英　　語

〈監督者の指示があるまで開いてはいけない〉

1. 試験開始後，まず解答用紙に自分の受験番号と氏名を正しく記入しなさい。
2. 試験開始後，速やかに問題冊子に落丁や乱丁がないか確認しなさい。
   落丁や乱丁があった場合は，手を挙げなさい。
3. 下書きは問題冊子の余白を利用しなさい。
4. 記入中でない解答用紙は必ず裏返しにしておきなさい。
5. 問題冊子は試験終了後，持ち帰ってもよい。
   ただし，試験途中には持ち出してはいけない。

I . Read the following passage and answer the questions that follow.

The type of blood coursing through your veins is likely different from the blood in your friends and maybe even your family. Knowing your blood type is important for blood transfusions and other medical purposes, which raises a question: Why do humans have different blood types?

There are four main blood groups: A, B, AB and O. Each is (A) by which antigens are present on the surface of red blood cells. Type A blood has the A antigen on red blood cells, B has the B antigen, AB has both and O has neither.

"The data are strongly suggestive that the whole reason we have different blood groups is malaria," said Dr. Claudia Cohn, medical director of the University of Minnesota's blood bank. "If you superimpose a map of where the malaria parasite is and the group O blood type, it is remarkably similar."

Malaria has a high death toll, having killed 627,000 people worldwide in 2020, according to the Centers for Disease Control and Prevention. In people carrying the parasite that causes malaria, infected red blood cells pile up in small blood vessels, blocking blood and the oxygen it carries from getting to the brain. But people with group O blood have significant protection against malaria. A 2007 study in the journal Proceedings of the National Academy of Sciences, for example, found that people with type O blood were 66% less likely to develop severe malaria than people with other blood types.

This is at least partially because the malaria parasite makes infected red blood cells (B) a protein on their surface called RIFIN, which acts like a glue that makes uninfected red blood cells pile up around an infected red blood cell, according to a 2015 study in the journal Nature Reviews Microbiology. But whereas RIFIN binds strongly to the surface of type A red blood cells, it binds weakly to type O red blood cells, according to a 2015 study in the journal Nature Medicine.

Yet blood group isn't the only aspect of a person's blood that affects their malaria risk. In addition to those that cause the four main blood groups, there are 15 other types of antigens that can be present on the surface of red blood cells. One of those is called the Duffy group. People who lack the Duffy antigen are relatively resistant to one of the two major malaria parasites. Duffy (C) is common throughout sub-Saharan Africa, where malaria is most prominent, but it is rarely seen elsewhere in the world, according to the Malaria Atlas Project.

There's quite a bit of evidence for why populations that evolved in malaria-prone areas have type O blood, but it's less clear why type A, B and AB blood can be found in relatively high proportions elsewhere. Some scientists point to disease associations between various blood types. For example, a 2021 study in the journal BioMed Research International found that people with type O blood are more likely to have cholera, plague, tuberculosis and mumps. Other blood types are

more likely to have other diseases; for example, people with type AB blood are more likely to have smallpox and *Salmonella* and *E. coli* infections.

Cohn doesn't find these associations (D), though, especially not as a potential reason for why humans have different blood types. These studies did not prove a (E) relationship between blood type and the prevalence of these diseases; the links may be due to other factors. As such, they don't actually find evidence of blood types causing protection or susceptibility to diseases. "Malaria is the only one where it really seems to bear itself out," she said.

It's also unclear why most people have a protein known as the Rhesus (Rh) factor on the surface of their blood cells, making them Rh positive, although about 15% of Caucasians, 8% of Black people, and 1% of Asians lack this protein, making them Rh negative. (This is what the + and - that follow blood groups indicate, for example A+ or B-.) In a 2012 study published in the journal Human Genetics, researchers investigated whether there was an advantage to being Rh negative that would keep this genetic variation around, despite it sometimes causing rhesus disease — a condition in which a pregnant person's antibodies attack their baby's blood cells. However, they couldn't find one, so they concluded that either the benefit existed in the evolutionary past and does not anymore, or humans have those two Rh types because of random chance.

[Adapted from: Santora, Tyler. "Why do we have different blood types?" *LiveScience*, 28 March 2022. URL: https://www.livescience.com/33528-why-blood-types-exist-compatible.html]

1. Choose the best word from the list to fill in blanks (A)~(E) and write the number in the space on the answer sheet.

(A) :	1. termed	2. defined	3. recognized	4. described
(B) :	1. advance	2. appear	3. detach	4. express
(C) :	1. negativity	2. exposure	3. frequency	4. effectiveness
(D) :	1. confirming	2. obvious	3. convincing	4. believable
(E) :	1. reasonable	2. considerable	3. causal	4. harmful

Choose the best answer for each question and write the number in the space on the answer sheet.

2. How does malaria cause death?
   1. It causes uninfected blood cells to pile up in the brain.
   2. It prevents the brain from getting enough oxygen.
   3. It weakens the binding of red blood cells.
   4. It infects red blood cells that carry blood to the brain.

