令和２年度

１１時２０分～１２時５０分

英　語

問題冊子 １ ～ １０ 頁
解答用紙 １ ～ ２ 頁

注　意　事　項

１．試験開始の合図［チャイム］があるまで、この注意をよく読むこと。
２．試験開始の合図［チャイム］があるまで、問題冊子ならびに解答用紙は開かないこと。
３．試験開始の合図［チャイム］の後に問題冊子ならびに解答用紙の全ページの所定の欄に受験番号と氏名を記入すること。
４．解答はかならず定められた解答用紙を用い、それぞれ定められた位置に問題の指示に従って記入すること。また、解答用紙に解答以外のことを書かないこと。
５．解答はすべて黒鉛筆を用いてはっきりと読みやすく書くこと。
６．質問は文字が不鮮明なときに限り受け付ける。
７．問題冊子に、落丁や乱丁があるときは手を挙げて交換を求めること。
８．試験開始６０分以内および試験終了前１０分間は、退場を認めない。
９．試験終了の合図［チャイム］があったとき、ただちに筆記用具を置くこと。
１０．試験終了の合図［チャイム］の後は、問題冊子ならびに解答用紙はいずれも表紙を上にして、通路側から解答用紙、問題冊子の順に並べて置くこと。いっさい持ち帰ってはならない。
なお、途中退場の場合は、すべて裏返しにして置くこと。
１１．その他、監督者の指示に従うこと。

受験番号		氏　名	

1 以下の英文は、紙面の都合上 Part 1 と Part 2 に分けているが、続いている文章である。英文を読み、問題に答えなさい。指示のあるもの以外は、すべて日本語で答えなさい。

Part 1

Fat sometimes gets a bad rap. It's often linked with being overweight and in poor health. But fat is an essential part of all living things. In our own bodies, fat lies beneath the skin and hugs our organs. Its job is to store extra calories until needed. Seems like a straightforward role. Or, is it?

In fact, body fat is complex. Until recently, scientists thought people had only one type. Called white fat, it stores excess calories in molecules called lipids, and they can be broken down for energy when food is hard to find. White fat is (1) people think of when they think of body fat. Scientists first discovered the other type of fat, brown fat, in hibernating marmots* about 500 years ago. To date, studies have uncovered its importance for hibernating animals and that research suggests that brown fat (2) in how bodies use energy. Furthermore, it turns out that's true not only in hibernating animals but also in people.

Most body fat in animals, (3) people, is white, and it's a life-saving tissue. Most animals don't have a constant supply (4) food, and until fairly recently, most people didn't either. White fat allows individuals to eat more than they need if food is available and stores those extra calories until food becomes scarce. Then the body burns it for energy to stay (5) until more food shows up.

Hibernating animals take this to the extreme. Hibernation allows many animals to (6) severe winter conditions. Bats, squirrels and bears, for example, all overeat in the fall. These mammals gain their weight—(7) half their body weight—in preparation for a long, cold winter. Animals don't eat when they're hibernating, rather, they burn their white fat to keep their bodies running. To make it last an entire winter, these creatures must use it much more (8) than they normally would. To do this, they enter a state called torpor.

When in torpor, animals appear to be sleeping since their body functions and metabolism become less active. (9) wasting energy keeping warm, a hibernating animal saves energy by keeping its body temperature very low—just above freezing. Then, in order to wake up from hibernation, it has to bring its body temperature back to normal in only a couple of hours. 1)<u>That's where brown fat becomes important</u>. Brown fat creates heat. If the outside temperature gets too cold, brown fat keeps the animal from freezing and it also pulls the animal out of torpor. (10)

the brown fat gives off heat, it warms the blood, which then carries that warmth to the rest of the body. This process burns up white fat.

注)

* a type of large squirrel that lives in mountain areas of Europe, North America, northwest Asia

〔1〕空欄(1)—(10)に入る最も適切なものを選択肢から選び、記号で答えなさい。

(1)	(a) how	(b) what	(c) where	(d) which
(2)	(a) plays a key role	(b) gives a result	(c) makes up for	(d) takes a look at
(3)	(a) to be included	(b) having included	(c) includes	(d) including
(4)	(a) for	(b) of	(c) to	(d) with
(5)	(a) lived	(b) in living	(c) alive	(d) aliving
(6)	(a) get through	(b) get rid of	(c) get by	(d) get out of
(7)	(a) by	(b) until	(c) up to	(d) through
(8)	(a) calmly	(b) quietly	(c) shortly	(d) slowly
(9)	(a) In charge of	(b) In search of	(c) In spite of	(d) Instead of
(10)	(a) As	(b) Like	(c) During	(d) Through

