

# Immunology ‘Snot’

## Introduction

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This activity has been created to introduce students to immunology in direct relation to snot and the ways in which it is formed, what diseases can cause it, how to get rid of it and what it is made of. It is an interactive type of learning which promotes learning through laboratory experiments to obtain knowledge. By using diagrams, cartoons, personal/educational questionnaires, a card game and entertaining videos, the students will understand all aspects of snot.

## Aim

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Provide students basic knowledge of a common infectious diseases. To simulate an epidemic and investigate how many people are infected. Test the viscosity of different snot consistencies and determine which viscosity of snot is more effective in trapping particles in a nasal passage.

## ACTIVITY 1 – Get to Know about the Common Cold and ‘Snot’

### TASK A: Answer the questions

It takes about two days for us to feel the symptoms of this virus (rhinovirus).

Answer the questions

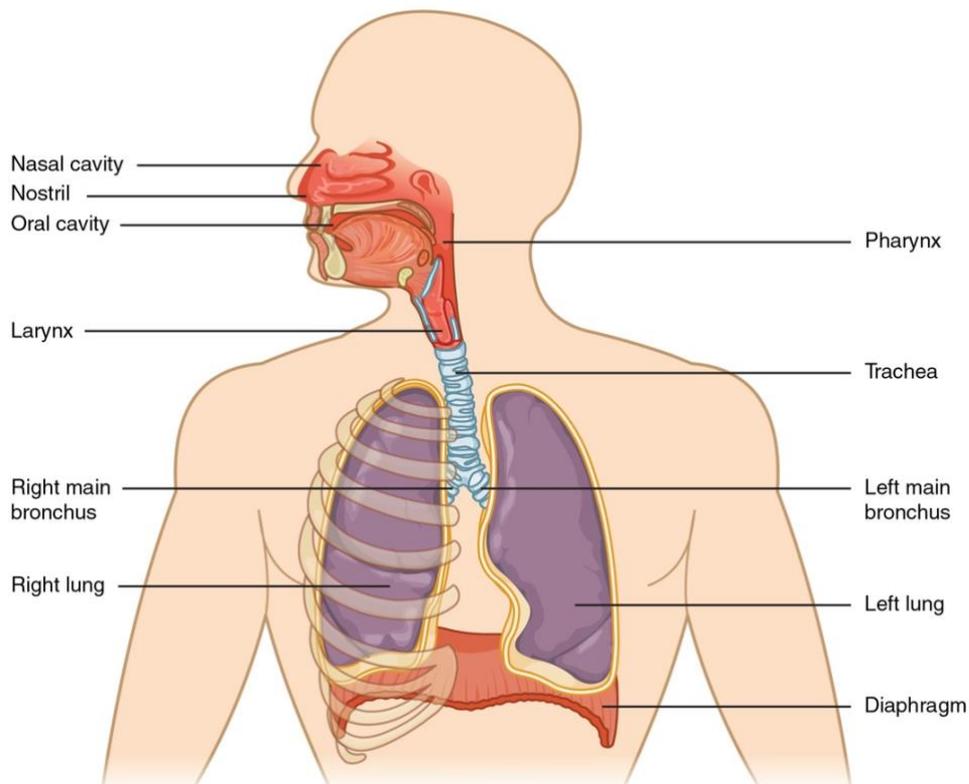
Question 1. What do you feel like when you have a cold?

Question 2. Where do you think this “snot” comes from? How do you make it? Why is there so much more of it when you have a cold?

Are your answers correct? Watch video in link below

<https://www.youtube.com/watch?v=vsVOdicP7h0>

Question 3. Snot helps protect the lungs by capturing dirt and dust as you inhale. Where does it all go?



**Respiratory System** '<https://cnx.org/contents/FPtK1zmh@6.27:t2sgkCQ-@8/Organs-and-Structures-of-the-Respiratory-System>' by OpenStax College (CC-BY-NC-SA 3.0 AU).

### Respiratory system

Question 4. Look at the picture of respiratory system to see how your nose and mouth connect. Concentrate on breathing in and then swallowing. Can you feel how your nose and mouth are connected?

Question 5. How do you get this cold virus?

