1. Please translate the following paragraph into Chinese (15%).

Terpenoids are the largest and most structurally diverse family of natural products with over 80,000 known members. They are ubiquitous among all domains of life, are essential constituents of both primary and secondary metabolism, and have a wide range of biological activities. In nature, terpenoids play important ecological roles in membrane stability, photosynthesis, communication among species, and chemical defense mechanisms. In medicine, terpenoids have been developed into some of the most successful and important clinically used pharmaceuticals with taxol and artemisinin representing the gold standards of natural product drug development. The chemodiversity of terpenoid natural products arises through an array of biosynthetic mechanisms including prenyltransfers, regio- and stereoselective cyclizations, attachments to a variety of other chemical scaffolds, and additional tailoring reactions. All terpenoids are constructed from a series of allylic diphosphates that are used as substrates for cyclization reactions or as prenyl donors to alkylate a multitude of chemical scaffolds (i.e., prenylation). These two central biosynthetic steps, cyclization and prenylation, are catalyzed by terpene synthases (TSs) and prenyltransferases (PTs), respectively. (Adapted from ACS Catalysis, 2021)

2. Please translate the following paragraph into Chinese (15%).

ADP-ribosylation (ADPr) is a reversible post-translational modification of proteins, which controls major cellular and biological processes, including DNA damage repair, cell proliferation and differentiation, metabolism, stress and immune responses. In order to maintain the cellular homeostasis, diverse ADP-ribosyl transferases and hydrolases are involved in the fine-tuning of ADPr systems. The control of ADPr network is vital, and dysregulation of enzymes involved in the regulation of ADPr signalling has been linked to a number of inherited and acquired human diseases, such as several neurological disorders and in cancer. Conversely, the therapeutic manipulation of ADPr has been shown to ameliorate several disorders in both human and animal models. These include cardiovascular, inflammatory, autoimmune and neurological disorders. Herein, we summarize the recent findings in the field of ADPr, which support the impact of this modification in human pathophysiology and highlight the curative potential of targeting ADPr for translational and molecular medicine. (Adapted from Open Biology, 2019)

3. Please translate the following paragraph into Chinese (20%).

Betalains are hydrophilic pigments responsible not only for the bright coloration of fruits and flowers, but also of roots and leaves of plants belonging to the order Caryophyllales. In this order, the only exceptions are the Caryophyllaceae and Molluginaceae, where coloration is due to anthocyanins. Betalains and anthocyanins are two different families of pigments that are never found together in the same plant. The evolutionary reasons for the apparent mutual exclusion have not been properly explained; however, at the biochemical level, it has been demonstrated that the relevant enzymes for the production of anthocyanins are not expressed in betalain-producing plants. There are two types of betalains: betaxanthins, which are immonium derivatives of betalamic acid with different amines and amino acids, and betacyanins, where betalamic acid appears condensed with *cyclo*-dihydroxyphenylalanine (*cyclo*-DOPA). Betaxanthins are yellow and their absorbance spectrum has a maximal wavelength (λ_m) at approximately 480 nm, independent of the amino acid nature. By contrast, betacyanins are violet, with an absorbance spectrum centered at $\lambda_m = 536$ nm. The presence of betalains in flowers is particularly interesting because of the importance of color in attracting animals for pollination. Flowers are bright violet or yellow in coloration depending on the presence of betacyanins or betaxanthins, respectively. The joint presence of the pigments generates orange to red shades and variegated patterns are also possible. Figure 1 shows a selection of betalain-containing plants with colors ranging from yellow to violet. The description of visible fluorescence in betaxanthins and its maintenance in plants suggested the possibility of visible-light emission acting as an additional signal to attract pollinators. Betalain-related pigments have also been described in the fungi *Amanita* and *Hygrocybe*. The presence of analogous pigments in plants and fungi implies an evolutionary convergence based on a characteristic aromatic ring-cleaving dioxygenase enzyme of the biosynthetic route. (Adapted from Trends in Plant Science, 2013)

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4. Please translate the following paragraph into Chinese (10%)

Although iron (Fe) is one of the most abundant elements on Earth, the extremely low solubility of free Fe in most soils often severely restricts its uptake, making Fe deficiency a common nutritional disorder in plants. In human populations, insufficient dietary Fe intake resulting from low Fe concentrations in edible plant parts is the cause of Fe deficiency-induced anaemia, affecting more than one billion people worldwide, particularly in areas where Fe supply depends mainly or entirely on plants. Understanding how plants regulate the uptake and distribution of Fe is thus mandatory to produce Fe-enriched crops and combat Fe deficiency- induced anaemia. (Adapted from Nature Plants, 2018).

