



Scientists Develop Bioengineered Photosynthesis to Combat Dry Eye Disease

Description

Photosynthesis, a vital process for life on Earth, recently became the focus of a groundbreaking study aiming to combat dry eye disease. Researchers at the National University of Singapore (NUS) successfully incorporated nanoscale light-absorbing structures from spinach into mammalian eye cells, presenting a novel approach that could revolutionise treatment for approximately 1.5 billion affected individuals globally.

The impetus for this research stems from the unique abilities of certain sea slugs, known as sacoglossans, which can absorb chloroplasts from algae and use them for photosynthesis. This concept prompted scientists to explore the potential of transplanting similar capabilities into other organisms, particularly humans. The eye, continuously exposed to light, emerged as an optimal environment for implementing this innovative strategy.

The team developed a particle called LEAF, derived from thylakoids—structures responsible for light absorption in chloroplasts. Unlike traditional plants, which expend energy converting absorbed light into sugars, LEAF was designed merely to harness light for charging chemical "batteries" in cells. Initial tests indicated that when exposed to light, LEAF effectively restored NADPH, a molecule that helps fight cellular damage from oxidative stress.

In trials with eye models, LEAF demonstrated the potential to combat inflammatory conditions by generating NADPH upon illumination. Researchers have indicated that this approach could represent a significant advancement in treating dry eye disease, diverging from conventional therapies that often focus solely on blocking inflammation.

While the idea presents remarkable possibilities, significant challenges remain. Researchers must address numerous safety concerns, including particle persistence in human tissue and potential immune responses. Despite these hurdles, the scientific community is optimistic that this pioneering work may eventually lead to effective treatments for dry eye disease, paving the way for further applications in human health.

Vocabulary List:

1. **photosynthesis** //,foʊtə'sɪnθəsis// (noun): how plants use light to make food
2. **nanoscale** //ˈnænəʊskeɪl// (adjective): extremely small; too tiny to see
3. **chloroplasts** //ˈklɒrəʊ,plæsts// (noun): parts inside plant cells that do photosynthesis
4. **thylakoids** //θaɪ'lækɔɪdz// (noun): thin layers in chloroplasts that catch light
5. **NADPH** //,ɛn.eɪ.di.pi:'eɪtʃ// (noun): a small molecule cells use to fight damage
6. **inflammatory** //ɪn'flæmə,tɔːri// (adjective): relating to swelling or irritation in body



Comprehension Questions

Multiple Choice

1. What is the focus of the recent study at the National University of Singapore?
Option: Treating diabetes
Option: Combating dry eye disease
Option: Improving eyesight
Option: Enhancing photosynthesis
2. From which plant were the light-absorbing structures incorporated into eye cells derived?
Option: Lettuce
Option: Kale
Option: Spinach
Option: Cabbage
3. What is the name of the particle developed by the researchers?
Option: LEAF
Option: NADPH
Option: Chloroplast
Option: Thylakoids
4. What does LEAF restore when exposed to light?
Option: Glucose
Option: Oxygen
Option: NADPH
Option: Chlorophyll
5. What percentage of the global population is affected by dry eye disease?
Option: 500 million
Option: 1.5 billion
Option: 2 billion
Option: 1 million
6. What method do traditional therapies for dry eye disease mostly focus on?
Option: Restoring moisture



- Option: Blocking inflammation
- Option: Enhancing vision
- Option: Surgery

True-False

7. The study aims to improve photosynthesis in plants.
8. LEAF is designed to convert light into sugars.
9. Sacoglossans are a type of sea slug that can absorb chloroplasts.
10. The research has already successfully treated dry eye disease in humans.
11. Initial tests indicated that LEAF helps fight cellular damage from oxidative stress.
12. The research team believes there are no safety concerns regarding the new treatment approach.

Gap-Fill

13. Photosynthesis is a vital process for life on Earth and is recently the focus of a study aimed to combat dry eye disease _____ .
14. The particle developed by researchers is called _____ .
15. Researchers aimed to restore _____ through their innovative strategy.
16. Dry eye disease affects approximately _____ individuals worldwide.
17. The inspiration for the research came from the abilities of certain _____ slugs.
18. LEAF was designed to harness light for charging _____ in cells.

