國立臺灣大學113學年度碩士班招生考試試題

題號：276

科目：專業英文(G)：科技英文

一、單選題 (共 50 題，每題 2 分，答錯倒扣 0.5 分，請作答於答案卡中)

Article 1.

New Growth Factor Facility Opens

(Source: Food Technology, IFT, December 20, 2023)

Cultivated meat production processes are relatively expensive, making it a challenge to scale up and reach price parity with animal-based counterparts. To help reduce production costs, BioBetter is transforming tobacco plants into natural bioreactors for the production of growth factors (GFs), which play a key role in the proliferation and differentiation of cultured meat cells, allowing for the formation of authentic and well-structured muscle tissue.

Designed for both environmental safety and efficiency, these bioreactors will be grown in a large-scale, net-house cultivation system. The tobacco plants are carefully engineered to prevent the escape of any transgenic material. They are induced to express growth factors only when chemically triggered, and the company exclusively uses non-food, non-feed tobacco plants to eliminate any risk of inadvertent consumption or cross-contamination of food crops.

BioBetter has opened its first food-grade pilot facility to accelerate the production of key growth factors for the cultivated meat industry. The newly established pilot plant has the capacity to process 100 kg of tobacco plant-derived GFs daily. The company is moving through the process of securing approval from the Israel Ministry of Health for food manufacturing licensing. BioBetter is targeting commercial production of five tons of GFs annually by the end of 2025.

Please answer the following questions:

1. What is NOT the role of 'growth factors' involved according to this article? (A) growth of tobacco cells (B) proliferation of meat cells (C) differentiation of muscle cells (D) formation of muscle tissue.
2. What are the 'bioreactors' mentioned in this article? (A) fermentation tanks (B) chemical reaction vessels (C) plants (D) food-grade pilot plants.
3. Why tobacco plants are selected for engineering? (A) It is safe for food. (B) It is safe for feed. (C) It is not cross-breeding with food crops. (D) It is environmental safety.
4. What is BioBetter's current commercial production capacity for growth factors? (A) 10 Kg (B) 100 Kg (C) 5 tons (D) not yet available.
5. Which is NOT a preventive action for controlling the spread of transgenic materials? (A) using net-house cultivation system (B) approval from the Ministry of Health for food manufacturing (C) chemically triggering expression (D) careful genetic modification.

Article 2.

Tackling sweetener aftertaste

(Source: Food Technology, IFT, August 1, 2023)

Adding a specific mixture of mineral salts to beverages containing noncaloric sweeteners may get rid of the lingering sweet aftertaste and add a sugar-like mouthfeel, according to a new study in the *Journal of Agricultural and Food Chemistry*.

Noncaloric sweeteners, such as saccharin, aspartame, and stevia, are used in beverages to lower the caloric content and reduce sugar. However, many consumers reject them because of the slow-to-develop sweetness and lingering aftertaste. In this study, the researchers mixed various mineral salts with beverages sweetened with rebaudioside A, which comes from stevia leaf, as well as other noncaloric sweeteners. The beverages were then tasted by a 15-subject panel and rated based on their mouthfeel intensity and sweetness linger.

Grant Dubois, chief scientific officer at stevia extract and taste modulator developer Almendra and lead author of the study, has worked most of his career on noncaloric sweeteners. In an interview with *Food Technology*, he said he first gained inspiration for the issues with these sweeteners from the world of pharmacology. He attended a presentation at the

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Massachusetts Institute of Technology with a professor who worked on increasing the bioavailability of therapeutic drugs.

"The issue is that when we take a pill, it goes into the small intestine and slowly goes into solution, but then it has to pass through the mucous layer lining the gastrointestinal tract, a hydrogel with hydrophobic sites," he explained. "So [the researcher] was trying to accelerate the rate of diffusion, and I realized for the first time that this is the exact problem we have with sweeteners traversing the mucous layer of the tongue."

Dubois and his team then experimented with using different mineral salts, such as calcium chloride, potassium chloride, and magnesium chloride, to break through the mucous hydrogel layer on the tongue. The results did reduce the lingering aftertaste, but only when using high concentrations of the salt, which exhibited salty, astringent off-tastes. Dubois then had another moment of inspiration from his pharmacology studies.

