

單選題，每題 2 分，答錯倒扣 0.5 分，請於試卷上「選擇題作答區」內依序作答。

Article 1

Source: Meat Science (Volume 184, February 2022, 108693)

Over the past half-century, human diet, activity patterns, and nutritional status have undergone a sequence of major changes throughout the world. In the developed world, diet is being linked to non-communicable diseases, rather than to undernutrition in developing countries. These trends have accelerated the shift from traditional to more modern eating habits, including westernized eating patterns featuring low fiber and high fat diets. The tendency of people who prefer to eat in restaurants, has risen by up to 40.20% from 2000 to 2008. For instance, compared to a traditional Chinese diet, which is mainly comprised of vegetables, grains, and plant-based proteins, more recently, people prefer to eat fast-food, which contains more meat with very limited vegetables, high fat, sodium, and cholesterol. A report has shown that the global per capita consumption of red meat has increased from 24.2 kg/year (1964) to 36.4 kg/year (1999), and by 2030, the per capita intake of meat is expected to rise by up to 45.3%. The rapid increase in meat consumption has had a negative impact on public health results in increased rates of obesity, diabetes, cardiovascular diseases, and gastric and colorectal cancer.

Several epidemiological studies have indicated that high consumption of well-done meat could increase the risk of cancer in humans, as cooking protein-rich foods like meat and fish at high temperatures can lead to high levels of carcinogenic compounds, such as heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbon (PAHs). HCAs were first discovered in 1939 by a Swedish scientist named Widmark who revealed that extracts of horse meat roasted at 275 °C caused mammary gland cancer in mice. This discovery has drawn the interest of researchers all over the world to explore how high temperature affects meat. Subsequently, in 1977, Sugimura and his collaborators discovered some carcinogenic compounds in meat during cooking and named them heterocyclic amines. Later on, HCAs were further classified as amino carbolines and amino amidazo azoarenes. Amino amidazo azoarenes or IQ type HCAs are formed through a reaction between creatine, creatinine, hexose, and amino acids during normal cooking (150–300 °C), whereas, amino carbolines or non IQ type HCAs are formed by pyrolytic reactions of amino acids and proteins at high temperatures. The International Agency for Research on Cancer (IARC) has documented MeIQ, PhIP, AαC, and MeAαC as possible human carcinogens, and IQ as a probable human carcinogen, and suggested lower dietary exposure to these hazardous substances. Furthermore, the American national toxicology program (NTP) has declared PhIP, MeIQ, and IQ as reasonably anticipated human carcinogens.

Numerous factors greatly affect the formation of HCAs during cooking including cooking time, cooking temperature, method of cooking, type of cooking oil used, fat content, precursors in meat, and pre-treatment techniques. Most of the previously reported studies on HCAs are limited to their mutagenic properties in cooked meat products, whereas, some have addressed the general aspects only, including formation, analysis, and mitigation, which offers detailed information on these issues. However, researchers need to conduct comparative studies on HCAs regarding food safety aspects to aware the public and minimize the risk to a minimal level. The cooking method has a substantial role in the formation as well as the type of HCAs produced during heat processing. In a recent study when goat meat was cooked via four different methods (deep fat frying, pan-frying, barbecue, and oven roasting), deep fat frying and pan-frying produced the maximum level of HCAs, followed by Oven roasting and barbecue cooking

1. Which of the below is NOT the abovementioned advantages of traditional Chinese diet as compared to fast food? (A) Less sodium (B) More vegetables (C) More grains (D) More plant based protein
2. It is estimated that the global per capita consumption of red meat may reach up to ____ by year 2030? (A) 45.3% (B) 24.2% (C) 36.4% (D) 40.2%
3. Which of the following is NOT the abovementioned member that declared by American national toxicology program as reasonably anticipated human carcinogen? (A) PhIP (B) IQ (C) MeAαC (D) MeIQ
4. Which of the below is NOT the factors mentioned above that affect the formation of HCAs? (A) cooking time and cooking temperature (B) Cooking method (C) Post-treatment technique (D) Fat content and type of cooking oil
5. As mentioned in the last paragraph, which of the following produced less HCAs when goat meat was cooked via four different methods (deep fat frying, pan-frying, barbecue, and oven roasting)? (A) deep fat frying (B) pan-frying (C) barbecue (D) oven roasting

見背面

Article 2

Source: Ageing Research Reviews (Volume 72, December 2021, 101510)

Iron is fundamentally important for cell survival, proliferation, and metabolism across multiple organisms. As a key element of many indispensable cellular players and co-factors (e.g., heme groups, iron sulfur clusters), iron is required for oxygen transport and involved in the biosynthesis of collagen, myelin, neurotransmitters, and many components of the mitochondrial electron transport chain. In addition, iron is involved in multiple cellular catabolic and anabolic processes such as DNA synthesis, respiration, and energy metabolism. Furthermore, iron plays a vital role in the innate immune response to infections, as the first-line host antimicrobial mechanisms often reduce iron availability to pathogens.

