令　和　5　年　度

医　学　科

外　国　語(英語)

注意事項

1. 問題は 1 頁から 12 頁に掲載されています。
2. 解答に用いる言語(日本語あるいは英語)は各設問の指示にしたがって選びなさい。ただし，記号で答えるように求められている場合は記号で答えなさい。
3. 解答は解答用紙に記入しなさい。

<パート1>　　(配点率 40 %)

次の英文を読んで，設問に日本語あるいは記号で答えなさい。

Katalin Kariko grew up the daughter of a butcher in a small town in Hungary, living under Communist rule in the 1950s and '60s. The family had electricity, but not running water or a refrigerator. Watching her father at his job, the young Kariko became fascinated with figuring out how living things work. That took her to undergraduate studies in biology at the University of Szeged, where she first learned about RNA. It would become her obsession through her *biochemistry Ph.D. studies, postgraduate work and, really, the rest of her life. If DNA makes up the letters of life, RNA creates the words, and ultimately the sentences. Indeed, RNA, and specifically messenger RNA, or mRNA, (1)instructs the body how to make all the proteins, *enzymes, *receptors and other *molecules that enable living things to function. As a Ph.D. student, Kariko grew convinced that mRNA, modified in the right way, could be used to turn the body into its own drug-making factory, and *churn out tailored, precision *compounds to treat any disease caused by a lack of a certain protein, which could be an enzyme or a hormone.

The challenge with mRNA is that it's notoriously unstable: inject it into the human body, and it gets *chewed up before it can serve its purpose. It is also difficult to work with, since it needs to be stored at extremely low temperatures to remain (2)intact. After a few years of frustrating work at the Biological Research Centre at Szeged with no success in *corralling mRNA, Kariko lost funding to her lab.

To continue her work, in 1985 she found a position at Temple University in Philadelphia but faced a new obstacle: to discourage *defection, the Hungarian government limited citizens to taking only $50 with them when they left the country. Kariko and her husband sold their car for $1, 200 and sewed the cash inside their 2-year-old daughter Susan's teddy bear.

Kariko moved to the University of Pennsylvania in 1989. Few others at Penn

or elsewhere were pursuing mRNA at the time, because its payoff seemed uncertain. But Kariko persevered, envisioning a *bonanza of new treatments for heart disease, *stroke and other conditions. She worked late nights and early mornings at her Penn lab and wrote at least one new *grant application every month — only to get turned down again and again. "I think I was rejected at least 24 times," she says, "but I kept pushing, because every time, I wanted to understand why they rejected it and how could I improve."

After six years, her supervisors at Penn grew weary of a lack of results and *demoted her, cutting off her research funding and control of a lab. *Undeterred, she moved to the *neurosurgery department for a salary and lab space to continue her research.

Things finally changed for Kariko in 1997, thanks to a casual office conversation by the copy machine. An *immunologist and physician named Drew Weissman had just joined Penn to start a lab focused on developing a vaccine against HIV and other diseases. He and Kariko shared a habit of photocopying articles out of recent scientific journals from the research library. By the machine, they discussed their respective approaches to vaccine development. Kariko tried to convince Weissman of the still unappreciated merits of the synthetic RNA she was making. "I'm open to anything," says Weissman, and so he decided to give it a shot.

Kariko's problem was that she hadn't found a way to *tamp down RNA's tendency to trigger the *immune system's *inflammatory response, which destroyed the RNA. Over nearly the next decade, Kariko and Weissman combined efforts, and eventually made a breakthrough: changing a specific mRNA *building block helped the molecule [3] evade the immune system. Building on that, Weissman figures out that *encasing the mRNA in a fat bubble protected the precious *genetic code when it was introduced to the body of a living thing, while at the same time triggering the immune system to target it — which is what a vaccine needs to do.

After that, their research sped up rapidly. For disease after disease — more than 20 in all, including norovirus, influenza, HIV, *hepatitis and *Zika — the

mRNA-based vaccines the duo developed during the 2000s were nearly 100% effective in protecting lab animals from getting infected and sick.

The beauty of the platform lay in its flexibility. Influenza vaccines, for example, take months to develop because most require growing the virus in chicken eggs. An mRNA vaccine requires only a *readout of a virus's *genetic sequence. Scientists can take that code, pick out the relevant parts of the genome, build the corresponding mRNA with chemical compounds, pop it into the fat bubble and —*presto! — a new vaccine is born.

In 2005, Kariko and Weissman reported their findings in what they thought would be a landmark paper in the journal *Immunity*, then waited for the *accolades to flood in. "I told Kati the night before the paper was published, Tomorrow our phones are going to ring off the hook," says Weissman. No one called.

