外　国　語

次の英文は*CNN*(2023年3月8日)に掲載された"Eating meat without slaughtering animals may be in our future" (Kristen Rogers ほか)の記事を一部改変したものです。この文章をよく読んで，医学科と歯学科の受験者は問題 3 , 4 , 5 , 6 に答えなさい。保健衛生学科と口腔保健学科の受験者は問題 1 , 2 , 3 , 5 , 6 に答えなさい。解答は解答用紙の指定された欄に記入すること。

What if there was a way to eat meat without farming and killing billions of animals per year, ***contributing*** to the climate crisis and risking high cholesterol levels?

"Cultivated meat is real meat grown directly from animal cells," Uma Valeti, founder and CEO of Upside Foods, said via email. "These products are not vegan, vegetarian or plant-based — **they**[1)] are real meat, made without the animal."

"The process of making cultivated meat is similar to brewing beer, but instead of growing yeast or microbes, we grow animal cells," Valeti added.

Scientists start by taking a small cell sample from a livestock animal such as a cow or chicken, then ***identify*** cells that can multiply.

"From there, we put these cells in a clean and controlled environment and feed them with essential nutrients **they**[2)] need to replicate naturally," Valeti said. "***In essence***, we can re-create the conditions that naturally exist inside an animal's body."

"It's meat without slaughter," said Christiana Musk, founder of Flourish*ink, in June 2022 at the Life Itself conference, a health and wellness event presented in partnership with CNN. Flourish*ink is a platform for curating and catalyzing conversations on the future of food.

Progressing from lab production to making products in commercial facilities, some companies are moving away from the term "lab-grown meat," said a spokesperson for Mosa Meat, a Netherlands-based food technology company.

Instead, these companies refer to it as cultivated meat, cultured meat, cell-based or cell-grown meat, or non-slaughter meat.

In addition to ***mitigating*** animal slaughter, cultivated meat could also help slow climate change driven by the emission of greenhouse gases such as carbon dioxide and methane. The food system is responsible for about a quarter of global greenhouse gas emissions, most of which are from animal agriculture. The transport needed for agriculture ***emits*** both methane and carbon dioxide, and clearing land and forests — including for agriculture — emits carbon dioxide, according to the United Nations.

"The ***presumption*** is we're going to do better because of the sustainability element here — to reduce the land footprint, reduce the water needs and reduce some of the waste streams that go out from feedlots," said David Kaplan, a professor of biomedical engineering at Tufts University. Waste streams containing carbon dioxide and methane are responsible for large flows of emissions into the atmosphere.

At this time, Singapore and the United States are the only countries to have approved cell-based meat for consumer consumption. The industry is about 10 years old, so cultivated meat is still a few years away from being commercially available to US consumers in grocery stores or restaurants — and maybe up to 20 years out from replacing a substantial ***portion***, or all, of the traditional meat industry, Kaplan said.

Until then, (ア) cultivated meat and its potential benefits for animal, human and environmental health are more hope than promise.

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Making cultivated meat is based on the field of tissue engineering — growing human tissues in a lab for medical repairs and regeneration, Kaplan said.

Scientists get cell samples from animals by harvesting a tiny piece of tissue taken via biopsy, isolating cells from eggs or traditionally grown meat, or obtaining cells from cell banks. These banks already exist for purposes such as medication and vaccine development, said Josh Tetrick, CEO of Eat Just, Inc., a California-

based company that makes plant-based alternatives to eggs. GOOD Meat is the cultivated meat division of the company.

The biopsy method is "just like a human biopsy," Kaplan said. "In principle, the animal's fine afterwards."

The second step is identifying nutrients — vitamins, minerals and amino acids — for the cells to consume. In the same way that a traditionally grown chicken has cells and gets nutrients from the soy and corn it's fed, isolated cells can ***absorb*** the nutrients they're fed in a lab or facility, Tetrick said.

Those cells go in their nutrient bath in a bioreactor, a large stainless steel vessel "that has an internal process by which it ***agitates*** cells under a particular pressure to create an environment that allows cells to grow efficiently and safely," Tetrick said. "That can be used for vaccine production or drug production, therapeutics — or, in our case, can be used to feed people."

This process is basically making raw meat, he added.

The cell sample takes roughly two weeks to grow into the desired size, which is "about half the amount that a chicken would take," Tetrick said. Next is converting the meat into the finished product, whether **that**[3)]'s a chicken breast or nugget, or beef burger or steak.

"What's cool about it is you can start to tweak the texture," said chef and philanthropist Kimbal Musk, cofounder and executive chairman of The Kitchen Restaurant Group and Christiana Musk's husband, at Life Itself. "Alternative meats can be too spongy or **they**[4)] can be too firm and, frankly, even bad chicken can be, too. With this technological approach to things, you have the ability to adjust that and really tweak it for a palette that matters to you."

