

1-50 為單選題，每題 2 分，答錯倒扣 0.5 分 ※ 注意：請於試卷上「選擇題作答區」

內依序作答。

Article 1

Sufu, which has existed in China for more than 1000 years, is a highly flavored, soft, cheese-like fermented product of soybean curd (tofu). It is widely consumed by Chinese people as relish in their daily diet.

Based on the production methods, sufu was categorized into various types, with mold-fermented and enzyme-ripened sufu as the primary types of sufu available in the market. The former was manufactured by first growing fungus such as *Actinomucor*, *Rhizopus* or *Mucor* sp. on the surface of tofu cubes to prepare pehtze. Then, the prepared pehtze was aged in saline solution for a period of 4-6 months. On the other hand, during the manufacturing of enzyme-ripened sufu, salted tofu cubes and koji mash are first prepared simultaneously. Koji mash is obtained by growing *Aspergillus oryzae* on a mixture of steamed rice and soybean before being soaked in syrup solution (65% sucrose). Then, the salted tofu cubes are ripened in the *Asp. oryzae*-koji mash at 37 °C for approximately 2-3 weeks. In addition to a shorter required ripening period, the enzyme-ripened sufu is generally sweeter and less salty than the mold-fermented sufu.

Soy isoflavones are known as phytoestrogens. Due to the similarity in their chemical structures, isoflavones are able to interact with the cellular receptors of estrogen. They were reported to prevent heart disease and to reduce the rates of breast, colon and prostate cancers. Additionally, isoflavones have been claimed to alleviate postmenopausal symptoms and to reduce the risk of osteoporosis in women.

Four chemical forms of isoflavones are found in soybean and soy-food with daidzein, glycitein and genistein being the three basic chemical structures for aglycons. Three other forms of isoflavones including β -glucoside, 6''-O-acetylglucoside and 6''-O-malonylglucoside, are derivatives from each aglycons. It has been reported that processing techniques alter the relative content of the isoflavone isomers in soy-foods. Despite contradictory reports, it has generally been suggested that isoflavone in the form of aglycone exhibit higher bioavailability and bioactivity than isoflavones in other forms.

Previously, researchers have reported that ripening caused a major reduction in the content and the distribution of β -glucoside and malonylglucoside isoflavones along with a significant increase of aglycone isoflavone in sufu. These changes were enhanced as the ripening period or temperature increased.

1. The incorrect statement listed below is (A) Sufu is made from soybean. (B) Sufu is a cheese product. (C) At least, there are three types of sufu. (D) Sufu is frequently consumed by Chinese people.
2. Which ingredient listed below was usually not involved in the manufacture of mold-fermented sufu? (A) Tofu (B) Salt (C) Fungus (D) Sugar
3. Select the wrong statement listed below: (A) It takes more time to prepare enzyme-ripened sufu than mold-fermented sufu. (B) Sucrose is used during the preparation of enzyme-ripened sufu. (C) *Aspergillus oryzae* was used during the manufacture of enzyme-ripened sufu. (D) Enzyme-ripened sufu was generally sold in the market with koji granules.
4. Which microorganism listed below is not used during the manufacture of mold-fermented sufu? (A) *Actinomucor* (B) *Aspergillus* (C) *Mucor* (D) *Rhizopus*.
5. Which one of the following statements is correct? (A) Yeast is involving in the preparation of sufu. (B)

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Mold-fermented sufu usually is less salty than enzyme-ripened sufu. (C) Enzyme-ripened sufu is usually less sweet than mold-fermented sufu. (D) *Rhizopus* and *Mucor* are molds.

6. It was generally suggested that (A) aglycone, (B) β -glucoside isoflavone, (C) acetylglucoside isoflavone (D) malonylglucoside isoflavone showed more bioactivity than did the other forms of isoflavone.
7. Soyfoods are expected to have a total of (A) three, (B) four, (C) eight, (D) twelve isoflavone isomers.
8. Which one of the following statements is not correct? (A) Isoflavone has a chemical structure similar to estrogen. (B) Soy isoflavone can reduce the symptom of postmenopausal. (C) Soy isoflavone was believed to associate with the reduced rate of breast cancer. (D) The distribution of aglycone decreased as the ripening period was extended.
9. Select the wrong statement listed below: (A) The fermented soybean product mentioned in the above article has been consumed by Chinese people for more than ten centuries. (B) Some literatures indicated that bioavailability of aglycone was less than other isoflavone isomers. (C) Ripening temperature did not affect the content of isoflavones in sufu. (D) Due to variation in process condition, soy foods may contain various amounts of isoflavone.
10. Select the ingredient listed below which was not included in the prepared koji mash. (A) Sugar (B) Salt (C) Rice (D) Soybean