〔2〕下線部 1)において、"That"は何を指すか説明しなさい。

Part 2

Researchers have been giving an eye to how this process can be applied to the problems of metabolic diseases including obesity.** Brown fat is brown because it's packed with mitochondria. 2)These structures are powerhouses within cells. They burn the fats, sugars and proteins that we eat. In most cells, this process creates a molecule called ATP that powers other reactions. But in brown fat, the mitochondria don't make ATP. Instead, they produce heat. So, the more brown fat we have, the more heat we produce and the less likely we are to store excess energy or food as white fat. However, it is very difficult to increase the number of brown fat cells because those cells are so small and lie deep under the skin. In addition, the amount generally increases a couple of ounces at most. So how can we use the idea of boosting brown fat? Here comes unpopular white fat.

Although white fat usually stays white, researchers have discovered that 3)under certain conditions some white cells will turn brown. Because these altered cells aren't as dark as true brown fat, scientists call them beige fat. The best trigger for this alteration is cold temperatures. When people are exposed to cold, their bodies raise their beige fat levels. It doesn't take extreme cold to make this happen. Just two hours a day at 19℃ for six weeks will trigger white fat's browning. Researchers explain this as (あ) system. White cells turn beige when the body needs

to burn calories for warmth. When that's no longer necessary, burning extra calories could lead to starvation, especially when food is hard to get. So the beige cells become white again and stay as they are until that situation happens.

Although cold causes the body to make beige fat, cold temperatures can be hard on people, especially for older people and those with heart problems. Blood vessels narrow when people are cold to prevent heat loss. But the heart has to work much harder to pump blood through those narrow passages. So cold temperatures could be dangerous for someone who already has high blood pressure. Since high blood pressure is often associates with obesity, another approach has to be a better option.

One promising—and already available—option for turning white fat beige is melatonin. This hormone is produced by the brain when light begins to dim in the evening. As the body's melatonin levels go up, we start to feel sleepy. It also helps to control body weight. One study shows that rodents given a daily melatonin supplement gain less weight than those that don't get one, even when they eat the same amount of food.

This finding prompted two cell biologists to investigate how melatonin reduces weight. 4)They teamed up and conducted a study using two types of rats to find out how melatonin affects body fat. One type of rat was fat and would develop diabetes. The other was thin and would never get diabetes. In every other way, genetically, these types of rats were the same. Half of each type were given their regular food and the other half received the same food plus melatonin. After six weeks, the researchers examined the fat just under the skin near the animals' shoulder bones.

The researchers found that melatonin induced browning of white fat cells in both fat and thin rats over the six weeks, and as a result, the fat rats lost weight. Furthermore, the body temperature of untreated fat and thin rats remained similar while melatonin treated rats raised their body temperature. Actually, the cells of beige fat of melatonin treated thin rats were more efficient at turning food into heat and when put in a cold room, they had no problem keeping warm. These suggested melatonin treated rats raised their metabolic rates. In conclusion, taking melatonin orally for an extended period will drive white fat cells into brown-fat-like function in rats.

Researchers now suspect that melatonin might help people manage their weight, too, and believe that would start by allowing natural melatonin levels in the brain to rise in the evening. They are still working to understand the genetics behind brown and beige fat well enough to turn them into treatments for people who are overweight or have diabetes. 5)Until then, supporting healthy melatonin levels and getting good, regular sleep may be the best ways for people to boost these helpful fat cells.

注)
**obesity: being extremely fat, in a way that is dangerous for health

〔3〕下線部 2)において、“powerhouses”と比喩している理由を説明しなさい。

〔4〕下線部 3)について具体的に説明しなさい。

〔5〕空欄(あ)に入る最も適切なものを選択肢から選び、記号で答えなさい。

(a) a resisting　(b) a heating　(c) an adaptive　(d) an exchanged

〔6〕下線部 4)に関して、問題に答えなさい。

尚、研究に関する情報は、一部、以下に示してある。

2つのタイプのマウスを研究対象とし、メラトニンが脂肪に与える影響をみた

研究対象のマウス

・糖尿病を発症する可能性のある太ったマウス

・糖尿病を発症する可能性のない痩せたマウス

この2つのタイプのマウスは、その他遺伝的差異はない

(1) 研究対象動物にどのような方法を用いて何を調べたか、具体的に説明しなさい。

(2) 以下に関して、どのような結果を得たか説明しなさい。

(a) 脂肪細胞　(b) 体温

(3) 考察及び結論を答えなさい。

〔7〕下線部 5)が示す内容を説明しなさい。

2 英文を読み、問題に記号で答えなさい。

On New Year's Day 2019, a little land snail named George died in his terrarium* at the University of Hawaii. He was 14 years old and lived quite long for his species, *A. apexfulva*. But George's passing nevertheless 1)came as a blow to the researchers who had raised him. George was, after all, likely the last snail of his kind.

