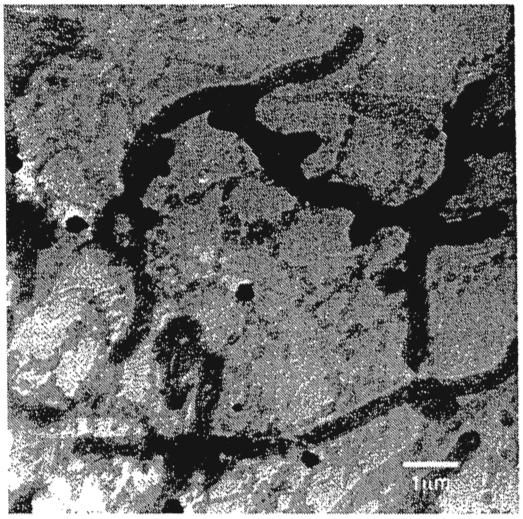
平成２０年度　大学院・生命理学研究科博士前期課程　入学試験

生命科学専攻　英語

英語　第１問

下記の図と文章を読んで以下の問に答えよ。



①Most cytoplasmic components of the cell, such as mitochondria, chloroplasts, Golgi apparatus, and centrioles, were discovered in the 19th century on the basis of their morphology and staining properties when viewed by conventional light microscopy. In contrast, the endoplasmic reticulum or ER, was not recognized as a universal cell component until the advent of electron microscopy in the middle of this century. The electron micrograph reproduced here, taken in 1952 by Keith Porter at the Rockefeller Institute, was one of the first to demonstrate the ER. It shows a small area of cytoplasm near the edge of an intact chicken macrophage, which was allowed to spread thinly before it was fixed and viewed as a whole mount. The ER appears as a delicate network of beaded vesicles somewhat overshadowed by the prominent branched mitochondria. ②At the time this micrograph was taken, microtomes that could cut sections thin enough for penetration by the beam of the electron microscope were just becoming available. One of the most reliable of these, the Porter Blum microtome, was developed by Porter and Joseph Blum, an instrument maker at the Rockefeller Institute. Thin sections soon revealed that in most cells the ER consists of stacks of flattened vesicles, often closely associated with the Golgi complex. In a few cell types the stacks of ER elements are very large and had, in fact, been seen previously by light microscopy as lamellar structures in irregular patches of darkly staining basophil cytoplasm—the “Nissl bodies” of neurons and the “ergastoplasm” of actively secreting gland cells. The staining was known to be due to RNA, but the relationship of that RNA to the ER remained obscure until combined cell fractionation and electron microscopic observations showed that the RNA was concentrated in small granules attached to the outer surface of the ER vesicles. These granules, named [a], were subsequently shown to play a central role in protein synthesis. (Views of the Cell, by J.G. Gull,1996)

Golgi apparatus ゴルジ装置,　centrioles 中心粒,　endoplasmic reticulum 小胞体

問１.下線部①を和訳せよ。

問２.下線部②を和訳せよ。

問３.　[a]に当てはまる適当な単語を英語で記せ。

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生命科学専攻　英語

英語　第２問

下記の文章を読み、下線①，②を和訳せよ。

①I got a master's degree in microbiology and immunology at the University of Michigan Medical School, followed by a soul-searching period working at a pharmaceutical company and trying to decide if I had what it took to get a PhD. I would be the first in my family. But I remembered my high school counselor's warnings: Was my intellect too weak?

But I grew weary of having others determine the direction of my research and going off to meetings to present my research. I summoned up my courage and headed off to graduate school—again in microbiology, again at the University of Michigan Medical School. In five years I had my degree and went off to the Stanford Medical School to join Stanley Cohen and learn genetic engineering, the powers of which his laboratory had just demonstrated. I used what I learned to manipulate antibiotic-producing *Streptomycetes,* to try to be the first to isolate the interferon gene, and to clone genes from the hepatitis B virus to develop a vaccine.

Interesting it was! But I still didn't feel fulfilled. Was it the memories of growing up on a farm that were tugging at me? Would shifting my focus calm my restless spirit? On a sunny spring day, I wandered over to the Carnegie Institution, Department of Plant Biology on the Stanford campus, and my life changed! I spent time there studying light harvesting in algae and then took a job at DeKalb Plant Genetics, where I really learned plant biology. ②I focused all of my efforts on figuring out how to apply the genetic engineering technologies I had learned at Stanford to one of the most important crops in the world—corn. We were the first to publish on how to introduce a new gene into corn and observe its passage to the next generation.　(After ASPB News, vol 34, 2007)

microbiology 微生物学, immunology 免疫学, University of Michigan Medical School ミシガン大学医学部, pharmaceutical company 薬品会社, Stanford Medical School スタンフォード大学医学部, genetic engineering 遺伝子工学

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生命科学専攻　英語

英語　第３問（１枚目）

下記の図と文章を読んで以下の問に答えよ。

Growth of vertebrates is mediated in part by the cascade of polypeptide hormones depicted in Figure 1. This pathway emanates[*1] from the hypothalamus which responds to neurotransmitters by liberating either somatostatin or growth hormone-releasing factor into the portal circulation[*2]; these polypeptide hormones impinge[*3] on the pituitary to either inhibit or stimulate, respectively, the synthesis and secretion of growth hormone. ① Growth hormone is released periodically from the pituitary. The amplitude of the cycles of release is more striking in males than in females; the significance of this difference in secretory patterns on sexual differentiation is only beginning to be appreciated. Nevertheless, in both sexes growth hormone is thought to stimulate the liver to produce insulin-like growth factor I (IGF-I), a polypeptide hormone, also called somatomedin C, which shows homology to proinsulin. IGF-I is thought to mediate growth by activating receptors on peripheral tissues.

