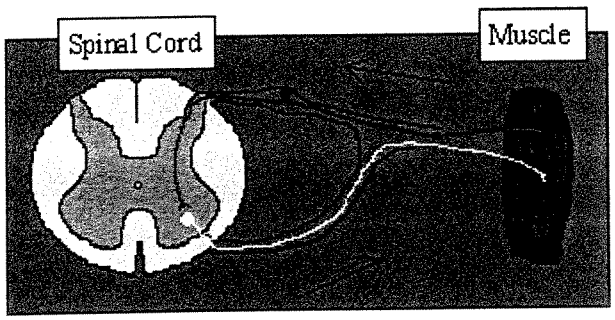
Knee Jerk Reflex (Patellar Reflex)

For grades 6-12

Methods

The knee jerk reflex is one we are are familiar with...the doctor hits your knee and your leg kicks out. Try it! Have a partner sit with his or her legs crossed so that his leg can swing freely. Hit his leg just below the knee with the side of your hand. DO NOT USE A HAMMER!!!! The leg will kick out immediately (if you hit the right place).

The knee jerk reflex (seen in the figure to the right) is called a monosynaptic reflex. This means that there is only 1 synapse in the neural circuit needed to complete the reflex. It only takes about 50 milliseconds of time between the tap and the start of the leg kick...that is fast. The tap below the knee causes the thigh muscle to stretch. Information is sent to the spinal cord. After one synapse in the ventral horn of the spinal cord, the information is sent back out to the muscle...and there you have the reflex.



Materials

NONE

For more information on the knee-jerk reflex, see:

- History and Trivia of the Reflex Hammer

Think Fast!

For grades 3-9

Methods

Our built-in reflexes really do protect us. Another demonstration of these built-in capabilites is the blink reflex. Have a student stand behind a see-through barrier like a window or a wire screen. Throw a cotton ball at the person. Did he blink? Probably. This is the blink reflex and serves to protect our eyes from damage.

Materials

- Cotton balls (or rolled-up paper towels)
- A transparent barrier (a wire screen, plastic or glass window)

Did you know?

The average person blinks about 12 times per minute. If you are awake for 16 hours a day, that is about 11,520 blinks per day!

How Fast are You?

For grades K-12

Methods

Unlike the other activities on this reflex page, this project does not test a simple reflex. Rather, this activity is designed to measure your response time to something that you see.

Get a ruler (or a yardstick or candy bar). Hold the ruler near the end (highest number) and let it hang down. Have another person put his or her hand at the bottom of the ruler and have them ready to grab the ruler (however, they should not be touching the ruler). Tell the other person that you will drop the ruler sometime within the next 5 seconds and that they are supposed to catch the ruler as fast as they can after it is dropped. Record the level (inches or centimeters) at which they catch the ruler (you can convert the distance into reaction time with the chart below). Test the same person 3 to 5 times (vary the time of dropping the ruler within the 5 second "drop-zone" so the other person cannot guess when you will drop the ruler).

Here is a table to convert the distance on the ruler to reaction time. Remember that there are 1,000 milliseconds (ms) in 1 second.

Distance of catch	Reaction Time (in seconds)
2 in (~5 cm)	0.10 sec (100 ms)
4 in (~10 cm)	0.14 sec (140 ms)
6 in (~15 cm)	0.17 sec (170 ms)
8 in (~20 cm)	0.20 sec (200 ms)
10 in (~25.5 cm)	0.23 sec (230 ms)
12 in (~30.5 cm)	0.25 sec (250 ms)
17 in (~43 cm)	0.30 sec (300 ms)
24 in (~61 cm)	0.35 sec (350 ms)
31 in (~79 cm)	0.40 sec (400 ms)
39 in (~99 cm)	0.45 sec (450 ms)
48 in (~123 cm)	0.50 sec (500 ms)
69 in (~175 cm)	0.60 sec (600 ms)

This reaction time experiment required visual information (the movement of the ruler) to travel to your brain. Then your brain sent a motor command ("grab that falling ruler") to the muscles of your arm and hand. If all went well, you successfully caught the ruler!!

Questions and Comparisons

-  Test the whole class. Who is fastest?
-  Compare boys vs. girls. On average, are the boys or girls faster?
-  Compare different ages. Who is fastest?...the older students or younger students?
-  Compare the scores after practice. Does reaction time improve with practice?
-  Compare kids' scores vs. parents' scores. Who is faster?
-  Test the whole school!!
-  Test the whole city!!.....you get the idea.

Materials

- Ruler or yardstick or long candy bar (give the candy bar to the person with the fastest reaction time)

More on Reflexes

There is also a great experiment where you can compare your auditory and visual response times on-line. Make sure you keep track of your responses while you do this experiment. However, to use this page, you need to have the "shockwave plug-in" for your browser.

