Reading 36

Cellular Slime Molds

Cellular slime molds are extraordinary life forms that exhibit features of both fungi and protozoa, although often classed for convenience with fungi. At one time they were regarded as organisms of ambiguous taxonomic status, but more recent analysis of DNA sequences has shown that slime molds should be regarded as inhabiting their own separate kingdom. Their uniqueness lies in their unusual life cycle, which alternates between a feeding stage in which the organism is essentially unicellular and a reproductive stage in which the organism adopts a multicellular structure. At the first stage they are free-living, separate amoebae, usually inhabiting the forest floor and **ingesting** bacteria found in rotting wood, dung, or damp soil. But their food supplies are relatively easily exhausted since the cells' movements are restricted and their food requirements rather large.

When the cells become starved of nutrition, the organism initiates a new genetic program that permits the cells to eventually find a new, food-rich environment. **A** At this point, the single-celled amoebae combine together to form what will eventually become a multicellular creature. **B** The mechanism by which the individual members become a single **entity** is essentially chemical in nature. **C** At first, a few of the amoebae start to produce periodic chemical pulses that are detected, amplified, and relayed to the surrounding members, which then move toward the pulse origin. **D** In time, these cells form many streams of cells, which then come together to form a single hemispherical mass. This mass sticks together through the secretion of adhesion molecules.

The mass now develops a tip, which elongates into a finger-like structure of about 1 or 2 millimeters in length. This structure eventually falls over to form a miniature slug, moving as a single entity orienting itself toward light. During this period the cells within the mass differentiate into two distinct kinds of cell. Some become prestalk cells, which later form into a vertical stalk, and **others** form prespore cells, which become the spore head.

As the organism migrates, it leaves behind a track of slime rather like a garden slug. Once a favorable location has been found with a fresh source of bacteria to feed on, the migration stops and the colony metamorphoses into a fungus-like organism in a process known as “culmination." The front cells turn into a stalk, and the back cells climb up the

stalk and form a spherical-shaped head, known as the sorocarp. This final fruiting body is about 2 millimeters in height. The head develops into spores, which are dispersed into the environment and form the next generation of amoebae cells. Then the life cycle is repeated. Usually the stalk disappears once the spores have been released.

The process by which the originally identical cells of the slime mold become transformed into multicellular structures composed of two different cell types - spore and stalk - is of great interest to developmental biologists since it is analogous* to an important process found in higher organisms in which organs with highly specialized functions are formed from unspecialized stem cells. Early experiments showed which parts of the slime mold organism contributed to the eventual stalk and which parts to the head. Scientists stained the front

part of a slug with a red dye and attached it to the back part of a different slug. The hybrid creature developed as normal. The experimenters then noted that the stalk of the fruiting body was stained red and that the spore head was unstained. Clearly, the anterior part of the organism culminated in the stalk and the posterior part in the spore head. Nowadays, experiments using DNA technology and fluorescent proteins or enzymes to label the prespore and prestalk cells have been undertaken. This more molecular approach gives more precise results than using staining dyes but has essentially backed up the results of the earlier dye studies.

*analogous: similar

1. According to paragraph 1, how the slime mold should be classified used to be
A. unknown
B. uncertain
C. controversial
D. unfamiliar

2. The word "ingesting" in the passage is closest in meaning to
A. chewing
B. catching
C. absorbing
D. consuming

3. According to the passage, what is unusual about the slime molds' life cycle?
A. They inhabit their own kingdom.
B. They are organisms whose classification is ambiguous.
C. They alternate between unicellular and multicellular structures.
D. They are free-living organisms.

4. According to the passage, what is the primary reason the cells need to combine into a single larger creature?

A. To move to find a new food source
B. To slow the rate of ingesting food
C. To become separate creatures
D. To create their own kingdom

5. Look at the four squares that indicate where the following sentence could be added to the passage.

Starvation is reached when the population of cells is high in relation to the abundance of the food source.

Where would the sentence best fit?