Low concentrations of iron result in restricted erythropoiesis and consequently anemia. By contrast, high concentrations of labile iron are highly toxic to the cell by generating reactive oxygen species (ROS) that may inflict damages on cells and organs. Thus, iron can act as a double-edged sword, which necessitates tight regulation of its cellular levels and exquisite equilibrium between iron storage and transport. Iron uptake is a dynamic process that mainly depends on the absorption from digested food. However, unlike iron uptake, systemic iron excretion occurs at an almost steady basal rate regardless of the physiological concentration of iron. Therefore, excess iron can accumulate and result in iron overload. Iron overload could also result from hereditary disorders or pathologies like in the case of hemochromatosis, a genetic disease that causes an increased intestinal iron absorption, eventually leading to the iron overload in body tissues and organs and causing tissue damages. In fact, many genetic variants of iron metabolism modulators have been linked to iron imbalance.

Aging has a profound impact on iron homeostasis. In humans, age-related iron accumulation occurs in multiple organs including the liver, kidney, and brain, which has been linked to several age-related pathologies including liver diseases, renal disorders, and Alzheimer's disease. Conversely, iron deficiency and various forms of anemia are also prominent among older adults as the intestinal dietary iron uptake becomes less efficient at advanced ages. Notably, there are two major forms of iron deficiency, absolute and functional deficiency. While absolute iron deficiency is a decrease in the total body iron content and is usually due to a decrease in intestinal iron absorption, functional iron deficiency is in general due to iron flux to iron storage sites, which leads to iron sequestration in macrophages and renders iron less bioavailable for erythropoiesis. Functional anemia is also known as anemia of inflammation or anemia of chronic disease, and its occurrence mostly results from immune activation. Importantly, iron deficiency in general is closely associated with impaired mental and immune functions as well as poor physical performance in the elderly. Studies in rodents demonstrated that while restricted iron availability can jeopardize certain physiological processes in the body, iron-enriched diets accelerate aging through increased oxidative stress and inflammation. Collectively, a better understanding of the age-related dysregulation of iron homeostasis can help us develop strategies for fine-tuning the process, restoring the balance, and therefore mitigating the associated pathologies.

In adult humans, iron enters the body mainly from diet through intestinal dietary iron absorption in two major forms, heme and non-heme iron. Non-heme dietary iron is abundant in plant foods and iron-fortified foods, and it can be in the ferric or more bioavailable ferrous states. Although the chemical nature of non-heme dietary iron is not very well understood, ferric citrate is thought to be the predominant species. Existing supplements mainly include ferrous sulfate, ferrous gluconate, ferric citrate, and ferric sulfate, and the low pH of the digestive system helps keep the non-heme iron in the soluble form. On the other hand, heme iron, which can be ingested from meat, seafood, and poultry, is bound to the porphyrin ring and less affected by diet and other factors, rendering its absorption more efficient.

6. Which of the following is NOT the role of iron mentioned above? (A) co-factor (B) biosynthesis of myelin (C) DNA synthesis (D) reduce ROS
7. Hemochromatosis is a genetic disease that may lead to _____. (A) accumulation of iron in organs (B) increase intestinal iron absorption (C) tissue damages (D) all of the above
8. According to the article, which of the following is considered as the predominant species of non-heme dietary iron? (A) ferrous sulfate (B) ferric citrate (C) ferric sulfate (D) ferrous gluconate
9. According to article, it has been found that age-related iron accumulation may occur in multiple organs. Which of the following disease is NOT mentioned in the article? (A) liver diseases (B) mammary cancer (C) renal disorders (D) Alzheimer's disease

10. According to the article, which of the following is the CORRECT? (A) Iron-enriched diets could slow down aging. (B) Absolute iron deficiency is usually due to reduction in intestinal iron absorption. (C) High concentration of iron may lead to anemia. (D) Iron does not involve in cell proliferation.

Article 3

The Unsung Virtues of Cocoa Honey

(Source: Food Technology-IFT, January 2022)

The cocoa industry produced nearly 4.9 million tons of cocoa in 2020, most of which is used for chocolate. However, cocoa production also generates many byproducts that mostly are treated as waste. But new research from Brazil suggests some of those byproducts could be exploited as ingredients or food products in their own right. One example is cocoa honey, which presents a novel flavor and has potential both as a stand-alone product and as an ingredient. Recent research identifies cocoa honey's potential to provide a nutritional food to help meet food security and improved nutrition as part of the United Nations Sustainable Development Goals, and help the chocolate industry improve its environmental sustainability.

Nutrients and Characteristics

According to Jacqueline Takahashi, professor in the Department of Chemistry at the Universidade Federal de Minas Gerais and co-author of a recent research paper published in *Future Foods*, cocoa honey has a unique flavor profile—sweet and slightly acidic, and a little like the taste of cocoa. It's also moderately viscous. Cocoa honey is produced when the cocoa fruit is cut open to remove the seeds and pulp. The contact with air triggers a fermentation process, which is necessary to develop the seeds' flavors. The juice—"honey"—is from the pulp liquifying due to enzymes acting on its pectin. One estimate included in Takahashi's research puts cocoa honey amounts at 0.59 kg for every kilogram of dried seeds. The liquid contains minerals and nutrients, including calcium, magnesium, phosphorous, iron, potassium, zinc, and vitamin C. It also has carbohydrates, predominantly glucose, sucrose, and fructose, and its pH level ranges from 2.76 to 3.58. In addition, it has phytochemicals, like flavonoids.

