

# Woodlice



*Links to 'A' level Biology specification: innate behaviour; kinesis (woodlice can also be used to demonstrate negative photo taxis by positioning the maze in relation to a light source); use of statistics (Chi Square).*

## TURN ALTERNATION IN WOODLICE

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### Objectives:

To discover how woodlice make decisions about which direction to walk.

To demonstrate that after being forced to turn in one direction woodlice will turn in the opposite direction when freely allowed to do so.

### Background:

Woodlice are crustaceans and require a moist habitat to enable gaseous diffusion across their gill filaments. When placed in a dry area they will exhibit an increase in hygro- kinesis i.e. an increased level of movement in response to low moisture levels. If woodlice find themselves in a

dry habitat then an adaptive response is to walk in a straight line to find moisture (rather than walking around in circles). Woodlice demonstrate simple procedural rules that result in maintaining a straight line direction despite having to traverse objects in their path i.e. if forced to turn left then they will immediately turn right afterwards – and vice-versa.

The following experiment demonstrates this behaviour and also explores ideas of causation (whether the woodlice use external cues or internal cues to 'notice' that they have changed direction). There is also an extension that

can demonstrate how long they retain the memory of turning.

### Hypothesis:

When allowed to turn freely, woodlice will show a greater number of turns in the opposite direction to the forced turn than in the same direction as the forced turn.

### Null Hypothesis:

When allowed to turn freely, woodlice will show no difference between the number of turns in the opposite direction to the forced turn compared to the number of turns in the same direction as the forced turn.

# EXPERIMENT 1

## Do woodlice attempt to walk in a straight line?

### Equipment:

- Static woodlice maze & lid SS1726 (diagram below);
- Woodlice kept in natural (moist & dark) conditions;
- Petri dish and lid;
- Cotton buds;
- paint brush;
- plastic spoon;
- small black blocks.

### Method:

Place two small black blocks in the maze as shown below. In this instance the woodlouse will be placed in the end of the left long arm of the maze – indicated by the 'x'.

Remove a woodlouse from its moist habitat and place it into a dry petri dish (put the lid on). Leave it there for a minute or two until it starts to become more active.

Using the paintbrush, gently brush the louse onto the spoon and then into the end of the left long arm of the maze.

Gently place the lid onto the maze.

The louse should move along the arm until it is forced to turn left.

Note the direction it turns at the next junction – i.e. the direction of turn at the 'free choice' point. You should note whether it turned in the same direction as the forced turn (in this case left), or in the opposite direction (in this case right).

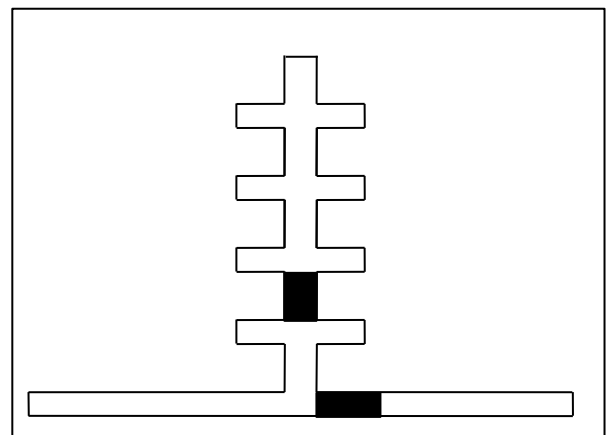
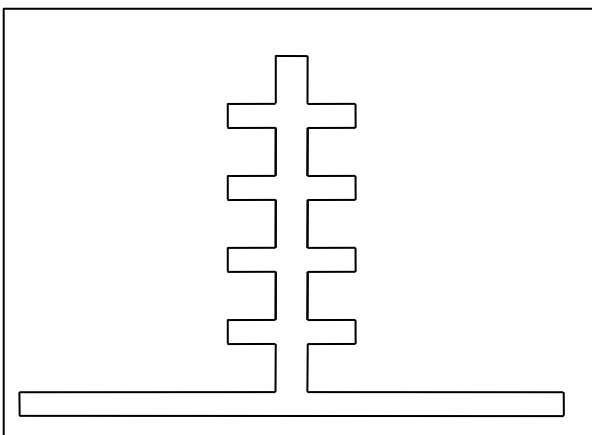
Repeat several times – using different woodlice and alternating the start position between the left and right long arm. You will need to switch the position of the small black block to prevent entry into the long arm that is not being used. After each trial spread out any chemical scent, that the woodlouse will have left, between all the accessible arms using the cotton bud.