It would take another 15 years — and the emergence of the devastating *SARS-CoV-2 virus — before the global science community would finally grasp the importance of their discoveries. In the meantime, some scientists were gradually starting to build the case for the promise of mRNA, including Ugur Sahin and Ozlem Tureci, co-founders of a German company called BioNTech. In 2013, Kariko joined the company to head its mRNA program, focused at the time on cancer vaccines. In January 2020, Chinese researchers published the genetic sequence of the new coronavirus causing COVID-19. BioNTech quickly (4)pivoted toward working on a vaccine for the novel coronavirus, eventually partnering with *pharmaceutical giant Pfizer. By then, the groundbreaking nature of the technology Kariko and Weissman had pioneered finally had the attention of scientists worldwide, who realized that the plug-and-play model meant potentially lifesaving shots could be developed — and, more important, delivered — in record time.

Source (excerpt with changes) :

Park, A., & Ducharme, J. (2021, December 27, & 2022, January 3). The miracle workers. *TIME*, 62-68.

Notes：

biochemistry：生化学

enzyme：酵素

receptor：受容体，レセプター

molecule：分子

churn out：短時間に大量に作る

compound：化合物

chew up：噛んだかのように壊す

corral：閉じ込める

defection：亡命

bonanza：大当たり

stroke：脳卒中

grant：補助金

demote：降格させる

undeterred：くじけないで

neurosurgery：神経外科学

immunologist：免疫学者

tamp down：抑える

immune system：免疫システム

inflammatory response：炎症反応

building block：構成要素

encase：すっぽり包む

genetic code：遺伝コード

hepatitis：肝炎

Zika：ジカ熱

readout：解読された情報

genetic sequence：遺伝配列

presto：あら不思議

accolade：称賛

SARS-CoV-2 virus：新型コロナウイルス

pharmaceutical giant：巨大製薬会社

設問 1　次の語は，本文の文脈ではそれぞれどのような意味で使われているか，最も近いものを選んで解答用紙の記号を○で囲みなさい。

(1) instructs

(a) directs

(b) employs

(c) acquaints

(d) authorizes

(2) intact

(a) failed

(b) broken

(c) working

(d) undamaged

(3) evade

(a) find

(b) face

(c) avoid

(d) invade

(4) pivoted

(a) fixed

(b) turned

(c) centered

(d) depended

設問 2　コピー機の側でどのようなことがあったのか，また，それが Kariko の研究にどのような影響を与えたのか，本文の内容にしたがって説明しなさい。

設問 3　新しく開発したワクチンは従来型のワクチンとどのように異なるのか，本文の内容にしたがって説明しなさい。

設問 4　本文の内容と合致するものを 3 つ選んで解答用紙の記号を○で囲みなさい。4 つ以上選んだ場合は 0 点とする。

(a) RNA controls the making of proteins.

(b) mRNA gets broken down very easily once injected into the human body.

(c) Kariko and her family brought only $50 when they moved to Philadelphia.

(d) Ever since she joined BioNTech, Kariko has been working on the new coronavirus.

(e) Kariko's father studied biology and fascinated her with his wide knowledge of how living things work.

(f) Kariko and Weissman contributed a paper to a journal in 2005, but they did not receive any accolades for it.

(g) Kariko worked very hard at the University of Pennsylvania because many other researchers were working on mRNA.

<パート 2 >　　(配点率 30 %)

Read the following passage and answer the questions that follow.

Are you aware of what helping others can do to your health? Most people still seem to be (①) about the impact such other-oriented behavior can have on their own *well-being. Fortunately, several researchers have already stepped in to (②) this important question. A research team from the University of British Columbia gave a group of older (③) with high blood pressure money to spend. On three (④) weeks they were each given $40. Half the participants were instructed to spend the money on themselves; the rest were asked to spend it on someone else — buy a gift for a friend, donate to a charity or otherwise (⑤) others with the money.

A few weeks (⑥) the researchers measured the *blood pressure of both groups. It turned out the blood pressure of those participants who had spent money on others had significantly decreased as (⑦) with the subjects who spent the money on themselves. Moreover, the decrease in blood pressure was similar in size to the (⑧) of starting high-frequency exercise or a healthier diet.

Aiding others can even help you live longer. A study of older adults compared receiving social support and giving it as (⑨) of *mortality over a period of five years. Whereas it would be intuitive to think receiving such support would be good for oneself, the results showed it was giving social support that predicted *longevity: Those who (⑩) *instrumental support to friends, relatives and neighbors as well as those who provided emotional support to their spouses were more likely to be alive at the end of the study period compared with less pro-social participants. These results held true even when the researchers controlled for (⑪) *demographic factors such as health, mental health, personality and marital status.