6. The word "entity" in the passage is closest in meaning to

A. division
B. species
C. piece
D. unit

7. The word "others" in the passage refers to

A. cells
B. stalks
C. spores
D. kinds

8. All of the following are mentioned in paragraph 4 as being parts of the multicellular slug EXCEPT

A. the head
B. the stalk
C. legs
D. spores

9. In paragraph 4, why does the author refer to the fungus-like organism as a fruiting body?

A. Because it has become one entity
B. Because it is 2 millimeters in height
C. Because it now has a stalk and head
D. Because it has reached its reproductive stage

10. Which of the sentences below best expresses the essential information in the highlighted sentence? Incorrect choices change the meaning in important ways or leave out essential information.

A. The next generation of amoebae cells disperses into the environment by attaching themselves to spores on the head.
B. After the spores that form the head are scattered around the area, they develop into a new generation of amoebae cells.
C. The spores develop into amoebae cells and then become spread around the head of the slug.
D. The spores spread throughout an area and develop into a new generation of amoebae cells.

11. It can be inferred that developmental biologists are especially interested in the slime mold because

A. the change in degree of specialization in its cells helps them to understand cell development in more complex organisms
B. it is convenient to perform experiments on a creature that is composed of two different cell types
C. scientists could form hybrid organisms in their experiments using the same process that slime mold uses to transform itself
D. it is easy to find specimens on which to perform experiments

12. According to the passage, the recent DNA studies

A. give similar results to the dye studies
B. contradict the dye studies
C. are less exact than the dye studies
D. have introduced confusion about the dye study results

13. Select the appropriate phrases from the answer choices and match them to the stage of slime mold life cycle to which they relate. TWO of the answer choices will NOT be used.
Write the letters of the answer choices in the spaces where they belong.

Unspecialized Cells	Specialized Cells
•	•
•	•
•	•
•	

Answer Choices

A. Alteration between feeding and reproduction
B. Bacteria-consuming amoebae inhabiting the forest floor
C. Culmination of dyed cells in stalk and head
D. Development of sorocarp
E. Dispersal of spores
F. Mass formed through the secretion of adhesion molecules
G. Migration oriented to fresh source of food
H. Production of chemical pulses causing members to merge
I. Transformation of cells into stalk and head

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Reading 36 — Keys

1 B
The passage states that slime molds "were regarded as organisms of ambiguous taxonomic status."
2 D
To "ingest" or "consume" bacteria means to eat it as food.
3 C
The passage states that "Their uniqueness lies in an unusual life cycle, which alternates between a feeding stage in which the organism is essentially unicellular and a reproductive stage in which the organism adapts a multicellular structure."
4 A
The passage states that "the organism initiates a new genetic program that permits the cells to eventually find a new, food-rich environment."
5 A
The word "Starvation" refers to "become starved" in the preceding sentence and explains when this occurs.
6 D
An "entity" or "unit" is an assemblage of parts, or as in this case, members.
7 A
There are two distinct kinds of cells. Other cells form prespore cells.
8 C
The author does not mention legs. The organism moves like a slug and then changes to a fungi-like form on a stalk.
9 D
When something bears fruit, it is at the stage where the next generation is produced. The author is referring to the organism as being ready to release its spores.
10 B
After the spores that form the head ("the head develops into spores", are scattered around the area ("are dispersed into the environment"), they develop ("form", into a new generation ("the next generation") of amoebae cells.
11 A
Developmental biologists are interested in this transformation because it is similar "to an important process found in higher organisms in which organs with highly specialized functions are formed from unspecializcd stem cells."
12 A
The passage states the DNA approach "has essentially backed up the results of the earlier dye studies."

13

Unspecialized Cells

B

The passage states that the organism is unicellular during the feeding stage.

F

The passage states that "This mass (the cells that have come together) sticks together through the secretion of adhesion molecules."

G

The passage states that "Once a favorable location has been found with a fresh source of bacteria to feed on, the migration stops."

H

The passage states that "a few of the amoebae start to produce periodic chemical pulses that are detected, amplified, and relayed to the surrounding members, which then move toward the pulse origin."

Specialized Cells

D

The passage states that "the back cells climb up the stalk and form a spherical-shaped head, known as the sorocarp."

E

The passage states that "The head develops into spores, which are dispersed."

I

The passage states that "The front cells turn into a stalk, and the back cells climb up the stalk and form a spherical-shaped head."