

Rhinovirus: How it Infects Humans

What is the Rhinovirus?

It may start as a sore throat or a runny nose but the feeling is all too familiar. Symptoms make themselves known and give way to a general sense of not feeling well and it becomes evident that the common cold has struck again. The rhinovirus is a species of viruses that causes up to 40 percent of common cold cases in humans.¹ The common cold leads to many different symptoms, however, most colds are generally considered to be an infection of the respiratory tract. “Rhino” comes from the Greek word for “nose” which is a typical way for the virus to get into the body. The rhinovirus belongs to the enterovirus genus and over 100 different rhinoviruses have been identified so far.²



Figure 2: A man sneezing respiratory fluid into the air

<http://www.popsci.com/science/article/2013-07/why-deaf-people-dont-achoo-when-they-sneeze>

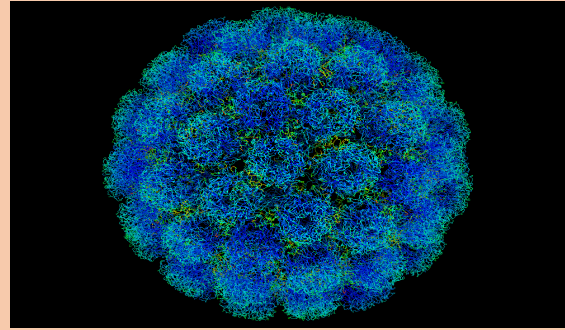


Figure 1: Computer Generated Image of the Rhinovirus

https://upload.wikimedia.org/wikipedia/commons/6/6a/Symian_virus.png

How it comes into contact humans

The common cold, in the form of the rhinovirus, is spread from person to person. One usually becomes infected after being in close proximity to an individual who is already sick or by touching a surface that has a sick person's germs on it. The rhinovirus is able to survive and remain contagious on surfaces outside the body for up to 24 hours and on hands for up to an hour.⁵ For this reason the virus is often transmitted by surfaces such as keyboards, doorknobs, desks, and water fountains. Individuals can also infect others up to 24 hours before they start noticing symptoms themselves; therefore, just because no one around is visibly ill does not mean the virus is not present.³

How it gets into the body

The rhinovirus enters into a human's body through the mouth, nose, or eyes. This often occurs when someone ingests particles of the virus that are floating in the air or touches a surface with the virus on it and then touches his/her face. Particles enter the air through a sick person's sneeze or cough which is why people are encouraged to cover their mouths when carrying out these bodily functions.

How it travels and reproduces throughout the body

Once the rhinovirus has entered into a human's upper respiratory tract it will begin infection when it binds to an intercellular adhesion receptor molecule-1(ICAM-1)⁴. If the rhinovirus were a key, ICAM-1 would be the lock it fits into to begin the infection process. Many of these ICAM-1 receptors are located in the adenoids that lie in the back of the nasal cavity. This is the most common area for the rhinovirus to bind to in order to infect humans.

Once the virus has attached itself inside the nasal cavity it begins to reproduce. Reproduction occurs through a process where the virus surrounds the walls of individual epithelial cells and inserts its RNA into the cell for it to be replicated. While in the cell the RNA is translated into a long polyprotein that then breaks down into more rhinovirus proteins.⁶ Cells will undergo a natural death called apoptosis when they realize they are defective. Then when the cell breaks down, the new proteins can be released allowing the virus to travel down the respiratory tract to the pharynx.⁶

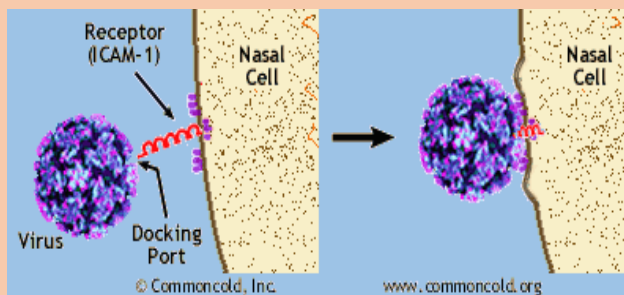


Figure 3: Rhinovirus Attaching to Nasal Lining
<http://www.erkbiz.com/commoncold/images/docking1.gif>

How it affects humans

The rhinovirus can be detected in the body roughly 24 hours after entering and it reaches its largest population in the body

around 48 to 72 hours after entry.⁸

Symptoms and their magnitude occur on a similar timeline, starting a day after initial contact with the virus and reaching a peak around day two or three.