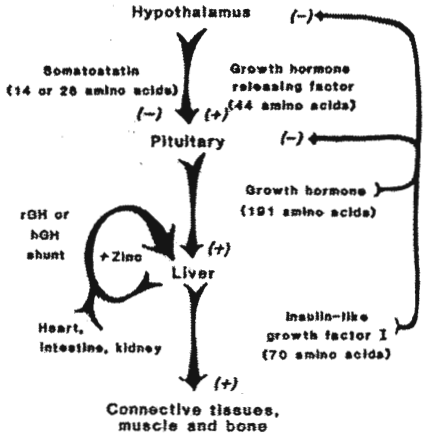

Figure 1

In a previous study we showed that it was possible to manipulate this pathway by introducing rat growth hormone (rGH) genes into fertilized mouse eggs. Most of the mice that incorporated the gene into their chromosomes, called transgenic mice, grew larger than normal. The success of this approach depended on the fusion of the rGH structural gene to the mouse metallothionein-I (MT-I) gene promoter, a technique used previously to obtain expression of microinjected thymidine kinase genes. This promoter is from a "housekeeping" gene which is expressed in most cells and is regulated by a variety of environmental stimuli. One class of stimuli includes certain heavy metals, such as cadmium and zinc, which are postulated to bind to regulatory proteins that interact with promoter sequences located in the region 40 to 180 base pairs upstream of the transcription start site. The consequence of using this particular fusion gene was that rGH was produced in the same tissues as MT-I, instead of the pituitary, with the result that circulating rGH reached levels several hundred times higher than normally achieved. This extrapituitary production of growth hormone is depicted as the growth hormone shunt[*4] in Figure 1. Some of the transgenic mice grew to almost twice the size of their normal littermates. We have extended these studies, as reported here, by showing that the more distantly related human growth hormone gene (hGH) is also capable of promoting accelerated growth of mice. This gene and its products are more easily distinguished from the endogenous mouse counterparts allowing certain technical advantages over our initial constructions with the rGH gene. The genetic engineering of mice with a hGH shunt and the regulation of this modified growth hormone cascade are described below.

（中略、Figure 2を省略）

英語　第３問（２枚目）

The growth rate of the largest transgenic mouse, which had integrated two copies of MThGH gene per cell and had a moderate level of circulating hGH (250 ng/ml), is shown in Figure 3A together with a typical normal littermate of the same sex. These two animals are shown on the cover at 24 weeks of age. ② Mice expressing MThGH genes are already larger than littermates at weaning[*5] (5 weeks) and they grow rapidly until 11 to 13 weeks; during this time the growth rate is typically two to three times that of normal mice of this strain. To establish more accurately when growth hormone first begins to be effective, we bred mouse C57-173-3 and compared the growth rates of offspring that did and did not receive the MThGH genes from their father. Figure 3B shows that accelerated growth begins between 16 and 22 days after birth. We have not yet systematically examined MThGH gene expression during fetal development, but we do know that these genes are expressed before birth. Thus, we suspect that the mice became sensitive to growth hormone 2 to 3 weeks after birth. This experiment also documents that the enhanced growth rate is heritable, a point that has also been established with the transgenic mice expressing MTrGH fusion genes.

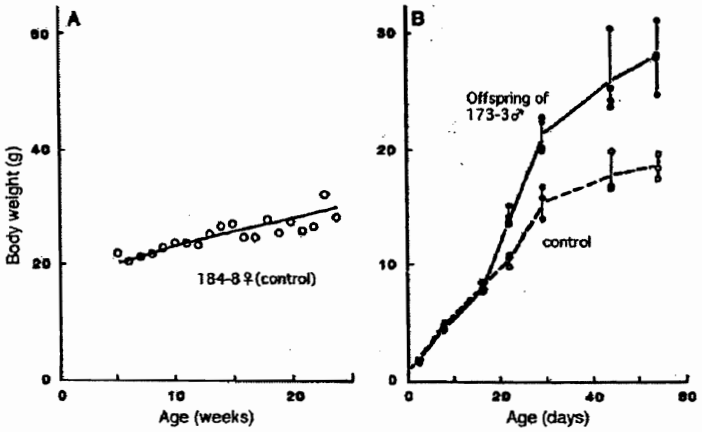

Figure 3 Comparative growth of transgenic mice expressing MThGH genes and controls.

