

第 1 問から第 4 問では、問題文の中の [] 内の数字はマークシートの間番号を示している。該当する問番号の解答記入欄に答をマークしなさい。

第 1 問 次の問 1～8 の空所 [1]～[8]に入れるのに最も適切なものを(1)～(4)から 1 つ選び、その番号をマークしなさい。

問 1. All of the staff members who attended the seminar [1] saying goodbye to their former director.

- (1) expected (2) missed (3) refused (4) wished

問 2. A: Does our supervisor think the professor will deliver a lecture at our university?

B: He guesses [2]. She is extremely sought after by other universities.

- (1) either (2) neither (3) not (4) too

問 3. For young children, [3] as if it were an eternity.

- (1) two hour feel (2) two hour feels (3) two hours feel (4) two hours feels

問 4. Looking at some wooden toys in that shop, he was surprised [4] cost over 10,000 yen.

- (1) anyone (2) it (3) one (4) that

問 5. Mr. and Mrs. Allen [5] to eat lunch, so they will be absent from today's conference.

- (1) had been (2) had gone (3) have been (4) have gone

問 6. Take better care of what belongs to others, [6]?

- (1) do you (2) don't you (3) shall we (4) will you

問 7. The mountain is a splendid site [7] landslides come about from time to time.

- (1) except that (2) except what (3) in that (4) in what

問 8. There are times when you had better [8] pressure from your partner.

- (1) catch up with (2) come down with
(3) give in to (4) look up to

第2問 次の問1～4においては、それぞれ日本語の意味に合うように下の(1)～(7)の語句を並べかえて空所を補い、最も適切な文を完成させなさい。解答は[9]～[16]に入れるものの番号のみをマークしなさい。ただし文頭にくる文字も小文字にしてある。

問1. 彼はお酒の飲みすぎで肝臓を悪くした。

_____ [9] _____ [10] _____ .

- (1) damaging (2) excessive drinking (3) him (4) his
(5) in (6) liver (7) resulted

問2. 彼は毎日欠かさず母親に連絡をする。

_____ [11] _____ [12] _____ his mother.

- (1) a day (2) contact (3) doesn't (4) he
(5) not (6) passes (7) that

問3. 警察は、その事件を慎重に捜査した結果、殺人犯を捕まえることができた。

_____ [13] _____ [14] the case enabled them to catch the murderer.

- (1) care (2) into (3) looked (4) the
(5) the police (6) which (7) with

問4. これは極めて複雑な状況だから、今すぐには対処できないと思う。

I find _____ [15] _____ [16] _____ right now.

- (1) a (2) complicated (3) handle (4) situation
(5) this (6) to (7) too

第3問 Read the article and answer the questions that follow.

The U.S. Centers for Disease Control and Prevention (CDC) reports that the prevalence of food allergies has increased by 50 percent since the 1990s, making it a serious public health concern.

Food allergies affect nearly 32 million Americans, including 1 in 13 kids. For many, even a tiny amount of an allergen can trigger a serious, even life-threatening response by the body's immune system. To address this growing concern, Intramural Research Program (IRP) senior investigator Pamela A. Guerrerio, M.D., Ph.D., and her colleagues in the Food Allergy Research Section at the National Institute of Allergy and Infectious Diseases (NIAID) are working to unravel how genetics, immune system development, and environmental factors interact to cause food allergies in children.

“It's becoming clearer that the development of food allergies likely involves both a genetic predisposition as well as exposure to triggers in the environment,” Dr. Guerrerio says. “Use of antibiotics early in life that disrupt the microbiome, vitamin D deficiency, and the age that solid foods are introduced into the diet might all contribute to the risk of developing food allergies.”

Most food allergies develop in childhood, and while some kids are lucky and outgrow them, they may not go away with age. Dairy, eggs, wheat, nuts, soy, sesame, and fish or shellfish are common culprits, although more than 170 different foods have been found to cause reactions in some people. While mild allergies can be treated with medications called antihistamines, more severe reactions require injection of a fast-acting medicine called epinephrine — the ‘epi’ in the ‘EpiPens’ that many severe allergy sufferers carry at all times — followed by a visit to the emergency department. Avoiding foods that cause allergic reactions is the cornerstone of management, which can curtail kids' ability to eat a nutritious diet.

“Since most of the major food allergens are nutritionally dense, there is a concern that children who need to avoid these foods because of their allergy will be at risk for a number of nutrient (あ),” Dr. Guerrerio says. “We want to define these risks and what measures can be implemented to ensure optimal growth and overall health.”