GO TO: Hearing Smell Taste Touch Vision Working Together

BACK TO: The Senses Experiments and Activities Table of Contents


Please send comments and suggestions about this page to me at chudler@u.washington.edu

Please take a few minutes and fill out this survey - it will help me improve this resource.

Brain Facts that make you go, "Hmmmmm".

One way to use these facts is to cut out each fact and place them all in a box. Pass the box around to each person. When the box gets to a new person, have him or her reach into the box and read off one fact. Then the box is passed to the next person. If you want to get fancy, you could even laminate each fact. These facts just might make you go, "Hmmmmmmmmm". (For more Brain Facts, go to brain facts and figures and amazing animal senses.)

Facts

The adult human brain weighs about 3 pounds (1,300-1,400 gm).

The adult human brain is about 2% of the total body weight.

The elephant brain weighs about 6,000 gm.

The cat brain weighs about 30 gm.

The average human brain is 140 mm wide.

The average human brain is 167 mm long.

The average human brain is 93 mm high.

The human brain has about 100,000,000,000 (100 billion) neurons.

The octopus brain has about 170 million neurons.

The total surface area of the cerebral cortex is about 2200 sq. cm (2.5 sq.ft.)

The world record for time without sleep is 264 hours (11 days) by Randy Gardner in 1963.

Unconsciousness will occur after 8-10 seconds after loss of blood supply to the brain.

Neurons multiply at a rate 250,000 neurons/minute during early pregnancy.

The weight of an adult human cerebellum is 150 gm.

The total volume of cerebrospinal fluid (CSF) is 125-150 ml.

A total of 400-500 ml of cerebrospinal fluid (CSF) is produced every day.

Cerebrospinal fluid is normally clear and colorless.

There are 12 pairs of cranial nerves.

There are 31 pairs of spinal nerves.

There are about 13,500,00 neurons in the human spinal cord.

The human spinal cord is 45 cm long in men and 43 cm long in women.

Humans can hear in the range of 20 Hz to 20,000 Hz.

Rats can hear in the range of 1,000 to 50,000 Hz.

The most sensitive range of human hearing is between 1,000-4,000 Hz.

Pain occurs when sounds are above 130 db.

Hearing damage can occur if people are exposed to sounds above 90 db for an extended period of time.

The total number of human taste buds (tongue, palate, cheeks) is about 10,000.

The total number of human olfactory receptor cells is about 40 The human eyeball is about 24.5 mm long.

The octopus does not have a blind spot.

The total weight of skin in an average adult human is 6 lb.(2.7 kg).

There are 1,000 to 10,000 synapses for a "typical" neuron.

Neurons vary in diameter from 4 microns (granule cell) to 100 microns (motor neuron in cord).

The resting potential in a squid giant axon is -70 mV.

Now for some selected facts about amazing animal senses:.

Bats can find food (insects) up to 18 ft. away and get information about the type of insect using echolocation.

The eyes of the chameleon can move independently. Therefore, it can see in two different directions at the same time.

Crabs have hair on claws and other parts of the body to detect water currect and vibration.

Like bats, dolphins use echolocation for movement and locating

objects.

Each eye of the dragonfly contains 30,000 lenses.

The entire body of an earthworm is covered with chemoreceptors.

Blowflies taste with 3,000 sensory hairs on their feet.

The frog has an eardrum (tympanic membrane) on the outside of the body behind the eye.

The giant squid eye is 40 cm in diameter.

The silkworm moth can detect pheromones up to 11 km. away.

Scorpions can have as many as 12 eyes.

famous brain

200 points

In an accident while riding a horse, Christopher Reeve injured this [spinal cord]

OR

This part of the brain was made famous by Adam Sandler [medulla oblongata]

400 points

Period of sleep when dreams occur, also the name of a famous Georgian band [REM]

600 points

Neurotransmitter lacking in patients like Michael J Fox, with Parkinson's disease [dopamine]

800 points

This lobe of the brain, primarily responsible for personality, was damaged in the famous Phineus Gage case [frontal]

1000 points

Julius Caesar and Vincent Van Gogh both suffered from this brain disorder which cause seizures [epilepsy]

brain damage

200 points

This covering of axons is damaged in the disease multiple sclerosis [myelin sheath]

400 points

The neurons containing acetylcholine die in this disease [Alzheimer's]

600 points

This can occur if people are exposed to sounds above 90 db for an extended period of time, which is about in the range of a lawnmower [hearing damage]

800 points

This drug kills more than 430,000 US citizens each year more than alcohol, cocaine, heroin, homicide, suicide, car accidents, fire, and AIDS combined [tobacco]

1000 points

This was the drug people were trying to make, but instead they made MPTP which caused instant Parkinsons in a group of young people [heroin]

neuroanatomy

200 points

The lobe containing vision [occipital]

400 points

This part of the brain is responsible for balance and movement. [cerebellum]

600 points

This lobe integrates sensory signals to form your perception of the world. [parietal][