Article 2

Pectin is a naturally occurring substance that exists in cell walls of plant tissue. It is a group of complex materials with high molecular weight (Mw) and the ability to form gel or to increase fluid viscosity in the presence of adequate acidity and sugar content. In food industry, pectin is utilized as a thickening, stabilizing, gel-forming or strength-building agent. It is widely applied in the making of jam, jelly, fruit juice, sauce, ice cream, confectionery products and bakery fillings. It is also used in the stabilization of acidified milk drinks and yogurts.

Pectin methyl esterase (PME; EC 3.1.1.11) is well-known to hydrolyze the methyl ester linkage of galacturonic acid moieties in pectin molecules and to release methanol and free carboxyl groups. Hou and Chang (1996) first hypothesized that PME may exhibit de-esterification function against the methoxyl group of a pectin molecule and then transfers the galacturonic acyl group from the pectin molecule to a hydroxyl group in the same molecule, or in another pectin molecule, to form a new ester linkage (transacylation reaction). The formation of transacylation reaction catalyzed by PME was supported by several later reports based on the changes in Mw and size of the suspended particles, and turbidity and viscosity of the pectin solution. No direct evidence has been provided yet.

The functional properties of pectin, such as gel forming, viscosity and texture modifying, and thickening capacities, are molecular weight (Mw) dependent. Jiang *et al.* (2001), Lee *et al.* (2003) and Wu *et al.* (2004) found the increase in the Mw of pectin and the viscosity of pectin solution treated by PME from tomato, jelly fig or some citrus fruits other than Valencia orange, and suggested it as a result of the PME-catalyzed transacylation between pectin molecules. Alternatively, Yoo *et al.* (2003) suggested that the gelation of pectin treated with a salt-independent PME isozyme from Valencia orange was resulted from the metastable aggregation of the enzymatically de-esterified low-methoxy pectin molecules. However, the Mw distribution of PME-treated pectins was not altered through the treatments of ethanol precipitation, dialysis and lyophilization (Kim *et al.*, 2008). We suspected that transacylation, instead of metastable aggregation, may be the major

mechanism for the change in Mw distribution in the treatment of pectin with PME. The present study was focused to obtain more evidences, including some direct one, for proving the occurrence of transacylation between pectin molecules.

11. What is the above essay most probably? (A) A part of a research proposal. (B) A part of an original research paper. (C) A part of a review article, (D) A part of a degree thesis.
12. By definition, “confectionery” is the set of food items that are rich in (A) flour, (B) fruit components, (C) oil, (D) sugar.
13. Which kind of bakery products usually contains a filling? (A) Bagel. (B) Pie. (C) Pizza. (D) Waffle.
14. “De-esterification” means (A) double-esterification, (B) the production of esterified derivatives, (C) returning to the state before esterification, (D) deionization and esterification.
15. Transacylation reaction of pectin molecules may occur (A) only in intramolecular pattern, (B) only in intermolecular pattern, (C) in both intramolecular and intermolecular patterns, (D) in neither intramolecular nor intermolecular pattern.
16. Which in the following is not a sort of citrus fruit? (A) Grapefruit. (B) Lemmon. (C) Pomegranate. (D) Pomelo.
17. “Metastable” means (A) very unstable, (B) somewhat unstable, (C) very stable, (D) can be stabilized by the presence of metal ions.
18. Who first proposed the occurrence of transacylation in pectin molecules? (A) Hou and Chang. (B) Jiang et al. (C) Yoo et al. (D) Kim et al.
19. “Lyophilization” is a synonym of (A) “freeze-drying”, (B) “freeze-concentration”, (C) “falling-film evaporation”, (D) “microwave-assisted evaporation”.
20. According to the author(s) of the above essay, what is the direct evidence of transacylation between pectin molecules ever found? (A) Increase in the Mw of pectin. (B) Increase in the size of pectin particles. (C) Increase in the viscosity of pectin solution. (D) None.

