

Why are people more likely to get sick when it is cold?

Authors:

Di Huang, Maie Taha, Benjamin Bleier, Mansoor Amiji, and others

Associate Editors:

Allison Gamzon and Alexandra Appleton

Abstract

UPPER READING LEVEL

Did you know that your nose protects you from germs? The nose makes small sacs called extracellular vesicles. These sacs prevent bacteria from causing infections. In this study, we investigated how the nose uses extracellular vesicles to fight viruses. We hypothesized that cold weather decreases the nose's ability to prevent viruses from infecting cells. Our findings confirmed that the nose does make extracellular

vesicles when exposed to a virus. They contain molecules that attach to and kill the viruses. But the amount of extracellular vesicles decreases in colder weather. Furthermore, when it's cold, the extracellular vesicles do not contain as many molecules that can kill the virus. That means that we are more likely to get sick when it is chilly outside!

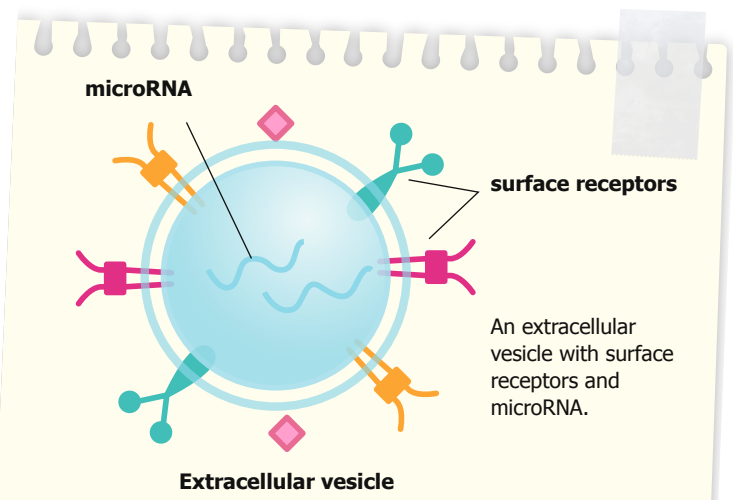
Introduction

The nose is a doorway for germs to get inside our bodies and make us sick. But the nose is also the first place where the body fights germs. In an earlier study, we found that the nose has an **immune response** to bacteria. That means that when bacteria enter the nose, the cells react to get rid of them. We learned that nasal cells in the front of the nose detect the bacteria. They then release billions of tiny fluid-filled sacs called **extracellular vesicles**. The extracellular vesicles carry different substances that can fight the bacteria. These substances include **nucleic acids**, **proteins**, and **amino acids**. The extracellular vesicles surround and attack the bacteria before they have a chance to infect the cells.

In this study, we wanted to find out if the nose responds in a similar way to fight viruses. A virus is a small piece of genetic information. When a virus enters a cell, it takes over the different **organelles** and uses them to make copies of itself. Viruses damage or kill cells when the virus copies itself many times over.

We investigated the nose's response to upper respiratory viruses, such as the common cold. We **hypothesized** that

nasal cells release extracellular vesicles that carry small nucleic acid pieces. We call these pieces of nucleic acid **microRNA**. MicroRNA prevents the virus from taking over by destroying the virus itself. Extracellular vesicles also have **surface receptors** that can attach to virus particles. This prevents them from entering cells. We also hypothesized that this nasal immune response does not work as well when the weather is cold.



Methods

→ Viral Response

We obtained nasal tissue samples from healthy volunteers and grew nasal cells in controlled laboratory conditions. We exposed the samples to three different common respiratory viruses as well as a molecule that mimics a viral infection. Then we analyzed the nasal cell response to each virus. We looked at the quantity of extracellular vesicles and their structure.

→ Effects of Temperature

We exposed the volunteers to a room that was about 4.4°C (39.9°F). Then we measured the temperature inside of their noses. Next, we took nasal tissue samples and lowered their temperature. We matched the sample temperature to the temperature of the volunteers' noses when it was cold. We exposed the colder nasal tissue samples to the three respiratory viruses. Then we analyzed the nasal cell response to each virus.

Results

→ Viral Response

We found that nasal tissue produced extracellular vesicles when exposed to viruses. We also detected a smaller amount of virus in the nasal cells. We found that the extracellular vesicles contained microRNA. We also noticed that the extracellular vesicles had more surface receptors.

