

# Biology investigation



**ASSIGN  
BUSTER**

Biology Investigation Aim: to investigate the effects of light and gravity on the growth of sunflower seeds. Background Info: Tropism is directional movement in response to a directional stimulus eg light or gravity. Plants are not able to relocate if they happen to start growing where conditions are not perfect but they can alter their growth towards more favorable conditions. Plants respond to light (phototropism) where the stems grow towards the light and the roots grow away from the light. They also respond to gravity (geotropism) where the stems grow away from the ground and the roots grow towards the ground.

Tropisms are controlled by auxins - a family of hormones that promote (and sometimes inhibit) growth. Sunflower seeds need regular watering in order to provide sufficient nutrients and ensure healthy and efficient growth. Hypothesis: I hypothesise that whatever orientation the seed is placed in, the shoot will always be positively phototropic and the root will always be positively geotropic, due to the basic laws of tropism. Risk Assessment: Hazard| Risk| Precautions/Disposal| Test tube breakage| Glass may cause injury to eyes or skin. | Be cautious when handling test tube; wear safety equipment such as safety glasses and gloves.

Place in glass bin. | Puncturing boxes with scissors| Scissors may injure someone if there is an accident. | Assign somebody to hold the box steadily while they are being punctured. | Using forceps| May injure skin. | Hold forceps steady and try to avoid contact with skin. | Equipment: Geotropism \* 4x large test tube \* 4x filter paper \* 4x sunflower seed \* 1x test tube rack Phototropism \* 1x cardboard box \* 4x sunflower seed \* 1x pair of scissors \* 1x forceps \* 4x test tube \* 4x filter paper \* 1x test tube rack Variables:

Geotropism \* Independent variable: orientation of sunflower seed  
Dependant variable: direction of growth of sunflower seed shoot and root  
\* Constant variables: the test tube in which the seeds are kept, the place the test tube rack sits, the orientation of each seed  
Phototropism \* Independent variable: orientation of sunflower seed, place of light source  
\* Dependant variable: direction of growth of sunflower seed shoot and root  
\* Constant variables: the box in which the seeds are kept, the place the box sits, the orientation of each seed, the materials used (filter paper, large test tube, test tube rack)  
Experimental Control: Geotropism

One of the test tubes was set up with a sunflower seed and the shoot facing up, the natural orientation. Phototropism A cardboard box was set up with hole punctures in the top and sides to allow light to get to the plants from all directions. Method: Geotropism \* Collect equipment \* Set up 4 large test tubes in a test tube rack and label them A, B, C and D. \* Soak the 4 filter papers under water \* Roll up one filter paper and place in test tube A, along with the sunflower seed shoot facing up to be the control. \* Repeat step 4 but with test tube B, with the sunflower seed shoot facing down. Repeat step 4 but with test tube C, with the sunflower seed shoot facing right. \* Repeat step 4 but with test tube D, with the sunflower seed shoot facing left. 1. Place in an area with adequate natural light 2. Water every day for 5 days, taking observations on the direction and length of growth on the seeds. Phototropism 1. Collect equipment 1. Set up 4 large test tubes in a test tube rack 1. Soak the 4 filter papers in water 1. Roll up filter paper and place in test tubes, along with the sunflower seeds with all shoots facing upward. 1. Label 3 cardboard boxes as 1. control, 2. left, 3. right 1. Puncture 10 holes in

both sides and the top of box 1 2. Puncture 10 holes in the left side of box 2 3. Puncture 10 holes in the right side of box3 4. Place a test tube rack in each box 5. Place in an area with adequate natural light 6. Water every day for 5 days, taking observations on the direction and length of growth on the seeds. Discussion During the experiment, it was observed that sunflower seed shoots, regardless of their orientation, will almost always grow towards the light. Likewise, the root of the seeds will almost always grow towards the ground.

This trend is due to the auxins in the plant, hormones that promote growth. When a seed is placed sideways, unnaturally, the auxins in the plant stimulate growth in the shoot to still curve upward towards the light, and in the root to curve downward towards the ground. The accuracy of this experiment was sound. The equipment used was the same for all groups and was reasonably suitable to the experiment as it allowed easily observable results, for example the glass test tubes allowed us to watch our seeds grow each day. However, watering the plants was not undertaken every day, affecting the overall accuracy.

Having a specific required amount of water to water the plants each day would have been beneficial to the accuracy of the experiment. The reliability of this experiment was poor. Most observations were not consistent. In many geotropism experiments, there were shoots that did not curve all the way down to the ground. This could have been due to the limited space they had between the glass of the test tube and the filter paper. The validity of this experiment was also poor. The constant variables were not very well

controlled; the place in which the apparatus was set up changed, which meant different environmental conditions for the plants.

The weather also changed every day, especially on Saturday when it was 41 degrees. This would have had an impact on the growth of the plants, and a burnt filter paper was observed, which could have been a result of the hot weather. The significant rise in temperature should have been predicted prior to the end of the school week so a more controlled environment could be created for the plants to have a consistent area to thrive in. To improve the accuracy and reliability of this experiment, a clearer and more specific method should be undertaken and a better set up of apparatus should be thought up to give the seeds more room to grow. However, the aim of investigating the effects of light and gravity on the growth of sunflower seeds was answered. This experiment is beneficial to society as it may assist gardeners, florists, other biologists etc in growing plants efficiently.

Conclusion: Based on observations, our hypothesis of the shoot always being positively phototropic and the root being positively geotropic was supported, bringing us to the conclusion that light and gravity have a major impact on the growth of sunflower seeds no matter what the orientation.

This is controlled by the auxins that respond to the light and gravity, promoting growth in the shoot of the seed to grow toward the light, and the root of the seed to grow toward the ground. Bibliography: Kimball, J W 2011, Tropisms, viewed 27 November, 2012, . Unknown, 2001, Plant Hormones, viewed 27 November, 2012, >.