"The first time I cooked this was probably two years ago and I tried it again this morning," he said during a June 2 session of the conference. "It is remarkably better, which means it's technology that you're constantly improving."

I tried the Upside Foods cultivated chicken breast Kimbal cooked during that Life Itself session. The chicken's texture and fibers were nearly identical to that of regular chicken, but the flavor profile seemed to be missing some element I

couldn't put my finger on.

Making cultivated meat as similar to regular meat as possible is still a work in progress. However, this discrepancy could also be due to the fact that traditional meat's flavor is influenced by myriad factors involved in the agricultural process, I learned from Valeti — including the conditions in which animals are raised and the feed they're given.

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"Whether it's animal welfare, climate, biodiversity or food safety, (there are) a lot of really important reasons to change how we eat meat," Tetrick said.

For one, few to no animals would have to be farmed and used for cultivated meat, and therefore hundreds of millions of acres of land wouldn't be needed to grow feed for them.

"The holy grail, if we all do our job right, is that you only need one animal in the initial biopsy," Kaplan said. "You can do what we call 'immortalize' those cells so **they** 5) essentially propagate forever."

A single cell could make hundreds of billions of pounds of meat, Tetrick said. "There's no ***ceiling***."

The Intergovernmental Panel on Climate Change's 2022 assessment report said that cultivated meat is an emerging food technology that could help substantially reduce global emissions from food production, because of its "lower land, water, and nutrient footprints."

Whether cultivated meat will require less water is debatable and remains to be seen, Kaplan said, "because you still need a lot of water for cellular agriculture."

And cellular agriculture may or may not result in a substantial reduction in energy use, according to the IPCC.

Lessening human encroachment on land and oceans for agricultural use could preserve biodiversity, Tetrick said.

Nutritional quality and impacts on human health are areas where "I think cultivated meat can shine, because the process is much more controlled than traditional agriculture," Kaplan said. "You have more control of inputs and outputs

to the system, meaning less chance for contamination and less chance for variability. ... You can sort of make sure only the best parts of meats end up in the meats that you make or grow, as opposed to the animal where you kind of have what's there."

Those tailoring possibilities include adjusting nutrient profiles, "whether that's less saturated fat and cholesterol, or more vitamins or healthy fats," said Valeti of Upside Foods. "Imagine if we could produce a steak with the fatty acid profile of salmon."

Eating too much saturated fat and cholesterol can increase risk for a heart attack or stroke.

Traditionally grown animals are given high doses of antibiotics to combat disease or contamination from bacteria such as salmonella and E. coli, Valeti and Tetrick said.

"You have lots of chickens in a facility and their throats have to be slit," Tetrick said. "You have blood and you have feathers and live animals bumping up against each other. Or, (with cultivated meat), you have a stainless steel vessel that is entirely contained without all that."

Because cultivated meat producers don't expect to use antibiotics — or at least large amounts — cultivated meat could also alleviate the antibiotic resistance problem among humans, Kaplan said. Cultivated meat also shouldn't need synthetic growth hormones, the subject of debate over their potential impact on human health, puberty and cancer. The US Food and Drug Administration maintains that approved synthetic hormones are safe for humans eating meat from treated animals.

And since cultivated meat would require less contact with animals and use of their habitats, it could also lower the risk of more virus spillover from animals to humans, according to the IPCC.

The top two human drivers of zoonotic diseases like Covid-19 are the increasing demand for animal protein and unsustainable agricultural intensification, according to the UN.

"This field is not intended to initially displace traditional animal agriculture. There (are) too many needs right now," Kaplan said. "But it's going to start slowly and build."

(イ) As promising as it may seem, it's unclear whether certain aspects of cultivated meat will be problematic.

Affordability for consumers remains to be seen.

While people in Singapore are able to enjoy cultivated meat, the product has only recently gained approval by the FDA. Along with the US Department of Agriculture, the FDA announced in 2019 it would jointly oversee the production of cultivated animal foods to ensure marketed products are "safe, unadulterated and truthfully labeled." They began seeking insights on labeling in September 2021

"The nomenclature is one of the things to be working on with the regulators, because it is real meat," Valeti said at Life Itself. "If someone's got, let's say, an allergy to meat or fish, they should know this is real meat. So, it's going to be called meat but the prefix is what we're working on."

Upside Foods will be able to start selling its products once its facilities have been inspected by the USDA.

The Academy of Nutrition and Dietetics emphasized "the need for a better understanding of the long-term health effects of cultured meat and poultry products," according to a comment letter it sent to the USDA. "There is also little available information about the bioavailability of nutrients in, or the nutrient density of, cultured meat and poultry products."

