***The digestive system*** Planning ahead and equipment list

## Introduction

Equipment per class (demonstration):

* 100 mL orange juice
* 100 mL water
* 2 water crackers
* 1 banana
* 1 plastic laboratory tray or foil tray
* 2 plastic cups, one with the bottom removed
* 1 paper or polystyrene cup with a hole the size of a 10c piece in the bottom
* 1 medium resealable plastic bag
* 1 leg of a pair of stockings

Prior to commencing this activity watch the demonstration video ‘Digestive System Experiment’, STEM Learning website (2:34 min) <https://www.stem.org.uk/resources/elibrary/resource/35396/digestive-system-experiment>

## Investigation 1: Digesting starch

Equipment needed per group:

* 3 test tubes
* 1 test tube rack
* 1 rubber stopper to fit test tube
* 1 x 10 mL measuring cylinder
* 3 Pasteur pipettes or droppers
* 3 sticky labels or a marker
* 1 spotting plate
* 1 dropper bottle of 1% starch solution
* 1 dropper bottle of 10% glucose solution
* 1 dropper bottle of 1% amylase solution
* 1 dropper bottle of iodine solution
* 3 pieces of glucose test tape or test strips

Equipment needed per student:

* 1 piece of white bread per student (~ 16th of a slice is plenty)
* [Worksheet 1: Digesting starch](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%201_Yr8_Digestive%20system.docx)

The starter activity requires the students to chew on some bread. This occurs outside the classroom before entering. If you are not doing this activity at the start of the lesson, you will need to consider the implications for your students with regards to eating in the laboratory, and modify accordingly.

The bread should get sweeter as they chew. Depending on the brand of bread used the amount of sweetness will vary. It may not taste sweet at all, but they will still notice a change in taste. It might be worth testing the different bread brands available to you to determine which one works the best for this activity.

It is important that the starch solution is fresh. Starch will break down to glucose over time. Test the solution for the presence of glucose prior to the lesson to ensure no glucose is present.

## Investigation 2: Absorbing nutrients

Equipment needed per class:

* 1% starch solution
* 10% glucose solution

Equipment needed per group:

* 2 lengths of dialysis tubing (~12 cm)
* 3 x 250 mL beakers
* 4 rubber bands or twist-ties
* 1 dropper bottle of 10% glucose solution
* 1 dropper bottle of 1% starch solution
* 1 dropper bottle of iodine solution
* 2 pieces of glucose test tape or strips
* distilled water

Equipment needed per student:

* [Worksheet 2: Absorbing nutrients](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%202_Yr8_Digestive%20system.docx)

Dialysis tubing is semipermeable like the gut. It allows small particles to pass through.

It is best to demonstrate to students how to prepare dialysis tubing. If you are unsure how to do this watch the video: ‘How to Set Up Dialysis Tubing for Your Osmosis Lab’,YouTube: (5:30 min) <https://youtu.be/V3mqR4iuCm8>

The dialysis tubing sausage should be left in the beaker for at least 15 minutes. It is preferable to leave it overnight to ensure diffusion occurs. If left overnight, you might like to test each beaker prior to the start of the lesson to check they will give students the expected results.

You could alter the results as follows:

* If glucose isn’t present in the ‘glucose’ beaker add a few drops of glucose to the beaker.
* If there is starch in the ‘starch’ beaker change the water in the beaker.

It is important that the starch solution is fresh. Starch will break down to glucose over time. Test the starch solution for the presence of glucose prior to the lesson to ensure no glucose is present.

## Investigation 3: Digesting proteins

Equipment needed per class:

* 1% pepsin solution + 100 mL beaker (to pour pepsin into measuring cylinder)
* 1 L of egg white suspension + 100 mL beaker (to pour egg white into measuring cylinder)

Equipment needed per group:

* 1 test tube
* 1 rubber stopper to fit test tube
* 1 test tube rack
* 2 x 10 mL measuring cylinders or graduated Pasteur pipettes
* 1 dropper bottle of 2 molL-1 hydrochloric acid
* 1 stopwatch

Equipment needed per student:

* [Worksheet 3: Digesting proteins](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%203_Yr8_Digestive%20system.docx)

Preparing the eggwhite suspension (500 mL)

1. Place the white (only) of one egg into 500 mL of water and thoroughly stir.
2. Heat the mixture to boiling
3. Filter/sieve to remove larger pieces of egg white (should look similar to milk)

The solid particles in the egg white suspension are minute, which is why the enzyme works in 10 minutes.

## Investigation 4: The effect of temperature on enzyme activity

**Part A:**

Equipment needed per student:

* [Worksheet 4a: Planning](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%204a_Yr8_Digestive%20system.doc)

**Part B:**

Equipment needed per class:

* 1% pepsin solution + 100 mL beaker (to pour pepsin into measuring cylinder)
* 1 L of egg white suspension + 100 mL beaker (to pour egg white into measuring cylinder)
* kettle/urn for hot water
* ice
* cold water

Equipment needed per group:

* 9 test tubes
* 3 rubber stoppers to fit test tubes
* 2 test tube racks
* 3 x 250 mL beakers (to use as water baths)
* 2 x 10 mL measuring cylinders or graduated Pasteur pipettes
* 1 dropper bottle of 2 molL-1 hydrochloric acid
* 3 thermometers
* 3 stopwatches

Equipment needed per student:

* [Worksheet 4b: Conducting](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%204b_Yr8_Digestive%20system.doc)

Preparing the eggwhite suspension (500 mL)

1. Place the white (only) of one egg into 500 mL of water and thoroughly stir.
2. Heat the mixture to boiling
3. Filter/sieve to remove larger pieces of egg white (should look similar to milk)

The solid particles in the egg white suspension are minute, which is why the enzyme works in 10 minutes.

Students will be setting up three water baths for their investigation—cold, warm and hot. The temperature ranges provided in the instructions will allow for some cooling to occur when setting up. The enzyme works best at around body temperature (37oC). If the temperature is greater than 60oC the enzyme will become denatured (will no longer work). The enzyme will still work in the colder temperature, however, it will be slower, and may not completely breakdown by the end of the experiment.

You could get the students to compete each test (temperature) separately if you think they may find it difficult to monitor all three tests at the same time.

20–30 minutes is sufficient time to get results. Adjust the time to suit the time you have available in the lesson.

**Part C:**

Equipment needed per student:

* [Worksheet 4c: Processing and evaluating](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%204c_Yr8_Digestive%20system.doc)

## Conclusion

Equipment needed per student:

* [Worksheet 5: The human digestive system](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Worksheet%205_Yr8_Digestive%20system.docx)