

令和 5 (2023) 年度入学者選抜個別学力検査問題

外 国 語

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1. 監督者の指示があるまで、この冊子を開いてはいけません。
2. 問題冊子は、全部で9ページあり、第1～3ページは下書用紙です。下書用紙は切り離してはいけません。
3. 問題は、冊子の間にはさみこんであります。
4. 解答用紙は、問題冊子と別に印刷されているので、誤らないように注意しなさい。
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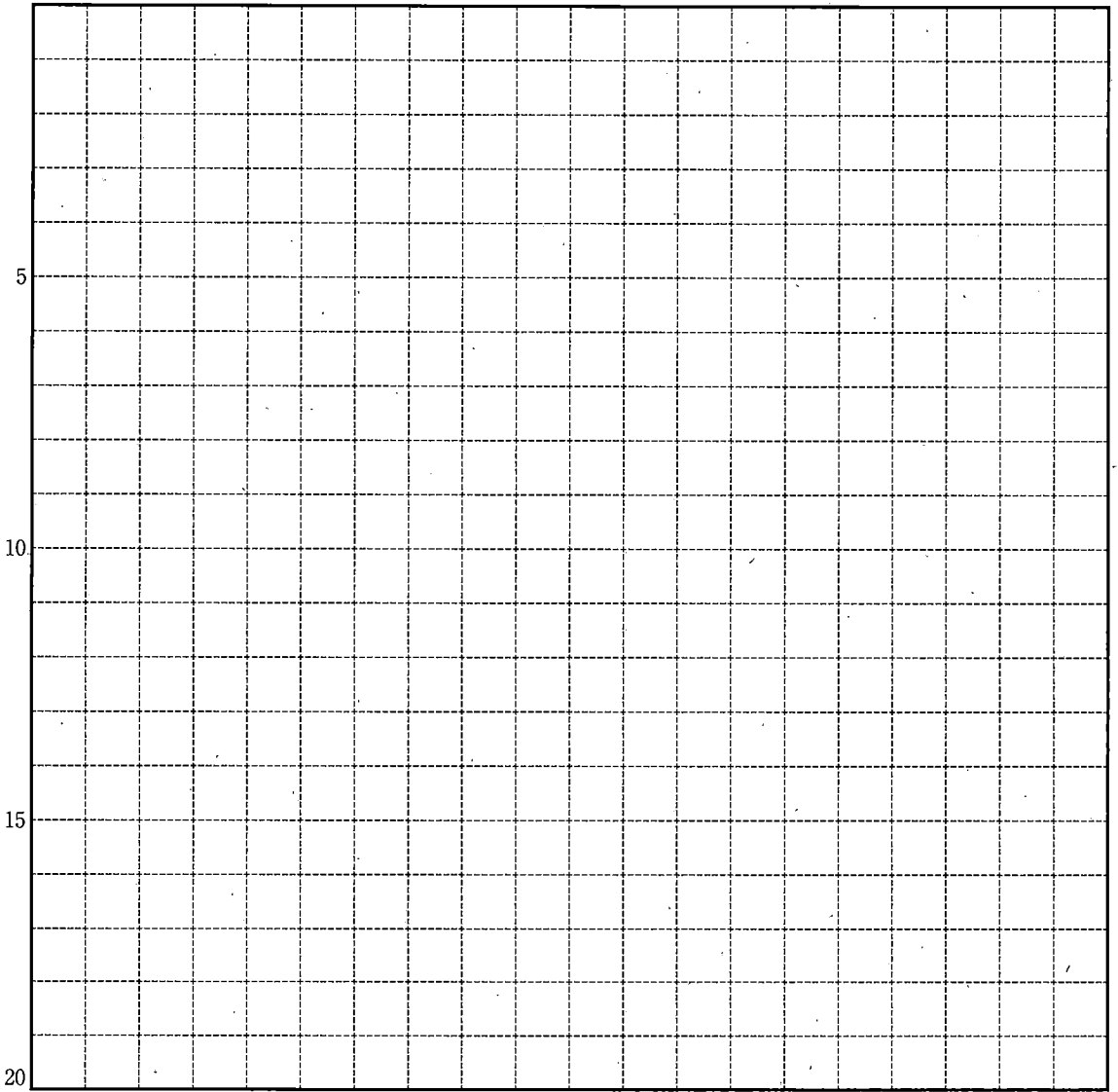
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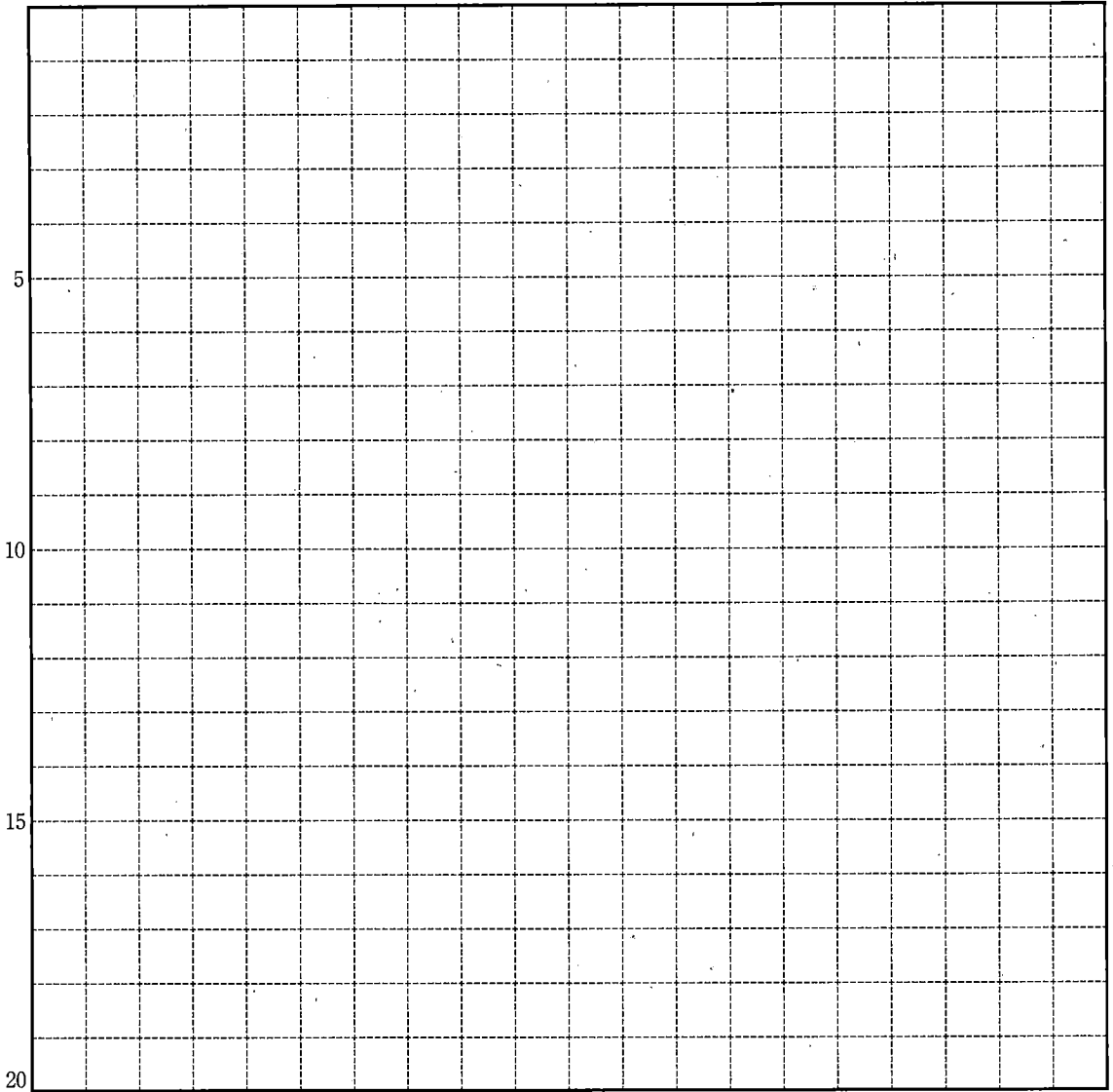
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外 国 語

