平 成 ３ ０ 年 度
ＡＯ入 試 問 題 集
（農学部）

東北大学入試センター

公表期限：2021 年 3 月末

※各学部試験問題の注意書きに記載されたページ数と、本問題集のページ数が異なる場合がありますが、問題の内容及び問題数は相違ありません。

東北大学

平成３０年度（２０１８年度）東北大学農学部

アドミッションズ・オフィス入学試験（ＡＯ入試）Ⅱ期

小　作　文（午　前）

試験期日　平成 29 年 11 月 18 日（土）

試験時間　9:00～9:30

注意

1　問題冊子は指示があるまで開かないこと。

2　問題冊子は１ページからなっている。試験開始後，直ちに確認すること。

3　ページの落丁・乱丁及び印刷不鮮明の箇所等に気づいた場合には，監督者に申し出ること。

4　解答用紙には，忘れずに受験記号番号及び氏名を記入すること。
解答用紙の裏面には，何も記入しないこと。

5　問題冊子は，試験終了後に持ち帰ること。

平成３０年度 AO 入試 II 期　小作文問題（午前）

インターネットの発達を含む情報化の進展が農業や食生活に及ぼす影響について、あなたの考えを述べてください。

（８００字程度）

東北大学

平成３０年度（２０１８年度）東北大学農学部

アドミッションズ・オフィス入学試験（ＡＯ入試）Ⅱ期

小　作　文（午　後）

試験期日　平成 29 年 11 月 18 日（土）

試験時間　13:30～14:00

注意

1　問題冊子は指示があるまで開かないこと。

2　問題冊子は１ページからなっている。試験開始後，直ちに確認すること。

3　ページの落丁・乱丁及び印刷不鮮明の箇所等に気づいた場合には，監督者に申し出ること。

4　解答用紙には，忘れずに受験記号番号及び氏名を記入すること。
　解答用紙の裏面には，何も記入しないこと。

5　問題冊子は，試験終了後に持ち帰ること。

平成３０年度 AO 入試 II 期　小作文問題（午後）

地球温暖化対応策へ農学分野が貢献できる項目について、考えを述べてください。
（８００字程度）

東北大学

平成３０年度（２０１８年度）東北大学農学部

アドミッションズ・オフィス入学試験（ＡＯ入試）Ⅱ期

筆記試験

試験期日　平成 29 年 11 月 19 日（日）

試験時間　10:00～12:00

注意

1　問題冊子は指示があるまで開かないこと。
2　問題冊子は６ページからなっている。試験開始後，直ちに確認すること。
3　ページの落丁・乱丁及び印刷不鮮明の箇所等に気づいた場合には，監督者に申し出ること。
4　すべての解答用紙に，忘れずに受験記号番号を記入すること。
5　解答は，問題ごとに別の解答用紙に記入すること。
6　問題冊子は，試験終了後に持ち帰ること。

問題１　次の英文を読み，以下の設問に答えなさい。
（*は注を参照）

(1) One of the great things about *IoT is that it's a sector that utilizes technology to solve problems that have plagued traditional industries for centuries. An example of that issue of food waste in agriculture.

According to UN FAO data, approximately $1 trillion in produced crops is annually lost post-harvest. This includes the various stages — from farm, to shelf, to fork. Even in technologically advanced regions such as the EU, post-harvest losses for grains and cereals are often more than 10%, with higher percentages seen in developing countries in Africa or in industrialized Asia. These losses are *incurred during raw material storage, processing — milling, for example — and distribution in the *logistics chain.

One company that is responding to the challenge of food waste with IoT technology is Centaur Analytics, the first full stack IoT company that provides real-time stored agriproducts monitoring and protection solutions. They develop and market end-to-end solutions for the Internet of Things, focused on the quality and safety of stored goods. Their mission is to dramatically increase post-harvest yields and eliminate waste from farm to shelf.