### TASK B: Watch videos and do the quiz

Let's watch these videos to find out what really happens!

<http://cen.chempics.org/post/147065970943/anatomy-of-a-sneeze-with-a-high-speed-camera>

<https://www.youtube.com/watch?v=shEPwQPQG4I>

#### Quiz:

1. How much of snot (approximately) in percentage is made up of water?  
%
2. \_\_\_\_\_% of humans air filtration occurs in the nose. Therefore, the snot is the \_\_\_\_\_ line of defence in the body.
3. Why is a steady stream of mucus needed in the body?

4. We produce more/less mucus when were sick to flush pathogens out. Immune cells are send to fight/work with the pathogens.

## ACTIVITY 2 – How easily can this infection spread?

Bubonic plague to AIDS to the common cold, scientists have struggled to understand and prevent the spread of infectious diseases. You will simulate the spread of an infectious disease to explore some factors that affect the rate of infection, the challenges of controlling disease and suggest measures which may help prevent the spread of disease.

### Materials

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- One pre-prepared test tube half filled with distilled water
- One pre-prepared test tube half filled with 0.1M NaOH
- Indicator: Phenolphthalein solution
- Pipettes

### Methods

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1. Students will model the transmission of a disease by sharing some of their test tubes contents, or bodily fluids, with other students.
2. Each student is to take a pre-prepared test tube and one pipette, with one student unknowingly having the 0.1M NaOH test tube.
3. Students are to walk around the room with their test tubes. When you say ‘Stop!’ each participant is to use their pipette to trade one drop of fluid with the person nearest them. Repeat until three trades have occurred.
4. Now test for the infection! Put one drop of phenolphthalein in each test tube. If the fluid turns pink, the person is infected.

### Results

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Question. How many people were infected?

## Discussion

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Question 1. Did the results support your hypothesis?

Question 2. Suggest one way you could have reduced the spread of disease.

## ACTIVITY 3 – Lets Become Scientists!

You now have the cold virus and it has decided to find a home in the mucus membrane cells of your nose, close to where it entered your body. Here it multiplies and causes a reaction in the mucus membranes.

The mucus membranes become inflamed to try and get rid of the virus. The membranes signal for more, thinner mucus to be made, which tends to run out of our nose. When you sneeze, some of the mucus is removed, so more is made. Your mucus may also become thicker when you are sick, causing it to build up in your nose and throat, making you feel congested.

Your mucus is made of water, sugars and proteins. It is made very fast, in milliseconds. Let's make some snot!

### TASK A: Making Snot

#### Materials

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- 50 ml boiling water
- 1 teaspoon gelatine
- 1 teaspoon (5 ml) glucose syrup
- 10 ml measuring cylinder

- 2 x 100ml beakers
- 250 ml beaker
- Food colouring (optional)
- Small plastic measuring jug for measuring hot water
- Newspaper

### Methods

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1. Add boiling water and gelatine to 250ml beaker and stir until dissolved.
2. Add glucose syrup and stir until mixed.
3. Let the mixture thicken for 15 minutes.
4. Add one drop of food colouring to make your snot look more realistic.

### TASK B: How fast does snot run?

### Methods

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1. Procedure to dilute the snot: using the original snot mixture, create two different consistencies of snot. Outline how you will do this.

*Hint:* Start with 10 ml of snot mixture and add a specific amount of water to dilute the snot.

2. Calculate the dilution factor of each solution. Dilution Factor =

$$\frac{\text{Final volume}}{\text{Initial volume}}$$

### 3. Procedure to test the viscosity of the snot:

- Clean the white tile with paper towel and place newspaper on the bench, underneath the tile.
- Tilt the tile on an angle of  $40^\circ$  (use a protractor to measure the angle).
- Place 1 drop of three different snot consistencies at the top of a white tile, equal distances apart.
- Measure the distance travelled down the tile over a specific amount of time.
- Time or measure your snot running down the nasal passage (white tile).
- Repeat the experiment.

## Results

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Question 1. How are you going to carry out a controlled experiment?

Draw your experiment.

Question 2. Draw a table to present your results.

Question 3. List the order of viscosity, from least viscous to most viscous.

## Discussion

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Question 1. Were you surprised by the results? Explain why or why not.