Answer

Multiple Choice: 1. Combating dry eye disease 2. Spinach 3. LEAF 4. NADPH 5. 1.5 billion 6. Blocking inflammation

True-False: 7. False 8. False 9. True 10. False 11. True 12. False

Gap-Fill: 13. globally



14. LEAF 15. NADPH 16. 1.5 billion 17. sea 18. chemical batteries

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. What process do plants use to convert sunlight into energy?
Option: Respiration
Option: Photosynthesis
Option: Digestion
Option: Fermentation
2. Which organelle is primarily responsible for photosynthesis in plant cells?
Option: Mitochondria
Option: Nucleus
Option: Chloroplasts
Option: Ribosomes
3. What is the role of NADPH in the photosynthesis process?
Option: Energy production
Option: Electron carrier
Option: Oxygen production
Option: Carbon fixation
4. What condition is characterized by redness, swelling, and pain as a response to injury?
Option: Infection
Option: Inflammation
Option: Metastasis
Option: Mutation
5. Which hormone is often released during stress and helps regulate metabolism?
Option: Adrenaline
Option: Insulin
Option: Cortisol
Option: Thyroxine
6. What treatment is commonly used to combat cancer by targeting rapidly dividing cells?



- Option: Radiation therapy
- Option: Chemotherapy
- Option: Immunotherapy
- Option: Surgery

7. What small plastic particles pose a significant environmental threat due to their prevalence in oceans?

- Option: Nanoplastics
- Option: Microplastics
- Option: Macrophages
- Option: Synthetic fibers

8. What term describes the spread of cancer cells from the original site to other parts of the body?

- Option: Invasion
- Option: Metastasis
- Option: Benign growth
- Option: Remission

9. What refers to the likelihood of developing a disease based on genetic or environmental factors?

- Option: Immunity
- Option: Resistance
- Option: Susceptibility
- Option: Infection

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

10. Chloroplasts contain structures called _____ that are essential for the light-dependent reactions of photosynthesis.

11. Research at the _____ level often involves studying materials and structures at the atomic or molecular scale.

12. Many people take dietary _____ to improve their health and fill nutritional gaps.

13. Efforts to _____ the effects of climate change have become increasingly important.

14. The strategy of _____ can sometimes prevent conflict but may lead to unresolved issues.



15. A single-celled organism known as a _____ can be beneficial or harmful to humans.
16. Some strains of bacteria have become _____ to traditional antibiotics.
17. Sometimes, attempts at resolving conflict can be _____ if not handled carefully.
18. Water treatment plants use _____ processes to remove contaminants from drinking water.
19. The _____ of a new drug is often determined through clinical trials.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

20. The degree of a person's openness to suggestions can vary significantly.
21. The storm began to as winds reached over 100 miles per hour.
22. The process by which your body converts food into energy is known as metabolism.
23. Sounds below the frequency of 20 Hz are referred to as infrasound.
24. Ferrofluid is a liquid that becomes magnetized in the presence of a magnetic field.
25. Proper waste is essential for environmental protection and public health.
26. There are several types of that can harm aquatic ecosystems.
27. Engineers often create a to test new designs before full-scale production.
28. Genetic can lead to variations in traits among organisms.
29. When tissues are damaged, they often exhibit signs of as part of the healing process.

Answer

Multiple Choice: 1. Photosynthesis 2. Chloroplasts 3. Electron carrier 4. Inflammation 5. Cortisol
6. Chemotherapy 7. Microplastics 8. Metastasis 9. Susceptibility

Gap-Fill: 10. thylakoids 11. nanoscale 12. supplements 13. mitigate 14. avoidance 15. bacterium 16.
resistant 17. counterproductive 18. filtration 19. efficacy

Matching sentence: 1. suggestibility 2. intensify 3. metabolism 4. infrasound 5. ferrofluid 6. disposal
7. contaminants



8. prototype 9. mutations 10. inflammation

CATEGORY

1. Health - LEVEL6

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1. bioengineer
2. dry eye disease
3. ESL learning
4. esl news
5. Level 6
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