Perform a Chi Square test on the raw data to see if the woodlice choose the 'opposite' direction significantly more often than the 'same' direction. You expect to find that they choose 'opposite' significantly more often i.e. they 'turn alternate'



### Extension:

Make the 'free choice' point available successively further and further up the maze by blocking off the short arms. You should find that the memory to 'turn alternate' disappears after a while.



# EXPERIMENT 2 AND 3

What cues do the woodlice use to determine that they have turned?

## EXPERIMENT 2

Do woodlice use external cues?

### Equipment:

- Turntable Woodlouse Maze & lid SS2092 (diagram below);
- Woodlice kept in natural (moist & dark) conditions;
- Petri dish and lid;
- Cotton buds;
- paint brush;
- plastic spoon;
- small black blocks.

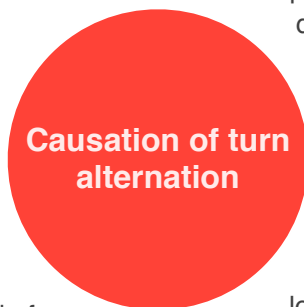
### Method:

Place a small black block in one of the long arms of the maze at the end of the turntable – as shown. In this instance the woodlouse will be placed in the end of the right long arm of the maze – indicated by the 'x'. The woodlouse will travel in the direction of the arrow.

House, handle and place the woodlice as described above (experiment 1)

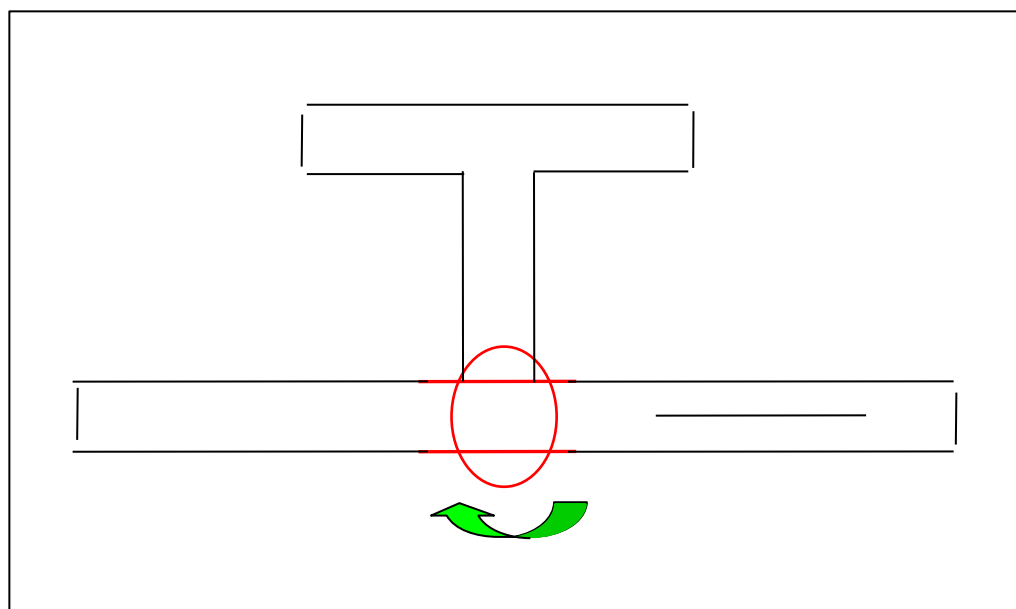
Once the woodlouse is fully inside the turntable, turn the turntable so that the woodlouse experiences a right hand turn (without actually turning itself).