"Sometimes in pharmacology, when you have two drugs that have the same effect, but they act by different mechanisms, if you use them in combination, you can get a synergistic effect," he said. "So we could use low concentrations of calcium chloride mixed with magnesium chloride and potassium chloride, and we get a nice synergistic effect, and we substantially cut off the sweetness linger."

According to the study, the beverage with the taste modulator composition using all three mineral salts showed a 70% lower sweetness linger than the control sample. Additionally, the formulation also showed a mouthfeel intensity similar to that of traditional sucrose.

Dubois said that the implications of this research could go beyond just the beverage category and be applied to categories such as frozen desserts and baked goods.

Please answer the following questions:

6. Which sweetener does NOT show a lingering aftertaste? (A) aspartame (B) rebaudioside A (C) saccharin (D) sucrose.
7. What is the job of Grant Dubois? (A) an editor of the *Journal of Agricultural and Food Chemistry* (B) a scientist at Almendra (C) a professor at Massachusetts Institute of Technology (D) a reporter of the *Food Technology*.
8. What is the proposed taste modulator in this article? (A) calcium chloride (B) magnesium chloride (C) potassium chloride (D) a mixture of previous salts.
9. What is the cause of the aftertaste of noncaloric sweeteners, according to this article? (A) They take a long time to pass through the mucous layer of the tongue. (B) They combine on hydrophobic sites of the hydrogel of the tongue. (C) They react with mineral salts in our mouths. (D) It is the result of their astringent off-tastes.
10. The word *synergistic* in the passage is closest to in meaning to (A) antagonistic (B) cooperative (C) incompatible (D) resistant.

Article 3.

(Source: Food and Function, 2023 Jul 31, 14(15):6998-7010)

Depression is a severe mental disorder, with approximately 300 million people suffering from it. Recent studies have demonstrated that chronic neuroinflammation is significantly associated with intestinal flora and barrier function in depression. As a therapeutic herb, garlic (*Allium sativum* L.) has detoxification, antibacterial activity, and antiinflammatory functions; however, its antidepressant effect through gut microbiota and barrier function has not been reported yet. The present study investigated the effect of garlic essential oil (GEO) and its active constituent diallyl disulfide (DADS) on depressive behavior by attenuating the NLRP3 inflammasome, alternating intestinal barrier function and gut microbiota in an unpredictable chronic mild stress (UCMS) model in rats. This study found that dopamine and serotonin turnover rates were reduced significantly with a low dose of GEO (25 mg per kg bw). The GEO groups effectively reversed sucrose preference and increased the total distance traveled in the behavioral test. Moreover, 25 mg per kg bw GEO inhibited the UCMS-induced activated inflammatory response, reflected by reduced expression in the frontal cortex of NLRP3, ASC, caspase-1, and its downstream IL-1β proteins, as well as the concentration of IL-1β and TNF-α in the serum. Supplementation with GEO increased the expression of occludin and ZO-1 and the concentration of short-chain fatty acids to influence the impact of intestinal permeability in depressive conditions. The

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results revealed that GEO administration caused significant changes in the α and β diversity and abundance of certain bacteria. At the genus level, GEO administration significantly increased the relative abundance, particularly beneficial SCFA-producing bacteria, and may improve depression-like behavior. In conclusion, these results indicated the antidepressant effects of GEO involved in the inflammatory pathway, short-chain fatty acids, intestinal integrity, and intestinal composition.

Please answer the following questions:

11. Recent studies have demonstrated that which of the following is significantly associated with intestinal flora and barrier function in depression? (A) oxidation (B) chronic neuroinflammation (C) antioxidation (D) acute neuroinflammation
12. Depression is a severe mental disorder, with approximately how many people suffering from it. (A) 100 million (B) 200 million (C) 300 million (D) 400 million
13. As a therapeutic herb, which of the following has detoxification, antibacterial activity, and antiinflammatory functions? (A) garlic (B) apple (C) pear (D) day lily
14. According to the article stated above, using what kind of animal model to do this research? (A) forced swimming test (B) social defeat test (C) tail suspension test (D) unpredictable chronic mild stress test
15. The above study investigated the effect of garlic essential oil (GEO) and which of its active constituent on depressive behavior (A) diallyl sulfide (B) diallyl disulfide (C) diallyl trisulfide (D) methyl allyl disulfide
16. This study found that dopamine and serotonin turnover rates were reduced significantly with a low dose of which of the following? (A) GEO 150 mg/kg bw (B) GEO 100 mg/kg bw (C) GEO 25 mg/kg bw (D) GEO 50 mg/kg bw
17. Supplementation with GEO increased the expression of occludin and ZO-1 and the concentration of what to influence the impact of intestinal permeability in depressive conditions. (A) long-chain fatty acids (B) short-chain fatty acids (C) saturated fatty acids (D) unsaturated fatty acids
18. The results of the above study revealed that GEO administration caused significant changes in which of the following and abundance of certain bacteria? (A) α and κ diversity (B) α and β diversity (C) α and λ diversity (D) α and μ diversity
19. According to the article stated above, which of the following statements is **incorrect**? (A) Moreover, 25 mg per kg bw GEO inhibited the UCMS-induced activated inflammatory response. (B) Moreover, 25 mg per kg bw GEO inhibited the UCMS-induced activated inflammatory response, reflected by reduced expression in the frontal cortex of NLRP3, ASC, caspase-1, and its downstream IL-1β proteins in the serum. (C) Moreover, 25 mg per kg bw GEO inhibited the UCMS-induced activated inflammatory response, reflected by reduced expression in the frontal cortex of NLRP3, ASC, caspase-1, and its downstream IL-1β proteins, as well as the concentration of IL-1β and TNF-α in the serum. (D) Moreover, 25 mg per kg bw GEO inhibited the UCMS-induced activated inflammatory response, reflected by reduced expression in the frontal cortex of NLRP3, ASC, caspase-1, and its downstream IL-1β proteins, as well as the concentration of IL-1β and TNF-α in the plasma.
20. According to the article stated above, which of the following statements is **correct**? (A) In conclusion, these results indicated the antidepressant effects of GEO involved in the inflammatory pathway, long-chain fatty acids, intestinal integrity, and intestinal composition. (B) In conclusion, these results indicated the antidepressant effects of GEO involved in the inflammatory pathway, short-chain fatty acids, intestinal integrity, and intestinal composition. (C) In conclusion, these results indicated the antidepressant effects of GEO involved in the oxidation pathway, short-chain fatty acids, intestinal integrity, and intestinal composition. (D) In conclusion, these results indicated the depressant effects of GEO involved in the inflammatory pathway, short-chain fatty acids, intestinal integrity, and intestinal composition.

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Article 4.

Sensory design in food 3D printing – Structuring, texture modulation, taste localization, and thermal stabilization

(Source: Innovative Food Science & Emerging Technologies, 2021, 72:102743)

The sensory perception during food consumption depends not only on the concentrations of odor- and taste-active compounds but also on the texture of food matrix. The possibility of targeted analysis and control of the sensory perception of foods is confined due to limited knowledge about texture-taste interactions. Particularly, the sensory activity can hardly be predicted by the integral overall concentration if taste compounds are heterogeneously distributed in complex food matrices. Thus, it could be shown that inhomogeneous spatial distribution of taste-active compounds causes intensified sensory perception. Noort et al. investigated the effects of local concentration gradients of sodium chloride in layered bread on the perceived saltiness intensity. For this purpose, starch-protein layers with varying NaCl contents were stacked in alternating fashion before baking. They reported a significant saltiness enhancement of bread with high NaCl contrasts between layers compared to bread with homogeneous NaCl distribution, allowing up to 28% sodium reduction while maintaining saltiness intensity. The enhancement of salty taste has been ascribed mainly to the sensory contrast and to a small extent to a faster sodium release. In these previous studies, a precise positioning of spatial concentration gradients was not possible. The studies were performed with conventional manufacturing techniques on sparsely defined food matrices. To systematically investigate the effect of taste distribution on the sensory perception, new texturing approaches are necessary that achieve highly defined and reproducible texture construction. For this purpose, our study presents an approach which utilizes dual extrusion 3D printing for structuring matrix textures with spatial localization of sensory-active compounds. The method enables the production of highly defined starch-based material systems with targeted incorporation of locally resolved concentration gradients of sodium chloride.

