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TOEFL TEST 2

Internet-based test

Reading
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Reading Set 1

Optogenetics

Utilizing methods and technology from the realms of genetic engineering, neurology, and optical imaging, optogenetics is a new science that uses genetic material from plants to create photosensitivity in neural tissues. Using light to trigger activity in photosensitive neurons is more **precise** than any existing technology and causes fewer side effects. Optogenetic research has resulted in promising advances in the quest for remedies to neurally degenerative diseases like Parkinson's and Alzheimer's. It also holds the potential for artificial limbs that can relay feedback like temperature or texture directly to the user's brain. The initial light-sensitive proteins, called channelrhodopsins, are derived from *Chlamydomonas*, a type of algae. This genetic material, when combined with neural tissue, can use light to **trigger** neurons to "spike." These spikes are electrical pulses from within the neuron that control muscle function or direct information. In an experiment at Stanford University, scientists used spikes to cause a mouse to run in a circle. At Yale University, spikes aimed at specific neurons caused flies to attempt to jump up and fly.

The ability to fire neurons existed before optogenetics; neurons can be caused to fire by sparking them with electrical currents. It is the addition of a promoter, a section of DNA that makes the gene affective to only one specific type of neuron, that makes the technology so **singular**. The promoter causes the channelrhodopsins to function in certain neurons, but to remain dormant in others. This means that only the neurons selected by the promoter will react to light, while the neural tissue in the surrounding area remains unaffected and unchanged. This composition of plant-derived channelrhodopsins and promoter is introduced into viral particles, which are injected into the brain. The modified virus inserts the mixture into a small area of neural tissue, which **assimilates** the botanical gene's sensitivity to light. **Minute** optical fibers are then threaded into the skull to introduce flashes of light. Chlamydomas reacts strongest to blue light, so when these neurons "infected" with the algae's gene sense blue spectrum light, they fire. But if effective control is to be attained, the ability to stop a neuron from firing is just as important as causing it to spike in the first place. Another gene taken from a bacteria and used similarly causes the neurons to stop firing when exposed to yellow light. The combined use of these two genes results in genetically modified neurons that can be switched off and on at extremely high speeds by different spectrums of light.

The product of this technology is a specific group of neurons that can be controlled very precisely through a relatively non-invasive procedure. ♦ Scientists working on optogenetic projects hope that **this** will soon replace the current methods of drug therapy and deep brain stimulation, which are much less precise. Drugs flood the entire brain with chemicals, often causing undesirable side effects. □ Deep-brain stimulation not only impacts all the tissue surrounding the target area, but also must be implanted deep within the brain through difficult and dangerous surgery. While effective, the high risks involved with deep-brain stimulation mean it is usually reserved for extreme cases in which all other options have been eliminated. **Δ** Since neither of these therapies are ideal and come with multiple secondary effects, the promise of a new, powerful and exact method is very encouraging.○

Optogenetics, providing explicit control over the function of specific neurons, means that areas of the brain that have lost their function can be re-programmed and forced to become

active again. Through the use of this technology, researchers have mapped the brains of mice and discovered connections between nerves on the surface of the brain and the deep-brain nerves that Parkinson's Disease seems to affect. These surface neurons imply that future therapies for Parkinson's may be much easier to devise than previous means, and their side effects may be much less severe. However, this is still a new technology. The scientific community is hopeful that human testing will be as successful as experiments on various animals have led them to believe. Only then will the true extent of optogenetics' advantages be understood.

1. The word **precise** in paragraph 1 is closest in meaning to
   (A) special
   (B) careful
   (C) exact
   (D) successful

2. The word **trigger** in paragraph 1 is closest in meaning to
   (A) cause
   (B) shoot
   (C) promote
   (D) request

3. According to paragraph 1, which of the following is true of optogenetics?
   (A) It is a well-established branch of science.
   (B) It might help persons who have neurologic diseases.
   (C) It uses light-sensitive neurons that come from flowers.
   (D) It uses genetic material and light to spike neurons to trigger.

