

外 国 語

(英 語)

90 分

注 意 事 項

1. 試験開始の合図までこの冊子を開かないこと。
2. 本問題冊子は 11 ページ、答案用紙は 2 ページである。
3. 各答案用紙の上の枠内には、**受験番号**を記入し、その右側の枠内には、**受験番号の下 2 桁の数字**を忘れずに記入すること。
4. 解答はすべて各答案用紙の所定の欄に記入すること。
5. 答案用紙の冊子は切りはなさないこと。
6. 答案用紙に記入する受験番号の数字の字体は、下記の例にならい、明瞭に記入すること。

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I 次の英文を読んで、以下の設問に答えよ。(80点)

My professional introduction to academia happened in the early 1980s, during my college years, when I volunteered at the American Museum of Natural History in New York City. Aside from the excitement of working behind the scenes in the collections of the museum, one of the most memorable experiences was attending their raucous weekly seminars. Each week a speaker would come to present some esoteric study on natural history. Following the presentation, often a fairly low-key affair, the listeners would pick the talk apart point by point. It was merciless. Frequently, these debates would devolve into shouting sessions with all the high dudgeon and operatic pantomime of an old silent movie, complete with shaken fists and stomped feet.

Here I was, in the hallowed halls of academe, listening to seminars on taxonomy. You know, taxonomy — the science of naming species and organizing them into the classification scheme that we all memorized in introductory biology. I could not imagine a topic less relevant to everyday life, let alone one less likely to lead eminent senior scientists into apoplexy and the loss of much of their human dignity. The injunction “Get a life” could not have seemed more apt.

The irony is that I now see why they got so worked up. I didn’t appreciate it at the time, but they were debating one of the most important concepts in all of biology. It may not seem earth-shattering, but this concept lies at the root of how we compare different creatures — a human with a fish, or a fish with a worm, or anything with anything else. It has led us to develop techniques that allow us to trace our family lineages, identify criminals by means of DNA evidence, understand how the AIDS virus became dangerous, and even track the spread of flu viruses throughout the world. Once we grasp this concept, we see the meaning of the fish, worms, and bacteria that lie inside of us.

The articulation of truly great ideas, of the laws of nature, begins with simple premises that all of us see every day. From simple beginnings, ideas like

these extend to explain the really big stuff, like the movement of the stars or the workings of time. In that spirit, I can share with you one true law that all of us can agree upon. This law is so profound that most of us take it completely for granted. Yet it is the starting point for almost everything we do in paleontology, developmental biology, and genetics.

This biological “law of everything” is that every living thing on the planet had parents.

Every person you’ve ever known has biological parents, as does every bird, salamander, or shark you have ever seen. Technology may change this, thanks to cloning or some yet-to-be invented method, but so far the law holds. To put it in a more precise form: every living thing sprang from some parental genetic information. This formulation defines parenthood in a way that gets to the actual biological mechanism of heredity and allows us to apply it to creatures like bacteria that do not reproduce the way we do.

The extension of this law is where its power comes in. Here it is, in all its beauty: all of us are modified descendants of our parents or parental genetic information. I’m descended from my mother and father, but I’m not identical to them. My parents are modified descendants of their parents. And so on. This pattern of descent with modification defines our family lineage. It does this so well that we can reconstruct your family lineage just by taking blood samples of individuals.

Imagine that you are standing in a room full of people whom you have never seen before. You are given a simple task: 部屋の中のそれぞれの人があなたとどのくらい近い関係にあるかを調べなさい。 How do you tell who are your distant cousins, your super-distant cousins, your great-granduncles seventy-five times removed?

To answer this question, we need a biological mechanism to guide our thinking and give us a way to test the accuracy of our hypothesized family tree. This mechanism comes from thinking about our law of biology. Knowing how

descent with modification works is key to unlocking biological history, because descent with modification can leave a signature, which we can detect.