Please answer the following questions:

21. What is NOT a factor that influences the sensory perception? (A) smell (B) flavor (C) crunchiness (D) color
22. What make it harder to predict the sensory activity? (A) surface property (B) softness (C) unequal distribution of flavor compounds (D) formulation
23. Saltiness intensity CANNOT be determined by (A) human mouth (B) analytical instrument (C) eye (D) Chemical test
24. What is the antonym of "complex"? (A) compound (B) homogeneous (C) multifactored (D) composite
25. 3D printing could produce food with (A) unified taste (B) interesting shape (C) localized flavor (D) all of the above

Article 5.

The fourth industrial revolution in the food industry—part II: Emerging food trends

(Source: Critical Reviews in Food Science and Nutrition, 2024, 64(2):407-437)

Industry 4.0 is an interdisciplinary approach that combines physical, digital, and biological domains. The main Industry 4.0 technologies in the agriculture and food industry are artificial intelligence (AI) the Internet of Things (IoT), smart sensors, robotics, and 3D printing. Since 2015, more attention has been paid to Industry 4.0 technologies, and the adaptation of these frontier technologies has accelerated global digitalization and digital transformation. Consistent with Industry 4.0, several food megatrends have evolved during the last few years, some of them being reinforced by the COVID-19 pandemic. For example, as healthy nutrition is an important pillar in the fight against the COVID-19 crisis, food fortification and functional food ingredients are receiving renewed attention as ways to address malnutrition and strengthen immunity. For example, the use of phenolic compounds and other bioactive ingredients in fortification has been widely reported to enhance antioxidant and antimicrobial properties.

One of the increasing food trends generally supported by environmentalists is the replacement of animal-based foods (e.g. meat, fish, eggs, milk, and their products) by plant-based products. Indeed, plant-based products have increased in popularity owing to increased awareness of consumers about the benefit of this diet to both health and the environment. Meat

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alternatives (e.g. cultured meat and plant-based substitutes) have been receiving increasing attention due not only to the huge burden of meat production on the planet (i.e. pollution, greenhouse gas emissions, and water requirements) but also to the potential concerns of high meat consumption on public health issues. Recent technological advances have also accelerated the development of cultured meat, with many different implications for the environment, human health, and animal welfare. In addition of animal-free meat, other products, such as eggs and dairy can be produced from a range of raw materials, including animal cells, plants, fungi, and non-living organisms.

Please answer the following questions:

26. Which of the following could be product resulting from Industry 4.0? (A) lab meet (B) plant burger (C) smart packaging (D) all of the above
27. Base on the philosophy of Industry 4.0, food may be produced with higher content of (A) cholesterol (B) bioactive compound (C) dyes (D) animal protein
28. What is the meaning of the word "accelerated"? (A) delay (B) augment (C) suspend (D) defer
29. What would NOT be a good protein alternative for vegetarian? (A) tofu (B) fungus (C) liver (D) eggs
30. Animal protein production is associated with (A) greenhouse gas (B) waste water (C) pollution (D) all of the above

Article 6.

Xylooligosaccharide production from lignocellulosic biomass

(Source: Carbohydrate Polymers, 2021 Jan 1, 251:117118)

Xylooligosaccharides (XOS) are sugar oligomers composed of β-D-xylopyranosyl (xylose) units bound through β-(1→4)-xylosidic linkages. These sugars, naturally present in bamboo shoots, fruits, vegetables, milk, and honey, are industrially produced through xylan hydrolysis of lignocellulosic biomass (LCB). In the past decade XOS has gained value in the market because of its prebiotic effect in humans and animals at low doses (1.4 g per day in adults). The documented health benefits of XOS include a reduction in blood cholesterol, an increase in calcium absorption, antioxidant effects, the maintenance of gastrointestinal health, a reduced colon cancer risk, a cytotoxic effect on human leukemic cells, and benefits to patients with type 2 diabetes mellitus 2. Therefore, the International Association of Probiotics and Prebiotics recognizes XOS as prebiotic oligosaccharides in the latest update of its prebiotic definition.