800 points

This bundle of nerve fibers links the left and right hemispheres [corpus callosum]

1000 points

This part of the neuron in squid can be 100 to 1000 times larger than in mammals [axon]

nt junction

200 points

Drugs can change the properties of these chemical messengers, found in vesicles [neurotransmitters]

400 points

This neuroactive peptide is deficient in diabetics [insulin]

600 points

This neurotransmitter is often antagonized in sinus medicines [histamine]

800 points

This neurotransmitter is important in depression, anxiety, and sleep. [serotonin]

1000 points

This neurotransmitter controls heart beat.

another word for this

200 points

Learning and memory are located in this part of the brain, named for its resemblance to a seahorse [hippocampus]

400 points

These are the support cells of the brain, originally thought to be the "glue" holding the brain together [glia]

600 points

This word, which describes the space between neurons, was first used in 1897; the word comes from two Greek words which mean "together" and "to clasp" [synapse]

800 points

Common name for a bundle of axons. [nerve]

1000 points

The nucleus, which holds the genetic information of the cell, is another name for this—a bundle of [neuronal cell bodies]

brain-pourri

200 points

The neuron is a unique type of cell because it transports this [information]

400 points

This extension from the neuronal cell body receives information [dendrite]

600 points

This half of the brain is dominant for spatial abilities, face recognition, visual imagery, and music [right]

800 points

The brain contains about 100 billion of these [neurons]

1000 points

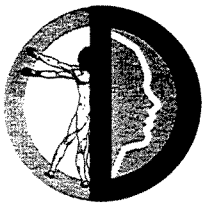
There are twelve of these in all, in order: olfactory, optic, oculomotor, trochlear, trigeminal, abducens, facial, vestibulocochlear, glossopharyngeal, vagus, spinal accessory, and hypoglossal [cranial nerves]

OR

The brain is not filled with blood, rather it is filled with this substance [CSF]

FINAL JEOPARDY

A spike of electrical activity created by a depolarizing current [action potential]



THE BRAIN QUIZ II

The human brain weighs a mere three pounds and looks like a gray, unshelled walnut, yet it is the most complex structure in our world and the body's most vital organ. It encases some 100 billion or more nerve cells, and is capable of sending signals to thousands of other cells at speeds of more than 200 miles an hour. It defines who we are, yet is influenced by what we do. It holds the secrets to conditions that have perplexed mankind for centuries.

Brain research is unraveling many of the deepest mysteries of the brain, helping us to understand how it works, what can go wrong and how it might be fixed. But how much do you know about your brain? The following quiz from the Dana Alliance for Brain Initiatives can help you find out.

1. **Which of the following is *not* a disorder or disease of the brain?**
   - ☐ a. Lou Gehrig's Disease
   - ☐ b. Obsessive/Compulsive Disorder
   - ☐ c. Learning Disabilities
   - ☐ d. Pain
   - ☐ e. Alcohol Addiction
   - ☐ f. All are disorders of the brain

2. **True or False:** There is now solid scientific evidence that eating certain foods can enhance brain function.

3. **True or False:** Highly intelligent people have larger-than-average brains.

4. **True or False:** Physical activity is closely linked to life-long brain health.

5. **True or False:** A newborn baby's brain is equipped with all of the basic "wiring" — the connections between brain cells that direct all of the body's functions — ever needed in life.

6. **True or False:** You are more likely to remember an event clearly — even decades later — if the event evoked a strong emotional reaction.

7. **True or False:** Emotional stress can lead to physical symptoms.

8. **True or False:** The left and right hemispheres of the brain operate separately, with one side responsible for creativity and the other for intellect.

9. **True or False:** Significant memory loss is inevitable as we grow older, and the degree of loss is directly linked to age.

10. **By the middle of the 21st century, more than 16 million Americans are likely to suffer from which brain disorder?**
    - ☐ a. Depression
    - ☐ b. Cerebral Palsy
    - ☐ c. Alzheimer's Disease
    - ☐ d. Spinal Cord Injury

Brain Awareness Week[SM]
March 16-22, 1998

Answers

7. True

There is growing evidence to support the idea that emotional and physical well-being are inseparable. Besides the well-known effects of emotional distress on heart rate, blood pressure, and gastrointestinal function, the brain is also affected. Animal studies have revealed direct damage to the brains and other body systems of animals subjected to prolonged stress, and investigations of soldiers who have survived the repeated, severe stress of active war duty have helped psychiatrists understand the condition now known as post-traumatic stress disorder. Though the process by which emotional distress leads to physical damage to the brain, heart, and other systems is only beginning to be understood, there is no doubt the brain plays crucial roles in both detecting and responding to stress. Progress in this field of study could unlock many mysteries of emotional and mental disorders.