Let's take a hypothetical humorless, quite unclown-like* couple who have children. One of their sons was born with a genetic mutation** that gave him a red rubber nose that squeaks. This son grows up and marries a lucky woman. He passes his mutated nose gene to his children, and they all have his red rubber nose that squeaks. Now, suppose one of his offspring gets a mutation that causes him to have huge floppy feet. When this mutation passes to the next generation, all of his children are like him: they have a red rubber nose that squeaks and huge floppy feet. Go one generation further. Imagine that one of these kids, the original couple's great-grandchild, has another mutation: orange curly hair. When this mutation passes to the *next* generation, all of his children will have orange curly hair, a rubber nose that squeaks, and giant floppy feet. When you ask "Who is this bozo***?" you'll be inquiring about each of our poor couple's great-great-grandchildren.

This example illustrates a very serious point. Descent with modification can build a family tree, or lineage, that we can identify by characters. It has a signature that we immediately recognize. Like a nested set of Russian dolls, our hypothetical lineage formed groups within groups, which we recognize by their unique features. The group of "full bozo" great-great-grandchildren is descended from an individual who had only the squeaky nose and the huge floppy feet. This individual was in a group of "proto-bozos," who are descended from an individual who had only the rubber nose that squeaks. This "pre-proto-bozo" was descended from the original couple, who didn't look overtly clown-like.

This pattern of descent with modification means that you could easily have hypothesized the bozo family tree without me telling you anything about it. If you had a room full of the various generations of bozos, you would have seen that all clown kin are in a group that possesses a squeaky nose. A subset of these have orange hair and floppy feet. Nested within this subset is another

group, the full bozos. The key is that the features — orange hair, squeaky nose, big floppy feet — enable you to recognize the groups. These features are your evidence for the different groups, or in this case generations, of clowns.

Replace this family circus with real features — genetic mutations and the body changes that they encode — and you have a lineage that can be identified by biological features. If descent with modification works this way, then our family trees have a signature in their basic structure. この真実は非常に強力なので、わたしたちが遺伝子のデータだけから家系図を再建する手助けとなりうる⁽⁵⁾, as we can see from the number of genealogical projects currently under way. Obviously, the real world is more complex than our simple hypothetical example. Reconstructing family trees can be difficult if traits arise many different times in a family, if the relationship between a trait and the genes that cause it is not direct, or if traits do not have a genetic basis and arise as the result of changes in diet or other environmental conditions. The good news is that the pattern of descent with modification can often be identified in the face of these complications, almost like filtering out noise from a radio signal.

But where do our lineages stop? Did the bozos stop at the humorless couple? Does my lineage stop at my great-great-grandparents? That seems awfully arbitrary. Does it stop at the first humans? Or does it continue to 3.8-billion-year-old pond scum****, and beyond? Everybody agrees that their own lineage goes back to some point in time, but just how far back is the issue.⁽⁶⁾

If our lineage goes all the way back to pond scum, and does so while following our law of biology, then we should be able to marshal evidence and make specific predictions. Rather than being a random assortment of creatures, all life on earth should show the same signature of descent with modification that we saw among the bozos. In fact, the structure of the entire geological record shouldn't be random, either. Recent additions should appear in relatively young rock layers. Just as I am a more recent arrival than my grandfather in my family tree, so the structure of the family tree of life should also have its parallels in time.

*unclown-like: not like a clown. A clown wears funny clothes, has a red nose, and does silly things to make people laugh, especially at a circus.

**genetic mutation: a change in the genetic structure of an animal or plant.

***bozo: someone who seems silly or stupid, like a clown.

****pond scum: any of various organisms that form a usually green film on the surface of stagnant water.

[Adapted from Neil Shubin, *Your Inner Fish: A Journey into the 3.5-Billion-Year History of the Human Body*, New York: Vintage Books, 2009, pp. 173-78.]

I-1. 下線部(1) “one true law” とはどのような法則か。日本語で説明せよ。

I-2. 下線部(2)を日本語に訳せ(文中の this の内容を明らかにする必要はない)。

I-3. 下線部(3)を英語に訳せ。

I-4. Look at the underlined part (4). What is the signature of a “pre-protoboza”? Answer in English.

I-5. 下線部(5)を英語に訳せ。

I-6. 下線部(6)を日本語に訳せ。

I-7. 下の(あ)から(こ)の文から、本文の内容に一致するものを3つ選べ。

(あ) When the author was a college student, he attended weekly seminars at the American Museum of Natural History, but he found the topics of the presentations dull.