LCB is mainly composed of three structures: lignin, cellulose and hemicellulose. The percentage of each compound varies according to the type of biomass. Still, the ranges are typically 30–50 % (w/w) of cellulose, 15–25 % (w/w) of lignin, and 20–40 % (w/w) of hemicellulose. Xylan, the principal constituent of hemicellulose (between 60 and 90%; w/w), is a heteropolysaccharide with degrees of polymerization between 50 and 200. In LCB, the xylan composition may reach values of up to 34 % (w/w) concerning the total mass of LCB. Its structure depends on the source, but the molecule that prevails in its backbone is D-xylose linked by β-(1→4)-linkages.

Xylans are grouped into different subclasses depending on their degree of substitution and the types of side groups presented in their structure:

a) Homoxylans:	Linear polysaccharides made up of D-Xylanopiranosyl (Xylp) residues linked by β-(1→3)-linkages, β-(1→4)-linkages, and mixed β-(1→3,1→4)-linkages.
b) Glucoronoxylans:	Polysaccharides are composed of a single side chain of α-D-glucuronic acid (GA) and its 4-O-methyl derivative (MeGA) linked to Xylp at position 2. The principal component (>90 %) of hardwoods are 4-O-methyl-D-gucurono-D-xylan molecules.
c) Arabinoxylans:	These polysaccharides have α-Araf residues attached to Xylp at locations 2 and 3 (monosubstitution or disubstitution). Phenolic acids such as ferulic acid and p-coumaric acid esterified to O-5 of some Araf residues may also be found in AX. These polysaccharides are typically present in the starch and bran of cereal grains and seeds.
d) Heteroxylans:	Polysaccharides are deeply substituted with different types of monosaccharides and oligosaccharides. Heterxylan has been found in cereal bran, seeds, and mucilage, among others.

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Please answer the following questions:

31. Xylooligosaccharides are sugar oligomers that exist naturally in foods. Which of the following material is **unlikely** to contain xylooligosaccharides? (A) honey (B) bamboo shoots (C) beef (D) fruits
32. Xylooligosaccharides are mainly composed of what? (A) xylitol (B) glucose (C) xylose (D) galactose
33. In the food industry, xylooligosaccharides are being used as a what? (A) gelling agent (B) vitamin supplement (C) probiotics (D) prebiotics
34. What is the full name of LCB? (A) liquid cultured biomass (B) lignocellulosic biomass (C) lactobacilli bacteria (D) *Lactobacillus bulgaricus*
35. Consuming xylooligosaccharides may bring health benefits to the host. Which of the following benefits of XOS consumption is **not** mentioned in the above article? (A) reduction in blood cholesterol (B) cytotoxic effect on cancer cells (C) increase in calcium absorption (D) better eye vision
36. Which of the following is **not** the main component of LCB? (A) hemicellulose (B) agarose (C) lignin (D) cellulose
37. How many glycosyl units can be found in a xylan molecule? (A) 2–10 (B) 2–20 (C) 50–200 (D) 15–25
38. Glucoronoxylans are mostly found in what? (A) hardwoods (B) seaweeds (C) grapes (D) cereal brans
39. Arabinoxylans are mostly found in what? (A) hardwoods (B) seaweeds (C) grapes (D) cereal brans
40. Which of the following locations is **unlikely** for α-Araf residues to attach on Xylp of xylan? (A) location 1 (B) location 2 (C) location 3 (D) location 2 and 3

Article 7.