Question 2. Why did you repeat the experiment?

Question 3. Account for any differences between your results.

### **TASK C: Which snot works best?**

Hypothesis: Which thickness of snot would be better to trap particles?

## Materials

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- 3 transparency sheets
- Particles: flour, glitter, confetti, pompoms (0.5cm diameter pieces)
- Wide sticky tape or small plastic bag
- Different snot mixtures
- Spatula
- Stapler
- Paint brush
- scissors

## Methods

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1. Drop 3 ml of one snot consistency on to the transparency sheet.
2. Use a paintbrush to paint the snot on to the transparency, keeping 3cm clear of the edges.
3. Repeat with the other snot consistency and the other transparency.
4. Keep one transparency free of snot.
5. Roll each transparency, lengthways, to 6cm in diameter and staple to hold in place. This simulates the nasal passage.
6. Cover one end of each rolled sheet with wide sticky
5. Hold one rolled sheet on a 45o angle (measured with a protractor).
6. Scatter a spatula of each type of particle down the tube. Shake the tube to circulate. Stand the tube upright.
7. Repeat with the other sheets.
8. Remove the sticky tape and compare the amount and type of untrapped particles.

9. Pull apart the tube so it is flat and compare the number of trapped particles.
10. Construct a table to present your results.

## Results

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Question 1. What were your results? Draw a table of your results.


Question 2. What other ways could you present your results?

## Discussion

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Question 1. Explain why one transparency is free of snot.

Question 2. Suggest why it is important to complete the experiment in the same way for each sheet.

Question 3. Was your hypothesis supported or rejected?

Question 4. What do your results suggest regarding the ability of mucus to trap different sized particles?

Question 5. Which type of mucus is more effective to trap particles?

Question 6. What is the function of snot in your nose? Does it matter if it is runny snot or not? Explain why.

## Hazards

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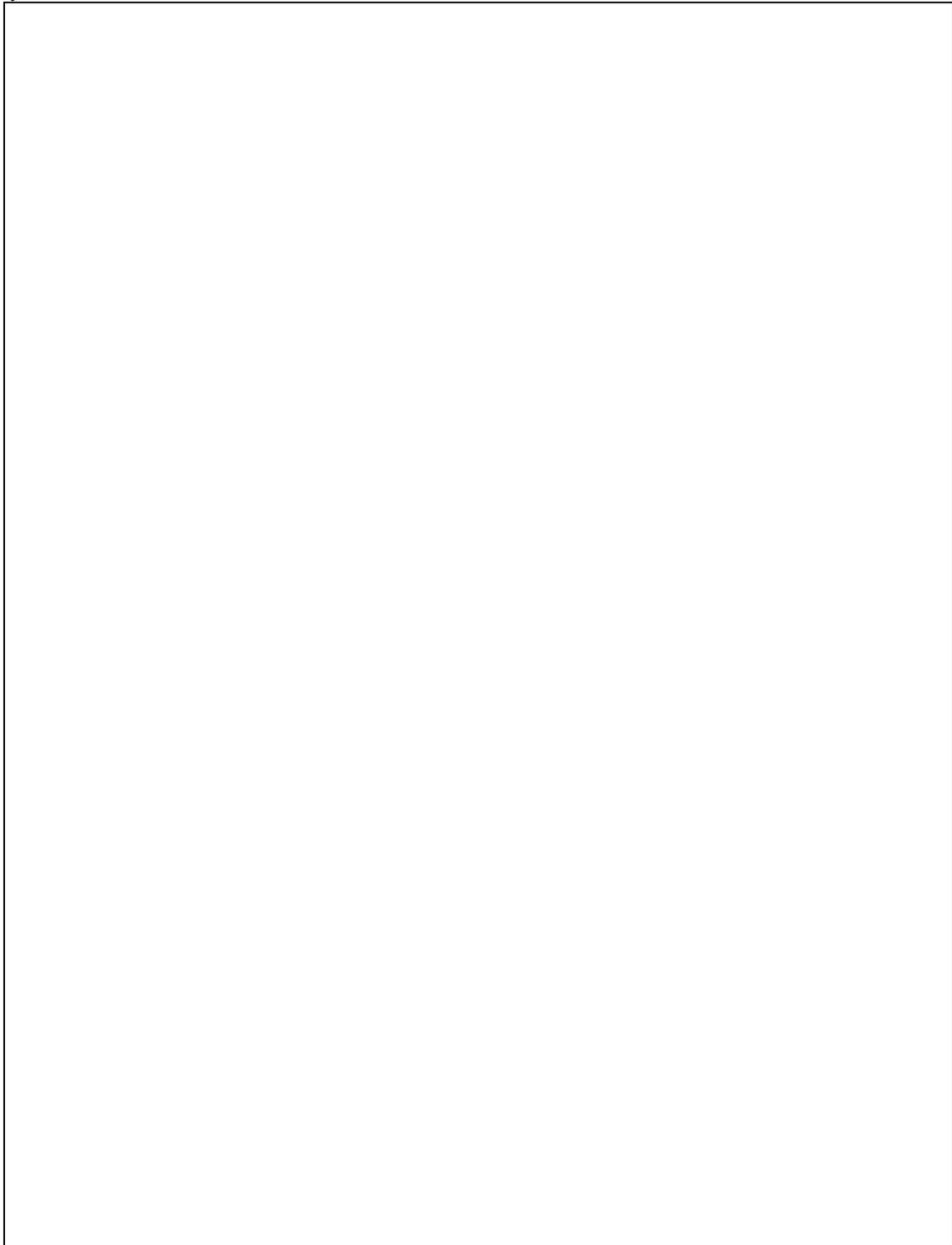
Corrosive and harmful chemicals are in use as well as sharp tools. **Risk management**

