Mushroom Meets Robot: A New Frontier in Sci-Fi Science!

Description

The enigmatic dreams of sleeping mushrooms remain an enigma, even as their extensive mycelial networks exhibit flickers and pulses resembling our own neural electrical activity.

What, one wonders, might transpire if this intricate network were afforded a moment of autonomy?

In pursuit of answers, an interdisciplinary team of researchers from Cornell University in the United States and the University of Florence in Italy embarked on a pioneering experiment. They placed a culture of the edible mushroom species *Pleurotus eryngii*, commonly known as the king oyster mushroom, in control of two mechanical vehicles capable of subtle movements across a flat surface.

The series of experiments indicated that the mushroom's electrophysiological responses could be effectively utilized to translate environmental stimuli into directives, thereby steering the mechanical devices' actions.

"Through the integration of mycelium within the robotic circuitry, we enabled the biohybrid apparatus to perceive and interact with its environment," remarked Rob Shepherd, a materials scientist at Cornell, upon the publication of their findings in August.

While the fusion of biological entities with machinery is not a novel concept, the potential of the Fungi kingdom as a reservoir for cybernetic technologies remains largely untapped.

With their simple cultivation requirements and remarkable resilience, molds and mushrooms could furnish engineers with a diverse array of living components tailored to various sensory and even computational applications.

Typically concealed from view, the delicate networks of fungal filaments react to environmental shifts as they navigate through soil in search of sustenance.

Distinct species exhibit transmembrane activities akin to our own neural functions, offering researchers a fascinating glimpse into their covert communications.

By applying algorithms inspired by the electrophysiological signals of *P. eryngii* mycelia, the researchers successfully configured a microcontroller to interpret those signals, activating mechanical responses in different mobile devices.


mushroom driven rolling robot
Real-time demonstration of a mycelium signal-controlled wheeled robot. (Robert Shepherd)

In controlled settings, the researchers utilized the fungal signals to direct the movements of both a five-limbed soft robot and a four-wheeled, untethered vehicle.

They successfully influenced and modulated the inherent impulses generated by the fungi, showcasing the capacity to harness the system's sensory capabilities for specific objectives.

"This endeavor transcends mere robotic control," noted Anand Mishra, a bioroboticist at Cornell. "It is fundamentally about establishing a genuine connection with a living system. By decoding its signals, we gain insight into its condition—perhaps even detecting stress responses. These signals remain unseen, yet the robot serves as a medium for their visualization."

Despite the seemingly rudimentary appearance of the 'roboshroom,' the true potential of this technology may someday extend to streamlined mechanical systems capable of interpreting complex environmental changes—enabling precise nutrient or pesticide applications, or dynamically responding to rising pollutant levels or alterations in human physiology.

The whispers of mushrooms harbor insights we have scarcely begun to comprehend. Who knows—one day, they may share with us the substance of their dreams.

This research was published in *Science Robotics*.

An earlier version of this article appeared in September 2024.

Vocabulary List:

1. **Enigma** /ɪˈnɪg.mə/ (noun): A person or thing that is mysterious or puzzling.
2. **Fungi** /ˈfʌŋgaɪ/ (noun): A kingdom of organisms that includes yeasts molds and mushrooms.
3. **Electrophysiological** /ɪˌlɛk.trəʊ.fɪz.i.əˈlɒdʒ.ɪ.kəl/ (adjective): Relating to the electrical properties of biological cells and tissues.
4. **Autonomy** /ɔːˈtɒn.ə.mi/ (noun): The right or condition of self-government.
5. **Biohybrid** /baɪoʊˈhaɪ.brɪd/ (noun): An organism or device combining biological and synthetic components.
6. **Resilience** /rɪˈzɪl.jəns/ (noun): The capacity to recover quickly from difficulties; toughness.

Comprehension Questions

Multiple Choice

1. What is the name of the edible mushroom species used in the experiment?

   Option: Pleurotus eryngii
   Option: Agaricus bisporus
   Option: Amanita muscaria
   Option: Lactarius indigo

2. Which universities were involved in the experiment?

Option: Cornell University and University of Michigan
Option: Harvard University and University of Cambridge
Option: Cornell University and University of Florence
Option: Stanford University and University of Paris

3. What did the researchers successfully direct using fungal signals?

Option: A helicopter
Option: A submarine
Option: A five-limbed soft robot
Option: A space shuttle

4. Which scientist remarked on the integration of mycelium with robotic circuitry?

Option: Anand Mishra
Option: Robert Shepherd
Option: Marie Curie
Option: Albert Einstein

5. What type of applications could the technology have in the future?

Option: Cooking applications
Option: Cleaning applications
Option: Sensory applications
Option: Transportation applications

6. Who noted that the mushroom signals could reveal stress responses?

Option: Anand Mishra
Option: Marie Curie
Option: Rob Shepherd
Option: Albert Einstein

True-False

7. The mycelial networks of mushrooms exhibit neural electrical activity.

8. Mushrooms have no potential for cybernetic technologies.

9. The mushrooms in the experiment were controlled by human operators.

10. The researchers utilized fungal signals to move a four-wheeled vehicle in controlled settings.

11. The research team was solely from Cornell University.

12. The technology may help in responding to environmental changes.

Gap-Fill

13. The edible mushroom used in the experiment is commonly known as the king oyster mushroom, Pleurotus eryngii, and is also referred to as the _____ mushroom.

