平成１９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

以下の英文を和訳しなさい。

A living cell is composed of a restricted set of elements, four of which (C, H, N, and O) make up nearly 99% of its weight. This composition differs markedly from that of the earth's crust and is evidence of a distinctive type of chemistry (Figure 2–1). What is this special chemistry, and how did it evolve?

The most abundant substance of the living cell is water. It accounts for about 70% of a cell's weight, and most intracellular reactions occur in an aqueous environment. Life on this planet began in the ocean, and the conditions in that primeval environment put a permanent stamp on the chemistry of living things. All organisms have been designed around the special properties of water, such as its polar character, its ability to form hydrogen bonds, and its high surface tension. Water will completely surround polar molecules, for example, while tending to push nonpolar molecules together into larger assemblies.

注）primeval　原始の

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英語　第２問

以下の英文の第２段落以降（The puzzle----）を和訳しなさい。

Cells must obey the laws of physics and chemistry. The rules of mechanics and of the conversion of one form of energy to another apply just as much to a cell as to a steam engine. There are, however, puzzling features of a cell that, at first sight, seem to place it in a special category. It is common experience that things left to themselves eventually become disordered: buildings crumble, dead organisms become oxidized, and so on. This general tendency is expressed in the *second law of thermodynamics,* which states that the degree of disorder in the universe (or in any isolated system in the universe) can only increase.

The puzzle is that living organisms maintain, at every level, a very high degree of order; and as they feed, develop, and grow, they appear to create this order out of raw materials that lack it. Order is strikingly apparent in large structures such as a butterfly wing or an octopus eye, in subcellular structures such as a mitochondrion or a cilium, and in the shape and arrangement of molecules from which these structures are built. The constituent atoms have been captured, ultimately, from a relatively disorganized state in the environment and locked together into a precise structure. Even a nongrowing cell requires constant ordering processes for survival since all of its organized structures are subject to spontaneous accidents and must be repaired continually. How is this possible thermodynamically? The answer is that the cell draws in fuel from its environment and releases heat as a waste product. The cell is therefore not an isolated system in the thermodynamic sense.

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英語　第３問

以下の英文を読んで問いに答えよ。

1)Plants excel at gas exchanges: They can literally build forests from CO_2 taken from the air at about 120 Pg C $year^{-1}$, half of which is respired back to the atmosphere. Up to 36% of the assimilated carbon is released as complex bouquets of volatile organic compounds (VOCs). Although some of these VOCs may be mere waste, others mediate various pollination and defense mutualisms with animals. These VOC-mediated interactions of plants with organisms of higher trophic levels suggested that they communicate similarly with each other. Two decades ago, researchers serendipitously discovered changes in herbivore resistance and secondary metabolites in plants ("receivers") growing adjacently to herbivore-attacked plants ("emitters"). Because in some experiments results were best explained by the aerial transfer of information, the phenomenon was popularly dubbed 2)"talking trees". This phrase seems unfortunate, because selection most likely favors plants that "eavesdrop" on VOCs released from neighbors and respond by tailoring their phenotypes to enhance their own fitness.

An obvious conversation topic concerns impending attack from mobile herbivores, and most VOC-elicited responses have been interpreted accordingly. Measures of herbivore performance have been broadened to include the elicitation of various direct plant defenses (e.g., phenolics, alkaloids, terpenes, and defense proteins). 3)Indirect defenses have also attracted attention, including food rewards that increase predation pressure on herbivores and VOCs that help predators or parasitoids locate feeding herbivores.

(Science, 311, 812 (2006) より抜粋)

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注） Pg: 10^{12} g, bouquet: 芳香, volatile, 揮発性の, mutualism: 相利共生, trophic: 栄養段階の, serendipitously: 運良く, herbivore: 草食動物, dub: 〜と称する, eavesdrop: 盗み聞きする, elicitation: 誘発, scrutinized, 細かに調べる.

問１　1)の下線部を和訳せよ。

問２　2)の下線部の言葉はどういうことを表しているのか説明せよ。

問３　3)の下線部を和訳せよ。

生命科学専攻　英語

英語　第４問

以下の英文を読んで問いに答えよ。

Since the time of Linnaeus (1707-1778), biologists have sought to classify organisms. At first the purpose was ease of identification ("artificial" classification schemes). Later, after 1)<u>Darwin</u>, the goal of classification was to reflect evolutionary relationships ("[a]" classification schemes). For the past 100 years or so, biologists have emphasized [a] systems of classification and have attempted to define morphological criteria that best reflect evolutionary relationships. However, we now know that morphology, the form and structure of organisms, is the end product of the action of genes. All of the information needed in its DNA sequences. DNA sequence analysis has thus provided evolutionary biologists with a powerful new tool for arriving at a truly [a] classification system.