The topic of meat is "a very difficult one because it's very culturally charged," Christiana Musk said at Life Itself. "It has all of these tradeoffs between access, health, sustainability, animal welfare and, of course, as my husband cares about as a chef, taste is a really important thing to keep in common. It's an issue of major debate."

But if cultivated meat ends up checking all the important boxes, "it will be a great achievement when people can eat the meat they love without slaughter," Valeti told CNN in an interview.

問　題

保健衛生学科と口腔保健学科のみ

1 ***The following words appear in bold italics in the text. On the answer sheet, circle the letter indicating the best definition for each word (based on how the word is used in the text).***

contributing

a) adding　b) admitting　c) evolving
d) facing　e) putting a stop

identify

a) copy　b) culture　c) find
d) keep　e) monitor

In essence

a) Apparently　b) Basically　c) Originally
d) Subsequently　e) Therefore

mitigating

a) adjusting　b) criticizing　c) following
d) lessening　e) treating

emits

a) includes　b) maximizes　c) produces
d) reduces　e) requires

presumption

a) belief　b) chance　c) conclusion
d) controversy　e) plan

portion

a) business　b) goal　c) income
d) method　e) part

absorb

a) display　b) grow　c) imitate
d) increase　e) take in

agitates

a) cools　b) dries　c) regulates
d) stimulates　e) stores

ceiling

a) amount　b) data　c) estimate
d) limit　e) work

保健衛生学科と口腔保健学科のみ

2 ***What do the following words, which are underlined in the text, refer to? Answer using one to five English words that can replace the underlined word.***

1) they　　2) they　　3) that

4) they　　5) they

全学科

3 ***According to the text, decide whether the following statements are true (T) or false (F). For each statement, circle the correct answer on the answer sheet.***

1) The article implies at the start that the way we eat meat is one reason the climate crisis is getting worse.

2) Uma Valeti suggests that cultivated meat is not a plant or animal-based food.

3) Cultivated meat is produced by growing yeast or microorganisms, like brewing beer.

4) The article suggests that Christiana Musk is against making cultivated meat.

5) Many countries have already approved cultivated meat for consumer consumption.

6) Tissue engineering is a crucial technology related to cultivated meat.

7) Josh Tetrick's company manages the cell banks where many scientists get cell samples from animals.

8) From the article, we can infer that some of Eat Just's products meet the needs of vegans.

9) David Kaplan indicates that obtaining cell samples from animals via biopsy does not harm the animals in the long run.

10) According to Tetrick, cell samples are placed in a bioreactor after taking what he refers to as a "nutrient bath."

11) Kimbal Musk suggests that the texture of cultivated meat can be adjusted depending on consumer preferences.

12) The author ate a cultivated chicken breast prepared by Kimbal Musk but seemingly was not satisfied with the taste.

13) The flavor of traditional meat is influenced by the animal's surroundings.

14) Tetrick claims that animal welfare is the main reason we should change the way we eat meat.

15) The article implies that the widespread introduction of cultivated meat will dramatically change how land is used.

16) In theory, according to Kaplan, it should be possible to produce an infinite amount of cultivated meat from only one initial animal.

17) The Intergovernmental Panel on Climate Change reported in 2022 that cultivated meat technology could eventually have a positive environmental impact.

18) In addition to reducing global emissions, cultivated meat also clearly reduces the amount of water used in meat production.

19) Cultivated meat producers expect to use large amounts of antibiotics in their production process.

20) Cultivated meat doesn't require synthetic growth hormones, which is a disadvantage according to the US Food and Drug Administration.

21) The FDA began seeking insights on labeling cultivated meat in September 2021.

22) Valeti notes that people allergic to meat or fish can eat cultivated meat safely.

23) Upside Foods can start selling its products once the US Department of Agriculture has inspected its facilities.

24) The Academy of Nutrition and Dietetics expressed concern about the impact of meats designed for particular cultures.

医学科と歯学科のみ

4 ***Briefly (in 10 to 25 words) answer the following questions in your own words, using complete English sentences. Base your answers on the information presented in the article.***

1) According to David Kaplan, what are three reasons why producing cultivated meat is thought to be more environmentally sustainable than producing traditional meat?

2) What are some of the steps involved in making cultivated meat as described on pages 5 and 6?

3) What are some potential benefits of cultivated meat specifically related to human health?

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5 下線部(ア)と(イ)を日本語に訳しなさい。

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6 培養肉が人間の健康と地球環境に対して与えうる影響について，この記事の著者が述べていることを以下のキーワードをすべて用いて日本語で400字以内にまとめなさい。なお，キーワードは初出の際に四角く囲むこと。

例) 栄 | 養

※英数字は2文字で1マスとすること。

気候変動

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感染