次の英文は *Knowable Magazine* (2022年4月28日) に掲載された “The awake ape: Why people sleep less than their primate relatives” (Elizabeth Preston) 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。

On dry nights, the San hunter-gatherers of Namibia often sleep under the stars. They have no electric lights or new Netflix releases keeping them awake. Yet when they rise in the morning, they haven't gotten any more hours of sleep than a typical Western city-dweller who stayed up doom-scrolling on their smartphone.

Research has shown that people in non-industrial societies — the closest thing to the kind of setting our species evolved in — average less than seven hours a night, says evolutionary anthropologist David Samson at the University of Toronto Mississauga. That's a surprising number when you consider our closest animal relatives. Humans sleep less than any ape, monkey or lemur that scientists have studied. Chimps sleep around 9.5 hours out of every 24. Cotton-top tamarins sleep around 13. Three-striped night monkeys are technically nocturnal, though really, they are hardly ever awake — they sleep for 17 hours a day.

1) Samson calls this *discrepancy* the human sleep paradox. “How is this possible, that we're sleeping the least out of any primate?” he says. Sleep is known to be important for our memory, immune function and other aspects of health. A predictive model of primate sleep based on factors such as body mass, brain size and diet concluded that humans ought to sleep about 9.5 hours out of every 24, not seven. “Something weird is going on,” Samson says.

Research by Samson and others in primates and non-industrial human populations has revealed the various ways that human sleep is unusual. We spend fewer hours asleep than our nearest relatives, and more of our night in the phase of sleep known as rapid eye movement, or REM. The reasons for our strange sleep habits are still up for debate but can likely be found in the story of how we became human.

* * *

Millions of years ago, our ancestors lived, and probably slept, in trees. Today's chimpanzees and other great apes still sleep in temporary tree beds or platforms. They bend or break branches to create a bowl shape, which they may line with leafy twigs. (Apes such as gorillas sometimes also build beds on the ground.)

Our ancestors transitioned out of the trees to live on the ground, and at some point started sleeping there too. This meant giving up all the perks of arboreal sleep, including relative safety from predators like lions.

Fossils of our ancestors don't reveal how well-rested they were. So to learn about how ancient humans slept, anthropologists study the best proxy they have: *contemporary* non-industrial societies.

"It's an amazing honor and opportunity to work with these communities," says Samson, who has worked with the Hadza hunter-gatherers of Tanzania, as well as with various groups in Madagascar, Guatemala and elsewhere. Study participants generally wear a device called an Actiwatch, which is similar to a Fitbit with an added light sensor, to record their sleep patterns.

Gandhi Yetish, a human evolutionary ecologist and anthropologist at the University of California, Los Angeles, has also spent time with the Hadza, as well as the Tsimane in Bolivia and the San in Namibia. In a 2015 paper, he *assessed* sleep across all three groups and found that they averaged between only 5.7 and 7.1 hours.

Humans, then, seem to have evolved to need less sleep than our primate relatives. Samson showed in a 2018 analysis that we did this by lopping off non-

REM time. REM is the sleep phase most associated with vivid dreaming. That means, assuming other primates dream similarly, we may spend a larger proportion of our night dreaming than they do. We're also flexible about when we get those hours of shut-eye.

To tie together the story of how human sleep evolved, Samson *laid out* what he calls his social sleep hypothesis in the 2021 *Annual Review of Anthropology*. He thinks the evolution of human sleep is a story about safety — specifically, safety in numbers. Brief, flexibly timed REM-dense sleep likely evolved because of the threat of predation when humans began sleeping on the ground, Samson says. And he thinks another key to sleeping safely on land was snoozing in a group.

“We should think of early human camps and bands as like a snail’s shell,” he says. Groups of humans may have shared simple shelters. A fire might have kept people warm and bugs away. Some group members could sleep while others kept watch.

“Within the safety of this social shell, you could come back and catch a nap at any time,” Samson imagines. (He and Yetish differ, however, on the prevalence of naps in today’s non-industrial groups. Samson reports frequent napping among the Hadza and a population in Madagascar. Yetish says that, based on his own experiences in the field, napping is infrequent.)

Samson also thinks these sleep shells would have *facilitated* our ancient ancestors’ journey out of Africa and into colder climates. In this way, he sees sleep as a crucial subplot in the story of human evolution.

* * *

It makes sense that the threat of predators may have led humans to sleep less than tree-living primates, says Isabella Capellini, an evolutionary ecologist at Queen’s University Belfast in Northern Ireland. In a 2008 study, she and her colleagues found that mammals at greater risk of predation sleep less, on average.