More than 10 studies have also (⑫) regular voluntary work predicts longevity. Helping behavior can even (⑬) against the negative effect that stress typically has on mortality: Among 846 participants around Detroit, stressful events predicted (⑭) mortality among people who did not provide help to others in the past year but not among those who did.

Also, being the caregiver of an ailing loved one is often assumed to be a (⑮) for the former. Although the stress and sorrow associated with seeing your spouse fade away is clearly a heavy burden, the active help provided to the spouse might still have a positive effect on caregiver longevity. A national study of over 3,000 elderly married individuals showed those who (⑯) at least 14 hours a week providing active care to their spouses actually lived longer, when controlled for demographic and health variables.

And as if longevity and better health would not be enough, providing support for others also tends to make the helper happier. In one of my own studies I invited a group of students to play a simple game on a computer where they had to match words with their synonyms. Half of the participants just played the game whereas the others were told that for every answer they get right, a small donation is made to the United Nations World Food Programme to help end hunger. After playing, this latter group experienced more positive emotions and reported finding the game more (⑰).

Similarly, Lara Aknin from Simon Fraser University has shown that when half the people are given $5 to spend on themselves and the rest $5 to spend on others, the latter group is happier afterward. And this is not only true in her home country Canada but (⑱) the world from — Uganda and South Africa to India. She even went to a small-scale, isolated rural village on the island of Vanuatu in the Pacific. Even there purchasing goods for others led to more positive emotions than purchasing them for oneself. There thus seems to be something rooted in our very human nature that makes helping feel good across cultures. This is *corroborated by *neurological studies that have confirmed charitable donations indeed activate the reward centers of the brain.

A dose of good deeds toward others, then, can thus be a good medicine for improving one's physical and mental health.

Of course, even here too much of a good thing can be *detrimental. If people only concentrate on the well-being of others, they can ignore their own needs. There are too many tragic stories of people (⑲) their own happiness in order to serve their families or some grand global cause. Helping is good but it should be strategic and self-determined, as Adam Grant, an expert on pro-social giving at The Wharton School, has emphasized: "There's a big difference between pleasing people and helping them." One should choose when and how to help, instead of being pushed to assist whomever happens to ask.

Indeed, a number of experiments have shown that whereas *autonomously motivated helping increases a helper's well-being, this is not true when one is *coerced or forced to benefit others. By learning to say no, one can concentrate on those ways of helping where one's interests and talents are put to best use, and where one can get the biggest impact for one's investment.

So don't believe the *false dichotomy between selfishness and sacrificing oneself for others. A man is no island. As social beings, we humans encompass both the desire to realize ourselves and the desire to be a meaningful part of a bigger whole. Both are an important part of a meaningful existence, as I've tried to show in my research. That's why the extremes — only look out for number one and only look out for others — are detrimental for well-being. In both cases part of our humanity is *suffocated. Finding a balance is key. But in our era of individualism and *unabashed self-interest reaching such balance often means a (⑳) to consciously start looking for the best ways to help those around you.

Source (with changes) :

Martela, F. (2018). Exercise, eat well, help others: Altruism's surprisingly strong health impact. *Scientific American*.

https://blogs.scientificamerican.com/observations/exercise-eat-well-help-others-altruisms-surprisingly-strong-health-impact/

Notes：

well-being：幸福(な状態)

blood pressure：血圧

mortality：死亡率

longevity：長生き

instrumental：役に立つ

demographic：人口統計学の

corroborate：裏づける

neurological：神経学的な

detrimental：有害な

autonomously：自律的に

coerce：強制して～させる

false dichotomy：偽の二分法

suffocate：窒息させる

unabashed：恥じない

設問 1：**Use the following words to best complete the text. Use each word once. Use a capital letter if necessary.**

demonstrated	participants	afterward	predictors
benefit	spent	meaningful	ignorant
investigate	provided	buffer	subsequent
commitment	sacrificing	across	burden
various	consecutive	effect	compared

設問 2：**Answer the following questions in English in complete sentences and in your own words.**

1. According to the article, how does helping others generally affect one's health? What are three specific health benefits that can be achieved through helping others?

2. According to the article, how can helping others have a negative effect on helpers, and why should people decide who they help on their own?

<パート 3 >　　(配点率 30 %)

Write paragraphs answering the following questions in English in your own words.

Question 1: What challenges do you think you will encounter in medical school?

Question 2: How do you plan to maintain your motivation through these challenges that lie ahead in medical school?

Your response should be written in your own words and:

1. be a total of approximately 100 words in English,
2. should be composed of two paragraphs,
3. the first paragraph is a response to the first question,
4. the second paragraph is a response to the second question,
5. leave a one-line space between each paragraph.

Do not double-space your essay; write on every line.