3. How does type O blood help protect against malaria?
   1. It does not bind well with the RIFIN protein.
   2. It prevents the Duffy antigen from reacting to parasites.
   3. It lacks the Duffy protein.
   4. It does not have the RIFIN proteins on its surface.

4. Why might positive or negative blood type exist?
   1. It makes people more or less susceptible to rhesus disease.
   2. It was an evolutionary adaptation to malaria.
   3. It was possibly caused by the RH protein.
   4. It could have had some former advantage.

5. Why did the researchers think there might be a connection between blood types and diseases?
   1. They found that certain diseases and blood types could be found in the same areas.
   2. They noticed that different blood types were vulnerable to different diseases.
   3. They realized that type O blood must provide some protection from malaria.
   4. They discovered a geographical correlation between malaria and type O blood.

II. Read the following passage and answer the questions that follow.

From the time of the ancient Greeks, it was believed that living organisms could be created from non-living matter, and this belief was not finally overthrown until the 19th century. Philosophers such as Aristotle noticed that maggots suddenly appeared in dead, rotting meat and that small fish unexpectedly showed up in freshly formed puddles of water. They speculated that air contained an invisible life force that could create living things out of nonliving matter when combined with sunlight and water or earth. This idea of life (A) out of non-living matter was called spontaneous generation.

By the 17th century, though, some scientists began to question this theory. A scientist called Francesco Redi performed an experiment in which he put meat in six glass jars. Two jars were open, two were covered with thin gauze at the top, and two were completely sealed. Maggots only appeared in the meat in the uncovered jars. The meat in the sealed and the gauze-covered jars had no maggots, but maggots did appear on top of the gauze of the gauze-covered jars. Reddi then realized that maggots were actually young flies, and that flies had to land on the meat to lay their eggs for maggots to form.

However, Redi's experiment did not completely (B) the theory of spontaneous generation. The invention of the microscope in the 17th century allowed scientists to confirm the existence of previously invisible microorganisms such as bacteria. No one knew where they came from, and many scientists believed that they must be the (C) of spontaneous generation. By the 18th century it was known that boiling could kill microorganisms, so a scientist called John Needham conducted an experiment in 1750. He took some meat broth, boiled it in some flasks to kill any bacteria, and sealed it so nothing new could get in. After a few days, the broth changed color and Needham found many bacteria when he examined the liquid with a microscope. Thus, he argued that spontaneous generation did occur with bacteria.

Some scientists disagreed with Needham, though, and speculated that maybe he did not boil his broth long enough to kill all the microorganisms. Several scientists performed experiments showing that new bacteria did not grow in broths that had been thoroughly sealed and boiled. Needham countered that the other scientist had boiled their solutions too long and killed the life force in the air in the flasks so that spontaneous generation could not occur. This debate continued for over 100 years until the Paris Academy of Sciences offered a prize to whoever could (D) the question. And that is when the chemist Louis Pasteur decided to conduct his most well-known experiment.

Pasteur had previously carried out many investigations with bacteria and had observed that bacteria could be found on dust particles in the air. He designed special glass flasks with long, thin

necks shaped like an S that was turned 90 degrees, with the open end up and the first bend going down. Because the curve of these necks resembled the neck of a swan, these flasks became known as swan-neck flasks. Their shape was crucial to the success of the experiment.

Pasteur filled the flasks with a rich yeast broth that bacteria normally thrive in. He then boiled the broth to kill any bacteria. He also left some flasks unboiled as a control group. After several days, the broth in the unboiled flasks changed color and had significant bacterial growth, while the broth in the boiled flasks remained clear and bacteria free.

Pasteur then broke the necks of some of the boiled flasks so that the broth was exposed to the air directly from above. Within a few days, the contents of those flasks became cloudy with bacteria. Finally, Pasteur turned some unbroken flasks on their sides, and the contents of those flasks also became full of bacteria.

This proved that germs in the air and not the air itself caused bacteria to appear in food. For bacteria to grow required outside (E). Pasteur was awarded the prize from the Paris Academy in 1862, and his swan-neck flask experiment is now considered one of the most significant experiments in science because it conclusively disproved spontaneous generation and ushered in the era of the germ theory of medicine.

1. Choose the best word from the list to fill in blanks (A)~(E) and write the number in the space on the answer sheet.

(A) :	1. emerging	2. showing	3. producing	4. breeding
(B) :	1. solve	2. demonstrate	3. disbelieve	4. refute
(C) :	1. product	2. source	3. effect	4. basis
(D) :	1. respond	2. settle	3. contradict	4. inquire
(E) :	1. stimulus	2. contamination	3. contact	4. impurity

Choose the best answer for each question and write the number in the space on the answer sheet.

2. Why did ancient Greek philosophers believe that life could come from nonliving things?
   1. They did not realize that small creatures were hatched from eggs.
   2. They observed small organisms such as maggots and fish reproducing in meat and water.
   3. They noticed living things materializing without any visible organic source.
   4. They did not yet know about microscopic life forms.