5. Please translate the following paragraph into Chinese (10%)

Plants acquire a large number of mineral nutrients from the soil through the rhizosphere, the interface of the root and soil. To manage nutrient bio-availability and cope with environmental metal stresses, plants secrete numerous metabolites from roots into the rhizosphere to change the pH or to form metal–metabolite complexes. The secreted metabolites are a complex mixture of inorganic ions (i.e., H^+, HCO_3^-), gaseous molecules (i.e., CO_2, H_2) and mainly carbon-based compounds They are divided into two groups: low-molecular-weight compounds including amino acids, organic acids, phenolics and sugar and high-molecular-weight compounds including mucilage and proteins. Under low-nutrient conditions, plants release certain metabolites to increase nutrient availability by directly binding to mineral nutrients or by changing the rhizosphere pH. In heavy-metal-polluted environments, root exudation can be enhanced by non-essential metal stress to increase external detoxification. (Adapted from Current Opinion in Plant Biology, 2017).

6. Please translate the following paragraph into Chinese (10%)

The beneficial effects of whole grains, including colored rice, consumption have been widely reported in this decade. The antioxidative activity, body fat reduction, anti-inflammatory, cardioprotective, and antiatherogenic effects of colored rice have been proved in vivo tests. In Taiwan, the cultivation and consumption of colored rice are getting popular for local farmers and people for health concerns. In this study, six commercially-available colored rice (3 black and 3 red) in local markets were studied. The objective of this study is to establish the profiles of bioactive compounds, including phenolics and flavonoids, anthocyanins, and vitamin E of outer and inner rice bran from these six, colored rice. The information revealed in this study can provide the distribution and contents of bioactive compounds in colored rice bran that are important for the use of colored rice as a healthy food. (Adapted from Journal of Food and Drug Analysis, 2016).

7. Please read the following paragraph and choose the correct answer to the questions (20%)

Soil properties such as soil pH, redox potential, organic matter (OM) content, and iron oxide content govern the solubility and speciation of Arsenic (As) in soils. Among those properties, redox potential, which can be controlled by water management, is a key factor. Under aerobic conditions, such as in upland soils, the solubility and mobility of As is low, and the predominant As species in soil solution is inorganic As^V (iAs^V). By contrast, under anaerobic conditions, such as in flooded soils, the solubility and mobility of As is increased by the dissolution of iron oxides and by the reduction of iAs^V to iAs^{III}. Anawar et al. (2008) indicated that the accumulation of As in plants strongly depends upon concentrations of available As in soils. Because of the increased bioavailability and toxicity of As under flooding conditions, paddy rice has frequently been a target plant for As accumulation research. There are many studies investigating the effect of water management on As accumulation in paddy rice. However, few studies have investigated the effects of water management on As accumulation in aquatic vegetables such as water spinach (*Ipomoea aquatica*) grown in As-contaminated soils. In recent years, the demand for vegetables has increased annually; thus, vegetable ingestion is also an important As exposure route for humans.
Water spinach is commonly cultivated in tropical and subtropical areas, such as Taiwan, Southeast Asia, India, and southern China, because it has a high nutritional value, containing vitamin A, vitamin C, and iron. Additionally, water spinach is a semi-aquatic vegetable and can be planted under both upland and flooded soils. In general, root surface of aquatic plants is covered by Fe plaque, which is formed when oxygen is released into the rhizosphere through the aerenchyma and induces

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the precipitation of iron oxides on the root surface. Previous studies indicated that the Fe plaque may act as a sink to sequester As released from soils and reduce As accumulation in plants, or it may act as a source to increase As uptake by plants. The effect of iron plaque on increasing or decreasing As uptake by plant depends on the availability or unavailability of sequestered As in iron plaque. To the best of our knowledge, the effects of water management and Fe plaques on As accumulation and speciation in water spinach are still unclear; these effects may pose different health risk to humans by ingesting water spinach. Therefore, the objective of this study was to investigate the effects of water management on As accumulation and speciation in water spinach grown in As-elevated soils. (Adapted from Journal of Hazardous Materials, 2021).

a- What is *Ipomoea aquatica*?
(A) A fish
(B) A popular vegetable
(C) A toxic plant
(D) A medicinal plant

b- Which of the following component accumulating in water spinach causes significant toxicity to humans?
(A) Iron
(B) Arsenic
(C) vitamin A
(D) Organic matter

c- How does iron affect the absorption of arsenic by water spinach?
(A) Iron decreases As uptake by the plants
(B) Iron increases the As uptake by the plants
(C) Iron can both increase or decrease the As uptake, probably depending on water management
(D) Iron does not affect the absorption of As by water spinach

d- What happens to iron when water spinach is grown on flooded soil?
(A) It precipitates in the soil and becomes unavailable to the plants
(B) Nothing happens, Fe is taken by roots and accumulates in the plant
(C) Oxygen released from aerenchyma causes the precipitation of Fe onto root surfaces
(D) Iron is sequestered by the As plaque that is deposited on the root surface

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