Potential Uses and Stability Issues

Cocoa honey could be processed into a white sugar substitute, a sweetener, a beverage, and a gelling agent, says Takahashi. Local and indigenous communities in cocoa-growing regions have traditionally used it to make beverages, syrups, and jellies, among other products. But while some of the byproduct is collected by cocoa plantation workers, and some is frozen to be transported, most of it is treated as waste, says Takahashi. Stability over time is an issue that Takahashi and others are researching. Once fermentation begins, the flavor changes and the honey becomes very acidic within only a few hours. Takahashi and her colleagues have had some success using additives and other technologies like gamma radiation to improve shelf-life, but she notes the artificial additives used would likely not be accepted by the natural foods market. Takahashi and her team are also experimenting with a powder form of cocoa honey that could be sold as an ingredient. The European Food Safety Authority recently approved pasteurized and frozen cocoa pulp as an acceptable food product, which could increase interest in cocoa honey and pave the way for an international market.

Improving Cocoa Sustainability

As the majority of cocoa production occurs in rural communities using manual labor and processes, Takahashi says the mass capture of cocoa honey would require some modernization to improve collection and control contamination, such as using stainless steel equipment. But capturing and marketing cocoa honey could provide an extra source of revenue for local communities and producers—70% of the world's cocoa comes from Ghana and Côte d'Ivoire, where cocoa farmers make about \$1 and 78 cents per day, respectively. It could also help the cocoa industry become more sustainable. And, Takahashi says, this could be the first step in putting the rest of the cocoa pod to full use. "What I see in the chemistry area is that once you have the fruit, you can use everything from it," she says.

11. What is cocoa honey? (A) honeydew from cocoa flowers (B) fermented cocoa pulp (C) juice of cocoa pods (D) liquid from cocoa seeds.
12. What is NOT the potential usage of cocoa honey suggested in this article? (A) a sweetener (B) beverages (C) jellies (D) flavoring agents.
13. What is the major challenge of using cocoa honey? (A) instability (B) high sugar content (C) discoloration (D) high in heavy metals.

見背面

14. According to this article, which is one of the most potential areas for producing cocoa honey? (A) Brazil (B) Federal de Minas Gerais (C) Ghana (D) European.
15. Currently, how is the majority of cocoa honey treated in cocoa-growing regions? (A) waste (B) beverages (C) chocolate ingredient (D) gelling agent.

Article 4

Mushrooms Sprout Solution for Vegan-Friendly Beer (Source: Digital Exclusives Article-IFT, October 8, 2021)

Startup Chinova Bioworks recently partnered with the College Communautaire du Nouveau Brunswick (CCNB) in Canada to develop a processing aid for vegan-friendly beers. At this point, you're likely asking yourself, "Is beer not already vegan?" While vegans, by definition, steer clear of the obvious culprits like eggs, milk, butter, and honey that are easily identifiable on ingredient lists, some might not realize that animal-derived and/or synthetic ingredients are often used in the processing of beer and other alcoholic beverages. And the tricky thing is that these ingredients aren't always listed on the label.

"Many brewed beers and other alcoholic beverages include animal-based compounds that are added through the production process," explains Natasha Dhayagude, CEO and co-founder of Chinova Bioworks. "For example, many include pepsin, a foaming agent obtained from stomach enzymes of pigs; chitin, derived from lobster and crab shells; as well as carmine, which is found in the crushed scales of cochineal insects."

Another commonly used compound is isinglass, a kind of gelatin obtained from fish swim bladders. These ingredients—termed "fining agents"—are often used in the alcohol production and filtering process to make drinks appear clearer and brighter. Through the partnership, the researchers have discovered that Chinova's proprietary fiber ingredient derived from the stems of white button mushrooms—called Chiber—can be used to replace isinglass fining agents and synthetic polyvinylpolypyrrolidone (PVPP).

"Through this collaboration, early results have already shown that Chinova's mushroom fiber works eight times faster at settling yeast post-fermentation and can even leave residual antimicrobial benefits to the beer, making it stay fresher, longer," says Dhayagude. In addition to being vegan and natural, the company claims that Chiber is cost effective, sustainable, odorless, tasteless, and doesn't contain any allergenic materials from the mushroom.

While many leading brews, including Budweiser, Coors, Corona, and Heineken have shifted their processing to eliminate animal-derived ingredients, some still rely on synthetic processing aids. Additionally, the use of isinglass and other animal-derived finings is still high among cask brewers in the United Kingdom in order to cut down on the time needed for unfinned casks to settle.

Chiber is already being used to extend the shelf-life in various food and beverage applications, including dairy, beverages, plant-based meat and dairy, sauces, and spreads. With the goal to go to market with Chiber for alcoholic beverages in the first quarter of 2022, the company is "currently working with early adopters for market testing," explains Dhayagude, "while actively seeking more innovative companies to take part in the initiative." In the future, the company hopes to launch additional product lines and find more applications for Chiber in categories like baked goods.

