

英 語

注 意

1. 問題は全部で18ページである。
2. 解答用紙に氏名・受験番号を忘れずに記入すること。(ただし、マーク・シートにはあらかじめ受験番号がプリントされている。)
3. 解答はすべて解答用紙に記入すること。
4. 問題冊子の余白等は適宜利用してよいが、どのページも切り離してはいけない。
5. 解答用紙は必ず提出のこと。この問題冊子は提出する必要はない。

マーク・シート記入上の注意

1. 解答用紙(その1)はマーク・シートになっている。HBの黒鉛筆またはシャープペンシルを用いて記入すること。
2. 解答用紙にあらかじめプリントされた受験番号を確認すること。
3. 解答する記号・番号の○を塗りつぶしなさい。○で囲んだり×をつけたりしてはいけない。

解答記入例(解答が1のとき)

1	<input checked="" type="radio"/>	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5	<input type="radio"/> 6	<input type="radio"/> 7	<input type="radio"/> 8	<input type="radio"/> 9	<input type="radio"/> 0
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4. 一度記入したマークを消す場合は、消しゴムでよく消すこと。×をつけても消したことになる。
5. 解答用紙をよごしたり、折り曲げたりしないこと。

1 次の英文を読み、以下の問いに答えなさい。

Imagine a microscopic machine that could swim through a person's blood vessels on its way to delivering medicine to a cancerous tumor. Or one that unclogs an artery to prevent a heart attack, or even performs delicate vision-saving surgery from inside the eye. These feats aren't possible yet. But researchers are designing miniature robots, called *microswimmers*, that may soon do all of these things. And more.

Imagine a robot and *Star Wars*' beloved R2-D2 may come to mind, or his pal C-3PO. The robots scientists want to deploy in the human body are much, much smaller. They're typically less than 1 millimeter (0.04 inch) in size. At their largest, they might be the size of a few grains of table salt. But they can be much smaller — so small that they can be seen only with a microscope.

The human body is made up mostly of wet stuff. Blood, spinal fluid and other liquids make up about 60 to 65 percent of the volume of the human body. So to move through this environment with ease, robots must swim. But finding the right materials and designs to send robots swimming through even the tiniest blood vessels has proven tough. But not impossible. Indeed, scientists have been inching toward this vision throughout the past decade.

The payoff should be worth the wait, says David Cappilleri. He's a microroboticist at Purdue University in West Lafayette, Ind. "Microrobots can go places that larger robots can't." ^A What's more, he argues, "they can handle tools with finer precision."

Humans don't have much experience moving things around micro-environments of the body, explains Bradley Nelson. He's a roboticist at the Swiss Federal Institute of Technology in Zurich. But some other organisms do this well. So Nelson and other robot designers are looking to them for inspiration.

12

Before scientists could create robots to swim inside the body, they first

had to solve the problem of scale. The physics of swimming changes as an object gets smaller and smaller, Nelson observes. That's because on a microscopic scale, liquids become much more *viscous*. (Viscosity is the thickness of a liquid.)

"If you were to shrink down to the size of a [microrobot] and jump into a pool of water," says Nelson, "the water wouldn't feel like water anymore. It would feel like thick honey."

That's why he and other scientists have copied some of nature's tiniest swimmers: single-celled lifeforms that infect people. These master swimmers can navigate swiftly through our bodies.

For design tips, Nelson focused on a type of microbe known as a *protozoan*. He picked the species *Trypanosoma brucei* (Try-PAN-oh-SO-mah BRU-see-eye). In people, this parasite causes African sleeping sickness. Affected people often can't sleep at night but are overcome with drowsiness by day.

T. brucei swims through the bloodstream by swishing a whiplike tail. This tail is called a *flagellum* (Fla-JEL-um).

As it moves, *T. brucei* also changes its shape. This helps it get from one part of the body to another. The protozoan can go from short and stumpy to slender and needle-like. That lets it penetrate blood vessel walls and invade the spinal cord.

Nelson liked the idea of building a microrobot with this talent for shape-shifting. Such a robot could do jobs in different parts of the body, depending on its shape. These tasks might include unclogging arteries or delivering medicines, Nelson explains. Or maybe the robot could make microscopic repairs in the blood vessels of the eye.

