生命科学専攻　英語

英語　第１問

地球温暖化が作物に与える影響について書かれた以下の英文を読んで問いに答えよ。

(1) Rising CO_2 levels will generally benefit crop growth, as this stimulates photosynthesis in most crop plants. However, the links between climate change and food production are even more complex than your story suggests. Rising temperatures could extend the geographical distribution and growing season of some agricultural crops, such as pasture grasses, by allowing the threshold temperature for the start of growth to be reached sooner. This assumes that water and nutrients are supplied at a level that permits pasture crops to benefit from a longer growing season. (2) But in general, and contrary to common perceptions, most crop physiologists expect global warming to reduce crop yields. This is because higher temperatures shorten the life cycle of most cereals, hastening senescence and reducing the length of the growing season. (3) Other effects such as an increase in tropospheric ozone level can exacerbate crop senescence. The staple cereal crops can only tolerate narrow temperature ranges, (4) which, if exceeded during the flowering phase, can damage fertile seed production and thus reduce yield. (5) Global warming would also be expected to increase the frequency of exposure to extreme temperatures and thus damage crop fertility. So far, efforts to predict climate change effects on food production and quality have been fragmented. For major crops, except wheat and soybean, we lack the agronomic scale experiments needed to understand and robustly predict the direct effects of CO_2 and ozone, and their interactions with temperature and water. With an extra three billion people to feed during the coming 40 to 50 years, closer cooperation among crop physiology, crop agronomy and climate science would be a positive outcome of the Royal Society meeting.

（*Nature*, 436, 174 (2005)より抜粋）

注）troposphere：対流圏，crop：作物，pasture：放牧地，cereal：穀物，hasten：急がせる，senescence：老化，exacerbate：悪化させる，staple：主要な，fertile：繁殖力のある，agronomic scale experiments：圃場栽培実験

問１　下線部(1)を和訳せよ。

問２　下線部(2)を和訳せよ。

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問３　下線部(3)の理由を説明するために最も適していると思われる文章を以下の(a)～(d)から選び、それを和訳せよ。

(a) Ozone creates reactive molecules that destroy RUBISCO, an enzyme crucial for photosynthesis.

(b) The depleted ozone layer allows more cancer causing ultra-violet solar radiation to strike the Earth, increasing the incidence of skin cancer.

(c) Ozone is generated after an electrical discharge as in lightning. Industrial ozone is produced by Corona Discharge or UV irradiation at specific wavelength.

(d) The solubility of ozone is a function of the temperature, pressure, and pH of the liquid.

問４　下線部(4)の「which」が指す意味を日本語で答えよ。

問５　下線部(5)を和訳せよ。

生命科学専攻　英語

英語　第２問

以下の英文を読んで問いに答えよ。

Many Gram-negative bacteria interact with human, animal, or plant hosts by injecting effector proteins into the cytosol of host cells through the so-called type III secretion system (injectisome). (1) The symptoms of infectious diseases, such as shigellosis and typhoid fever, largely depend on the repertoire of bacterial proteins injected by the type III secretion system, and what they do once inside eukaryotic host cells. The filamentous needle, composed of a single protein, projects beyond the bacterial surface. For bacterial effector proteins to be translocated into host cells, the tip of the needle must make contact with the eukaryotic host cell membrane.

The enteric pathogen *Shigella* possesses a type III secretion system that enables invasion of the gut epithelial cells of mammalian hosts. Invasion provokes an extensive inflammatory reaction in the gut mucosa. To survive host inflammatory processes such as increased production of antibacterial peptides, *Shigella* is equipped with a lipopolysaccharide structure in its outer membrane that contains protective repeat units of an O-antigen polysaccharide. This O-antigen polymer extends out from the bacterial cell surface, and may impede the ability of the needle tip to contact host cells.

(2) This dilemma is solved by a resident bacteriophage. The *gtr* operon of a resident bacteriophage directs the addition of a glucose residue to each O-antigen repeat unit. Substantially attenuated virulence was observed in glucosylation-defective *gtr* mutants. The *gtr* mutants could still produce lipopolysaccharide with the correct number of O-antigen repeats, and could withstand noxious conditions in the gut. A monoclonal antibody, recognizing the tip of the needle complex, revealed a much lower exposure of the needle at the bacterial cell surface in the glucosylation-defective *gtr* mutants.

(3) How does bacteriophage-mediated glucosylation of the O-antigen affect exposure of the type III secretion needle? Glucosylation causes a conformational change, from a more filamentous to a more compact O-antigen structure. The more compact structure allows exposure of the needle tip, enabling invasion of gut epithelial cells to proceed without compromising the ability of the O-antigen polymer to protect the bacterium against host inflammatory mediators.