Article 3

Calorie restriction (CR), the reduction of calorie intake without malnutrition, has been found to extend the average and maximum life span from yeast to primates and delay the onset of many age-associated pathologies, although the mechanisms that underlie these effects remain unclear. If CR can extend life span through conserved mechanisms, the use of model organisms to elucidate the genetic pathways involved may ultimately allow for discovery of compounds with great health benefits as calorie restriction mimetics (CRM). Consistent with this idea, two conserved nutrient responsive signal transduction pathways, insulin/insulin-like growth factor I (IGF-I) and the target of rapamycin (TOR), have been found to modulate life span in yeast (*Saccharomyces cerevisiae*), worms (*Caenorhabditis elegans*), flies (*Drosophila melanogaster*), and mice (*Mus musculus*). Likewise, a few lifespan extending compounds such as resveratrol and rapamycin have been proposed to act as CRMs in several organisms.

Studies of aging in mammals are time consuming due to their long life spans. Mice and rats live 3–5 years and primates up to 40 years. The use of invertebrate organisms as models is more rapid and straightforward for genetic and environmental manipulation. Although longevity has been studied in a number of organisms, most studies have employed fruit flies, worms, or yeast. Worms live approximately 2–3 weeks and flies 2–3 months.

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Budding yeast has a much shorter life span (chronological mean life span is 6–15 days), well-established genetics, and is suitable for high-throughput screening.

In the yeast model, two common aging assays have been established. Replicative life span (RLS) of yeast aging refers to the number of cell division occurring in a mother cell. Yeast replicative aging may serve as a suitable model for the aging of mitotic cells in multicellular eukaryotes, such as human stem cell populations. Replicative aging is thought to occur through the asymmetric segregation of damage to daughter cells during yeast budding. It suggests that during replicative aging of normal young mother cells, an age barrier asymmetrically prevents the passage of various senescence factors including nuclear components such as extra chromosomal ribosomal-DNA circles (ERCs), and cytoplasmic components such as oxidatively damaged proteins and dysfunctional mitochondria.

21. In this introduction of the research article, what kind of experimental model organism that the authors will use? (A) flies (B) yeast (C) mouse (D) *C. elegans*.
22. What are the characteristics of replicative aging in yeast? (A) cells stops budding (B) cells can not survive in medium (C) cells produce spores (D) cell cycle progression is blocked.
23. What will you expect the description of next paragraph followed by this introduction? (A) DNA damage (B) mammalian aging (C) chronological aging in yeast (D) age-related diseases.
24. What are the benefits of using lower eukaryotic or invertebrate organisms as models for studying aging (A) the aging mechanisms are the same in all of the model organisms (B) genes can be modified (C) various genetic mutants can be screened at the same time (D) less time consuming.
25. Which description(s) about CRM is/are correct? (A) compounds can extend life span. (B) compounds can result in calorie restriction (C) compounds can extend life span via a pathways similar to CR (D) compounds with great health benefits.

Article 4

Through its history, the growing understanding of niacin deficiency pathologies has gone hand in hand with emerging fields of genomic instability and ADP-ribose metabolism. Pellagra, the human disease of niacin deficiency, ravaged certain corn-consuming populations for several hundred years, producing the unique end points of sun-sensitivity and dementia. A real understanding of sun-sensitive dermatitis was only possible after the discovery of poly(ADP-ribose) in 1966. Since that time, there has been tremendous progress in describing the many roles of poly (ADP-ribose) in DNA damage responses, which will be briefly summarized later in this article. Animal models have examined the impact of niacin status on genomic instability and cancer development in several tissues. However, there is a lack of human data on the association of niacin status and skin cancer risk, or of niacin status and the risk of genomic instability in other tissues that were not an obvious aspect of the pellagra spectrum. Thus, it will be difficult to make detailed recommendations about niacin status and genomic instability in human populations, but we can create a framework and identify some areas which show promise.

To characterize the impact of niacin status on genomic instability, one must determine which categories of NAD-dependent reactions are required to maintain genomic stability, and then determine which are at risk of failure as niacin deficiency progresses. Many essential roles of NAD will be preserved by enzyme affinity and subcellular localization, while other functions will fail as deficiency progresses. Dietary precursors lead to the

production of NAD⁺, which can be reduced to NADH, or phosphorylated to contribute to the NADP⁺ and NADPH pools. The large majority of metabolic functions are based on the dinucleotide structures (NAD, NADP), although nicotinic acid and nicotinamide have some interesting metabolic properties, especially at pharmacological levels. The NAD⁺/NADH redox couple participates in ~400 reactions, while that of NADP⁺/NADPH redox couple participates in ~30 others, and there appear to be ~50 reactions in the sirtuin/ADP-ribosylation/cyclization groups, that degrade NAD⁺ as a substrate. It would not have been surprising to early researchers that niacin deficiency would have severe health consequences given the multitude of redox reactions that depended on it. However, the unique pathologies of pellagra were puzzling given that other redox nutrients like iron and riboflavin participate in the same pathways of energy metabolism, but deficiencies do not lead to sun sensitivity. Riboflavin deficiency does cause skin pathologies and causes oxidant stress and DNA damage in cultured cells, so there might be more overlap in function than is currently appreciated.

