Cellular intelligence, rebuilding cities with moulds

Lesson Map:
https://storymaps.arcgis.com/stories/1a43425050404becaa29fe05a90e45b7

Engage

What is a slime mould? Is it the same as fungi?

→ Click on the map URL above to open this lesson's Story Map, titled *Cellular intelligence, rebuilding cities with moulds*. Scroll down to begin.

→ Read the preface section and take notes if necessary.

? Have you seen similar structures or organisms in forests, creeks, reservoirs, or parks? *[Answers will vary but may include the following: Forests in tree barks, national parks decaying wood, leaf litter and in rock surfaces.]*

? What makes this slime mould known as the blob, *Physarum polycephalum* different from any other? [*Its ability to solve mazes, solve complex spatial problems and anticipate patterns without a nervous system*].

? What is phagocytosis and why is it relevant to the slime mould dissipation and movement? [*Process by which organisms engulf and internalize solid particles. This movement allows the slime mould to forage for food sources for promoting survival and dispersal*].

Download student worksheet here.

Time
40 minutes

Activity
Investigate and review geographical approaches and cellular intelligence-based solutions of slime moulds.

Learning Outcome
Students will be able to:

- Identify unique characteristics of *Physarum polycephalum* slime moulds.
- Evaluate cellular intelligence applications in solving complex human challenges.
- Compare existing network transport configurations against cellular intelligence-based ones.
- Evaluate the life cycle stages of slime moulds.

ACARA Curriculum Link
Year 7 Science: Earth and space sciences

ACSHE121 | ACSHE119 |ACSSU112

Unit 3 Senior Curriculum: Earth and Environmental Science

ACSES061 | ACSES070

Teacher Feedback:

To share your feedback on this, or any Spatial Activity, please contact education@esriaustralia.com.au

Explore

Which are some examples of slime moulds applied to human challenges?

➔ Scroll down and read the section titled *Case study*. Take notes if required and stop discuss as necessary.

? What were oat nodes used for and what did they represent on the Japanese experiment? *[The oats were used as the food source for the mould, and they represent Tokyo and the principal surrounding cities to be connected by the subway system.]*

? Briefly describe the sequence of events of the mould growing and route modelling. *[Inoculation, exploratory random growth (5 hours after inoculation)), and re organization (26 hours after inoculation).]*

? What is inoculation? What parallel could be traced when compared to plants? *[Inoculation refers to the Introduction of fungal-mould spores, mycelium, or other propagules into a substrate or environment to initiate fungal growth. Its parallel to plant a seed in the soil.]*

Explain

Why the lifecycle of slime moulds is important for comprehending its full potential?

➔ Scroll down and read the section titled *Map*. Take notes if required and stop to discuss as necessary.

? What can you observe from comparing the 2 maps? [*Answers may vary but should include simpler networks, less redundancy and limited to the food sources – cities boundary.*]

➔ Scroll down and read the section titled *Life cycle*. Take notes if required and stop to discuss as necessary.

? Define the following terms: spore, haploid, diploid, swarm cell, plasmodium, Amoeba, and sclerotium. If required, use internet sources to research the answer.[

Spore:

A tiny cell that can grow into a new organism. It's made by fungi, bacteria, and other living things, helping them spread and survive.

Haploid:

A cell or organism with one set of chromosomes. In animals or plants, it's what they have in their sex cells.

Diploid:

A cell or organism with two sets of chromosomes. When an egg and sperm combine, they create a diploid cell.

Swarm Cell:

A moving cell that's part of a group. They work together, often seen in tiny organisms like bacteria or some protists.

Plasmodium:

A bunch of cells stuck together, often in slime moulds. They move around and act like a feeding structure.

Amoeba:

A simple, single-cell organism that can change its shape. It moves by sticking out parts of its cell.

Sclerotium:

A tough, small mass made by fungi to store nutrients. It helps them survive tough times and can grow into new fungi afterwards.]

Extend

How can we use cellular intelligence in our favour?

→ Scroll down and read the section titled *Take home message*. Take notes frequired and stop to discuss as necessary.

? In your own words, explain what cellular intelligence is. [*Although the sun and winds will always be a source of energy, they can be unreliable. These sources of energy can be.*]

? EXTENSION ACTIVITY: Access and read the article titled *Rules for Biologically Inspired Adaptive Network Design.* As you read through the article, make notes, and discuss if necessary.

- How did they impose the geographical constraints such as high elevation mountains or waterbodies? [*by an illumination mask to restrict growth to more shaded areas corresponding to low-altitude regions. The ocean and inland lakes were also given strong illumination to prevent growth.*]
- Why this makes sense? [*Slime moulds prefer shaded, cool, and humid areas to grow.*]
- What is the term hey use to describe obstacles levels? [*Cost*]

Next Steps:

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