Fast growth can counteract antibiotic susceptibility in shaping microbial community resilience to antibiotics

(Source: PNAS, 2022 Apr 12, 119(15):e2116954119)

Microbial communities often display alternative stable states that regulate their ecological functions. For example, while the human gut microbiome is stable to changes in daily life, exposure to strong perturbations can induce lasting shifts in its community composition, in turn leading to persistent changes in community functions. Such is the case of *Clostridioides difficile* infections, which can opportunistically take over a gut community that has been compromised by antibiotic exposure. This shift toward a *C. difficile*-dominated community constitutes a switch toward an alternative, and unhealthy, stable state of the community that can be resilient to further antibiotic treatments. In soil microbiomes, human-driven leakage of antibiotics can cause lasting shifts in microbial community composition—e.g., changes in the fractions of Gram-positive bacteria and antibiotic resistant taxa—that can in turn compromise long-term soil productivity. Given their strong impact in human health and ecosystem functioning, understanding the drivers of regime shifts in microbial communities is an important challenge.

Over the last 70 years, the use of antibiotics has been one of the most powerful tools in taming microbial pathogens. The use of this tool is guided by assays that measure the drug susceptibility of pathogen isolates, yet treatments generally expose not only the pathogen but also a broader host-associated bacterial community to the antibiotic. The resulting multispecies dynamics are difficult to predict, and expectations based on drug susceptibility can be misleading. Such complexities arise in part due to emergent properties of communities that allow microbes to either tolerate or deactivate the drug. For instance, horizontal gene transfer can rapidly provide some pathogens with antibiotic resistance mechanisms. Microbial interactions such as cross-protection due to active or passive inactivation of antibiotics by resistant strains frequently allow susceptible strains to survive drug exposure. The relative importance of antibiotic susceptibility over other microbial traits that can shape community dynamics after antibiotic exposure remains largely unknown.

Several microbial traits have been shown to influence community resilience, the ability to return to the initial state after a temporary perturbation. Growth rates can play an important role when conditions become favorable after temporary perturbations, as the fastest responders have an advantage at repopulating the ecosystem. This can potentially increase the resilience of stable states dominated by fast growers. Beyond growth rates, community resilience depends on microbial

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interactions. Within a population, intraspecies interactions, such as cooperative growth, can determine population abundance thresholds separating the capability to recover from temporary harm versus population collapse. Interspecies interactions—interactions between different community members—also shape community resilience. Predominantly mutualistic communities can be relatively fragile, as the failure of the weakest member can strongly compromise the survival of the rest. While competitive interactions can potentially lead to higher resilience, competition can also increase the number of alternative stable states that the community can reach, potentially making transitions between such states more likely. There is a pressing need for a quantitative understanding of the interplay between community member traits and the kinds—and strengths—of perturbations that are required to steer microbial communities between alternative stable states.

Dispersal, the flux of individuals entering and leaving the community, can also play key roles in shaping microbial community stability and dynamics. Ingestion, for example, results in the frequent influx of large amounts of microbes into gut-associated communities, where the incoming cells interact with the resident microbiota influencing the overall community dynamics. A wealth of theoretical studies postulate that dispersal can enhance community richness and heterogeneity in ecological communities, as well as promote regime shifts and fluctuations in species abundances. Not only this, but also dispersal is essential to reseed community members after local extinctions, which can dramatically increase community resilience. Over recent years, some of these theoretical predictions have been experimentally tested in both natural and synthetic microbial communities. The role of dispersal rates in driving the resilience of alternative stable states of microbial communities to antibiotic exposure is yet to be understood.

In recent work, we characterized a simple model community composed of two species, *Corynebacterium ammoniagenes* and *Lactobacillus plantarum*, that displays two alternative stable states. Both of these species are common in soils, and they are also among the culturable, human-associated microbiota. The genus *Lactobacillus* contains several probiotics, including *L. plantarum*, often considered beneficial for the host. Such a beneficial role might, however, depend on the ecological context, as members of this genus could also interfere with the recovery of microbial diversity—e.g. through acidification and metabolite production in the gut environment following antibiotic treatment. While the *Corynebacterium* genus has a number of human pathogens, *C. ammoniagenes* is considered a nonpathogenic species with potential use in the manufacture of prebiotics. In the laboratory, *C. ammoniagenes* and *L. plantarum* provide a minimal experimental model to study alternative stable states in microbial communities, as these species interact antagonistically through modifying the environmental pH in opposite directions.