But Capellini isn’t sure that human sleep is as different from that of other primates as it seems. She points out that existing data about sleep in primates

come from *captive* animals. “We still don’t know much about how animals sleep in the wild,” she says.

5) In a zoo or lab, animals might sleep less than is natural, because of stress. Or they might sleep more, Capellini says, “just because animals are that bored.” And the standard laboratory conditions — 12 hours of light, 12 hours of dark — might not match what an animal experiences in nature throughout the year.

Neuroscientist Niels Rattenborg, who studies bird sleep at the Max Planck Institute for Ornithology in Germany, agrees that Samson’s narrative about the evolution of human sleep is interesting. But, he says, “I think it depends a lot on whether we have measured sleep in other primates accurately.”

And there’s reason to suspect we haven’t. In a 2008 study, Rattenborg and colleagues attached EEG devices to three wild sloths and found that the animals slept about 9.5 hours per day. An earlier study of captive sloths, on the other hand, had recorded nearly 16 daily hours of sleep.

Having data from more wild animals would help sleep researchers. “But it’s technically challenging to do this,” Rattenborg says. “Although sloths were compliant with the *procedure*, I have a feeling primates would spend a lot of time trying to take the equipment off.”

If scientists had a clearer picture of primate sleep in the wild, it might turn out that human sleep isn’t as *exceptionally* short as it seems. “Every time there is a claim that humans are special about something, once we start having more data, we realize they’re not that special,” Capellini says.

* * *

Yetish, who studies sleep in small-scale societies, has collaborated with Samson on research. “I do think that social sleep, as he describes it, is a solution to the problem of maintaining safety at night,” Yetish says. However, he adds, “I don’t think it’s the only solution.”

He notes that the Tsimane sometimes have walls on their houses, for example, which would provide some safety without a human lookout. And Yetish has had

people in the groups he studies tell him in the morning exactly which animals they heard during the night. Sounds wake most people at night, *offering* another possible layer of protection.

Sleeping in groups, predator threats or not, is also a natural extension of the way that people in small-scale societies live during the day, Yetish says. “In my opinion, people are almost never alone in these types of communities.”

Yetish describes a typical evening with the Tsimane: After spending the day working on various tasks, a group comes together around a fire while food is cooked. They share a meal, then linger by the fire in the dark. Children and mothers gradually move away to sleep, while others stay awake, talking and telling stories.

And so Yetish suggests that ancient humans may have traded some hours of sleep for sharing information and culture around a dwindling fire. “You’ve suddenly made these darkness hours quite productive,” he says. Our ancestors may have compressed their sleep into a shorter period because they had more important things to do in the evenings than rest.

How much we sleep is a different question, of course, from how much we wish
(1) we slept. Samson and others asked Hadza study participants how they felt about their own sleep. Out of 37 people, 35 said they slept “just enough,” the team reported in 2017. The average amount they slept in that study was about 6.25 hours a night. But they awoke frequently, needing more than 9 hours in bed to get those 6.25 hours of shut-eye.

By contrast, a 2016 study of almost 500 people in Chicago found they spent nearly all of their time in bed actually asleep, and got at least as much total sleep as the Hadza. Yet almost 87 percent of respondents in a 2020 survey of U.S. adults said that on at least one day per week, they didn’t feel rested.

Why not? Samson and Yetish say our sleep problems may have to do with stress or out-of-whack circadian rhythms. Or maybe we’re missing the crowd we evolved to sleep with, Samson says. When we struggle to get sleep, we could be

experiencing a mismatch between how we evolved and how we live now. “Basically we’re *isolated*, and this might be influencing our sleep,” he says.

A better understanding of how human sleep evolved could help people rest better, Samson says, or help them feel better about the rest they already get.

“A lot of people in the global North and the West like to problematize their sleep,” he says. But maybe insomnia, for example, is really hypervigilance — an evolutionary superpower. “Likely that was really adaptive when our ancestors were sleeping in the savannah.”

Yetish says that studying sleep in small-scale societies has “completely” changed his own perspective.

“There’s a lot of conscious effort and attention put on sleep in the West that is not the same in these environments,” he says. “People are not trying to sleep a certain amount. They just sleep.”