Since there are so many potential factors contributing to the development of allergies, Dr. Guerrerio and her colleagues are studying disorders caused by single-gene mutations that appear strongly associated with allergy development. For example, they have been studying a condition called Loeys-Dietz syndrome, which is caused by a mutation in the gene that codes for a receptor for TGF-beta, a protein involved in growth and development. Even though this condition primarily affects connective tissues, patients have a noticeably higher risk of developing food and other allergies, as well as a condition called eosinophilic esophagitis, in which immune cells accumulate in the esophagus and can cause food to get stuck. The TGF-beta protein has long been known to play an important role in how the immune system develops, so Dr. Guerrerio and her team have been conducting experiments to see how disrupting its function can lead to allergies.

“It's pretty amazing — because there are so many factors that we think play a role in the development of food allergy — that just disrupting this one gene, this one pathway, is enough to cause food allergy,” Dr. Guerrerio says. “I think this tells us that TGF-beta could be a really important pathway in terms of

understanding the disease and that targeting this pathway could have therapeutic benefit.” She hopes her research will help lead to new prevention strategies and treatments that target the genetic and immune processes that govern food allergies.

注 allergen: アレルギー原因物質	unravel: ～を解明する	predisposition: 体質
antibiotic: 抗生物質	microbiome: 微生物叢	outgrow: ～を脱する
culprit: 犯人	cornerstone: 基本	curtail: ～を制限する
optimal: 最適な	connective tissue: 結合組織	esophagus: 食道

<https://irp.nih.gov/blog/post/2023/05/digging-up-the-roots-of-food-allergies>

問 1. Based on the context of the article, which word best fits (あ)? Write the number of your answer in [17].

- (1) allergies (2) deficiencies (3) excesses (4) treatments

問 2. Which statement is closest to what is mentioned in this article? Write the number of your answer in [18].

- (1) Dr. Guerrerio believes that it is possible that the reasons why people develop food allergies are linked to environmental and genetic factors.
- (2) Dr. Guerrerio is attempting to identify the main factors that cause food allergies to become less severe as children grow up.
- (3) The number of Americans suffering from food allergies has been declining over the past few decades thanks to Dr. Guerrerio’s research.
- (4) The standard use of antihistamines and epinephrine to prevent people from developing food allergies is being reexamined by Dr. Guerrerio.

問 3. Which statement is closest to what is mentioned in this article? Write the number of your answer in [19].

- (1) Considering the importance of TGF-beta protein, Dr. Guerrerio is researching how interference with the protein’s function may cause food allergies.
- (2) Dr. Guerrerio is trying to uncover why the risk of developing food allergies is higher than other types of allergies for people with Loeys-Dietz syndrome.
- (3) Dr. Guerrerio was able to find convincing evidence suggesting that food allergies might be able to be prevented by the disruption of a single gene.
- (4) The research being conducted by Dr. Guerrerio was the first to propose that a connection exists between the immune system and the TGF-beta protein.

第4問 Read the article and answer the questions that follow.

Studies show that holding hands can reduce pain and buffer stressful experiences. But its impact on brain activity suggests something more profound is going on. “If you really understand hand-holding — what it is and how it has its effects — you begin to understand just about every single facet of what it is to be a human being,” said James Coan, a clinical psychologist and director of the Virginia Affective Neuroscience Laboratory at the University of Virginia. “It expresses all the things that we are for each other.”

Coan and his team have conducted several experiments on the effects of holding hands. The first set involved 16 married women who were placed in an MRI brain scan and confronted with the threat of an electric shock. The brain scans showed that when these women held a stranger’s hand, it lowered the stress of being shocked.

But the effect was even more pronounced when they held their husbands’ hands. Notably, the quality of the relationship mattered too. The benefit of holding hands was strongest among women with the highest scores on marital quality tests. Later studies showed reduced stress in other kinds of relationships, including people who were dating or were just friends.

According to Coan, the findings suggest that holding hands actually helps the brain unload the work of confronting stress. So when you hold a loved one’s hand in a difficult time, it’s like you’re (あ) them.

During the experiments, Coan and his team kept bumping into an odd finding. Emotional regulation had been established by many in the field to be managed by the prefrontal cortex. It’s the part of the brain that helps us control our instincts and see reason — telling you, “Relax, it’s only a movie!” when you’re watching a horror film, Coan explained.

Coan hypothesized that holding the hand of someone close to them would cause an increase in activity in the prefrontal cortex as the participant relaxed and felt more secure. With more activity in the prefrontal cortex, he thought, less emotional activity — like those involved in fear or anxiety — would occur elsewhere in the brain.

But that’s not what happened. When couples held hands, Coan did observe a decrease in all the emotional regions of the brain as he had expected. However, in experiment after experiment, there was no associated increase in prefrontal cortex activity — instead, there was a decrease.

At first, Coan couldn’t account for what part of the brain was responsible for the participants’ stress relief when they held hands. It was as if people were getting snacks out of the vending machine without paying any money.