8. False

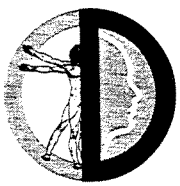
Brain imaging studies, which enable scientists to see which parts of the brain are active during various tasks, have shed new light on the age-old debate over the specialization of the brain's hemispheres. Technologies such as PET (positron emission tomography) and fMRI (functional magnetic resonance imaging) can track specific mental tasks to brain regions, but "creativity" and "intellect" involve any number of mental tasks, and, as such, are not exclusive to either hemisphere. Indeed, communication *between* the hemispheres is as crucial as communication *within* a hemisphere, since so many different areas of the brain are involved in mental skills.

9. False

While forgetting things may be a common experience among older people (and indeed, the young as well), losing your memory is not inevitable. Certain aspects of memory, including short-term memory, show little change with aging. More difficult memory tasks, such as later recalling something recently learned, are more susceptible to decline. In older people, memory lapses are often due to slower learning, rather than more rapid forgetting. Honing your attention skills — concentrating, repeating key words, and reducing distractions — can help improve your memory, no matter what your age.

10. c. Alzheimer's Disease

If current patterns persist, the number of Americans with Alzheimer's is expected to skyrocket from 4 million to more than 16 million as baby boomers age. But researchers are zeroing in on Alzheimer's disease: dozens of treatments are being tested, several genes have been identified, and a simple test may aid early detection, enabling treatments to be begun earlier. To fight the battle against Alzheimer's and all brain disorders, greater public awareness and increased funding of research is crucial.



For more information about Brain Awareness Week, visit the web site on the Internet, at http://www.dana.org/brainweek/

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MIND BOGGLE

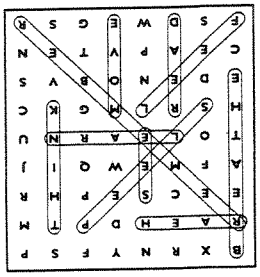
The "Brains" of the Operation

Your brain does a lot for you. In fact, it's in charge of most of the things you do that make you who you are. Hidden in this puzzle are the names of ten things your brain helps you do every day.

Hear
Feel
Sleep
Breathe
Learn
Think
Remember
Move
See
Read

B	X	R	N	Y	F	S	P
R	A	E	H	D	P	T	M
E	E	C	S	E	P	H	R
A	F	M	E	W	Q	I	J
T	O	L	E	A	R	N	U
H	S	R	L	M	G	K	C
E	D	E	N	O	B	V	S
C	E	A	P	V	T	E	N
F	S	D	W	E	G	S	R

Hint: *Words can be spelled forwards, backwards, or on a diagonal.*



Brain Awareness Week℠
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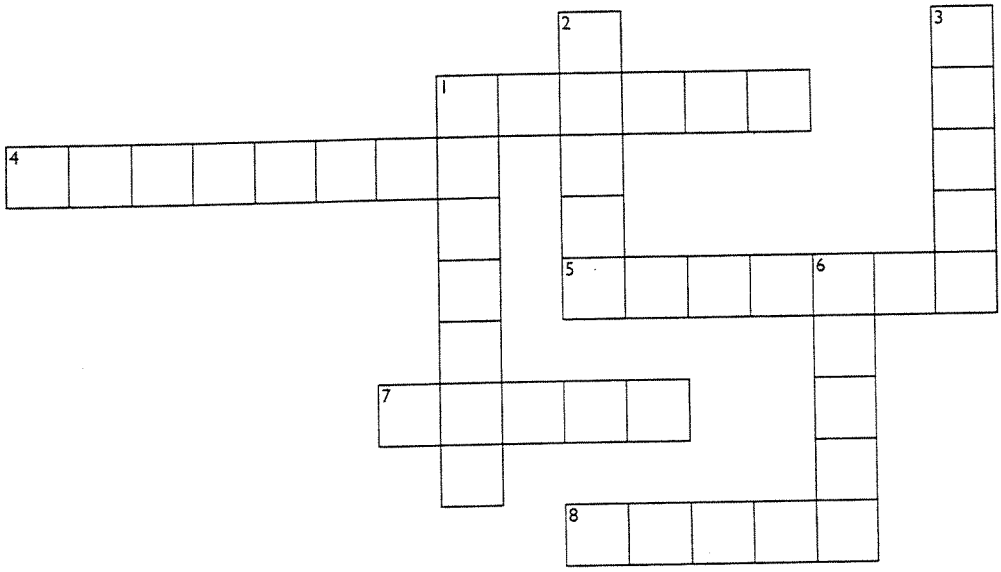
MIND BOGGLE

Brain Building

Your brain is in charge of most of the things that make you who you are. You can help take care of your brain and be the best that you can be!