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).

discrepancy

- | | | |
|---------------|---------------|--------------|
| a) complexity | b) difference | c) evolution |
| d) fact | e) finding | |

contemporary

- | | | |
|---------------|--------------|------------|
| a) accessible | b) agreeable | c) current |
| d) rural | e) stable | |

assessed

- | | | |
|-------------|----------------|-----------|
| a) analyzed | b) controlled | c) linked |
| d) selected | e) wrote about | |

laid out

- | | | |
|--------------|---------------|--------------|
| a) corrected | b) criticized | c) explained |
| d) explored | e) withdrew | |

facilitated

- | | | |
|--------------|--------------|-------------|
| a) admitted | b) eased | c) inspired |
| d) prevented | e) prolonged | |

captive

- | | | |
|------------|---------------|-----------|
| a) anxious | b) available | c) boring |
| d) caged | e) researched | |

procedure

- | | | |
|-------------|---------------|-----------------|
| a) decision | b) experience | c) interruption |
| d) machines | e) process | |

exceptionally

- | | | |
|------------------|--------------|----------------|
| a) arguably | b) seemingly | c) technically |
| d) unfortunately | e) unusually | |

offering

- | | | |
|--------------|----------------|-------------|
| a) covering | b) eliminating | c) limiting |
| d) providing | e) requiring | |

isolated

- | | | |
|----------------|--------------|------------|
| a) alone | b) confused | c) fearful |
| d) intelligent | e) unhealthy | |

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) there | 3) they |
| 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) Since the San hunter-gatherers of Namibia do not have electric lights or Netflix, they sleep longer than typical Western city-dwellers.
- 2) Chimpanzees sleep less per 24 hours than cotton-top tamarins.
- 3) Three-striped night monkeys sleep longer than any other primate mentioned in the article.
- 4) A predictive model of primate sleep suggests humans should get as much sleep as chimps typically get.
- 5) It is implied that scientists cannot use fossil evidence to estimate the sleeping hours of humans who lived millions of years ago.
- 6) In order to participate in a study to record their sleep patterns, the Hadza hunter-gatherers of Tanzania lived together with people from Madagascar and Guatemala.
- 7) Gandhi Yetish's 2015 study results suggest that Hadza, Tsimane and San communities got more sleep than most primates.
- 8) The 2015 paper revealed that the Hadza people in Tanzania sleep less than other contemporary non-industrial societies.
- 9) The article suggests that humans spend a greater percentage of their time at night dreaming than other primates do.

- 10) According to the article, in a 2018 analysis David Samson showed that other primates do not have vivid dreams.
- 11) Samson's research suggests that humans began spending more of their sleeping time in REM sleep after they stopped sleeping in trees.
- 12) Samson's social sleep hypothesis suggests that people began to sleep longer when they started sleeping in groups.
- 13) Samson's research indicates that humans constructed hard shell-like shelters to keep away predators and enable group sleep.
- 14) According to the article, not all researchers agree that napping is infrequent among non-industrial communities.
- 15) Based on a 2008 study by Isabella Capellini and her colleagues, it is reasonable to conclude that lions sleep less than zebras.
- 16) Capellini implies that we have little understanding of the sleep habits of wild animals.
- 17) Niels Rattenborg found that wild sloths sleep more than 6 hours longer than captive sloths per day.
- 18) Rattenborg could not get reliable data regarding wild primates' sleeping hours because they spent so much time taking their devices off.
- 19) Yetish says that people in small-scale societies spend most of their time in company with other people.
- 20) Yetish proposes that our ancestors' sleeping hours may have been reduced to allow more time for sharing information.
- 21) The article implies that the Hadza stay in bed longer than 6.25 hours.
- 22) A 2016 study of people in Chicago revealed a tendency for them to spend too much time in bed awake.
- 23) Samson seems to think that the sleeping disorder insomnia is not a problem from an evolutionary perspective.
- 24) According to Yetish, people in small-scale societies should pay more attention to sleep.

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) Summarize the “human sleep paradox.”
- 2) What are some reasons why captive animals might sleep differently than they do in the wild?
- 3) According to Yetish, what are solutions to the problem of maintaining safety at night in small-scale societies, besides social sleep?

全学科

5 下線部(ア)と(イ)を日本語に訳しなさい。

全学科

6 人間の睡眠に関わる変化や特徴について、この記事の著者が述べていることを、以下のキーワードすべてを用いて日本語で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)

進	化
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※英数字は2文字で1マスとすること。

進化

レム睡眠

集団