WAYNE STATE UNIVERSITY

STEM Day Lesson Plan

Title: ***C. elegans*: how does it smell its food?**

Subject Area: Genes and behavior lab

Learning Activity Description: Students will learn how sensory behavior is controlled by genes using the worm *C. elegans*. Students will observe that *C. elegans* is attracted to some odors (*e.g.*, diacetyl, the smell of popcorn butter) and repelled by other odors (*e.g.*, high concentrations of benzaldehyde, odor of almond oil). Students will learn that *C. elegans* attraction to and repulsion by specific odors require the activity/expression of specific genes.

Lesson Activity Objective and Outcome: Students will distinguish between *C. elegans* that are wild type (normal) versus mutant for smelling of specific food odors.

Materials/Supplies Listed:
Young adult *C. elegans*: wild type and mutant
Four 10-cm agar plates
Pipette and tips for transferring 2-20 ul or 20-200 ul volumes
Kimwipe tissues
Chemicals: diacetyl, benzaldehyde, ethanol, sodium azide
Dissecting microscope

Procedure:
Chemotaxis assays
Record your observations of each plate at the end of this section. To draw the right conclusions, it is very important to work carefully, to label your samples/plates accurately and record your observations completely.

(1) There will be four plates:

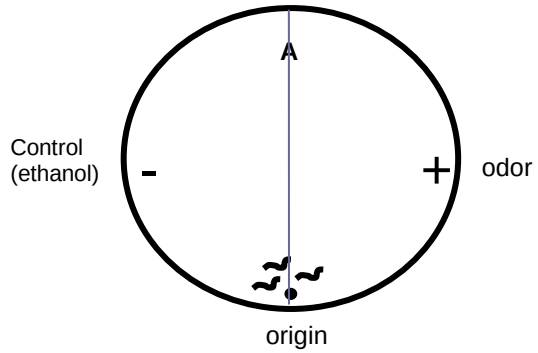
Plate 1 will have diacetyl at the (+) end of the plate. Wild-type *C. elegans* will be added to this plate at the origin.

Plate 2 will have benzaldehyde at the (+) end of the plate. Again, wild-type *C. elegans* will be added to this plate at the origin.

Plate 3 will have diacetyl at the (+) end of the plate. Strain A will be added to this plate at the origin.

Plate 4 will have diacetyl at the (+) end of the plate. Strain B will be added to this plate at the origin.

You have to determine the following:
(a) Is the odor diacetyl attractive to *C. elegans*?
(b) Is the odor benzaldehyde attractive or repulsive to *C. elegans*?
(c) Which strain (A or B) is wild type and which strain (A or B) is mutant?



(2) Add 2 ul sodium azide to the (–) and (+) poles (see figure above). The sodium azide allows the *C. elegans* to stay at the poles toward which they migrate. Otherwise, *C. elegans* start to adapt to the odors and can no longer smell them. Then, add 2 ul ethanol or odors (diacetyl or benzaldehyde) at the (–) and (+) poles, respectively.

(3) Spot about 30 ul *C. elegans* in a drop at the origin.

Aim for 100-150 adult *C. elegans* per assay plate. Use Kimwipe tissue to remove moisture from the drop of *C. elegans*, by patting the animals gently against the agar. Sometimes *C. elegans* stick to the Kimwipe. To regain these animals, pat the Kimwipe gently against the **A** spot (see figure above) and the animals will stick back to the agar. We use 1-2-day-old adult *C. elegans* for the assay. Larvae or 5-day-old adults do not chemotax as easily as the young adults.

(4) Look under the microscope to count how many *C. elegans* are at the (+) pole or (–) pole on each plate. You can count the animals after approximately 20 minutes - 30 minutes. The assay is normally done around 20^0C - 22^0C (68^0F - 71.6^0F), since higher temperatures are stressful for *C. elegans*.

Preparation Time for Learning Activity:
Grow worm cultures during the week at 68^0F - 71.6^0F. The assays need well-fed young adult worms. Agar plate preparation should be done the day before. This may take 1h - 2h.

Group Strategies
Groups of 2-3 students work together to carry out the chemotaxis assays. The assays take about 20 minutes - 30 minutes at 68^0F - 71.6^0F.

Student Products/Artifacts/work pages:
Observations and report:
Plate (1)
Calculate the number of wild-type *C. elegans* at the diacetyl pole versus the control pole. Is this odor attractive to the animal?

Plate (2)
Calculate the number of wild-type *C. elegans* at the benzaldehyde pole versus the control pole. Is this odor attractive or repulsive to the animal? Based on the earlier lecture, speculate whether this experiment used low or high concentrations of benzaldehyde.

Plate (3)
Calculate the number of strain A at the diacetyl pole versus the control pole. Does this strain behave like wild type (normal worms) or mutant (not normal worms)?

Plate (4)
Calculate the number of strain B at the diacetyl pole versus the control pole. Does this strain behave like wild type (normal worms) or mutant (not normal worms)?

Assessment Criteria/Rubric:
Were the students able to identify the wild type from the mutant worms?