It is logical to suggest that deficits in redox function during niacin and riboflavin deficiencies could lead to oxidant stress, through a decrease in NADPH, and its ability to maintain GSH levels. In fact, oxidant stress, including oxidant injury to DNA, has been observed during niacin deficiency, *in vitro* and *in vivo*. (Adapted from Mutation research 2011, November)

26. Which description(s) about pellagra is/are correct? (A) a skin cancer (B) it happens often in maize-consuming populations (C) Patients often have dementia (D) Patients are often blind.
27. What kind of nutrient deficiency may result in pellagra? (A) Vit. A (B) Niacin (C) Riboflavin (D) Vit. C
28. What is/are the biological function(s) of the nutrient that causes pellagra? (A) it is an enzyme (B) it is an oxidant (C) it is a protein to repair DNA damage (D) it is a precursor of dinucleotides
29. What's the main focus of this review article? (A) Review the discovery history of pellagra (B) Discuss the DRIs of the nutrients which can be sufficient to prevent pellagra (C) Discuss antioxidation systems in cells (D) The possible linkage of pellagra and the defects of DNA repair.
30. What is/ are the possible causes of pellagra? (A) DNA damage (B) low levels of oxidant stress (C) high levels of NADH (D) high levels of GSH

Article 5

Elevations in fasting plasma triglycerides, principally very low-density lipoproteins, are a consistent feature of diets high (20% of energy) in sucrose, glucose, and fructose. The effects of sucrose or fructose on fasting triglycerides maybe more marked in men than women, in sedentary overweight people or those with the metabolic syndrome, and in those eating low-fiber diets. Sucrose and fructose also increase postprandial triglyceride levels and may augment the lipemia associated with fat-containing meals. There are several mechanisms by which fructose increases fasting and postprandial triglyceride levels. These include increased *de novo* lipogenesis in the liver, increased hepatic triglyceride synthesis, and secretion of very-low-density lipoproteins, as well as reduced lipoprotein lipase activity at the adipocyte, which decreases the rate of peripheral triglyceride clearance. Compared with other carbohydrate sources (starch or glucose), recent studies have not demonstrated an added effect of either sucrose or fructose to lower high-density lipoprotein cholesterol levels; however, these studies have not agreed on the effects on low-density lipoprotein cholesterol. In summary, although the mechanisms are unclear, relative to other carbohydrate sources, sugar intake appears

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to be associated with increased triglyceride levels, a known risk factor for coronary heart disease; however, relative to other sources of carbohydrate, the effects of sugar intake on high-density lipoprotein and low-density lipoprotein levels remain unclear. In some but not all studies, a higher consumption of high-sugar beverages and foods is associated with evidence of increased inflammation and oxidative stress. Few studies have assessed the effects of long-term sugar consumption on inflammatory and oxidative stress markers. (Circulation. 2009; 120:1011-1020)

31. Which one is the mechanism of high plasma triglyceride induced by fructose and fat-containing meals?(A) increased de novo hepatic lipogenesis (B) elevated hepatic triglyceride synthesis (C) decreased lipoprotein lipase activity at the adipocyte (D) all of the above
32. What does “fasting” as in the term “fasting triglyceride” mean? (A) accurate (B) elevated (C) not eating food (D) very quick
33. Which description about “increased triglyceride” is correct? (A) secreted by colon (B) would cause asthma (C) a risk factor for coronary heart disease(D) is induced by low-fiber diets
34. What does postprandial triglyceride mean? (A) the value of triglyceride after a meal (B) unexpected triglyceride concentration (C) uncontrolled triglyceride concentration (D) fasting triglyceride
35. What does de novo lipogenesis mean? (A) newly synthesized lipid (B) abnormal lipid accumulation (C) lipid oxidation (D) gene mutation of adipocytes
36. Which of the following phrases is more possibly appearing in the conclusion section? (A) in addition (B) in summary (C) on the contrary (D) in general
37. Which of the conclusions could be proposed after reading the article (A) overweigh people might be easier to have cancer (B) fatty liver is due to over consumption of alcohol (C) glucose might have an added effect on lower high-density lipoprotein cholesterol (D) probiotics intake would improve chronic inflammation
38. Which one might be wrong according to the effects of sucrose or fructose mentioned in this article?(A)increase of the fasting plasma very-low-density lipoproteins (B) more marked in the people with inactive life style (C) augment the postprandial triglycerides (D) reduction of the hepatic lipogenesis
39. According to this article, which of the followings might lead to increased inflammation? (A) a less sedentary life style (B) long-term fiber consumption (C) decreased oxidative stress (D) a higher consumption of high sugar beverages
40. Which of the followings is a suitable title for this article? (A) Effects of dietary sugars on lipids, and inflammation (B) Plasma triglyceride is a marker for prediction of de novo lipogenesis (C) The effects of probiotics on inflammation (D) The mechanism study of obesity