- (㍁) The author could not understand why the discussions at the weekly seminars often devolved into informal talks about their favorite silent films.
- (㍂) The use of DNA evidence in identifying criminals is based on a technique developed by a group of biologists who lost their human dignity.
- (㍃) Ideas that can be developed into explanatory theories are born when scholars are focused on rare or extraordinary phenomena.
- (㍄) To have a proper understanding of your family lineage, you must be well acquainted with the way descent with modification works.
- (㍅) The example of the clown family is cited to illustrate how puzzling and mysterious the mechanism of descent with modification is.
- (㍆) You can easily tell one particular generation of bozos from the others, as they all have a squeaky nose.
- (㍇) It is not so easy to trace a family lineage in the real world, because some bodily changes are rather due to eating food different from the preceding generations.
- (㍈) Just as we improve radio reception by suppressing external noise sources, we can develop a new theory of evolution by ignoring various environmental conditions.
- (㍉) The author is very knowledgeable about geology, and advocates that the idea of descent with modification should be applied when studying the structure of the earth.

II 次の英文を読んで、以下の問いに答えよ。(70点)

Many years ago, when I was still in high school, I was extremely fond of chewing gum, especially during class hours. However, sooner or later the chewing gum would either lose its taste or I would become bored with it. After a while, I would start looking around, wondering how I could get rid of the gum nice and quietly. As you might have guessed by now, yes, I was that kid sticking his used gum underneath the desk. And as I grew older, I started noticing that I wasn't the only one deviating from the social norms that society has laid out for us. How often is it that we conveniently forget to return dirty food trays in the cafeteria? Or let our dogs poop in the park and head off before anyone has a chance to notice?

I think Thomas Jefferson was on a similar train of thought when he wrote, "Whenever you do a thing, act as if all the world were watching." I always found this to be a particularly interesting quote, as it (_____⁽¹⁾ _____). While this may seem obvious, new research points to something far less obvious: it doesn't take a fellow human being to make us feel "as if the world were watching," not even another living organism. All it takes is an image of a pair of human eyes.

A group of scientists at Newcastle University, headed by Melissa Bateson and Daniel Nettle of the Center for Behavior and Evolution, conducted a field experiment demonstrating that merely hanging up posters of staring human eyes is enough to significantly change people's behavior. Over the course of 32 days, the scientists spent many hours recording customers' "littering behavior" in their university's main cafeteria, counting the number of people that cleaned up after themselves after they had finished their meals. In their study, the researchers determined the effect of the eyes on individual behavior by controlling for several conditions (e.g. posters with a corresponding verbal text, without any text, male versus female faces, posters of something unrelated like flowers, etc.). The

posters were hung at eye-level and every day the location of each poster was randomly determined. The researchers found that during periods when the posters of eyes, instead of flowers, overlooked the diners, twice as many people cleaned up after themselves.

In fact, this research builds on a long tradition of psychologists being interested in explaining and stimulating human cooperation in matters of the collective. In technical terms, we often speak of a “social dilemma,” that is, a situation where personal interests are at odds with that of the collective. (For example, it would be easier for me to throw my trash on the ground, but if everyone thought that way, we would all be stuck with a huge pile of waste.) Robyn Dawes and colleagues showed in the 70’s that the presence of other people in the room tends to have a positive effect on people’s decision-making when faced with a social dilemma. Yet, it wasn’t until a few years ago that Terence Burnham and Brian Hare published an article in *Human Nature* that showed people make more cooperative choices in economic computer games when they are “watched” on the screen by a robot with human-like eyes. いくらか当惑しつつも、多くの研究者たちは最初の発見が正しいことを確認するために、一連の実験を行った。

Ernest-Jones, Bateson and Nettle sought to better understand the effect of staring-eyes on behavior. Part of the added value of the scientists’ current research is that the results were generated outside of the laboratory. This is important because it allowed the researchers to document naturally occurring behavior, providing greater confidence that the results obtained are not merely an artefact of experimentation. Equally important, it also served to illustrate that the effect of staring-eyes carries across a range of social behaviors.