（*Science*, 307, 1211-1212 (2005)より抜粋）

注）type III secretion system：III 型分泌装置，shigellosis：赤痢，typhoid fever：チフス熱，*Shigella*：赤痢菌，gut：腸，epithelial：上皮の，O-antigen：O抗原，inflammatory：炎症性の，mucosa：粘膜，glucosylation：グルコシル化

生命科学専攻　英語

英語　第２問

問１　下線部(1)を和訳せよ。

問２　下線部(2)の「this dilemma」が指すことを和訳せよ。

問３　下線部(3)の疑問に対する解答として文中で述べられていることを和訳せよ。また、その根拠として文中で述べられている実験結果を和訳せよ。

生命科学専攻　英語

英語　第３問

以下の英文を読んで問いに答えよ。

Chemists thrive on finding creative new ways to assemble molecules. (1) For the last 100 years, they have done that mostly by making and breaking the strong covalent bonds that form when atoms share electrons. Using that trick, they have learned to combine as many as 1000 atoms into essentially any molecular configuration they please.

Impressive as it is, this level of complexity pales in comparison to what nature flaunts all around us. Everything from cells to cedar trees is knit together using a myriad of weaker links between small molecules. These weak interactions, such as hydrogen bonds, van der Waals forces, and π-π interactions, govern the assembly of everything from DNA in its famous double helix to the bonding of H_2O molecules in liquid water. More than just riding herd on molecules, (2) such subtle forces make it possible for structures to assemble themselves into (3) an ever more complex hierarchy. Lipids coalesce to form cell membranes. Cells organize to form tissues. Tissues combine to create organisms. Today, chemists can't approach the complexity of what nature makes look routine. Will they ever learn to make complex structures that self-assemble?

Well, they've made a start. Over the past 3 decades, chemists have made key strides in learning (4) the fundamental rules of noncovalent bonding. Among these rules: Like prefers like. We see this in hydrophobic and hydrophilic interactions that propel lipid molecules in water to corral together to form the two-layer membranes that serve as the coatings surrounding cells. They bunch their oily tails together to avoid any interaction with water and leave their more polar head groups facing out into the liquid. Another rule: Self-assembly is governed by energetically favorable reactions. Leave the right component molecules alone, and they will assemble themselves into complex ordered structures.

Chemists have learned to take advantage of these and other rules to design (5) selfassembling systems with a modest degree of complexity. Drug-carrying liposomes, made with lipid bilayers resembling those in cells, are used commercially to ferry drugs to cancerous tissues in patients. And selfassembled molecules called rotaxanes, which can act as molecular switches that oscillate back and forth between two stable states, hold promise as switches in future molecular-based computers.

（*Science*, 309, 95 (2005)より抜粋）

注）rotaxane：ロタキサン（化学物質の名称）

生命科学専攻　英語

英語　第３問

問１　下線部(1)を和訳せよ。

問２　下線部(2)の「such subtle forces」が指すことを和訳せよ。

問３　下線部(3)の「an ever more complex hierarchy」が指すことを和訳せよ。

問４　下線部(4)の「the fundamental rules」として文中であげられている例２つを和訳せよ。

問５　下線部(5)の「selfassembling systems」として文中であげられている例２つを和訳せよ。

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英語　第４問

以下の(a)～(j)の文章を最も的確にあらわすと思われる科学技術用語を例にならい英語で書け（略語および略称は不可）。

（例）The process of constructive metabolism by which carbohydrates are formed from water vapor and the carbon dioxide of the air in the chlorophyll-containing tissues of plants exposed to the action of light.

（解答例）

	解答
例	photosynthesis

(a) A hemoprotein composed of four subunits (called as two α and two β). Each subunit contains a heme group. Its function is primarily to transport oxygen from the lungs to the body tissues.

(b) A unicellular organism having cells lacking membrane-bound nuclei. Bacteria are the prime example but also included are blue-green algae and actinomycetes and mycoplasma.

(c) A polymer molecule that encodes genetic information. It is composed of two anti-parallel strands which wind about a common axis to form a double helix. Each strand is composed of a linear array of nucleotides bonded in such a way that the bases extend toward the central axis of the molecule while the two backbones are composed of alternating sugar (β-D-2-deoxyribose) and phosphate subunits.

(d) The motion of charged particles in a gel (polyacrylamide or agarose) under the influence of an electric field. Particles with a positive charge go to the cathode and negative to the anode.

(e) A supra-molecular complex consisting of many proteins and several RNAs. In catalyzing protein synthesis, it undergoes dynamic interactions with mRNA, tRNAs and protein factors. This is called as the site of protein synthesis.

生命科学専攻　英語

英語　第４問

(f) A metabolic process that breaks down carbohydrates and sugars through a series of reactions to either pyruvic acid or lactic acid and release energy for the body in the form of ATP.

(g) An essential amino acid found in proteins and needed for growth of children and for protein metabolism in children and adults. It contains a phenyl ring attached in place of one of the hydrogen atoms of alanine. It is abundant in milk and eggs, and is normally converted to tyrosine in the human body.

(h) A constant number used to refer to atoms, molecules, ions and electrons. Its value is 6.023×10^{23} mol^{-1}.

(i) A substanced dug from the earth. Formerly all minerals were called like that, but the word is now restricted to express the remains of animals and plants found buried in the earth.

(j) A scientific technique to study molecular or atomic structure of a substance by observation of electromagnetic spectra arising from either emission or absorption of radiant energy.