16. This article explains why many beer and alcoholic beverages are not vegan-friendly. (A) PVPP (polyvinylpolypyrrolidone) is used as a clarifying agent. (B) Carmine is used as a colorant. (C) Honey is commonly added to products. (D) Yeast is not exhaustively removed after fermentation.
17. What is "Chiber"? (A) a pig enzyme (B) a crustacean polysaccharide (C) an insect protein (D) a fungal fiber ingredient.
18. What is NOT the property of "Chiber" described in this article? (A) a fining agent (B) an antimicrobial agent (C) an expensive additive (D) a beer processing aid.
19. What is NOT true about isinglass? (A) a fining agent (B) a food processing aid (C) a synthetic polymer (D) a fish's protein.
20. Which company or organization is the owner of "Chiber"? (A) College Communautaire du Nouveau Brunswick (B) Chinova Bioworks (C) Budweiser (D) It is not mentioned in this article.

Article 5

What is depression and what can I do about it?

接次頁

(Source: Medical News Today, November 22, 2019)

Depression is the main cause of disability Trusted Source worldwide, according to the World Health Organization (WHO). It can affect adults, adolescents, and children. In this article, learn what depression is and what causes it. We also describe the types, their treatments, and more.

Definition

A person with depression may experience persistent sadness.

Depression is a mood disorder that involves a persistent feeling of sadness and loss of interest. It is different from the mood fluctuations that people regularly experience as a part of life. Major life events, such as bereavement or the loss of a job, can lead to Trusted Source depression. However, doctors only consider feelings of grief to be part of depression if they persist. Depression is an ongoing problem, not a passing one. It consists of episodes during which the symptoms last for at least 2 weeks. Depression can last for several weeks, months, or years.

Signs and symptoms

- The symptoms of depression can include:
- a depressed mood
- reduced interest or pleasure in activities once enjoyed
- a loss of sexual desire
- changes in appetite
- unintentional weight loss or gain
- sleeping too much or too little
- agitation, restlessness, and pacing up and down
- slowed movement and speech
- fatigue or loss of energy
- feelings of worthlessness or guilt
- difficulty thinking, concentrating, or making decisions
- recurrent thoughts of death or suicide, or an attempt at suicide
- Find out more about recognizing the hidden signs of depression.

In females

Depression is nearly twice as common Trusted Source among women as men, according to the Centers for Disease Control and Prevention (CDC). Below are some symptoms Trusted Source of depression that tend to appear more often in females:

- irritability
- anxiety
- mood swings
- fatigue
- ruminating (dwelling on negative thoughts)

Also, some types Trusted Source of depression are unique to females, such as:

- postpartum depression
- premenstrual dysphoric disorder

In males

Around 9% of men in the United States have feelings of depression or anxiety, according to the American Psychological Association. Males with depression are more likely than females to drink alcohol in excess, display anger, and engage in risk-taking as a result of the disorder. Other symptoms of depression in males may include:

- avoiding families and social situations
- working without a break
- having difficulty keeping up with work and family responsibilities
- displaying abusive or controlling behavior in relationships
- Learn more about the symptoms of depression in men.

見背面

In college students

Time at college can be stressful, and a person may be dealing with other lifestyles, cultures, and experiences for the first time. Some students have difficulty coping with these changes, and they may develop depression, anxiety, or both as a result. Symptoms of depression in college students may include:

- difficulty concentrating on schoolwork
- insomnia
- sleeping too much
- a decrease or increase in appetite
- avoiding social situations and activities that they used to enjoy

In teens

Physical changes, peer pressure, and other factors can contribute to depression in teenagers. They may experience some of the following symptoms:

- withdrawing from friends and family
- difficulty concentrating on schoolwork
- feeling guilty, helpless, or worthless
- restlessness, such as an inability to sit still

In children

The CDC estimates that, in the U.S., 3.2% of children and teens aged 3–17 have a diagnosis of depression. In children, symptoms can make schoolwork and social activities challenging. They may experience symptoms such as:

- crying
- low energy
- clinginess
- defiant behavior
- vocal outbursts

Younger children may have difficulty expressing how they feel in words. This can make it harder for them to explain their feelings of sadness.

Please indicate the following statements are Yes, No or Not Given according to the passage above. Write Y, N or NG respectively.

Yes (Y) if the statement agrees with the passage above

No (N) if the statement contradicts with the passage above

Not Given (NG) if the statement is not mentioned in the passage above

21. The CDC estimates that, in the U.S., 4.2% of children and teens aged 3–17 have a diagnosis of depression.
22. Males with depression are less likely than females to drink alcohol in excess, display anger, and engage in risk-taking as a result of the disorder.
23. Depression is nearly two times as common among women as men, according to the Centers for Disease Control and Prevention (CDC).
24. Depression is a mood disorder that involves a persistent feeling of sadness and loss of interest. It is different from the mood fluctuations that people regularly experience as a part of life.
25. Depression is not the main cause of disability worldwide, according to the World Health Organization (WHO). It can affect adults, adolescents, and children.