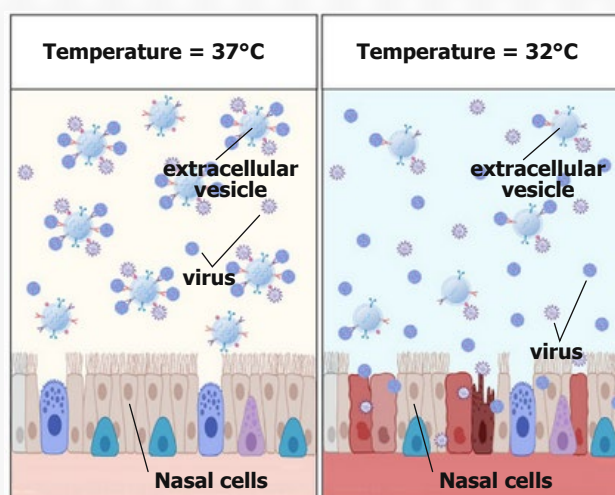
→ Effects of Temperature

A decrease in room temperature from 23°C to 4.4°C caused a decrease in nose temperature. The temperature decrease was between 4.7°C and 6.4°C.

When the temperature of the nasal tissue decreased by 5°C, the nasal tissue produced fewer extracellular vesicles (Fig.1). These extracellular vesicles also did not contain as much microRNA or as many surface receptors.

Figure 1:
Extracellular vesicles produced
in the nose at 37°C and 32°C.

What are two changes that happen to the extracellular vesicles when it is colder?



Discussion

Nasal tissue uses extracellular vesicles to fight viruses. As when fighting bacteria, the nasal cells produce a large quantity of extracellular vesicles. But when there is a virus, the extracellular vesicles act as distractors. The virus binds to the extracellular vesicles instead of the nasal

cells. These extracellular vesicles contain microRNA which then kill the viruses. That means the extracellular vesicles get rid of the viruses before they can bind to the nasal cells. Thus, the viruses are unable to start an infection.

Colder weather makes it more difficult for the nose to protect the body from viruses. When the nose's temperature decreases, the number of extracellular vesicles decreases. Their quality also reduces. That's because they don't have as many surface receptors and microRNA molecules. This

allows the virus to stick to and infect the nasal cells. We now have a biological reason why people are more likely to catch colds in colder weather.

Conclusion

Our study shows the vital role the nose plays in preventing viral infections. It also proves that people are more likely to get sick when it is colder. That means that everyone should take extra precautions during the colder parts of the year.

- Make sure to wash your hands with soap and water frequently.
- Clean common surfaces, such as in the kitchen or bathroom.

- Stay home when you aren't feeling well.
- Consider wearing a mask when you are sick or in situations where you will come into contact with someone else who is sick.

Also, practice good health habits, such as eating healthy food and exercising. Healthy habits keep your body at its best to fight viruses!

Glossary of Key Terms

Amino acids – molecules that combine to make proteins.

Extracellular vesicles – tiny fluid-filled sacs released by nasal cells into the nasal mucus that contain substances used to destroy bacteria and viruses. These substances can include nucleic acids, proteins, and amino acids.

Hypothesize – to give a possible but not yet proven explanation for something.

Immune response – the reaction of cells to the presence of a substance that is not recognized as a part of the body.

microRNA – a small piece of RNA that prevents a virus from taking over a cell. The microRNA destroys the genetic information of the virus.

Nucleic acids – molecules in a cell that carry information. Examples include DNA and RNA.

Organelles – a part of a cell with a particular function. Examples include the nucleus, ribosomes, and mitochondria.

Proteins – molecules made out of amino acids. Proteins are the building blocks for substances in the body.

Surface receptors – proteins on a cell or extracellular vesicle to which a virus can attach. When a virus attaches itself to these proteins, the cell lets the virus inside.

REFERENCES

Di Huang, Maie S. Taha, Angela L. Nocera, Alan D. Workman, Mansoor M. Amiji, and Benjamin S. Bleier (2022) *Cold Exposure Impairs Extracellular Vesicle Swarm-mediated Nasal Antiviral Immunity*. American Academy of Allergy, Asthma & Immunology.

[https://www.jacionline.org/article/S0091-6749\(22\)01423-3/fulltext](https://www.jacionline.org/article/S0091-6749(22)01423-3/fulltext)

Pan American Health Organization: Influenza and Other Respiratory Viruses

<https://www.paho.org/en/topics/influenza-and-other-respiratory-viruses>

PBS Learning Media: Virus Information & Prevention

<https://cptv.pbslearningmedia.org/collection/virus-information-and-prevention/>