- Students must be educated about laboratory safety before the activity
- Gloves must be worn during the activity
- Hands need to be washed after the activity.
- Food and drink is not allowed during activity
- Do not touch eyes, mouth or swallow substances.

## Conclusion

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Summarise the learning outcomes you have achieved by completing these experimental activities



## Extension Information

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### UNDERSTANDING HOW THE IMMUNE SYSTEM WORKS

Ever wonder how your immune system works and how to improve its functioning? Here is a basic outline told in cartoon superhero style.

The immune centres of your body are located in the tonsils, thymus, spleen, and bone marrow.

- The Tonsils are thought to be the first line of defence against ingested or inhaled diseases, however, their full role in the immune system is yet to be understood.
- The Thymus is involved with the proper functioning of certain immune cells called T-lymphocytes or (T Cells).
- The Spleen filters the blood for diseases, foreign materials, also called "antigens."
- The Bone Marrow is responsible for producing leukocytes, cells which are responsible for capturing cellular debris, foreign particles, and invading microorganisms

## Extension Questions

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Mucus is necessary for all of us, whether we are sick or not. Mucus is our own personal garbage removal system. Mucus is made of water, sugars and protein. It lines the nose, mouth, throat and lungs and stops them from drying out. Mucus traps particles such as dust, pollen, particles, bacteria and viruses from the 500 L of air we breathe in per hour. It also moistens and warms this air.

- 1) Compare and contrast mucus/snot and phlegm.

Mucus	Phlegm

- 2) What causes boogers?

3) Explain why snot can be different colours.

4) List the other physical and chemical barriers in the human body and how they respond to invading pathogens. *Hint: write at least 4.*

5) How do viruses replicate?

6) Why does your doctor not give you antibiotics for a viral infection?

You are always making mucus, even if you are healthy. We can make up to 1.5 litres per day! This may seem surprising, however, most of it just slides down the back of your throat. If the mucus is dry it becomes boogers. The colour of your snot can tell you how sick you are. When you are healthy, your mucus is clear. If it is yellow or green, you may have an infection. When you have a cold, your body produces more white blood cells to fight the infection. These white blood cells can turn your mucus a different colour. When it thickens, it can turn green. It can also be red or brown, indicating you have blood in your mucus, probably due to lots of nose blowing.

Our nasal hairs catch bacteria, viruses, grains of dust and pollen and other unwanted foreign substances that enter our nose. This is so that they don't move down into our lungs. Snot transports it out again through the nose or to the back of the nose and down into your stomach. You are swallowing your snot all day, every day, without even noticing it.

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