Article 6

What are the gut microbiota and human microbiome?

(Source: Medical News Today, June 26, 2018)

The human body is host to trillions of microbes, or bacteria. Some of these are useful, and some are harmful. Some scientists have estimated that there are 10 times more microbial cells in the body than there are human cells, while others say that the ratio may be closer to 1:1. Recent scientific advances in genetics mean that humans now know a lot more about the microbes in

接次頁

題號： 322
科目： 專業英文(G)
節次： 5

國立臺灣大學 111 學年度碩士班招生考試試題

題號： 322

共 11 頁之第 7 頁

the body. Many countries have invested a lot in researching the interactions within the human body's ecosystem and their relevance to health and disease. The two terms microbiota and microbiome are often used to mean the same thing and are used interchangeably. This article will explain the differences between them and how both are being used and research in modern medicine. The human microbiota consists of a wide variety of bacteria, viruses, fungi, and other single-celled animals that live in the body. The microbiome is the name given to all of the genes inside these microbial cells. Every human being harbors anywhere between 10 trillion and 100 trillion microbial cells in a symbiotic relationship. This benefits both the microbes and their hosts, as long as the body is in a healthy state. Estimates vary, but there could be over 1,000 different species of microorganism making up the human microbiota. There are plenty of projects trying to decode the human genome by sequencing all human genes. In a similar way, the microbiome has been subject to intensive efforts to unravel all its genetic information. The following video about the human ecosystem, produced by the Genetic Science Learning Center of the University of Utah, Salt Lake City, will help create a picture of this delicate but vital relationship. It is a good introduction to the range of habitats for different types of microbe in the body, including the differences between the dry environment of the forearm and the wet and oily environment of the armpit. The microbes in the body are so small that they make up only about 2 to 3 percent of the total weight of the human body, despite outnumbering the cells.

A 2012 study Trusted Source published in Nature by the Human Microbiome Project Consortium found the following: Samples of mouth and stool microbial communities are particularly diverse. In contrast, samples from vaginal sites show particularly simple microbial communities. The study demonstrated the great diversity of the human microbiome across a large group of healthy Western people but poses questions for further research. How do microbial populations within each of us vary across a lifetime, and are patterns of colonization by beneficial microbes the same as those shown by disease-causing microbes? The gut microbiota used to be called the microflora of the gut. Around this time, in 1996, Dr. Rodney Berg, of Louisiana State University's Microbiology and Immunology department, wrote about the gut microbiota, summing up its "profound" importance. "The indigenous gastrointestinal tract microflora has profound effects on the anatomical, physiological, and immunological development of the host," Dr. Berg wrote, in a paper published in Trends in Microbiology. "The indigenous microflora stimulates the host immune system to respond more quickly to pathogen challenge and, through bacterial antagonism, inhibits colonization of the GI tract by overt exogenous pathogens." This symbiotic relationship benefits humans, and the presence of this normal flora includes microorganisms that are so present in the environment that they can be found in practically all animals from the same habitat. However, these native microbes also include harmful bacteria that can overcome the body's defenses that separate them from vital systems and organs. In summary, there are beneficial bacteria in the gut, and there are harmful bacteria that can cross into wider systems and can cause local infections of the GI tract. These infections include food poisoning and other GI diseases that result in diarrhea and vomiting. The gut microbiota contains over 3 million genes, making it 150 times more genetically varied than the human body.

Please indicate the following statements are Yes, No or Not Given according to the passage above. Write Y, N or NG respectively.

Yes (Y) if the statement agrees with the passage above

No (N) if the statement contradicts with the passage above

Not Given (NG) if the statement is not mentioned in the passage above

26. The gut microbiota contains over 3 billion genes, making it 150 times more genetically varied than the human body.
27. The human body is host to trillions of microbes, or bacteria. All of them are useful.
28. A 2012 study Trusted Source published in Nature by the Human Microbiome Project Consortium found the following: Samples of mouth and stool microbial communities are the same.
29. The two terms microbiota and microbiome are often used to mean the same thing and are used interchangeably.
30. There are plenty of projects trying to decode the human genome by sequencing all human genes. In a similar way, the microbiome has been subject to intensive efforts to work out all its genetic information.

Article 7

Bacteriophages as Weapons Against Bacterial Biofilms in the Food Industry

見背面

(Source: Frontiers in Microbiology, 2016)

Food safety is an important issue for health authorities and industries due to the health impact and economic losses caused by the contamination of foodstuffs. Despite the implementation of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCPs) in food industries, in 2014 the European Food Safety Authority (EFSA) reported a total of 5,251 foodborne outbreaks resulting in 6,438 hospitalizations. In the United States, 866 foodborne outbreaks were reported in 2014, resulting in 714 hospitalizations.

Food is often contaminated during processing and packaging through contact with equipment surfaces. Of note, contamination with hemolytic bacteria (*Staphylococcus aureus* and *Streptococcus agalactiae*) was detected in hands, hand-contact and food-contact surfaces in foodservice settings; the presence of coliforms in washing water and industrial facilities are involved in the low microbiological quality of tomatoes or the notable incidence of *S. aureus* and other pathogenic bacteria on food industry surfaces in Spain are some of the great number of reported examples.