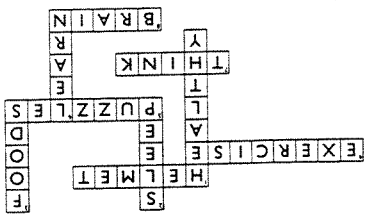


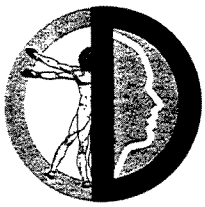
Across

1. Wear a _____ when you skateboard, roller blade, or ride a bike.
4. You _____ in gym class. This sends oxygen to your brain and makes your body stronger, too.
5. Exercise your brain. Solve tricky questions. Do crossword _____.
7. To solve this puzzle, you use your brain to _____.
8. Drugs and alcohol can kill your _____ cells.

Down

1. Working your brain hard keeps it strong and _____.
2. Get enough _____ every night. Your brain works better when it's rested.
3. Eat healthy _____. Your brain needs fuel, too.
6. Your brain likes it when you study and _____ new things in school.





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MIND BOGGLE

Take Your Brain to the Movies

Hidden in the letters are movie titles where a brain disease or disorder was an integral part of the film; also hidden are the names of some disorders of the brain. Letters may be used more than once.

T	S	R	E	T	A	R	D	A	T	I	O	N	X	W	O	V
U	M	E	E	R	B	R	A	I	N	L	Q	P	S	T	S	A
N	I	G	T	M	O	D	Y	G	H	C	D	E	I	P	Y	O
V	W	A	A	U	T	I	S	M	G	H	I	K	L	Q	M	E
N	M	R	Y	Z	L	S	O	P	A	D	N	F	E	L	T	L
A	I	D	P	E	R	P	F	M	A	L	T	E	N	S	R	E
M	G	I	Q	I	N	Q	W	V	E	R	N	O	C	A	M	G
O	R	N	S	R	R	A	I	N	M	A	N	A	E	L	P	E
S	A	G	Y	S	C	E	N	T	O	F	A	W	O	M	A	N
I	I	H	S	R	I	S	E	T	O	M	D	A	F	T	R	D
S	N	E	L	T	A	L	A	P	E	T	O	I	T	B	K	S
O	E	N	A	M	T	E	N	W	S	A	I	N	H	L	I	O
R	S	R	P	B	A	R	O	T	T	L	C	E	E	M	N	F
E	I	Y	L	G	W	T	R	H	E	Z	T	R	L	R	S	T
L	N	S	A	J	A	O	O	R	D	H	I	H	A	Q	O	H
C	O	V	R	N	K	T	S	K	C	E	O	P	M	S	N	E
S	I	U	B	E	E	I	E	S	P	I	N	O	B	E	S	F
E	S	M	E	O	N	O	S	Y	D	M	P	Z	S	C	O	A
L	S	K	R	O	I	E	L	Y	B	E	Q	I	E	N	I	L
P	E	R	E	D	N	U	N	O	L	R	X	H	S	A	S	L
I	R	E	O	F	G	R	A	T	Y	S	B	C	S	R	E	M
T	P	D	A	R	S	C	S	A	M	L	L	S	H	F	A	O
L	E	E	B	E	N	N	Y	A	N	D	J	O	O	N	S	N
U	O	S	L	T	F	K	L	D	E	N	Y	R	P	B	E	E
M	U	S	C	U	L	A	R	D	Y	S	T	R	O	P	H	Y

Addiction
Alzheimer's
Autism
"Awakenings"
"Benny & Joon"
Cerebral Palsy
"Days of Wine & Roses"
Deafness
Depression
"Frances"
"Legends of the Fall"
Migraines
Multiple Sclerosis
Muscular Dystrophy
Parkinson's disease
"Rainman"
"Regarding Henry"
Retardation
"Scent of a Woman"
Schizophrenia
"Silence of the Lambs"
Stroke