3. What did Francesco Redi's experiment seem to prove?

1. Spontaneous generation was a persuasive theory.
2. Maggots could not autonomously originate out of dead meat.
3. Cloth covering was ineffective for preventing flies from laying eggs.
4. Uncovered jars with meat would have maggots appear.

4. Why did the debate over spontaneous generation continue for over 100 years after Needham's experiment?

1. No one could agree on how spontaneous generation occurred.
2. Scientists could not figure out how to test the air in the flasks for bacteria.
3. Neither group had yet recognized the existence of microorganisms.
4. Both sides of the debate said that the other side boiled their flasks wrong.

5. What was significant about the design of Pasteur's flasks?

1. It prevented air and bacteria from affecting the broth inside the flasks.
2. It was not sealed to the outside but kept bacteria from reaching the broth.
3. The long necks of the flasks made it impossible for bacteria to generate.
4. The flasks could be adjusted so that bacteria could enter or not.

Ⅲ. Read the following passage and answer the questions that follow.

The most difficult place to retain control over your life is in a hospital, yet doing so may be vital to your recovery. You should not be passive but take an active interest in all that is being done for you. You should insist that your doctor explain all procedures and that you understand what is going on. If you disagree, you should voice your disagreement. It is not presumptuous to ask the doctor to give you a good reason for what is done if it makes little sense to you. You are not in the hospital to protect tradition or the medical establishment; you are there to find out all you can to help yourself get well. You should be especially sensitive to getting rest and should insist that procedures be coordinated so that you are not continually disturbed. You have a right to expect that the hospital procedures serve you, not them, and it's especially important that you not acquiesce passively while angering inside. Your old brain is working hard enough to get you well; it does not need the added hormonal and (A) fatigue.

You should also do as much as you can for yourself. If there is any way you can help the nurses or aides with your treatment, the more you do, the more effective the treatment will be. The passivity and dependency fostered by most hospital treatment are your enemies, and you must be as active as you can be. Think as much as possible in terms of what you can *do* and as little as possible about how you *feel*. Avoid talking about (B), because if you see your misery is controlling them, it will be hard to stop choosing more misery even as you are getting physically better. The key again: keep as much control as possible. Your ability to control your life even when seriously ill is your best chance for health. How to stay in charge when you are acutely ill is well described in Norman Cousin's book *The Healing Heart*, in which he recounts his personal battle to remain in control when he suffered a severe heart attack. You can learn much from this valuable book.

When you leave the hospital, work out a detailed recovery plan with your doctor and follow it. Now you have a chance to be in charge, and you should do everything you can to avail yourself of this chance. If you have to stay home, do not stay in bed unless you don't have the strength to get up. Get dressed and engage yourself in some worthwhile activity. When you get tired, go back to bed and rest or nap until you feel refreshed. Push to the limits of your physical restrictions and always ask the doctor if you can do more. Question the value of any long-term medication, and do not take any addicting drug for a protracted period. Try to use as little medication as possible, because all medication has dangers. But if you are convinced that the medicine prescribed for you has (C) to support its efficacy, take it faithfully for as long as it can be justified to you that you need it.

To be healthy is far different from not being sick. Health means to feel good, strong, alert,

rested, mentally sharp, and physically active. Health means to look forward to challenge, both mental and physical. It means time passes quickly rather than dragging. Only you can assess your health. Doctors can only tell you that you have no observable illness, (D). To be healthy, you must have good control of your life; and to help you maintain this control, it is important to have a regular relaxing time each day, which I would like to call an in-control time. It does not matter what you do — a pleasant nap, a long hot shower, a regular after-work get-together, even a hard tennis game can be very relaxing. But whatever it is that you do, for at least thirty minutes each day you should [X].

[Adapted from Glasser, William, MD. *Take Charge of Your Life: How to Get What You Need with Choice-Theory Psychology.* iUniverse, Inc. Bloomington. 2011.]

Choose the most appropriate option from the ones given below and write the number in the space on the answer sheet.

A. Choose the best phrase to fit blank (A).

1. partial acceptance related to
2. mental cure to your
3. chemical burden of anger or
4. medicinal remedy of

B. Choose the best phrase to fit blank (B).

1. what could have been done fast
2. physically becoming unhealthy
3. your feelings to those who visit
4. fostering emotional dependency

C. Choose the best phrase to fit blank (C).

1. a substantial body of research evidence
2. been tested negative yet proved positive
3. a better chance that is highly effective as
4. a probable worth for treating your illness

D. Choose the best phrase to fit blank (D).

1. regardless of your wellness
2. not having a direct access
3. which is a far cry from health
4. but you cannot tell the illness

X. Write fewer than ten words in blank [X] that best follows up the idea of the author before.

Writing Question: Do you agree or disagree with the author that patients should demand more information and more control over their treatment? Use details and examples (hypothetical examples are acceptable) to support your opinion. There is no wrong answer as long as you can explain your opinion logically in English.