In fact, elimination of bacteria in food processing environments is greatly hindered by the presence of biofilms which provide a reservoir of foodborne pathogens. Usually most bacteria are organized in multispecies communities attached to a surface as biofilms, which confer ecological advantages that free-living bacteria in planktonic cultures do not have. Extracellular matrix, composed of a mixture of polymeric compounds such as polysaccharides, proteins, nucleic acids, and lipids, keeps the bacteria in close proximity each other and forms channels to distribute water, nutrients, oxygen, enzymes, and cell debris. This structure provides a microenvironment with physicochemical gradients, horizontal gene transfer, and inter-cell communication. In addition, biofilm matrix protects the involved bacteria from environmental damages, antimicrobial agents, and host immune defenses. The low diffusion of antimicrobial substances through the matrix, together with an altered growth rate of bacteria constitutes the main barrier in the fight against relevant microorganisms living in biofilms.

Biofilm formation has notable implications in industrial processes, in particular in food processing, with a negative impact on food safety and the subsequent economic losses. In this regard, further studies about biofilm development and disassembly have been performed for important pathogenic bacteria such as *S. aureus* and *Listeria monocytogenes*. Numerous biofilm control strategies have been proposed but the problem remains unsolved, probably because of the complexity of these structures, which contain both cells and extracellular substances. Ideally, a biofilm removal system should be able to get inside the biofilm structure and eliminate efficiently all the matrix components and the bacteria.

New approaches are focused on preventing biofilm formation by the development of anti-adhesive surfaces or by the inhibition or reduction of bacterial adhesion. Moreover, removal strategies like physical and chemical treatments, antimicrobial photodynamic therapy, induction of biofilm detachment, blocking of biofilm regulation, matrix degradation, and quorum sensing inhibitors have been explored.

Another promising approach to control and eradicate biofilms is the use of bacteriophages. These viruses are harmless to humans, animals, and plants because they specifically target and kill bacteria. Virulent phages follow a lytic cycle where they multiply within bacteria to finally release the phage progeny by lysis of the cell. This process confers phages their antimicrobial activity. Phages have been used as treatment against human infections in countries from Eastern Europe, but the increase in antibiotic resistance has boosted new research and a notable interest worldwide for the use of phages to fight against pathogenic bacteria in clinical, veterinary, food safety, and environment. Phage-encoded lytic proteins such as endolysins and virion-associated peptidoglycan hydrolases (VAPGHs) have also been assessed as antimicrobial agents against pathogens and other phage-encoded proteins with polysaccharide depolymerase activity can be used as anti-biofilm agents. Therefore, bacteriophages are not only bacterial killers but also a source of antimicrobial phage-derived proteins that can be exploited to fight against pathogenic bacteria.

31. In the following scenarios, what is a possible scenario for food contamination? (A) food preparation on a cutting board (B) washing vegetables (C) cured meat slices from automated meat cutter (D) all of the above
32. What is NOT the benefits for bacteria to form biofilms? (A) altered growth rate (B) performing horizontal gene transfer (C) forming barriers against antimicrobial agents (D) being free-living
33. Which of the followings impedes elimination of foodborne pathogens in food processing environments? (A) the emergence of virulent phages (B) the implementation of Hazard Analysis Critical Control Point (HACCPs) (C) the presence of biofilms (D) the

development of anti-adhesive surfaces

34. According to the article, which of the followings is NOT a new biofilm control strategy? (A) development of surface treatment to reduce bacterial adhesion (B) the use of compounds to interfere quorum sensing (C) the use of specific virus that targets biofilm (D) the use of antibiotics
35. Which of the following descriptions is incorrect regarding “bacteriophage”? (A) a type of viruses (B) being detrimental to human cells (C) can be used to treat infections caused by bacteria (D) can produce proteins to break down polysaccharides.

Article 8

The Definition of Gene Therapy Has Changed

(Source: Nature Collections, 2021)

Three decades after its first, faltering steps in humans, gene therapy is emerging as a treatment option for a small but growing number of diseases. Although the concept faced scientific and ethical uncertainty when it was floated in the 1970s, the foundation of the approach—replacing or fixing a single, disease-causing gene—has proved solid. Researchers have developed different ways to correct or influence the way someone’s genes function and used those techniques to create therapies for several blood disorders, as well as degenerative eye and muscle diseases. More than half a dozen such treatments have gained approval in the U.S. in the past five years, and numerous others, aimed at a variety of conditions, are progressing toward clinical trials.

Existing gene therapies rely on two fundamental approaches. The more common approach draws blood from the patient and reprograms specific cells within the laboratory before reinjecting them into the person’s body. The other method delivers gene treatments directly into the body, usually to easier-to-reach areas such as the eye. Now the field is beginning to mature and move beyond these initial tactics. Continued advances have made gene delivery safer and more effective, leading to dozens of human trials in new tissues, such as the liver and heart. Other approaches are pushing beyond the original definition of gene therapy, with cutting-edge molecular tools that fix errors within genes rather than replacing or inserting a whole gene.