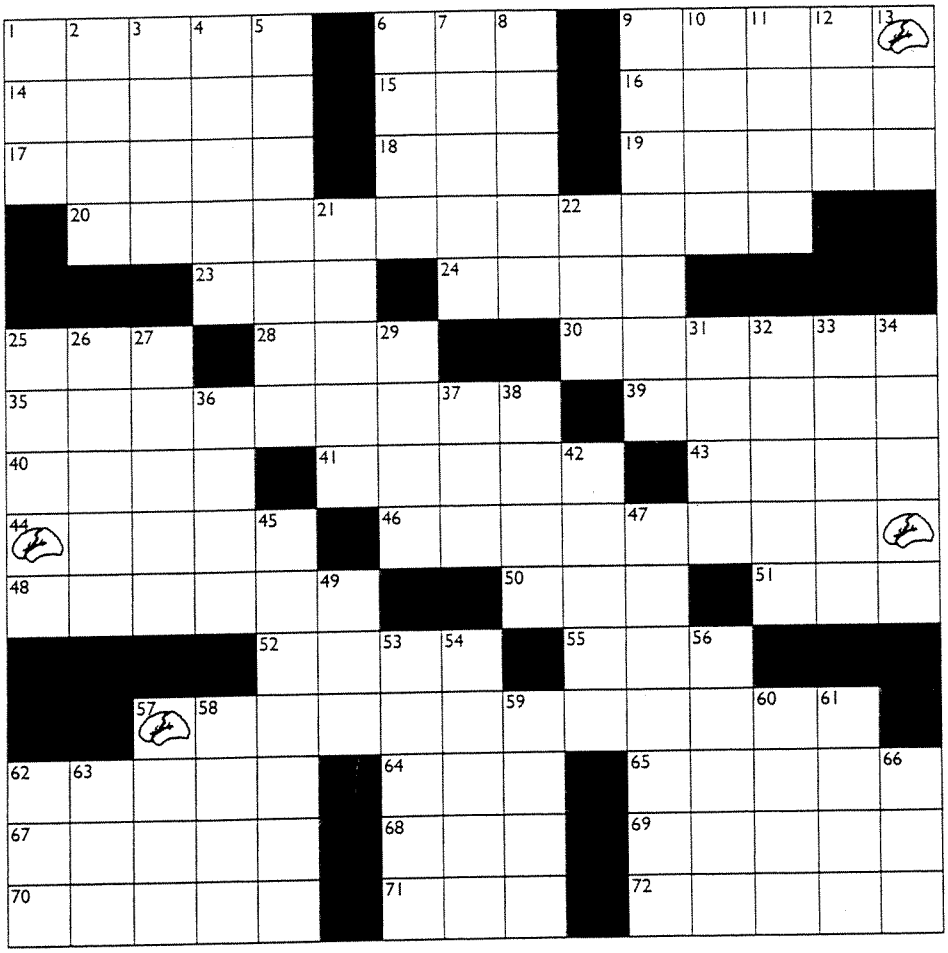
Provided by The Dana Alliance for Brain Initiatives for Brain Awareness Week – March 16-22, 1998

Brain Awareness Week℠
March 16-22, 1998

MIND BOGGLE

"No-Brainer"

Brain research is providing growing evidence that mental activities like reading, learning a new task, or doing a crossword puzzle stimulate the brain and help to keep it functioning properly. So keep brain-fit with this puzzle created by the Dana Alliance for Brain Initiatives.

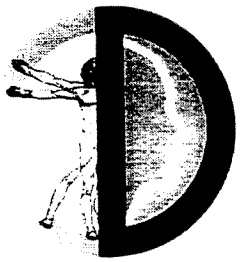


Across

1 Newly discovered brain pathogen
6 Old-time sailor
9 Scarecrow's lament: "If I Only —"
14 Ex-governor
15 Paleozoic, e.g.
16 Solo
17 "— up, Joe!"
18 Top
19 Lay a new lawn
20 Our organization: The — (with 57 across)
23 60's radical org.
24 Only
25 Football pts.
28 Doctrine
30 What you are while your brain is in R.E.M.
35 Violently twisting
39 French composer
40 Wine-related (prefix)
41 Kind of macaroni
43 — Lisa
44 Indoctrinate
46 1953 sci-fi movie
48 Lustrous material
50 Grad school brain test
51 Holy men (abbrev.)
52 Destroy
55 Sign of a B'way hit
57 For — (see 20 across)
62 Russian pancakes
64 Finish
65 Small pies
67 "— Kick Out Of You"
68 Mass transportation org.
69 Lance in hand
70 Roman emperor & others
71 Timid
72 Spanish mister

Down

1 Electronic brains
2 Regretted
3 Infinitesimal amount
4 Portents
5 Wandering
6 Relate
7 Seed coverings
8 Marconi brainstorm
9 Fasten a horse to a cart
10 Smart-sounding name?
11 Measured amount
12 Year, in Barcelona
13 Bashed on the head
21 "Steady — goes"
22 In the manner of
25 Steve Martin movie, "The Man With —"
26 — blank (had a mental lapse)
27 French legislative body
29 Gentle
31 Dalai —
32 Collars named for English school
33 Once, in Munich
34 Dimwits
36 Organ gathering olfactory information for the brain
37 Popular discount store
38 Percussion instrument
42 Most unfavorable
45 Ruptures
47 You'll find it in vino
49 Rapa — (Easter Island)
53 List components
54 Last inning
56 Egg-shaped
57 Smarter
58 Hung up with
59 Let's call it —
60 Emerald Isle
61 WWII battle site
62 Storage place
63 T-shirt size
66 Narrow waterway (abbrev.)



BRAIN-SURFING THE INTERNET
EDUCATIONAL TOOLS FOR SCIENTISTS, TEACHERS, AND PARENTS

Below follows an annotated listing of websites which may be of particular interest to educators, scientists, and parents interested in teaching K-12 students more about the brain. These sites can be accessed directly or through the BAW homepage at http://www.dana.org/brainweek.

NOTE: This listing is intended to be a resource and does not represent an endorsement of the organizations represented nor an affirmation of the information contained therein.