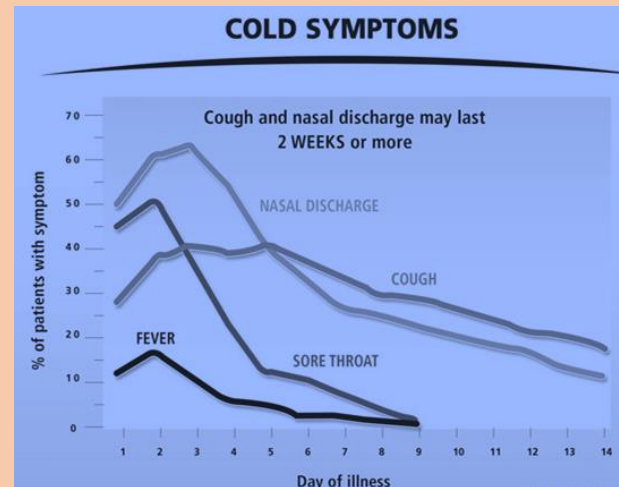


Figure 4: Cold Symptom Timeline
<http://cold-fx.ca/howTo.htm>

When the rhinovirus invades the epithelial cells inside the nose, membranes begin to swell through edema and hyperemia; and the humans' immune system starts to fight back.⁷ Actual cold symptoms come as a result of the body's immune response. The body's first tactic to fighting the rhinovirus is to send in white blood cells, and if the particular strain of the virus has been encountered before by the body then this initial attack will be a success. If the particular strain has not been encountered before then the body will send in back-ups and this is when symptoms such as swelling of the throat and nasal cavity start to occur.²

Swelling is one of the body's most common defense tactics and this swelling is what causes a sore throat at the beginning of a cold. The swelling leads to increased mucous secretions throughout the respiratory tract which is the body's natural mechanism of getting rid of the virus. This increased production and build-up of

mucous leads to symptoms like a runny or stuffy nose. Other common symptoms that accompany a cold are sneezing, coughing, fatigue, and fever.

With increased mucus production, the lining of the nose and throat tend to get irritated. In an attempt to dispel whatever may be causing the irritation, a sneeze is triggered.⁹ The body works hard to fight off a cold and this over exertion is what leads to the feeling of fatigue and exhaustion. Fevers are not common during a cold but sometimes the body will heat up to try and alter the virus's environment and ultimately kill it off.

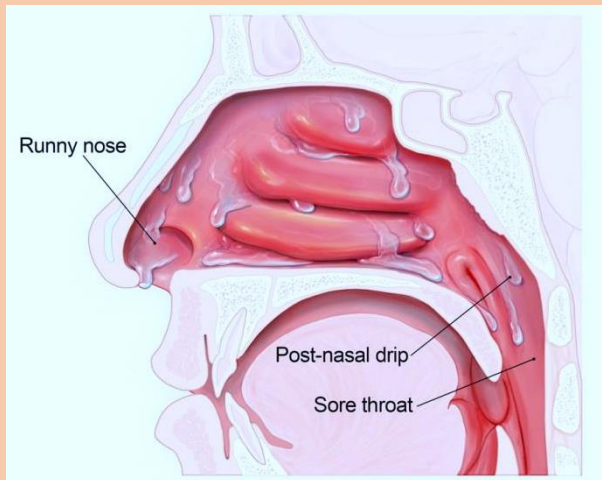


Figure 5: Image of the Rhinovirus Symptoms
<http://www.cdc.gov/getsmart/community/images/colds-lg.jpg>

Most cold symptoms tend to fade away within 5 to 7 days but a runny nose and a cough may persist longer. Coughing is a similar bodily defense to sneezing in that it is an attempt to rid the body of an irritant. Coughing occurs during the common cold due to excess mucus building up further down the respiratory tract in the throat.⁹ A cough tends to be the last symptom of a cold and will often linger for two to three weeks.

Summary

The rhinovirus is the most common virus responsible for giving humans the common cold. It is transmitted from person to person by nasal fluid of an infected person getting into the respiratory tract of another person. The virus attaches to cell membranes inside a person's nasal cavity and begins to reproduce and travel down the respiratory tract. The body's immune system responds by deploying white blood cells, causing the throat and nose to swell, and increasing mucus production. These changes in the respiratory tract are what are responsible for the common cold symptoms of a sore throat, a runny nose, a cough, sneezing, and fatigue.

References

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- (3)<http://www.everydayhealth.com/cold-and-flu/common-cold.aspx>
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- (6)http://www.rhinologyjournal.com/Rhinology_issues/108.pdf
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