I recently spoke to Dr. Sotiris Bantas, co-founder and CEO of Centaur Analytics about their work. He explained a bit about the need for their role:

"We're basically losing about 1/3 of our annual (2) output on a global scale. So we've been working with our own experts in the field.

(3) *What goes wrong in crop storage*

Storing crops is a tricky process. Most farmed crops are stored in massive quantities in big metal containers like *silos, an environment that is susceptible to a range of challenges like moisture, temperature and insect infestation.

(4) Traditionally methods of managing these challenges have involved farmers physically visiting their silo or storage container in person by testing each one individually — not an exact science — and provide treatments. Insect infestation is particularly problematic.

"*Fumigation is used for all kinds of crops: tobacco leaves, flowers, grain, rice , feeds, fruit fresh, died and so on, people have been fighting this product with fumigating gases but have been doing so without monitoring," Bantas said.

Centaur has *developed proprietary wireless sensors which are designed to "*sniff" crop storage conditions inside shipping containers, grain *bins, and storage *bunkers. (5) This is notable as most sensors cannot transmit from within a metal storage container, like those typically used to store farmed crops.

Behind the scenes, *entomological models are applied to the data stream and predictive analysis is passed to (6) the end user. Importantly, the sensors mean that crops can be monitored in a range of scenarios including ship carriers and transportation which may take weeks or months. “Basically it helps users be *proactive in terms of the fumigation and pest control practices that they should be following to ensure the product is safe and properly *sanitized,” Bantas explained.

The farmer has become connected

(7) Farmers are becoming more technologically sophisticated. Bantas attributes this in part to the fact that farmers in general are way more educated than previous generations and with the *advent of the smartphone and the tablet people become closer to technology. He notes,

“For our users, it’s becoming a *no-brainer that they should not have to visit the silo to check if the wheat is damp or the what smells funny, they actually have an alarm notification about a possible problem in the storage facility. ”

Centaur recently announced a $1.3 million funding round. It’s a great achievement for any *startup, particularly in Greece’s economically challenged startup environment. They company is in a great position as the first mover in this sector, having created a globally relevant solution to a problem affecting farmers from Australia to Algeria. The issue of food security is one that impacts not only current but future generations and technology like that developed by Centaur provides an important solution to some of the challenges.

出典：ReadWrite 2016 年 12 月 6 日（一部省略）

注：IoT=Internet of Things、incurred=招かれる、logistics=物流、silo=サイロ（穀物などの貯蔵庫）、fumigation=くん蒸、developed proprietary=独自に開発した、sniff=においをかぐ、bin=容器、bunker=倉庫、entomological=昆虫学的な、proactive=先を見越して対応できる、sanitized=消毒される、advent=登場、no-brainer=頭を悩ます必要のない、startup=ベンチャー企業