He used a gel-like material to build a soft microrobot. By altering the gel's temperature, he can make his robot short and stumpy or long and needle-like.

Nelson described this new design last year in the journal *Nature*

Communications.

Nelson's soft-bodied microswimmer isn't the only nano-medic that researchers are building. Some at Drexel University in Philadelphia, Penn., created a different type to bring cancer-killing medicine to tumors.

One challenge to designing robots that will go inside the body is powering
B them. These robots are too small to carry an engine or battery pack, notes Min Jun Kim, who led the Drexel team.

Kim is a mechanical engineer. (He now works at Southern Methodist University in Dallas, Texas.) Mechanical engineers use rules of motion, energy and force to design and build machinery. Kim's team used magnets to solve the power problem. Unlike Nelson's soft microswimmer, Kim's design is made entirely of metal.

He looked to bacteria for inspiration. And he found it in *Borrelia burgdorferi* (Bor-REL-ee-ah Burg-DOR-fur-eye). This spiral-shaped germ causes an illness known as Lyme disease. People fall ill after being bitten by an infected tick. The bacterium uses a corkscrew-like motion to swim and bore through tissue.

Kim mimicked its corkscrew shape by joining together strands of magnetic beads. Those beads are so small they can barely be seen without a microscope.

He used magnets to propel his microrobot through artificial blood vessels in a *petri dish*. By increasing or decreasing the strength of the magnets, Kim can make the robot swim faster or slower. Changing the direction of the magnetic field lets him steer the robot left or right. He can join several chains together to make strands as long as 20 to 30 beads. Or he can break them apart into strands as short as three beads.

Kim says the surfaces of these beads could be coated with medicines. To
13
treat cancer, a microswimmer that's a longer chain could bore into a thick tumor. Once inside, it could break apart into smaller chains to spread its

cancer-killing medicine around, he says.

Kim's team shared its findings last year in the journal *Scientific Reports*.

Some microrobots can already swim in petri dishes. But there would likely be big hurdles before they could be released in people, notes Zhang Li. He studies nanotechnology — the design and harnessing of extremely small devices — at the Chinese University of Hong Kong. Scientists need to know, for instance, how safe the itty-bitty devices are. They also need to know how to remove those tiny swimmers once their work is done, Li notes.

For now, researchers plan to test their microscopic devices in animals such as mice. Those tests can also help scientists make sure that the materials in their robots aren't toxic.

Scientists also can use animals to practice inserting, tracking and removing microswimmers before they put them in people. Working with robots in a real body — whether a human or a mouse — is a lot different than doing it in a petri dish under a microscope, Li explains. In a petri dish, there's no skin, blood or other tissues to block the view.

Despite these challenges, scientists find this “an exciting time” Li observes. “There's so much left to learn.”

Notes:

microscopic 顕微鏡でしか見えない, blood vessel(s) 血管,
cancerous ガンの, unclog(s) ~から障害を取り除く,
artery 動脈, spinal fluid せき髄液, microbe 微生物; 病原菌,
parasite 寄生虫(寄生動物), drowsiness (うとうとする)眠さ,
whiplike むち状の, stumpy ずんぐりした, spinal cord せき髄,
tick ダニ, bacterium バクテリア(bacteriaの単数形),
corkscrew らせん状の, petri dish ペトリ皿, itty-bitty ちっぽけな

[1] 下線部A, Bを日本語にきなさい。(解答用紙その2)

[2] 1~15の質問に対して英文の内容から判断し, 最も適切なものを一つ選び, その番号をマークきなさい。(解答用紙その1)

1. What is the best title for this passage?

- (1) Therapeutic robots may soon swim within the body
- (2) Star Wars' robots fit the image of science
- (3) Robots can't be adopted to help us with our health
- (4) Scientists have figured out a way to deliver robots to our bloodstream

2. A microscopic machine today can

- (1) swim through a human's bloodstream.
- (2) deliver medicine to a cancerous tumor.
- (3) unclog arteries.
- (4) None of the above.

3. About 60 to 65% of the human body is made up of

- (1) blood alone.
- (2) blood and table salt.
- (3) spinal fluid and liquids.
- (4) blood, spinal fluid and other liquids.