4. Why does the author mention experiments on a mouse and flies?
   (A) To illustrate how spikes work in the brain
   (B) To demonstrate the formation of channelrhodopsins
   (C) To argue that optogenetics is a dangerous science
   (D) To indicate two potentially dangerous side effects

5. The word **singular** in paragraph 2 is closest in meaning to
   (A) spectacular
   (B) obtuse
   (C) common
   (D) unusual

6. According to paragraph 2, a promoter
   (A) sparks electrical current
   (B) produces different-colored lights
   (C) selects specific neurons
   (D) is derived from channelrhodopsins

7. The word **assimilates** in paragraph 2 is closest in meaning to
   (A) rejects
   (B) absorbs
   (C) measures
   (D) reproduces

8. The word **minute** in paragraph 2 is closest in meaning to

(A) sensitive
(B) tough
(C) flexible
(D) tiny

9. Which of the following best expresses the essential information in the highlighted sentence? Incorrect choices change the meaning in important ways or leave out essential information.

(A) The use of two genes can create genetically modified proteins that can be turned on and off like a light switch.

(B) It's easy to control neurons by the combined use of special genes that allow them to be switched on and off in reaction to light spectrums.

(C) Neurons that can combine these two genes react at high rates of speed to blue lights and yellow lights.

(D) Two combination of two genes produces special neurons that are capable of being manipulated very quickly by different-colored lights.

10. The word **this** in paragraph 3 refers to
(A) procedure
(B) group
(C) product
(D) technology

11. Look at the four symbols [♦, □, **Δ** , ○] that indicate where the following sentence can be added to the passage.

Deep brain stimulation is by far the most precise clinical procedure for controlling areas of the brain, but it's still disappointingly non-specific.

Where would this sentence best fit?

12. Complete the table below to summarize information about the three methods of therapy described in the passage. ***This question is worth three points.***

Optogenetics	Drug Therapy	Deep Brain Stimulation

(A) Precise neuron control
(B) Difficult and dangerous surgery
(C) Flood the brain with chemicals
(D) Non-invasive procedure
(E) Minimal side effects

LISTENING SECTION

Lecture

Narrator: *Listen to part of a lecture from a geology class.* (Listening 1)

1. What is the lecture mainly about?
   (A) Radioactive dating
   (B) Igneous rock formation
   (C) Chemicals of rocks
   (D) Half lives

2. What happens during radioactive decay?
   (A) Daughter elements become parent elements.
   (B) Lava cools and turns into rock.
   (C) Parent elements become daughter elements.
   (D) Sand empties from the top of the hourglass.

3. Listen again to part of the lecture. Then answer the question. (Listening 2)

Why does the professor say this:

Are you with me so far?

   (A) He doesn't think the students understand.
   (B) He is checking the students' comprehension.
   (C) He is reminding the students to review the material.
   (D) He is trying to wake up a sleeping student.

4. According to the professor, what does a half-life measure?
   (A) Type of rock
   (B) Number of elements
   (C) Age of the Earth
   (D) Rate of decay

5. Listen again to part of the lecture. Then answer the question. (Listening 3)

What can be inferred about the professor when he says this:

AHA! We're on to something.

   (A) He is not very good at math.
   (B) He is inexperienced.
   (C) He is enjoying teaching.
   (D) He has just learned something new.

6. Why does the professor discuss an hourglass?
   (A) To explain ancient beliefs
   (B) To make a comparison
   (C) To illustrate an hypothesis
   (D) To point out a myth.

Conversation

Narrator: *Listen to a conversation between a student and a university professor.* (Listening 4)

7. Why does the student visit the professor?
   (A) To invest in stocks
   (B) To review for a test
   (C) To challenge a grade
   (D) To receive clarification

8. How is price-to-earnings ratio determined?
   (A) Divide current earnings by annual price
   (B) Divide current price by annual earnings
   (C) Divide annual price by current earnings
   (D) Divide annual earnings by current price

9. What is the professor's attitude toward the student?
   (A) Arrogant
   (B) Rude
   (C) Patient
   (D) Patronizing

10. Listen again to part of the conversation and answer the question. (Listening 5)

What does the professor mean when she says this:

With me?
   (A) She wants to know if the student understands.
   (B) She wants to know if the student is done writing.
   (C) She is asking the student to accompany her.
   (D) She wants to know if the student is paying attention.

11. What does the professor encourage the student to do?
   (A) Buy a stock
   (B) Ask a question
   (C) Study harder
   (D) Take better notes