Article 6

Cellulose is the most abundant macromolecule on earth and most cellulose is produced by vascular plants. Unlike plant cellulose, bacterial cellulose (BC) does not require remedial processing to remove unwanted impurities and contaminants such as lignin and hemicellulose. BC can be grown into any desired shape such as pellicles, pellets and spherelike balls, depending on the cultivation method, additives and cell population. In this study, *Acetobacter xylinum* (ATCC 700178) was grown in the production medium with different concentrations of carboxyl methyl cellulose (CMC), and were evaluated for BC production by using a PCS biofilm reactor. The results demonstrated that BC production was enhanced to its maximum (~13 g/L) when 1.5% of CMC was

applied, which was 1.7-fold higher than the result obtained from control culture. The major type of the produced BC was also switched from BC pellicle to small pellets. The ratio of BC pellets in suspension increased from 0 to 93%. Fourier transform infrared (FTIR) spectroscopy demonstrated that CMC was incorporated into BC during fermentation, and resulted in the decreased crystallinity and crystal size. The X-ray diffraction (XRD) patterns indicated that CMC-BC exhibited both lower crystallinity (80%) and crystal size (4.2 nm) when compared with control samples (86% and 5.3 nm). The harvested BC was subjected to paper formation and its mechanical strength was determined. Dynamic mechanical analysis (DMA) results demonstrated that BC paper sheets exhibited higher tensile strength and Young's modulus when compared with regular paper. The tensile strength increased from 1390 to 1941 MPa (50%-BC paper sheet). The Young's modulus increased from 1356 to 2366 MPa (50%-BC paper sheet).

41. According to above article, (A) pellicle, (B) pellets, (C) triangle and (D) spherelike balls of BC cannot be synthesized by *A. xylinum*.
42. The WRONG statement concerning *A. xylinum* which has been subjected to BC production is (A) produced cellulose with impurities. (B) produced more BC with CMC addition. (C) exhibited lower crystallinity. (D) produced BC.
43. *A. xylinum* will produce highest BC when (A) 0%, (B) 0.5%, (C) 1.5%, (D) 2.0% of CMC was applied.
44. As mentioned in this article, (A) FTIR, (B) XRD, (C) DMA, (D) CMC was adopted to determine crystallinity and crystal size.
45. As mentioned in this article, the tensile strength increased from 1390 to 1941 MPa with (A) 0%, (B) 25%, (C) 50%, (D) 75% BC-paper sheet.
46. According to above article, (A) pellicle, (B) pellets, (C) triangle and (D) spherelike balls of BC is the major form of BC synthesized by *A. xylinum* here.
47. What is the full name of ATCC mentioned here? (A) Aloha Thomas, Chris and Christine, (B) American Type Culture Collection, (C) Association of Taiwanese Culture collection and (D) American Transportation Car Collection.
48. The authors of this article have investigated the BC production of (A) *A. xylinum* (B) *Salmonella* Typhimurium, (C) *Cronobacter sakazakii* (D) *Acetobacter xyliol*.
49. Addition of (A) CMC, (B) CNC, (C) CMG, (D) GMG will affect the BC production by *A. xylinum*.
50. Which statement mentioned below is TRUE? (A) Addition of CMC will decrease BC production. (B) FTIR spectroscopy demonstrated that CMC wasn't incorporated into BC during fermentation. (C) BC-paper sheets exhibited lower tensile strength when compared with regular paper. (D) Cellulose is the most abundant macromolecule on earth and most cellulose is produced by vascular plants.

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