Yet despite recent progress, gene therapy faces numerous hurdles on the path to wider clinical use—chief among them is how to target specific tissues without triggering an immune response. Broader, long-term challenges include improving both manufacturing efficiency and cost: Gene therapy treatments in the U.S. currently average more than \$400,000 per dose. Nevertheless, with so much potential and so many patients in need of new solutions, gene therapy will only continue to grow in both prominence and potency.

The concept underlying the original gene therapy approaches, some of which are still in use, is fairly straightforward: When a disease results from a missing or dysfunctional gene, deliver a functional copy of the gene into affected cells. That, says Prashant Mali, a bioengineer at the University of California, San Diego, was the “version 1.0 definition of gene therapy.”

In the past decade technological advances have ushered in a new era, and the definition of gene therapy continues to evolve, Mali says. The newest approaches forgo the delivery of healthy genes and instead aim to precisely repair the gene within the cell. When there is a mutation or other error in the genome, Mali says, now the question is, “Could we actually go in and fix it?”

This innovation is fueled by the Nobel Prize-winning discovery of CRISPR-Cas9, an immune defense system in bacteria that detects specific DNA sequences of invading viruses and directs an enzyme to slice up and destroy the viral genome. The system has utility far beyond bacteria: Scientists found they could also use it to make precise cuts within the mammalian genome. In just seven years the technique has moved from in vitro lab experiments in mammalian cells to human trials.

The “cargo” in CRISPR-based therapies is not a piece of DNA but the gene-editing system itself, introduced into cells either by a virus, within a nanoparticle, or on its own as an RNA-protein complex. The therapies can be used ex vivo (outside the body) to alter cells in the lab before returning them to the patient or by sending gene-editing tools directly to affected tissues, where they edit cellular genomes.

Emerging methods have allowed for greater precision and nuance—exchanging individual nucleotides, for example, or temporarily dampening a gene’s activity without changing its DNA—giving researchers the latitude to set their sights ever higher. They are working on treatments for neurological diseases, autoimmune disorders and additional cancers. Over the long term they aim to move beyond single-gene disorders to treat conditions caused by interactions of multiple genes, such as cardiovascular disease and chronic pain. With gene treatments successfully alleviating some illnesses, researchers, clinicians and patients are hoping to sustain the progress of the past decade and establish gene therapy as a cornerstone of modern medicine.

見背面

36. According to the article, which following descriptions is correct on the approaches for gene therapies? (A) Gene delivery in the eye is safer than in the liver. (B) Some methods can influence the activity of genes that existed in patients. (C) Methods to fix errors within genes are better than methods to insert a whole gene. (D) Bacteria are used to carry genes or gene-editing tools directly into cells of patients.
37. What is the main difference between the definition of version 1.0 and version 2.0 gene therapy? (A) the way to rapidly deliver genes (B) the way to precisely manipulate cellular genomes (C) the way to efficiently produce molecular tools (D) the location where gene therapy takes place
38. According to the article, which of the followings is not a type of carrier applied to deliver gene-editing system into cells? (A) viruses (B) nanoparticles (C) molecular complexes containing proteins and RNA (D) bacteria.
39. Which of the following statements is incorrect regarding CRISPR? (A) CRISPR-Cas9 system requires viral DNA sequences and an enzyme to ward off the invasion of viruses. (B) CRISPR-Cas9 system guides an enzyme to segmentalize the viral genome based on the identified viral DNA sequences. (C) CRISPR-based therapy is adapted from the immune defense system in bacteria. (D) Unlike traditional gene therapy approaches, CRISPR-based therapies modify cellular genome by inserting a whole gene.
40. Which of the followings is NOT the prospect for gene therapy? (A) to treat chronic diseases associated with multiple genes (B) to exchange a fragment of nucleotides within a dysfunctional gene (C) to make gene therapy affordable for the general public (D) to avoid triggering immune responses

Article 9

Cold Plasma Technology for Food Allergy Control

Source: Food Chemistry 371 (2022): 131120.

With the increasing requirements of health and safety of food, plasma technology has gained immense attention in recent years. As a potent technology, plasma technology has been proved suitable for effective preservation, microbial decontamination, and modification of food products. The discharge ways of cold plasma include dielectric barrier discharge (DBD), radio frequency (RF) discharge, corona discharge, plasma jet, and so on. The electrical conductivity of plasma is extremely high and different from ordinary gases in electromagnetic properties; hence it is commonly regarded as the fourth state of matter, which is an aggregate of reactive particles generated following excitation and ionization of gas, i.e., UV photons, ions, electrons, free radicals, neutral molecules, and excited atoms. These active constituents form active oxidation system waves: reactive oxygen species (ROS) and reactive nitrogen species (RNS). It has been reported that these plasma reactive components could induce certain interactions with proteins and then their conformational structures changed. Because food allergens are mostly proteins, cold plasma can react with allergens in a similar way through these above active particles. Currently, many conjectures about the mechanism of controlling allergens by cold plasma have been posed; although the exact pathway is not clear, all depend on the linear and conformational epitopes alterations induced by active particles. To be specific, conformational epitopes can be destroyed by the aggregation or crosslinking of proteins, while linear epitopes can be altered by fragmentation. Besides, active substances may lead to the breakage of peptide bonds and the oxidation of amino acids, resulting in the destruction of protein integrity. Disulfide bonds in proteins can also be attacked by free hydroxyl radical in active particles to form RSH and RSO. All the above possible mechanisms reflect that, to a certain extent, the active oxidizing substances in the cold plasma will affect the protein structures, thereby incapacitating the antibody binding sites and achieving the purpose of controlling allergenicity.