Finally, he arrived at a new conclusion: What if he had gotten the baseline and experimental states backward? Maybe the brain didn’t perceive holding hands as something new he was adding to a baseline of being alone. What if our neuropsychological baseline was feeling connected to someone? Perhaps feeling alone was the deviation all along — one that would require the metabolically expensive activation of our prefrontal cortex to cope.

“To the human brain, the world presents a series of problems to solve,” Coan said. “And it turns out (い) is a problem.” He called this phenomenon social baseline theory: It’s the idea that the human brain expects access to relationships and interdependence because without them, the world’s problems are mammoth and we need to expend so much more physiological and psychological effort. But when we know we’re in a relationship — as is conveyed through holding hands — it’s as if we can access snacks freely with no vending machine at all.

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注	buffer: ~を緩和する	facet: 面	marital: 夫婦間の
	bump into: ~に遭遇する	prefrontal cortex: 前頭前皮質	baseline: 基準
	deviation: 逸脱	physiological: 生理学的な	

問 1. Based on the context of the article, which word best fits (あ)? Write the number of your answer in [20].

- | | |
|-----------------------------|--------------------------------|
| (1) conveying messages to | (2) learning more deeply about |
| (3) predicting reactions by | (4) sharing the burden with |

問 2. Based on the context of the article, which word best fits (い)? Write the number of your answer in [21].

- | | |
|-------------------|--|
| (1) being alone | (2) decreased emotional activity |
| (3) holding hands | (4) increased prefrontal cortex activity |

問 3. Which statement is closest to what is mentioned in this article? Write the number of your answer in [22].

- (1) Coan expected there would be more activity in the prefrontal cortex when a person held hands with someone who is close to that person.
- (2) Coan found that the benefits of hand holding were consistent among married couples regardless of the reported quality of their marriage.
- (3) Coan’s research revealed that levels of stress reduction remained similar when women held the hand of their spouse and a stranger.
- (4) Coan’s study showed that the regions of brain associated with emotional activity were more active when couples were holding hands.

この後の第5問と第6問は記述用解答用紙に解答しなさい。

第5問 次の英文を読み、後の問いに答えなさい。

The strongest solar flare in recorded history burst into Earth's atmosphere in 1859, bathing both hemispheres in brilliantly colorful auroras as it wreaked worldwide havoc on telegraph systems. The celestial chaos was broadly witnessed, but lingering physical evidence of that storm, called the Carrington event, has proven stubbornly elusive — until now, researchers report in the March 16 *Geophysical Research Letters*.

【 あ 】

Ecologist Joonas Uusitalo of the University of Helsinki and his colleagues have identified the first known traces of the Carrington event: atoms of carbon-14 preserved in tree rings in Finland's far north. Scientists previously hadn't detected tree ring evidence of this event, although other trees have recorded more powerful solar flares that occurred before modern recordkeeping began, such as in 774 and 993.

Those storms were perhaps 10 times more intense than the one in 1859, Uusitalo says, so it makes sense that they'd leave a stronger signal. Also, he says, the trees in which scientists have previously hunted for clues to the Carrington event have all been located in the mid-latitudes — for example, in Japan, Europe or the United States. But “based on our earlier research, we had this idea that maybe the polar trees are more sensitive to less powerful storms.”

【 い 】

So Uusitalo's team examined rings from three trees at different sites within the Lapland region of Finland, above the Arctic Circle, as well as rings from three trees from the mid-latitudes. These rings all dated between 1853 to 1871. The team found a statistically significant increase in carbon-14 in the polar trees compared with those in the mid-latitudes during the year of the Carrington event. That suggests it is possible to use polar tree rings to detect moderate-sized solar storms.

Solar flares are bursts of particles that swiftly stream from the sun toward Earth. As the particles enter the stratosphere, they react with atmospheric molecules to produce carbon-14, normally produced by the interaction of cosmic rays with atmospheric nitrogen. Researchers have hypothesized that that extra burst of carbon-14 from the solar particles eventually makes its way to the Earth's lowest atmospheric layer, the troposphere, where it is drawn into the tissue of living trees, preserving a record of the solar flare.

【 う 】

Scientists previously thought that the carbon-14 would mix quickly into the atmosphere, and by the time it reaches the surface, it would be evenly distributed among trees at different latitudes. But recent studies suggest that in the Arctic, there's faster air exchange between the stratosphere and the troposphere than at lower latitudes, Uusitalo says. So trees closer to the poles could receive a slightly bigger infusion of the carbon-14 than those in the mid-latitudes, making them better sensors for relatively weaker storms.

Using polar trees could give researchers more insight into how common more moderate solar storms are, Uusitalo says. Historical archives suggest that there were also flares in 1582, 1730 and 1770 that, so far, haven't shown traces in mid-latitude tree rings. His team now plans to look for them closer to the north pole.