BEEMNET

Internet address: http://www.beemnet.com

BEEMNET (Brain Exchange Electronic Mentorship Network) is a research-oriented, educational organization that uses the World Wide Web as the means for linking elementary school children and their teachers with research neuroscientists. The goal of BEEMNET is to provide resources and support for children and their teachers as they participate in various classroom and community activities. These hands-on, minds-on activities are designed to promote critical thinking skills and to explore science as it relates to brain and behavior. Password protection is used in some areas of the site.

Bill Nye the Science Guy

Internet addresses:

Episode #2-08 **The Brain**	http://nyelabs.kcts.org/nyeverse/shows/e208.html
Episode #1-20 **Eyeball**	http://nyelabs.kcts.org/nyeverse/shows/e120.html
Episode #1-04 **Skin**	http://nyelabs.kcts.org/nyeverse/shows/e104.html

These sites replicate aspects of brain-related programs that have appeared on the award-winning television program, Bill Nye the Science Guy. *Each site contains "fast facts" on the topic, suggested home experiments, and topic-related Internet links.*

Brain Awareness Week: Dana Alliance for Brain Initiatives

Internet address: http://www.dana.org/brainweek

As the main Internet destination for Brain Awareness Week, this site provides information about partner organizations, activities taking place across the country, and various educational activities for audiences of all ages. The site links to the web pages of all partner organizations with their own home pages.

The Eye and the Way it Works: Anatomy and Optics
Internet Address: http://www.eyeinfo.com/wayworks.html

This site includes a brief, but thorough explanation of the eye and related brain functions. The description is easy to read and comprehend at the high-school level.

Making Connections
Internet address: http://www.son.washington.edu/~makcon/

The Making Connections Program focuses on the brain and nervous system to teach basic science concepts. It is a partnership effort of the University of Washington, Group Health Cooperative, Pacific Science Center and the Washington Association for Biomedical Research. The program features: a Summer Institute for educators held annually at the University of Washington; Brain Power, a traveling program for middle schools which features workshops for teachers and students, multi-media all school assemblies, hands-on exhibits, a science/health curriculum to help students understand the brain and how it affects behavior; and Bioscientist in the Classroom and Community which features a Speakers' Bureau and provides free speakers on the topics of biomedical research and science careers.

National Aeronautics and Space Administration - Neurolab On-line
Internet Address: http://quest.arc.nasa.gov/neuron/

NeurOn (Neurolab On-line) is now active as classrooms around the world participate in preparing for the Neurolab mission, STS-90, which will conduct research to study neurological and behavioral changes in space. NeurOn uses the Internet and E-mail to help break barriers between NASA and the classroom. It focuses on the people of the project, their efforts, their successes, and their challenges, as revealed through informal biographies, journals, and Web chats. Hands-on activities will help students experience the mission in their classroom.

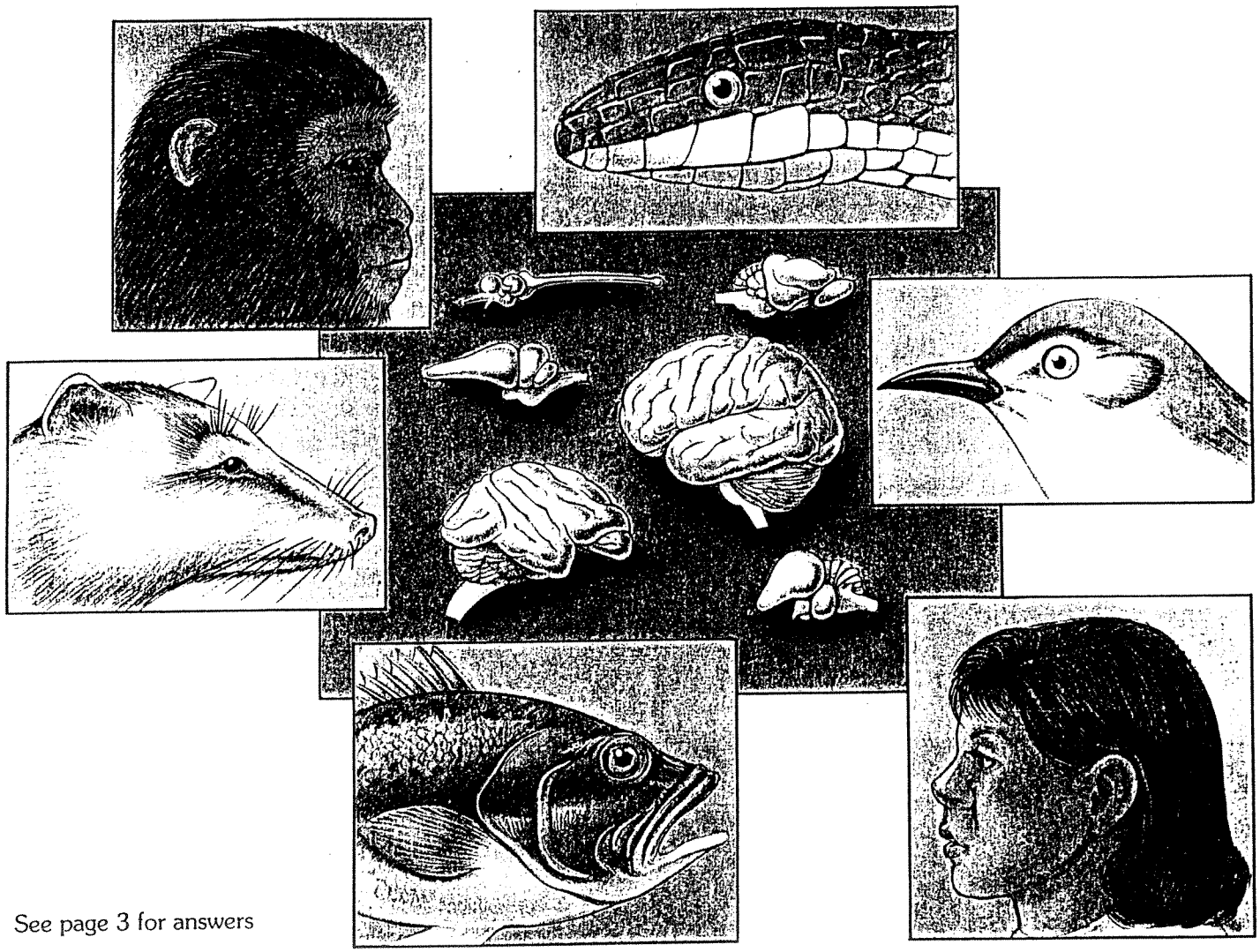
National Institute on Drug Abuse
Internet Address: http://www.nida.nih.gov/PublicationsIndex.html