Snails were once incredibly numerous in Hawaii, and the loss of a species leads to damage of the ecosystem. The Hawaiian tree snails graze 2)the sticky substances that grow on leaves. Upon feeding, they reduce the abundance of fungi** on leaves while increasing fungal diversity—and because of that, they may have helped protect their host*** trees from diseases. Some biologists think 3)healthy snail populations could have prevented the current outbreak of a new fungal disease wiping out native trees.

Records from the nineteenth century state that 10,000 or more snails could be collected in a single day. "Anything that is abundant in the forest is an essential part of it," says an invertebrate biologist who ran the captive breeding program for rare native Hawaiian snails. These creatures are incredibly diverse: There were once more than 750 species of land snail in Hawaii, including a little over 200 in the tree snail family. When they arrived on the islands, the snails 4)branched out and took on a variety of ecological roles. Some of these species came to function as decomposers—like earthworms, which are not native to the islands—and fulfill the essential ecological role of breaking down waste materials.

By the 1980s, every kind of Hawaiian tree snail was listed as endangered. About a decade ago, it was commonly believed that over 90 percent of Hawaii's snail species were gone. The snails that remain in Hawaii are in serious trouble. Most are only found on a single ridge or valley, and in recent years, declines have (5) as introduced predators have started invading their last environments. These snails are likely to go extinct in the blink of an eye unless they're protected in the wild or brought into the laboratory.

6)This led to the establishment of a captive breeding**** facility in the hopes of saving the rarest species, and it was in that laboratory at the University of Hawaii at Manoa that George was born in the early 2000s. George's parents, along with a handful of other members of the species, were collected from the last known population found in a few trees near Oahu's Poamoho trail. 7)Only a few offspring were produced, but they and their parents didn't make it long. By the mid-2000s, all of the *A. apexfulva* kept in the laboratory died, except for one young snail. That's when he got his name—after Lonesome George, the Pinta Island Galapagos tortoise who was also the last of his kind.

(8), it became a tradition amongst the snail researchers to stop at the spot where the last *A. apexfulva* were found and pull out binoculars to scan the trees to find more snails. For over a decade, researchers searched in vain for another member of the species for George to mate with, but it was hopeless. The snail lived over a decade in a terrarium of his own, and then, on the first day of 2019, he died.

Throughout his life, George was a public face for the struggles facing Hawaiian land snails. In short, his death highlights both the decreased diversity of domestic snails—and their desperate condition. "The land snail extinction crisis hasn't gotten much publicity," one expert notes, even though "these species are an important part of life on Earth, and when they start going extinct, it means that something is really wrong with the environment that supports us."

Notes

*terrarium: a usually transparent case for keeping or raising small animals (such as turtles or snails) indoors

**fungus: a plant that has no flowers, leaves, or green coloring, such as a mushroom

***host: a plant or animal that another plant or animal lives on as a parasite

****captive breeding: the breeding of wild animals in places such as zoos, especially animals which have become rare in the wild

〔1〕 Which choice can replace the underlined phrase 1)?

(a) was a relief (b) was a surprise
(c) was a disappointment (d) was a collision

〔2〕 What can we understand about the underlined part 2)? Choose All that apply.

(a) Snails eat them. (b) Trees protect them.
(c) They contain fungi. (d) They harm snails.

〔3〕 From the underlined part 3), what can we understand?

(a) Because the sick snails spread their disease on the trees, they also became sick.
(b) If there were more tree snails, more native trees would survive this epidemic.
(c) An abundance of native trees can prevent snail diseases from breaking out.
(d) Healthy populations of snails and trees alike are now dying from disease.

〔4〕 What does the underlined phrase 4) mean?

(a) moved in a different direction (b) grew limbs or offshoots from their bodies
(c) began doing different kinds of activities (d) evolved into a new species of snail

〔5〕 Which choice fits gap (5) the best?

(a) accelerated (b) decreased
(c) slowed down (d) leveled off

〔6〕 Which choice does the underlined word 6) refer to?

(a) Predators have started invading the snails' environment.
(b) Most snails are only found on a single ridge or valley.
(c) The snails are likely to go extinct unless they're protected.
(d) Some snails will die in the blink of an eye in the wild.

〔7〕 From the underlined part 7), what can we understand?