【 え 】

The finding could be “hugely important” for scientists’ understanding of radiocarbon spikes in the tree ring record, says physicist Benjamin Pope of the University of Queensland in St. Lucia, Australia. “It has always been a problem for us that the biggest-ever flare from the sun observed during the modern scientific era — the Carrington event of 1859 — doesn’t even show up in the radiocarbon record,” he says.

Pope and his colleagues recently questioned whether solar flares were even responsible for the Miyake events. If the new findings hold up, they lend a new line of support to the link between Miyake events and solar storms. Still, Pope notes, this study’s findings are based just on three trees in polar regions, and replicating those results with other high-latitude trees will be essential before drawing any conclusions.

【 お 】

Either way, he says, “I want to emphasize the importance of studying high-latitude trees.” Because scientists tend to analyze trees closer to where they live, most measurements come from the mid-latitudes. But, as this study hints, the trees of the far north may guard many secrets about the intertwined history of Earth and the sun.

Source: Carolyn Gramling, Science News, April 9, 2024. Used with permission.

- 注 solar flare: 太陽フレア (太陽表面の爆発現象で、大規模なフレアが地球に被害を及ぼす現象が太陽嵐)
 wreak havoc on: ～に甚大な被害を及ぼす
 stratosphere: 成層圏 troposphere: 対流圏
 radiocarbon: 放射性炭素 spike: 急増
 intertwine: ～を絡み合わせる
 elusive: 見つけにくい
 infusion: 注入
 replicate: ～を再現する

問 1. Uusitalo は「木はその生息地の緯度によって太陽嵐に対する反応が異なる」という仮説を立てた。この仮説に関して、以下の問いに日本語で答えなさい。

(i) Uusitalo はこの仮説の実証につながるどのような発見をしたのか。

(ii) 太陽嵐に対する反応の違いをもたらす原因として考えられることを述べなさい。

問 2. 研究者によると、太陽嵐が生じた場合に炭素 14 はどのような過程でその記録を残すのか、本文の内容に即して日本語で答えなさい。

問 3. Uusitalo の研究結果が太陽嵐と炭素 14 の急増の関連性を示唆するとしても、他の研究者は今後どのような研究の必要があると述べているか、本文の内容に即して日本語で答えなさい。

問 4. 次の段落は本文のどの位置に置くのが最も適切か、【あ】～【お】の記号で答えなさい。

These carbon-14 spikes in tree rings are known as Miyake events, after physicist Fusa Miyake of Nagoya University in Japan, who first connected the observed spikes to solar storms. Miyake is a coauthor on the new study.

注 spike: 急増

第6問 次の英文を読み、下線部(1)～(3)の内容を英語にしなさい。

Omega 3 is a type of fat. Small amounts of omega 3 fats are essential for good health, and they can be found in the food that we eat. The main types of omega 3 fatty acids are; alphalinolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). ALA is normally found in fats from plant foods, such as nuts and seeds (walnuts and rapeseed are rich sources). EPA and DHA, collectively called long-chain omega 3 fats, are naturally found in fatty fish, such as salmon and fish oils including cod liver oil.

(1)オメガ3脂肪酸は心臓病の予防に効果があると一般的に信じられているため、それを多く摂取することは広く世界規模で推進されている。 There is more than one possible mechanism for how they might help prevent heart disease, including reducing blood pressure or reducing cholesterol. Omega 3 fats are readily available as over-the-counter supplements and they are widely bought and used.

A new Cochrane systematic review, published today in the Cochrane Library, combines the results of seventy-nine randomised trials involving 112,059 people. These studies assessed effects of consuming additional omega 3 fat, compared to usual or lower omega 3, on diseases of the heart and circulation. Twenty-five studies were assessed as highly trustworthy because they were well designed and conducted.

The studies recruited men and women, some healthy and others with existing illnesses from North America, Europe, Australia and Asia. Participants were randomly assigned to increase their omega 3 fats or to maintain their usual intake of fat for at least a year. (2)ほとんどの研究では、長鎖オメガ3サプリメントをカプセル形で与えることの影響が調査され、それと偽の錠剤との比較がなされた。 Only a few assessed whole fish intake. Most ALA trials added omega 3 fats to foods such as margarine and gave these enriched foods, or naturally ALA-rich foods such as walnuts, to people in the intervention groups, and usual (non-enriched) foods to other participants.

(3)Cochrane の研究者らによると、彼らが調べた研究結果の大半において、長鎖オメガ3脂肪酸摂取量増加による恩恵はほとんど得られていなかった。 They found high certainty evidence that long-chain omega 3 fats had little or no meaningful effect on the risk of death from any cause. The risk of death from any cause was 8.8% in people who had increased their intake of omega 3 fats, compared with 9% in people in the control groups.