Here, we use the *C. ammoniagenes–L. plantarum* experimental community to study shifts between alternative stable states after antibiotic exposure. While monocultures revealed that *C. ammoniagenes* was more susceptible to several antibiotics than its competitor *L. plantarum*, exposing the community to antibiotics resulted in shifts toward the stable state dominated by the more susceptible *C. ammoniagenes*. A simple theoretical model suggested that the most harmed species could still take over the system by growing faster than its competitor after the antibiotic was removed. Experimental measures over a range of experimental conditions verified the faster growth of *C. ammoniagenes*, while they also revealed signatures of cooperative growth. Incorporating cooperativity into the theoretical model predicted an interplay between cooperative growth and dispersal rate in driving community resilience. Indeed, lowering the experimental dispersal rate accentuated the effects of cooperative growth in *C. ammoniagenes*. In these conditions, a wide range of antibiotic perturbations involving different antibacterial mechanisms induced transitions toward the alternative stable state dominated by *L. plantarum*. Our results highlight that species susceptibility to antibiotics is often uninformative of community resilience, and ecological drivers such as cooperative growth and dispersal rates can play a much more dominant role after antibiotic exposure.

Please answer the following questions:

41. What does the term "counteract" mean in the title of the article? (A) Neutralized (B) Strengthened (C) Exaggerated (D) Exacerbated
42. According to the 2nd paragraph, why can expectations based on drug susceptibility of pathogen isolates be misleading in antibiotic treatments? (A) Pathogens often have unpredictable growth rates. (B) Horizontal gene transfer provides rapid

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resistance. (C) Dynamic and complex responses of members in a bacterial community exposed to the antibiotic. (D) Antibiotic exposure compromises long-term soil productivity.

43. According to the 2nd paragraph, what are some emergent properties of microbial communities that contribute to their resilience? (A) Horizontal gene transfer (B) Dispersal rates (C) Cross-protection through microbial interactions (D) All of the above
44. In the 3rd paragraph, what does community resilience mean? (A) The ability to tolerate strong perturbations without shifts in composition. (B) The capacity to maintain stable states dominated by fast-growing species. (C) The ability to recover and return to the initial state after temporary perturbations. (D) The resistance to changes induced by antibiotic exposure.
45. How does dispersal contribute to microbial community stability and dynamics, as mentioned in the 4th paragraph? (A) It inhibits transitions between alternative stable states. (B) It enhances community richness and heterogeneity. (C) It decreases the number of community members after local extinctions. (D) It influences the susceptibility of species to antibiotics.
46. As mentioned in the 5th paragraph, the genus *Lactobacillus* contains several probiotics, including *L. plantarum*, often considered beneficial for the host. What does the term "probiotics" refer to? (A) sources of food for the beneficial microbes (B) metabolites or soluble products of beneficial microbes (C) formulations of probiotics and prebiotics that work in synergism (D) a category of health-promoting microbes
47. According to the last two paragraphs, what is the best description to the two species: *Corynebacterium ammoniagenes* and *Lactobacillus plantarum*? (A) Both species belong to the same genus. (B) Both species are pathogenic. (C) The two species prefer similar environmental pH for the growth. (D) *C. ammoniagenes* is more harmed by antibiotics than *L. plantarum*.
48. What was the primary focus of the research mentioned in the 5th paragraph? (A) Exploring the ecological context of *C. ammoniagenes* and *L. plantarum* in soils. (B) Investigating the interference of *L. plantarum* with microbial diversity after antibiotic treatment. (C) Assessing the potential use of *C. ammoniagenes* in the manufacture of prebiotics. (D) Studying alternative stable states in microbial communities using a model community of *C. ammoniagenes* and *L. plantarum*.
49. According to the article, what is **not** considered a primary influence to community resilience after temporary perturbations? (A) Antibiotic susceptibility (B) Intraspecies interactions (C) Interspecies interactions (D) Growth rates
50. According to the article, what is the primary argument proposed by the authors in their latest work? (A) Assays that measure the drug susceptibility of pathogen isolates provide informative guidelines for the use of antibiotics. (B) Cooperative growth and dispersal rates following antibiotic exposure can significantly influence community resilience. (C) *C. ammoniagenes* is a promising candidate for applications in the production of prebiotics. (D) All of the above.

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