14. An interdisciplinary team of researchers from Cornell University in the United States and the University of Florence in Italy embarked on this pioneering experiment to explore the potential of utilizing fungal signals in controlling _____ devices.

15. By applying algorithms inspired by the electrophysiological signals of P. eryngii mycelia, the researchers configured a microcontroller to interpret those signals, activating mechanical responses in different _____ devices.

16. The integration of mycelium within the robotic circuitry enabled the biohybrid apparatus to perceive and interact with its _____.

17. Fungi kingdom remains largely untapped as a reservoir for _____ technologies.

18. Molds and mushrooms could furnish engineers with living components tailored to various sensory and even computational _____.

Answer

Multiple Choice: 1. Pleurotus eryngii 2. Cornell University and University of Florence 3. A five-limbed soft robot 4. Robert Shepherd 5. Transportation applications 6. Anand Mishra
True-False: 7. True 8. False 9. False 10. True 11. False 12. True
Gap-Fill: 13. king oyster 14. mechanical 15. mobile 16. environment 17. cybernetic 18. applications

Vocabulary quizzes

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

1. What is a term used to describe something mysterious or puzzling?

   Option: Secret code
   Option: Electrophysiological
   Option: Resilience
   Option: Indulgences

2. Which plant is known for its medicinal and recreational uses?

   Option: Fungi
   Option: Cannabis
   Option: Correlations
   Option: Resilience

3. What is the term for taking action to reduce the severity or risk of something?

   Option: Inclusive
   Option: Mitigate
   Option: Proliferation
   Option: Susceptibility

4. Which term refers to the ability of an individual or entity to govern itself independently?

   Option: Potent
   Option: Autonomy
   Option: Chronic
   Option: Epidemiology

5. What is the collection of chemical compounds that guide the functioning of our genes?

   Option: Causation
   Option: Enhancing
   Option: Epigenome
   Option: Propensity

6. Which term describes the rising again or renewal of an activity after a period of dormancy?

Option: Transiently
Option: Impairments
Option: Resurgence
Option: Propagation

7. What does the term "propensity" refer to?

Option: Identification
Option: Enhancing
Option: Resilience
Option: Propensity

8. What are acts of satisfying desires without restraint called?

Option: Phenomena
Option: Correlations
Option: Indulgences
Option: Mitigate

9. Which term refers to a group of organisms that includes mushrooms yeasts and molds?

Option: Enigma
Option: Transients
Option: Fungi
Option: Telophase

10. Which term means to improve or increase the quality value or extent of something?

Option: Enhancing
Option: Propagation
Option: Susceptibility
Option: Identification

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

11. The _____ of the novel won numerous awards for their captivating storytelling.

12. The study focused on the _____ responses of the brain to different stimuli.

13. Prolonged stress can lead to various _____ health conditions.

14. The team analyzed the genetic factors influencing _____ to certain diseases.

15. The scientist studied natural _____ to understand underlying principles.

16. Effective _____ measures can reduce the impact of environmental disasters.

17. Water _____ in the region serve as crucial sources for agriculture.

18. The report outlined strategies for the rapid _____ of renewable energy sources.

19. The forensic team used DNA _____ to determine the victim of the crime.

20. The study established strong _____ between diet and overall health.

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

21. The research project aims to develop a new generation of medical implants using living cells and organic materials.
22. The community showed great in rebuilding after the natural disaster.
23. The policy was designed to be of all members of society regardless of background or status.
24. The new drug demonstrated a effect in treating the rare disease.
25. Long-term smoking can lead to respiratory diseases.
26. The migratory birds were considered in the region only staying for a short period each year.
27. Public health officials relied on data to track the spread of the contagious disease.
28. The rapid of rumors led to widespread misinformation within the community.
29. Individuals with weakened immune systems have increased to infections.
30. In times of stress people often seek as a form of comfort and escape.

Answer

Multiple Choice: 1. Secret code 2. Cannabis 3. Mitigate 4. Autonomy 5. Epigenome 6. Resurgence 7. Propensity 8. Indulgences 9. Fungi 10. Enhancing
Gap-Fill: 11. Author 12. Electrophysiological 13. Chronic 14. Susceptibility 15. Phenomena 16. Mitigation 17. Reservoirs 18. Propagation 19. Identification 20. Correlations
Matching sentence: 1. Biohybrid 2. Resilience 3. Inclusive 4. Potent 5. Chronic 6. Transients 7. Epidemiology 8. Propagation 9. Susceptibility 10. Indulgences

CATEGORY

1. Sci/Tech - LEVEL5

Date Created
2024/12/10
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