4. Finding out how to send tiny robots through a human's blood vessels has

- (1) been and will be impossible.
- (2) been difficult thus far.
- (3) proven to be easy.
- (4) been delayed for years.

5. Nelson of the Zurich Institute used _____ as his model for minirobots.

- (1) a professional swimmer
- (2) an affected person
- (3) a microbe
- (4) a navigator

6. Nelson chose *T. brucei* as his model because it can

- (1) change its shape.
- (2) move through the bloodstream.
- (3) enter blood vessels and the spinal cord.
- (4) All of the above.

7. Nelson's robots

- (1) remain short and stumpy.
- (2) have gel applied to their surface.
- (3) can shift shape when the temperature of the gel is changed.
- (4) are hard but can be made to be soft.

8. Kim's robots

- (1) swim just like Nelson's.
- (2) are made of the same material as Nelson's.
- (3) differ from Nelson's in the way they move.
- (4) were produced in a petri dish.

9. Kim's microrobots imitate _____ to swim and bore through material.

- (1) a corkscrew
- (2) magnetic beads
- (3) artificial blood vessels
- (4) a microscope

10. Li's concerns about the microrobots are related to

- (1) safety.
- (2) removal of the devices.
- (3) working with them outside of a petri dish.
- (4) All of the above.

11. The word "typically" means

- (1) unusually.
- (2) generally.
- (3) exceptionally.
- (4) rarely.

12. The word "inspiration" is closest in meaning to

- (1) motivation.
- (2) discouragement.
- (3) depression.
- (4) invitation.

13. The word "coated" means

- (1) warmed.
- (2) covered.
- (3) uncovered.
- (4) bared.

14. The word "tiny" means

- (1) small.
- (2) adequate.
- (3) cheap.
- (4) hard.

15. The word "toxic" means

- (1) difficult.
- (2) healthy.
- (3) harmful.
- (4) beneficial.

2

以下のそれぞれの定義に従って、最初と最後の文字が与えられた最も適切な単語を書きなさい。ただし、1下線に1文字が入る。(解答用紙その2)

(解答例)

someone who is trained in science, especially someone whose job is to do scientific research

⇒(s _____ t)

正解(scientist)

1. easy or possible to get or use

⇒(a _____ e)

2. an organization, company, or system that provides something to the public

⇒(s _____ e)

3. the inside surface at the top of a room

⇒(c _____ g)

4. a system of lines, wires, etc., that are connected to each other

⇒(n _____ k)

5. the action or process of making land, water, air, etc., dirty and not safe or suitable to use

⇒(p _____ n)

6. something (such as a river, a fence, or an imaginary line) that shows where an area ends and another area begins

⇒(b _____ y)

7. normal or usual: not unusual, different, or special

⇒(o _____ y)

8. a usually written promise stating that the quality of something (such as a product that is being sold) will be as good as expected

⇒(g _____ e)

9. the point or place where something begins or is created; the source or cause of something

⇒(o _____ n)

10. a situation in which people are uncertain about what to do or are unable to understand something clearly

⇒(c _____ n)

3

下線部に最も適切なものを選び、その番号をマークしなさい。(解答用紙

その1)

16. The new product exceeded the _____ sales target by 10 percent.

- (1) expect
- (2) expects
- (3) expected
- (4) expecting

17. _____ your help, I would not have made it.

- (1) It were not for
- (2) Were it not for
- (3) For it were not
- (4) Not it were for

18. The campus will be closed _____ Monday, September 4 due to the typhoon.

- (1) in
- (2) on
- (3) at
- (4) during

19. For Christmas, he _____ out of his way to buy me a gorgeous ring.

- (1) made
- (2) put
- (3) went
- (4) gave

20. _____ that he's always late?

- (1) Why is it
- (2) Why it is
- (3) How it is
- (4) How does it

21. I want to attend the graduate program, but _____ I am rejected, I will continue my studies.

- (1) since
- (2) whenever
- (3) although
- (4) even if

22. What attracted me to the area, _____, is its cool and dry climate.

- (1) nonetheless
- (2) as long as
- (3) above all
- (4) due to

23. Once you turn on the computer, the main menu will appear _____.

- (1) automate
- (2) automatically
- (3) automatic
- (4) automation

24. The higher your position is, the _____ responsibilities you will have to take on.

- (1) more
- (2) best
- (3) most
- (4) worst

25. _____ all of the papers, Ken found some mistakes.

