2021年度
大学院理工学研究科【環境共生工学専攻】博士前期課程
一般選抜試験(第Ⅱ期)問題

英　　語

開始時刻　午前10時00分
終了時刻　午前11時00分

【注意事項】

1．答案用紙には、氏名を必ず記入してください。
2．配布された答案用紙は試験が終了したら、必ず提出してください（問題用紙は提出しなくてよい）。

問１：次の文章を読んで、下の問い（１）～（５）に答えなさい。

In the last decade, researchers have done a lot of work showing that animals can pick up and share each other's emotions, particularly fear, says Monique Smith, a neuroscientist at Stanford University. She and colleagues published their new findings on pain and relief. (a)Investigating these building blocks of empathy in animals can help researchers understand human empathy, Smith says, and may someday lead to treatments for disorders that affect the ability to be sensitive to the feelings and experiences of other people.

In experiments on pairs of mice, one mouse received an injection that caused arthritis*-like inflammation* in one hind paw while the other mouse was unharmed. After hanging out together for an hour, (b)"the bystander has it worse than the mouse that got the injection," says Jeffrey Mogil, a neuroscientist at McGill University in Montreal who was not part of the work. Injected mice acted as though one paw is in pain, as expected, showing extra sensitivity to being prodded there with a plastic wire. Their uninjured companions also showed heightened sensitivity, and in both hind paws. Those mice act as though they're in the same amount of pain and in more places, Mogil says. "The behavior is astounding."

The transfer of other emotions between mice may rely on different brain connections. The researchers examined how mice feel each other's fear in experiments where mice saw other mice receive an electric shock. The team found that fear transfer relied on connections from the anterior cingulate cortex* to part of the amygdala*, a region known to respond to fear. That suggests that different processes in the brain are involved in different types of empathy. (c) But the differences may also be linked to how mice sense their fellows' emotions, Mogil says. In the pain and pain relief experiments, mice spend time together sniffing each other, and odors can contain clues to the animals' feelings. But in the tests on fear, visual cues conveyed animal emotions.

(d) "Not surprisingly, the circuits that they're looking at are remarkably similar to some of these processes in humans," says Jules Panksepp, a social neuroscientist at the University of Wisconsin–Madison who was not part of the study. Both mice and humans share a connectedness with their compatriots in emotional situations, he says, and research points to a shared evolutionary basis for empathy.

If scientists can home in on the neurochemicals that foster empathic processes, Panksepp says, they may be able to design drugs to treat conditions, [E] psychopathy or social personality disorders, that cause empathy to go awry.

(Source: Modified from Carolyn Wilke, "Mice may 'catch' each other's pain — and pain relief", Science News, January 12, 2021.)

* arthritis 関節炎, inflammation 炎症, anterior cingulate cortex 前側帯状皮質, amygdala 扁桃体

（１）下線部 (a) を和訳しなさい。

（２）下線部 (b) の "the bystander has it worse than the mouse that got the injection," とは何を意味しているのか説明しなさい。

（３）下線部(c)の文は具体的に何を指しているのか説明しなさい。

（４）下線部(d)で、なぜこの研究者は“Not surprisingly”と述べたと考えられるか、文脈を読み取って説明しなさい。

（５）文章中の［　E　］に入る最も適切な語句を、次のi.～iv.のうちから一つ選びなさい。

i. such as　　ii. causing　　iii. mimicking　　iv. supporting

問２：次の文章を読んで、下の問い（１）～（５）に答えなさい。

Housebound by a pandemic, humanity slowed its emissions of greenhouse gases in 2020. The annual update of global surface temperatures shows 2020 essentially tied records set in 2016; about 1.25°C warmer than in preindustrial times. But the years were nothing alike. [a]Temperatures in 2016 were boosted by a strong El Niño, a weather pattern that warms the globe by blocking the rise of cold deep waters in the eastern Pacific Ocean. Last year, however, the Pacific entered La Niña, which has a cooling effect. That La Niña didn't provide more relief is an unwelcome surprise, says Nerilie Abram, a climate scientist at Australian National University.

The past 6 years are the six warmest on record, but the warming of the atmosphere is unsteady because of its chaotic nature. The ocean, which absorbs more than 90% of the heat from global warming, displays a steadier trend, and here, too, 2020 was a record year. [b]The upper levels of the ocean contained 20 zettajoules (10^{21} joules) more heat than in 2019, and the rise was double the typical annual increase. The subtropical Atlantic Ocean was particularly hot, fueling a record outbreak of hurricanes, says Lijing Cheng, a climate scientist at the Chinese Academy of Sciences Institute.

This captured heat is spreading deeper into the ocean while also migrating toward the poles. [c]For the first time, warm Atlantic waters were seen penetrating into the Arctic Ocean, melting sea ice from below and reducing its extent nearly to a record low. The warming ocean and melting ice sheets are raising sea levels by 4.8 millimeters per year, and the rate is accelerating.

On land, 2020 was even more relentless, with temperatures rising 1.96°C above preindustrial levels, a clear record, Berkeley Earth reported. It was the warmest year ever in Asia and Europe and tied for the warmest in South America. Russia was particularly hot, breaking its previous record by 1.2°C, while swaths of Siberia were 7°C warmer than in pre-industrial times, leading to large-scale fires and thawing permafrost that caused buildings to founder and set off oil spills.

[d]Although the global economic slowdown of the COVID-19 pandemic cut carbon dioxide (CO_2) emissions by some 7%, atmospheric CO_2 is long-lived, and warming from previous emissions is preordained. In any case, the drop in emissions is unlikely to last. [e]Later this year, in May, before photosynthesis in the Northern Hemisphere draws down CO_2, the United Kingdom's national weather service (U.K. Met Office) predicts that levels of atmospheric CO_2 will pass 417 parts per million for several weeks, 50% higher than preindustrial levels. Only dramatic action by the world's countries, far beyond existing efforts, can begin to halt this build up, Cheng says.

[Source: Modified from Paul Voosen, "Global temperatures in 2020 tied record highs", *Science*, 371(6527), 334-335]

（1）下線 (a) で、2016 年と 2020 年の違いを説明しなさい。

（2）下線部 (b) を和訳しなさい。

（3）下線部 (c) を和訳しなさい。

（4）下線 (d) で、なぜ 2020 年の CO_2 排気の 7％減少は続かないのか説明しなさい。

（5）下線 (e) で、二酸化炭素は何によっていつ減少すると言われているか説明しなさい。

問 3 ：次の語群から<u>1つだけ</u>を選び、その概要を英語で説明しなさい。少なくとも 50 語以上書くこと。

（1）バイオ・エネルギー(Biomass energy)
（2）炭素循環(Carbon cycle)
（3）光合成 (Photosynthesis)
（4）細胞説 (Cell theory)
（5）水の性質　(Properties of water)
（6）酵素活性 (Enzyme activity)