（Science、1983年222巻より一部を引用）

（注）[*1] emanate：生じる、発する　[*2] the portal circulation：視床下部－下垂体門脈系の血流を指す　[*3] impinge：作用する　[*4] shunt：側経路　[*5] weaning：離乳期

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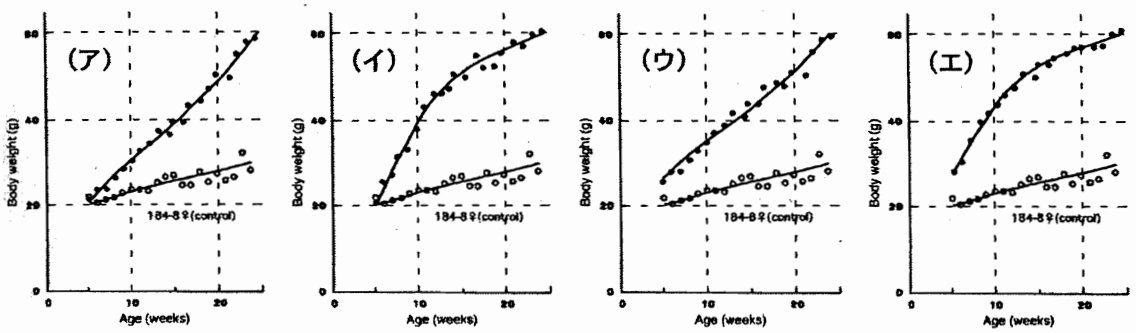
生命科学専攻　英語

英語　第３問（３枚目）

問１．下線部①の英文を日本語に訳せ。

問２．下線部②の英文を日本語に訳せ。

問３．下線部②とその前後で記述された内容およびFigure 3Bで提示されたデータを総合的に判断すると、遺伝子導入マウスの生後5週から24週までの成長を最も的確に表しているグラフは次の(ア)～(エ)のどれになるか。なお、図中の184-8♀は対照として測定した個体である。



問４.以下に示す(1)から(3)の文章は本文中で使われている用語の意味を解説したものであるが、各々が最も的確に意味する単語を本文中から抜き出して答えよ。

(1) A region of DNA, usually upstream of a coding sequence which directs RNA polymerase to bind and initiate transcription.

(2) A sequence of nucleotides along a nucleic acid molecule which can determine the composition of one polypeptide.

(3) One of a pair of animals born or reared in the same group of offspring produced by a multiparous animal at one birth.

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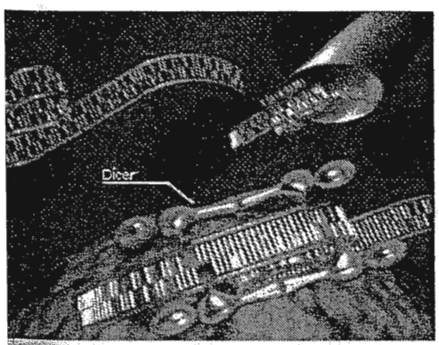
英語　第４問

以下の文章はRNA interference (RNA干渉、RNAiと省略)を解説したアニメーションに収録されている英語ナレーション原稿より一部分を抜粋したものである。下に示したアニメーションの画面を参考にして、この英文原稿を日本語のナレーション原稿に翻訳せよ。RNAi、*C. elegans*、Dicer、およびsiRNAの特殊用語と、endonucleaseおよびRNAの一般的な用語については日本語訳をしなくてもよい。

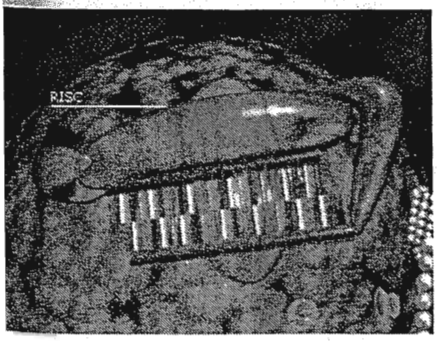
(1) RNAi was popularized by work in *C. elegans*[*1]. When long double-stranded RNAs were injected into a worm's gonad[*2] – a standard way of introducing transgenes[*3] into worms, they blocked the expression of endogenous genes in a sequence-specific manner.

(2) When long double-stranded RNAs enter a cell, they are recognized and cleaved by Dicer[*4], which is a member of the RNase III family of double-stranded RNA-specific endonucleases[*5]. Cleavage by Dicer creates short double-stranded RNAs that are characterized by 2-nucleotide-long 3' overhangs[*6]. These are called small interfering RNAs – siRNAs.

(注) [*1] *C. elegans*：研究材料として用いられる線虫の一種　[*2] a worm's gonad：線虫の生殖腺を指す　[*3] transgenes：外来遺伝子　[*4] Dicer：ダイサーと読む、二本鎖RNAの特定領域に切れ目を入れるタンパク質　[*5] endonucleases：エンドヌクレアーゼ、核酸の末端側ではなく内側で切断する加水分解酵素　[*6] 2-nucleotide-long 3' overhangs：3'側の二塩基突出末端



細胞内で二本鎖RNAがDicerによって切れ目を入れられている様子を表す。



全体が２１塩基の長さで互いに２塩基ずれた形式で対合する二本鎖RNAをsiRNAという。これをRISC（リスクと読む）が認識する。