問 1　a）下線部（1）、（4）を和訳しなさい。

b）下線部（4）において、なぜ“not an exact science”と述べられているのか、自分の考えを説明しなさい。（日本語 50 字程度）

問 2　下線部（5）に関連して、なぜ“notable”なのか、本文に則して説明しなさい。

問 3　a）下線部（2）は何を指すか、最も適切な本文中の単語 1 つで答えなさい。

b）下線部（3）について小見出しであることを意識して和訳しなさい。

c）下線部（6）は何を指すか、最も適切な本文中の単語 1 つで答えなさい。

問 4　下線部（7）について、なぜこのように考えられるのか、本文に則して説明しなさい。

問 5　将来の世代への IoT の貢献について、本文に則して説明しなさい。

問 6　本文に書かれた事例以外で、IoT を使って農学部でどのような研究が可能か、あなたのアイデアを自由に述べなさい。（日本語 100 字以内）

問題 2　次の英文を読み，以下の設問に答えなさい。
（*は注を参照）

In the mid 1950's scientists observed a new specialized cellular compartment, called an *organelle, containing enzymes that digest proteins, carbohydrates and lipids. This specialized compartment is referred to as a "*lysosome" and functions as a workstation for *degradation of cellular *constituents. The Belgian scientist Christian de Duve was awarded the Nobel Prize in Physiology or Medicine in 1974 for the discovery of the lysosome. New observations during the 1960's showed that large amounts of cellular content, and even whole organelles, could sometimes be found inside lysosomes. The cell therefore appeared to have a strategy for delivering large cargo to the lysosome. Further biochemical and microscopic analysis revealed a new type of *vesicle transporting cellular cargo to the lysosome for degradation. Christian de Duve, the scientist behind the discovery of the lysosome, *coined the term *autophagy, "self-eating", to describe this process. The new vesicles were named *autophagosomes. During the 1970's and 1980's researchers focused on elucidating another system used to degrade proteins, namely the "*proteasome". Within this research field Aaron Ciechanover, Avram Hershko and Irwin Rose were awarded the 2004 Nobel Prize in Chemistry for "the discovery of *ubiquitin-mediated protein degradation". (1) <u>The proteasome efficiently degrades proteins one-by-one, but this mechanism did not explain how the cell got rid of larger protein complexes and worn-out organelles.</u> Could the process of autophagy be the answer and, if so, what were the mechanisms?

Yoshinori Ohsumi had been active in various research areas, but upon starting his own lab in 1988, he focused his efforts on protein degradation in the *vacuole, an organelle that corresponds to the lysosome in human cells. *Yeast cells are relatively easy to study and consequently they are often used as a model for human cells. They are particularly useful for the identification of genes that are important in complex cellular pathways. But Ohsumi faced a major challenge; yeast cells are small and their inner structures are not easily distinguished under the microscope and thus he was uncertain whether autophagy even existed in this organism. (2) <u>Ohsumi reasoned that if he could disrupt the degradation process in the vacuole while the process of autophagy was active, then autophagosomes should accumulate within the vacuole and become visible under the microscope.</u> He therefore cultured *mutated yeast lacking vacuolar degradation enzymes and simultaneously stimulated autophagy by *starving the cells. The results were striking! Within hours, the vacuoles were filled with small vesicles that had not been degraded. The vesicles were autophagosomes and Ohsumi's experiment proved that authophagy exists in yeast cells. (3) <u>But even more importantly, he now had a method to identify and</u>

characterize key genes involved this process. This was a major break-through and Ohsumi published the results in 1992.

Ohsumi now took advantage of his engineered yeast strains in which autophagosomes accumulated during starvation. This accumulation should not occur if genes important for autophagy were *inactivated. Ohsumi exposed the yeast cells to a chemical that randomly introduced *mutations in many genes, and then he induced autophagy. His strategy worked! Within a year of his discovery of autophagy in yeast, Ohsumi had identified the first genes essential for autophagy. In his subsequent series of elegant studies, the proteins encoded by these genes were *functionally characterized. (4) The results showed that autophagy is controlled by a *cascade of proteins, each regulating a distinct stage of autophagosome initiation and formation.

After the identification of the machinery for autophagy in yeast, a key question remained. Was there a corresponding mechanism to control this process in other organisms? Soon it became clear that virtually identical mechanisms operate in our own cells. The research tools required to investigate the importance of autophagy in humans were now available.

Thanks to Ohsumi and others following in his footsteps, we now know that autophagy controls important *physiological functions where cellular components need to be degraded and recycled. (5) Autophagy can rapidly provide fuel for energy and building blocks for renewal of cellular components, and is therefore essential for the cellular response to starvation and other types of stress. After infection, autophagy can eliminate invading intracellular bacteria and viruses. Autophagy contributes to *embryo development and *cell differentiation. Cells also use autophagy to eliminate damaged proteins and organelles, a quality control mechanism that is critical for counteracting the negative consequences of aging.

*Disrupted autophagy has been linked to Parkinson's disease, type 2 *diabetes and other disorders that appear in the elderly. Mutations in autophagy genes can cause genetic disease. Disturbances in the autophagic machinery have also been linked to cancer. Intense research is now ongoing to develop drugs that can target autophagy in various diseases.