The National Institute on Drug Abuse publishes research-based information on drugs of abuse for teachers, students, and the general public. Many of these publications are available on-line. New publications and updated information are added every few weeks.

Neuroscience for Kids
Internet Address: http://weber.u.washington.edu/~chudler/neurok.html

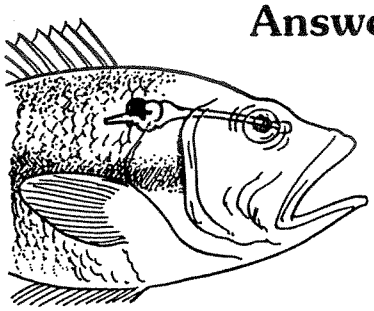
The single most comprehensive assembly of educational materials on the brain for children, this web site links directly to all other sites included in this index. Author Dr. Eric Chudler has developed a wealth of activities, experiments and information useful for a variety of age groups, both in the classroom and in small group settings.

Can you match the animal to its brain?

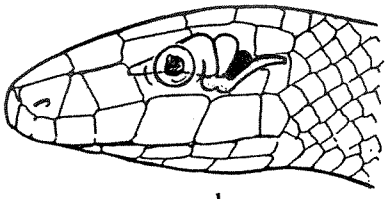


See page 3 for answers

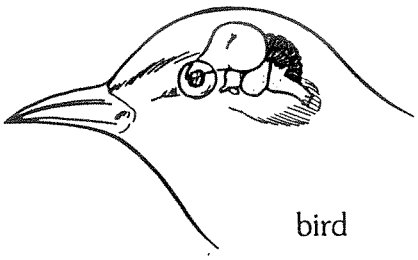
Answers to the cover's Brain Match



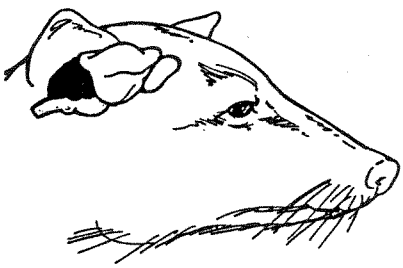
fish



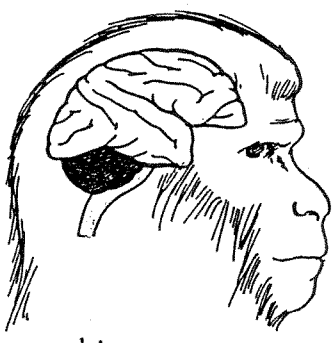
snake



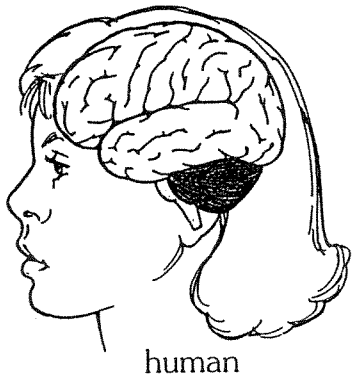
bird



opossum



chimpanzee



human

- How many did you guess right?
- After reading "Gray Matters" and examining the answers above, what do you notice about the