While the researchers have convincingly illustrated that displaying a mere image of human eyes is sufficient to actually alter real-life social behavior, the real question is how. Humans (and other animals) have a dedicated neural architecture for detecting facial features, including the presence of eyes. This

built-in system, also known as “gaze detection,” served as an important evolutionary tool in ancestral environments (e.g. for detecting lurking enemies). Furthermore, the ability to function in social situations hinges on our ability to exploit social information provided by the expressions of the faces and eyes of others. What’s interesting is that this system largely involves brain areas that are not under voluntary control. Experiments have shown that people are unable⁽⁴⁾ to inhibit responses to gaze even when instructed to. This makes sense, because there is great evolutionary value in being able to quickly assess whether any predators are on the prowl; neural activation of the gaze detection system is fast and automatic. Yet this also means that it’s possible to “trick” the system and this is exactly what the new experiment has shown: objects that merely resemble human eyes are sufficient to trigger human gaze detection and subsequently alter social behavior.

These research findings are not just food for theory. Supermarkets could use cameras in the form of “blinking eyes” as a means to reduce theft, and quiet, unsafe areas might benefit from displaying pictures of human eyes. And perhaps images of angry looking eyes will also help schools win their battle against those rascals who stick used gum underneath school property.

[Adapted from Sander van der Linden, “How the Illusion of Being Observed Can Make You a Better Person,” *Scientific American*, 3 May 2011]

II-1. 下線部(1)が以下の日本語の下線部を引いた部分とほぼ同じ意味の英文になるよう、空所に適当な英語を入れよ。

「われわれは見られているとわかっている時には精一杯りっぱにふるまう傾向がある、という事実をそれはわれわれに思い起こさせるので、この引用はとも興味深いとわたしはいつも思うのである。」

II-2. 下線部(2)の指す内容を、本文中の具体例を挙げつつ、簡潔に説明せよ。

II-3. 下線部(3)を英語に訳せ。

II-4. 下線部(4)を日本語に訳せ。

II-5. Choose the correct answer to each question.

- (1) According to the text, what would be an effective strategy to encourage diners at a cafeteria to return their food trays after eating?
- (あ) Playing soothing music
 - (い) Requesting over the loudspeaker that people clean up after themselves
 - (う) Decorating the cafeteria walls with photos of people's faces
 - (え) Posting signs that say, "The world is watching"
 - (お) Painting landscape murals on the cafeteria walls
- (2) Which of the following statements could be true, according to the text?
- (あ) When people are in a group, they tend to lose their reserve.
 - (い) In some cultures, people are more sensitive to gazes than in other cultures.
 - (う) Robots will never replace humans as guards.
 - (え) People who avoid eye contact are suspicious.
 - (お) During a drought, people save water more in public than in private.
- (3) Which application of the research findings appears in the text?
- (あ) When making a bouquet, try not to use two flowers of the same color.
 - (い) To prevent shoplifting, install two camera lenses overlooking merchandise.
 - (う) Place a mirror by the kitchen table in order to lose weight.
 - (え) When you want to relax, you should wear sunglasses.
 - (お) To fall asleep more easily, remove pictures of people from around your bed.

- (4) How might gaze detection have helped ancient humans?
- (あ) It helped them depict realistic hunting scenes on cave walls.
 - (い) It helped them find footprints of animals on hunts.
 - (う) It helped them domesticate and tame wild animals.
 - (え) It helped them protect themselves from wild animals.
 - (お) It helped them determine when meat was spoiled.

II-6. Choose the phrase that best fits in the blank space, taking into consideration the context.

- (1) And as I grew older, I started noticing that I wasn't the only one _____
_____ the social norms that society has laid out for us.
- (あ) departing from
 - (い) inquiring about
 - (う) advocating for
 - (え) depending on
 - (お) campaigning against
- (2) This is important because it allowed the researchers to _____
_____, providing greater confidence that the results obtained are not
merely an artefact of experimentation.
- (あ) recruit a diverse group of research participants
 - (い) control variables in the environment
 - (う) witness the effects of weather on behavior
 - (え) record naturally occurring behavior
 - (お) conduct research at night and on weekends