Autophagy has been known for over 50 years but its fundamental importance in physiology and medicine was only recognized after Yoshinori Ohsumi's paradigm-shifting research in the 1990's. For his discoveries, he is awarded this year's Nobel Prize in physiology or medicine.

出典：ノーベル財団プレスリリース “The 2016 Nobel Prize in Physiology or Medicine.”

（一部省略）

注）organelle=細胞内小器官（オルガネラ）, lysosome=リソソーム（細胞内消化を司る小器官）, degradation=分解, constituents=構成成分, vesicle=小胞（オルガネラ間を結ぶ輸送小胞のこと）, coined=造語を作る, autophagy=自食作用（オートファジー）, autophagosome=自食胞（オートファゴソーム）, proteasome=プロテアソーム（タンパク分解酵素複合体）, ubiquitin-mediated=ユビキチン介在性の, vacuole=液胞, yeast=酵母, mutated=突然変異を起こさせた, starving=飢餓状態にさせる, inactivated=不活性にする, mutation=遺伝子変異, functionally characterized=機能を解析された, cascade=多段階反応, physiological=生理的な, embryo development=胚発生, cell differentiation=細胞の分化, disrupted=崩壊した, diabetes=糖尿病

問 1　下線部（1）、（2）、（3）、（4）、（5）を和訳しなさい。

問 2　autophagy と autophagosome とは何か、それぞれ英語 1 文で説明しなさい。

問 3　大隅博士がオートファジーに必要な遺伝子を同定した過程を、本文に則して説明しなさい。（日本語 150 字程度）

問 4　ヒトの老化や感染、疾病におけるオートファジーの役割を、本文に則して説明しなさい。（日本語 150 字程度）

問 5　大隅博士の業績は、農学分野の研究にも活かされています。あなたが、東北大学農学部に入学してオートファジーに関連する研究をするとしたら、どのような研究になるか、あなたのアイデアを自由に述べなさい。（日本語 150 字程度）

東北大学

平成３０年度（２０１８年度）東北大学農学部
アドミッションズ・オフィス入学試験（ＡＯ入試）Ⅲ期

小　作　文（午　前）

試験期日　平成 30 年 2 月 5 日（月）

試験時間　9:30～10:00

注意

1　問題冊子は指示があるまで開かないこと。

2　問題冊子は１ページからなっている。試験開始後，直ちに確認すること。

3　ページの落丁・乱丁及び印刷不鮮明の箇所等に気づいた場合には，監督者に申し出ること。

4　解答用紙には，忘れずに受験記号番号及び氏名を記入すること。
　解答用紙の裏面には，何も記入しないこと。

5　問題冊子，草案紙は，試験終了後に持ち帰ること

次の課題について３０分以内に８００字程度で記述してください。

課　題

日本の野菜や果物を輸出する場合に考えられる問題点や解決法、輸出を促進するためのアイデアなどについてあなたの考えを述べてください。

東北大学

平成３０年度（２０１８年度）東北大学農学部

アドミッションズ・オフィス入学試験（ＡＯ入試）Ⅲ期

小　作　文（午　後）

試験期日　平成 30 年 2 月 5 日（月）

試験時間　13:30～14:00

注意

1　問題冊子は指示があるまで開かないこと。

2　問題冊子は１ページからなっている。試験開始後，直ちに確認すること。

3　ページの落丁・乱丁及び印刷不鮮明の箇所等に気づいた場合には，監督者に申し出ること。

4　解答用紙には，忘れずに受験記号番号及び氏名を記入すること。
　解答用紙の裏面には，何も記入しないこと。

5　問題冊子，草案紙は，試験終了後に持ち帰ること。

次の課題について３０分以内に８００字程度で記述してください。

課　題

将来、日本の食料生産において危惧される具体的な問題点を取り上げ、解決するためには、どのような農学研究が必要なのか？あなたの考えを述べてください。