- (1) Check
- (2) Checks
- (3) Checked
- (4) Having checked

26. This e-mail is to _____ everyone that the new students' orientation will be held today.

- (1) make
- (2) remind
- (3) deliver
- (4) force

27. I'm afraid your request for a pay raise was turned _____ again.

- (1) down
- (2) on
- (3) for
- (4) with

28. Agnes can speak Chinese with the same ease _____ it were her mother tongue.

- (1) unless
- (2) even if
- (3) as if
- (4) if

29. If _____ I had caught that train!

- (1) just
- (2) only
- (3) even
- (4) that

30. _____ introducing new recipes, she will explain some simple yoga poses.

- (1) Even though
- (2) As for
- (3) Along with
- (4) Whether or not

31. This textbook was reviewed by many teachers, but _____ of them said it was useful.

- (1) no
- (2) none
- (3) nobody
- (4) neither

32. No matter _____ hard he may work, he won't be able to finish the job by tomorrow.

- (1) what
- (2) when
- (3) where
- (4) how

33. There will be eighteen people at the party, _____ you and me.

- (1) exist
- (2) existing
- (3) include
- (4) including

34. Are you _____ with your part-time job?

- (1) satisfied
- (2) satisfactory
- (3) satisfying
- (4) satisfaction

35. I'm sorry I cannot answer the phone right now. Please _____ a message.

- (1) leave
- (2) take
- (3) get
- (4) receive

4

次の会話文を読んで、以下の問いに答えなさい。

Jan: I'm looking forward to meeting your cousin.

Ben: Yeah, I'm pretty excited Hector is coming over this weekend.

Jan: When is he going to get here?

Ben: (36). I think he'll be arriving sometime this evening.

Jan: Cool. When was the last time you guys (37)?

Ben: Let me think. I would (38) a couple of years ago.

Jan: It's been a while then.

Ben: But somehow it doesn't feel like it.

Jan: (39)?

Ben: We Skype each other every (40).

[1] 下の選択肢1～0の中から、上の空欄36～40に最も適切なものを一つ選び、その番号をマークしなさい。ただし、同じ語句を複数回選択してはならない。また、文頭に来る選択肢も全て小文字で表している。(解答用紙その1)

1. have to say

2. amazing

3. awesome

4. hung out

5. good question

6. kind of

7. how come

8. now and then

9. time to time

0. go and see

〔2〕 次の文で、会話文の内容と一致するものは1を、一致しないものは2をマークしなさい。(解答用紙その1)

41. Jan wants to meet Ben.
42. Jan is Hector's cousin.
43. Hector stayed over at Ben's place last weekend.
44. Hector is coming later today.
45. Ben has not spoken to Hector in about two years.

5

次の日本語の文を表す英文を、与えられた語句を用いて完成させた場合、2番目と4番目になる語句の組み合わせを一つ選び、その番号をマークしなさい。ただし、文頭に来る語句も全て小文字で表している。(解答用紙その1)

46. 体調が戻るまでゆっくりした方がいいですよ。

You .
2番目 4番目

A. until B. easy C. feeling better

D. you're E. take it F. should

1) F—A 2) E—A 3) E—D 4) B—F

47. 面接を受ける人たちは皆、面接官に好印象を与えようとしてました。

good impression .
2番目 4番目

A. on B. all C. the interviewers

D. make a E. tried to F. the interviewees

1) F—D 2) C—D 3) F—E 4) C—E

48. あなたを最後に見たのがつい昨日のことのようです。

It I saw you
2番目 4番目
 last.

A. when B. seems to me C. only yesterday

D. that E. was F. it

1) A—E 2) C—F 3) D—B 4) D—E

49. 2週間前にひいた風邪が治っていません。

I ago.
2番目 4番目

A. recovered from B. caught C. I

D. haven't E. two weeks F. the cold

1) B—C 2) A—B 3) A—C 4) F—D