41. What is NOT a potential use for plasma technology in food processing? (A) thermal treatment (B) preservation (C) pathogen inactivation (D) carbohydrate modification.
42. What component in the plasma makes it a strong oxidizer? (A) neutral molecules (B) UV photons (C) reactive oxygen species (D) excited atoms.
43. A food allergen is a (A) carbohydrate (B) lipid (C) vitamin (D) protein
44. Epitops can NOT be altered by (A) crosslinking (B) aggregation (C) DNA mutation (D) peptide breakage
45. What is the antonym of "Incapacity" ? (A) ineffectiveness (B) efficient (C) Incapability (D) Malfunction

接次頁

Article 10

COVID-19 Triggers 2021 Food Trends, Opportunities

(Source: Food Technology-IFT, January 2022)

Eating for Immune Health Steals the Spotlight: A 2020 survey from the International Food Information Council (IFIC) found that 85% of Americans made changes in how they eat in light of the pandemic, indicating a heightened awareness from consumers around nutrition and its impact on overall health. The year ahead will bring an increasing awareness of the importance of a healthy microbiota, from the immunity benefits to the promise of personalized nutrition, which will spur research efforts on the microbiome and lead to products with strong scientific backing. Our recent podcast exploring the impact of diet on our gut and the role of microbiota in proper immune functioning and overall health is a worthwhile listen if this trend interests you.

Meat Analogues Go Mainstream: Initially developed as a lower cost, partial replacement for meat in the food away from home market 50 years ago, plant-based proteins have increasingly gained traction for health, cultural, and environmental reasons. 24% of people surveyed in the IFIC report mentioned above said they are eating more protein from plant sources than they did before the pandemic began. A follow-up survey from IFIC revealed 41% of people believe a plant-based burger is healthier than a burger made with ground beef. Significant work will be needed to develop sustainable sources of plant proteins that are nutritionally balanced and meet the taste and texture needs of consumers. Meanwhile, work will continue to accelerate on alternative protein sources such as cell-based meat in 2021. If you're interested in this trend, you may want to give a listen to our podcast on the rapid expansion in the alternative protein market.

CRISPR Answers the Call for More Nutritious Foods: FAO reports climate change is dramatically hindering our ability to grow nutritious foods. As the pandemic motivates consumers to take an increased interest in their overall nutrition, the global food system will need to lean on additional methods to create sustainable, healthy options for our growing population. This need will drive advancements to the gene editing technology, CRISPR, in 2021. CRISPR is simpler, faster, and more cost-effective than more traditional gene insertion, making it an attractive option to a broader range of companies and for use on a wider variety of crops. In addition to the current benefits on agricultural output, we will see more relevant health benefits derived from CRISPR crops which could drive consumers to seek out these varieties.

Urban Farming Potential Unlocked: According to the U.S. Census Bureau, approximately 80% of Americans live in urban areas. People in these densely-populated cities have traditionally relied heavily on grocery and convenience stores to access food. As the pandemic causes people to be more thoughtful about where they get food, we anticipate a notable rise in the prevalence of urban farming. The surge in preparing and eating food at home combined with the need to know the origin and safety of ingredients will also fuel this trend. Additionally, rising temperatures, extreme heat, drought, wildfires, and flooding are expected to increasingly disrupt agricultural productivity, necessitating investments in innovative practices such as urban farming to supplement food supply.

Technology Answers the Call for Increased Food Safety: Just as 2020 brought forth a heightened interest from consumers in nutrition, it also shined a light on food safety. In the coming year, we'll see widespread adoption of digital technologies such as blockchain in our food traceability practices as food companies work to implement the recommendations within the FDA New Era of Smarter Food Safety blueprint. We expect to see an increase in the use of sensors and artificial intelligence, which the food industry has been slow to adopt due to the investment required. Not only will these technology advancements prevent significant outbreaks of foodborne illnesses, they will also create a more secure, less wasteful food supply chain. Our recent podcast on food safety, food recalls, COVID-19, and food traceability discusses this critical topic.

46. What is NOT a food trend stemming from the pandemic? (A) healthy microbiota (B) plant meat (C) genetic modified crop (D) unlimited food supply
47. What is the purpose of personalized nutrition? (A) making food taste better (B) making food more beneficial to health (C) making food with larger portion (D) making food more convenient
48. What is the meaning of the word "urban"? (A) country (B) clean (C) city (D) fashion
49. Digital technologies is NOT for (A) safety (B) food appearance (C) traceability (D) foodborne illness prevention
50. What could be contribute to the implementation of sustainable food practice? (A) green technology (B) herbicide (C) nuclear weapon (D) food waste

試題隨卷繳回