On the basis of phylogenetic analyses of highly conserved DNA sequences, living organisms have been divided into three major domains: Bacteria, Archaea and Eucarya. The Eucarya include the eukaryotes, organisms whose cells contain a true [b]. The Bacteria, or eubacteria, which include the cyanobacteria, lack a true [b] and are therefore prokaryotic. The Archaea, or archaebacteria, are also prokaryotic, but they differ from the Bacteria: Besides their morphological and biochemical differences, they are often adapted to extreme environments, such as sulfur hot spring or saline ponds. Phylogenetic studies have suggested that the Archaea and Eucarya split after the Bacteria separated from the common ancestor. Thus Archaea and Eucarya represent sister groups. This closer relation between Archaea and Eucarya is reflected in their similar promoter structures and RNA polymerases, the presence of histones, and many other characteristics.

Before the three domains of life were recognized, the five-kingdom classification scheme of living organisms was widely accepted. According to this scheme, all living organisms were divided into five kingdoms: Monera, Protista, Fungi, Plantae, and Animalia. The Monera include all prokaryotic organisms: the eubacteria and the archaebacteria. Some biologists still adhere to this grouping, which is based on the dichotomy between prokaryotic and eukaryotic. However, the discovery that the archaebacteria and eukaryotes are sister groups suggests that the archaebacteria do not belong in the same kingdom with the eubacteria. Hence, biologists who prefer a [a] classification scheme project the Monera grouping, while those who prefer an artificial classification scheme (i.e., one based on criteria other than evolutionary relationships) continue to use it. Whereas in the [a] system the distinction between prokaryote and eukaryote is ignored, in the artificial system this distinction becomes the primary criterion for dividing the organisms.

The "kingdom" Protista presents 2)<u>a similar dilemma</u>. Protists are usually defined as unicellular eukaryotes, although the classification also includes multicellular algae with relatively simple structures. Proponents of a [a] classification scheme divide the protists into three separate kingdoms according to their relatedness: Archezoa, Protozoa, and Chromista. The Archezoa are extremely primitive eukaryotic cells, such as the intestinal parasite *Giardia*, which lacks both mitochondria and chloroplasts. The Protozoa include both photosynthetic unicellular cells that were formally grouped with the algae, such as dinoflagellates and *Euglena*, and unicellular organisms that have lost their chloroplasts, such as the ciliates. The Chromista, which include the brown algae, water molds, and diatoms, are characterized by both multicellular forms and unicellular forms, many of which have chloroplasts that differ biochemically from the chloroplasts of green algae and plants.

(Plant Physiology second edition, edited by Taiz, L. and Zeiger, E. より抜粋)

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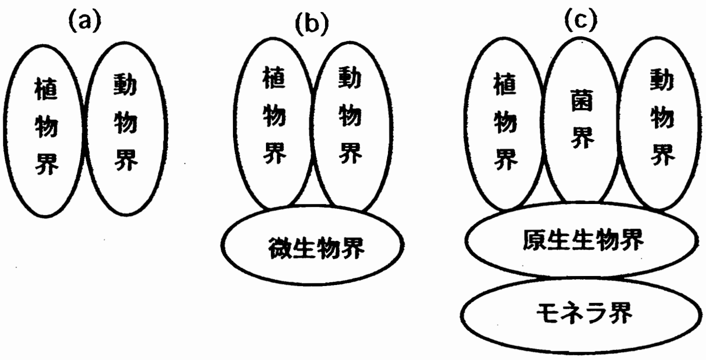
注）Archaea:古細菌界, Protista:原生生物界, proponent: 提案者, Archezoa: アーケゾア亜界, Protozoa: 原生生物亜界, Chromista: クロミスタ亜界, *Giardia*: ランブルベンモウチュウ属, dinoflagellates: 渦鞭毛虫, *Euglena*: ミドリムシ属, ciliates, 繊毛虫類.

問１　[a], [b]の中の単語を答えよ。

問２　1) の下線部の人物により書かれた本の題名を英語で記述せよ。

問３　2) の下線部の a similar dilemma とは、どのような事を指すのか説明せよ。

問４　次に示した生物界の模式図の中で文中に述べられているものを選んで、記号で答えよ。



問５　本文を参考にして系統樹を作成した。次のうち該当するものを記号で答えよ。