The life cycle of physarum polycephalum

Food & Diet

In this practical, the life cycle of Physarum polycephalum is being studied. Slime Moulds refers to a wide range of several groups of different and controversial classifications. They have certain characteristics similar to those of animals, plants and fungi. Slimed moulds live in dark, moist habitats where there is abundance of food. They eat bacteria, protozoans, yeasts, fungi, decaying organic materials, and other microorganisms. They are mostly found in forests and lawns, under rotting logs and leaves.

Cellular slime moulds live in moist soil or manure. Both types of the slime moulds move across their habitats using amoeboid movement, ingesting food by the process of phagocytosis, a form of endocytosis. Slime moulds may also use chemotaxis, following the chemical gradient given off by their food sources, to find food. Chemotaxis is used by cellular slime moulds when they aggregate.

The cellular and plasmodial slime moulds have a motile phase when growth and ingestion of food occurs and an immotile reproductive phase, and they differ mainly in the motile phase. Plasmodial slime moulds begin as gamete cells that are either flagellated or amoeboid that fuses together and forms a zygote. The zygote’s nucleus divides, but no cell walls form, resulting in a single celled multinucleate plasmodium that grows as the organism feeds and the nuclei continues to divide. The plasmodium moves in amoeboid fashion using cytoplasmic streaming in order to find favourable conditions and food, and may move several feet in a single day. The plasmodium continues to feed along as conditions are good, but when food runs short or its habitat becomes to dry, the plasmodium changes into a fruiting body, the next phrase in its life cycle it hardens and produces stalked sporangia that

contain spores, often after moving to a drier or better lit location. The spores are released and will develop into gametes to begin the life cycle again.

There are four main stages in slime moulds which are vegative, aggregation, migration and culmination. In the vegetative stage, a slime mould is single and is known as amoeba and this will eat bacteria. In this case of this practical, the bacterium fed to the slime mould is the Physarum polycephalum. After the food preferences of the single cell are partially completed or most of the food preferences are completed, the slime mould will moved to its next stage of the life cycle which is known as the aggregation cycle.

In this stage, a slime mould will reproduce and secrete cyclic AMP. Cyclic AMP will attract neighbouring cells together. As single celled slime moulds come into contact they will stick together through glycoprotein adhesion molecules. Once enough slime moulds have been attached to each other, they will move onto the next stage of the life cycle which is known as the migration stage.

The multitude of slime moulds will form what is known as slugs. The slug is able to move towards heat and light. However, the cell in the slug will differentiate into two types of cell and they are both known as the prestalk and prespore cells. The prestalk cells will move towards the anterior end of the slug and the prespore cells will move towards the posterior end of the slug. The slug will then start to produce a fruiting body out of prestalk cells on the anterior end of the slug. However, it also starts to form spores out of prespore cells at the posterior end of the slug. This is when the posterior end

of the slug will start to spread out as the anterior end of the slug starts to rise up into the air. This is when the last stage of the slime moulds cell cycle begins known as the culmination stage.

The prestalk cells will form the base the form of the fruiting body. The pretalk cells form the cellulose stalk tube. The cellulose stalk tube pushes prespore cells to the top towards the fruiting body. This process will take around 8-10 hours and ends with a good fruiting body releasing mature spores that will become the single celled slime mould.

The purpose of this practical is to examine the life cycle of the slime mould using the different food preferences. Each stage should be observed and recorded. This practical will force the slime moulds through each stage of the slime mould life cycle and a mature spores will be observed at the end of this practical.

Method

This practical started by preparing the petri dishes. This proportion of this procedure was done by the demonstrators.

During this practical, I was provided with some phyrasum a genus of mycetozan slime moulds, and this was to investigate the different food preferences on chemotaxic behaviour.

First of all I was provided with two agar plates one with water with no nutrient levels and the other second agar plate with corn meal agar with low nutrient levels. After the petri dishes were prepared, the next procedure was to inoculate the plates.

The materials that I used for this procedure was an inoculated loop, and this was done by sterilising the loop over an open flame until the loop was red. Using the loop I removed a small piece of the slime mould with agar from the advancing margin (edge of the growth) and placed into the middle of the plate onto the two agar plate’s one with the water and one with the corn meal agar and streaked it onto the petri dishes.

The water agar plate was the experimental where I had to put some food preferences; the corn meal agar plate was to be inoculated without any food to observe the cytoplasmic streaming for the following day.

In the water agar plate, there was combination of food preferences including apple, chocolate, raising and jelly babies.

I added one of each of the food and which was already cut and placed them in each of the corner near to the slime mould, and then both of the agar plates were incubated at 20oC for 12 hours, and they were observed using a dissecting microscope using the x40 magnification.

Results

Which food had the most growth and which type of food was most visible

Different food choices

Amount of growth

chocolate

Growth was quite visible was spreading

Apple

No growth at all not visible at all

Raisin

Big growth was spreading

Jelly babies

Big growth was spreading around the plate

However there were not many results for this practical. Once the slime mould had food preferences containing a type of food source the cell together aggregated together to form a growth in the slime mould. In the plate with food sources there was a mixture of stalks with spores. However, in relation to this result Chocolate, Raisin, and jelly babies had the most growth and this was quite visible and was spreading around the plate and the growth was very visible and was being seen clearly. However, the majority of the agar plate with the food preferences in was covered in fruiting body as food preferences was placed all-round the plates and they were all spread out. This suggests that the food that had a high percentage of sugars the more growth it had, this has shown in my practical, however apple had the least growth as it mainly because it was sweeter than sugar and mainly it’s a fruit and dries up quickly and changes it colour so maybe that’s the reason why it didn’t show any growth at all.

Discussion

As both of the agar plates were incubated for 12 hours, and was at the temperature 20oC, the slime mould didn’t develop through its life cycle as it was expected, which means it didn’t achieve the purpose of my practical, as there were only growth near the food choices of chocolate and raisins, and only achieved the first stage of the life cycle, which was the vegetative stage.

The vegetative stage was observed and recorded. The spores were quite visible on the petri dishes and they started to grow and eat the bacteria where the food preferences were placed.

However, the observations shows us that the agar plate the corn plate without the food preferences added, the slime mould will aggregate together and move to the nearest food preferences that are available, so it can form a fruiting body, and create spores to hard and different environments. If unfavourable conditions had been a factor, the amoeba may have formed cysts rather than producing a fruiting body.

However, the introduction of other factors on different plates of slime moulds may have possibly altered the differentiation of the growth of the slime mould. However, it is quite hard to tell since the slime mould was only kept for 12 hours and kept under room temperature and also kept on optimum conditions at all times.