Record whether the louse chooses the same or opposite direction as the forced turn when it arrives at the free choice arms.



Repeat several times – using different woodlice and alternating the start position between the left and right long arm. You will need to switch the position of the small black block to prevent entry into the long arm that is not being used. After each trial spread out any chemical scent, that the woodlouse will have left, between all the accessible arms using the cotton bud.

Perform a Chi Square test on the raw data to see if the woodlice choose the 'opposite' direction significantly more often than the 'same' direction. You expect to find that they choose randomly i.e. they do not 'turn alternate'. They seem therefore to ignore external cues in deciding whether they have turned.



### EXPERIMENT 3

#### Do woodlice use internal cues?

##### Equipment:

- Mechanised Woodlice Maze & lid SS2141 (diagram below);
- Woodlice kept in natural (moist & dark) conditions;
- Petri dish and lid;
- Cotton buds;
- paint brush;
- plastic spoon;
- small black blocks.

##### Method:

House, handle and place the woodlice as described above (experiment 1).

Turn on either the right or left treadmill belt. The treadmill should move the legs of the woodlouse faster on that side – this should replicate movement in the other direction (i.e. if the right legs move faster the louse should ‘think’ that it has turned left).

Caveat: – choose an appropriate sized woodlouse (too small and both sets of legs will move when on the treadmill).

Place the louse in the end of the long arm (indicated by the ‘x’).

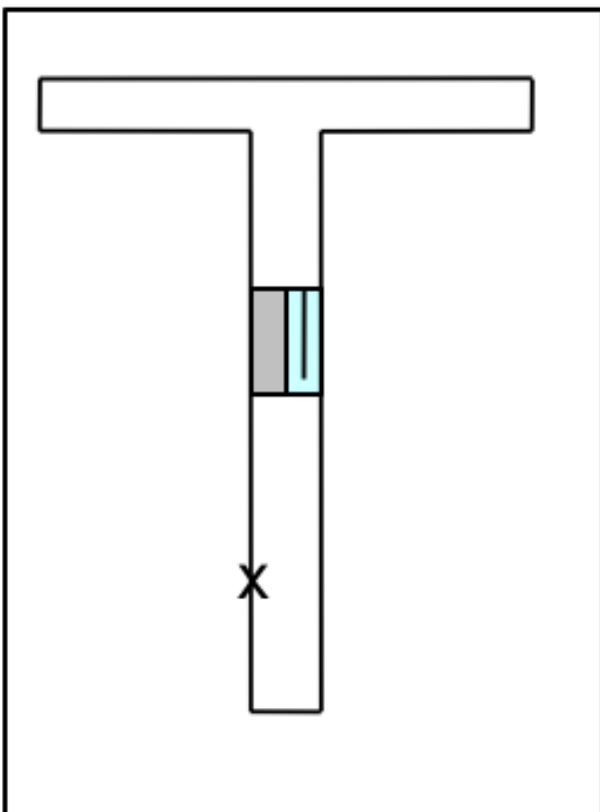
After the louse has passed over the treadmill, record whether it

chooses the same or opposite direction as the forced turn when it arrives at the free choice arms.

Repeat several times – using different woodlice and alternating the belt that is moving. Between each trial, spread out any chemical scent evenly between all the accessible arms using the cotton bud.

#### Causation of turn alternation

Perform a Chi Square test on the raw data to see if the woodlice choose the ‘opposite’ direction significantly more often than the ‘same’ direction. You expect to find that they choose ‘opposite’ significantly more often i.e. they ‘turn alternate’; thus indicating that they use internal cues in detecting that they have turned.



##### Acknowledgements:

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