(a) The program closed because parents did not produce children long enough.
(b) Adult snails produced baby snails, but neither could travel great distances.
(c) A handful of the snails were capable of giving birth and survived a long time.
(d) Although some snails were bred, snails of all ages soon died.

〔8〕 Which choice fits gap (8) the best?

(a) Determined to find George a mate (b) To discover a new species of snail
(c) Always on the lookout for predators (d) To understand more about extinction

〔9〕 Which statement would the expert in the last paragraph agree with?

(a) Snails are an invasive species and have harmed the Hawaiian Islands.
(b) The land snail extinction crisis is evidence that our environment is badly damaged.
(c) With more publicity, we could have prevented snails from going extinct.
(d) It is sad that George died, but other environmental issues are more urgent.

〔10〕 Read the following statements and identify 2 true statements.

(a) The species *A. apexfulva* is now extinct.
(b) All species of snail are protected in University of Hawaii's captive breeding program.
(c) In the 1800s, Hawaii had no fewer than 950 species of land and tree snails.
(d) Decomposition of waste materials is an important role of some Hawaiian snails.
(e) George was named after Lonesome George, Pinta Island's last living land snail.

3 与えられた状況に関して、最も適切な表現を選択肢から選び、記号で答えなさい。

〔1〕It's possible that Mariko will need to get in touch with you, so you give her your email address.

(a) You could write to me by this email address.

(b) Are you going to send messages to my email address?

(c) Here's my email address in case you need to contact me.

(d) Send messages to email address I had given if you want to.

〔2〕You want to buy some envelopes. You ask your friend if there is a place selling them.

(a) Tell me the place in which envelopes are selling.

(b) Let me know how to find somewhere selling some envelopes.

(c) Could you show me any store which I can find some envelopes?

(d) Is there someplace near here where I can buy some envelopes?

〔3〕Last week, your friend told you that his bicycle was broken. Today, you saw him riding his bicycle on the way to school. What do you say to him?

(a) Your bicycle was repaired, weren't you?

(b) You got your bicycle renew, didn't you?

(c) You've had your bicycle fixed, haven't you?

(d) Your bicycle had been reformed, hadn't it?

〔4〕You're having dinner with your friend. The dinner is really good. You tell your friend about it.

(a) The best dinner is for which I'm having now.

(b) This is the best dinner I've ever had.

(c) I've never had the best dinner like this one.

(d) I think this dinner has served the best.

〔5〕You lent your friend, Mario, your notebooks before exams. Mario spilled some coffee on your notebooks. Now, you regret lending your notebooks to him.

(a) I wish I hadn't lent him my notebooks.

(b) I am regretting why he was borrowing my notebooks.

(c) I hoped he didn't spill some coffee.

(d) I expected him not to spill his coffee on my notebooks.

4 空欄に入る最も適切なものを選択肢から選び、記号で答えなさい。

A: Did you hear the weather warning on television this morning?

B: No, I didn't. (1)

A: It was about a big typhoon heading our way from the Philippine Sea.

B: What's the number of that one?

A: Typhoon No. 18. According to the report, it will be a very strong typhoon which may leave a trail of death and destruction.

B: Oh, no! (2) We must take every possible precaution against it.

A: It's the typhoon season now.

B: (3)

A: So, what should we do first?

B: Well, it's lucky for us that we live rather far inland. (4)

A: Absolutely they are. But do you remember the last big typhoon that lashed the Kanto area?

B: I do, indeed. It blew off part of our roof, drenched the furniture, and knocked down many of the trees in the garden.

A: This new typhoon is said to be even worse, with terrific wind velocity.

B: (5)

A: I don't know. The TV newscast said there is a fifty-fifty chance. The enhanced weather satellite is sending data every minute, and we can get information on the way the typhoon is moving.

B: (6)

A: This afternoon, I'm going to close all the windows, and put the storm shutters into place.

B: (7)

A: I will. I'm also going to fill the bathtub, as well as bottles and pans with water, and buy a lot of canned food to be ready for any kind of emergency.

B: You'd better keep a flashlight or candles handy, too, to use in the event of a power failure.

A: That's good advice.

B: And one more important tip. (8) Just report them to the police or to the power companies.

(a) If the typhoon does hit this area, avoid going out unless absolutely necessary.

(b) During a typhoon, never touch any fallen wires.

(c) This coming typhoon wouldn't hit this area again.

(d) This sounds serious.

(e) The coastal areas are especially vulnerable to typhoons.

(f) There is a possibility that it might change its course, isn't there?

(g) We'd better be prepared to cope with several violent storms.

(h) We don't have to be too careful.

(i) Well, we must keep our mobile phones charged so we can access official weather reports at all times.

(j) What was it for?

以　上