

The nose – our personal high-performance air conditioning system and mighty protector

Fascinating analogy, isn't it? Let me introduce you to your own nose. It can do so much more than just help you breathe and smell! There are ventilation and air-conditioning functions performed by this crucially important, yet underappreciated part of the human body.

Let's have a look: the description of this fascinating "device" in technical terminology should read:

The Nose is a bidirectional, cyclic, two-part mini-combined device for air conditioning, heat and moisture recovery, air filtration with integrated disposal, odour sensor, direct access to the brain (known as the "nose-brain axis") and for infection defence!

With the last aspect becoming more understood, we realize what tremendous performance healthy noses can deliver, with every breath we take. And therefore, how important is the conditioning of the indoor air



WALTER HUGENTOBLER
MD, family doctor, medical consultant, and indoor climate expert
See also: <https://www.condair.de/fachartikel/aerztemeinung-zum-thema-luftbefeuchtung>
<https://www.humidification.com/medical-advisors>
<https://40to60rh.com/>

by the buildings' HVAC systems, as this factually represents the first stage in ensuring gas exchange in our lungs and in enabling our efficient immune response. How exactly does this functional dependence work?

One key capability of our nose is to protect us from viral infections and consequences of air pollution. With a functioning respiratory mucosa, a series of obstacles are put-up against viruses and other pathogens. First, a mechanical removal through the moving mucus carpet, swallowing and coughing. An effective disposal prevents the viruses from reaching the target, the receptors of the epithelial cells, quickly enough to start an infection.

Processed illustration: © Fritz Kahn, Das Leben des Menschen III, Franckh/Kosmos, Stuttgart 1926

Functions of the nose

- 0 Smell
- 1 Filtration
- 2 Mucociliary clearance
- 3 Mucus production
- 4 Germ control by antibodies
- 5 Humidification
- 6 Cellular memory (immunology)
- 7 Moisture recovery

The seven functions of the nose, 1939
Fritz Kahn

www.fritz-kahn.com

This is called the mucociliary clearance. Second, the viruses cannot penetrate critical mucus layers and get us sick, if these layers are intact. A third obstacle subjects viruses to chemical attacks by antibodies and enzymes, while a fourth sees the local immune cells creating a toxic environment for viruses and also call upon the acquired immunity cells for help via messenger substances and stimulate antibody production, as a fifth and final step.

Nevertheless, all these defence mechanisms can only function optimally, if the water content of the mucus layer is between exactly 96 and 98 percent and the temperature is around 37 degrees Celsius.

Especially the capability of viruses' removal is severely impaired by dry air, leading to the water content of the mucus to fall below 96%.

Our wonderfully designed nose must prepare the inhaled air – provided to it in any given initial condition – in such a way, that it supports optimal hydration levels of the mucus so that the air reaches the alveoli at 100% relative humidity and 37°C. This is an absolute must, by physiological design. Consequently, the respiratory tract must add-on every percent of moisture that is not provided by the air conditioning technology: if the inhaled air is too dry, the nose, mouth, throat and bronchi get in competition with the mercilessly “thirsty air”, which strives for saturation, i.e. 100% moisture. The air fetches the moisture wherever it is present, in whatever form – and in dry indoors, the human being is often the only source of moisture – thus the person becomes one's own humidifier, leading to discomfort and illness. So, if the indoors relative humidity does not rise above 20 to 30% – like most commonly during wintertime – then the nose, throat and bronchi of any occupants are challenged until possible decompensation.

Depending on the outdoor climate region, in winter, as the cold outside air contains very little water, heating often leads to very dry indoor air. In about a half (!) of the population, the nose is not able to provide the humidification required without desiccation of the respiratory mucus. Particularly at risk are seniors, babies, allergy sufferers, asthmatics, bronchitis sufferers, smokers, and COPD patients, all overwhelmed as a result of the extreme dryness of heated indoor air. Dehydration symptoms appear and the mucous membranes of their respiratory tract are damaged. The result: more frequent infectious diseases, nasal, and paranasal sinus problems as well as worsening of allergic and chronic respiratory diseases.

Dryness and dust exposure belong together

The drier the air, the more dust-laden it is. Therefore, during the heating season, both the air dryness and the dust strain the air conditioning and cleaning function of the respiratory tract to its performance limit and beyond. These factors represent a double burden and are mutually dependent. Our indoor climate presents the respiratory tract with days and weeks of challenges that it never faces outdoors in this form!

So now you see the connection: the quality of the provided indoor air, especially the often-overseen relative humidity levels of indoor air, are key for keeping us healthy and striving. Because not only the respiratory tract's performance is affected, but also the eyes and skin, brain, kidneys and blood. Changes under air dryness stress are measurable in all these organs, without exception. The effects on the eyes and skin are best known. So are the negative effects on the brain performance, also well documented e.g., the scientific aviation literature presents numerous papers on the dangerous consequences of excessive dehydration on pilots' vision, responsiveness, and decision-making processes. The negative effects of air dryness on the intellectual performance of office staff and students are well documented.

Fact: air humidification during winter is a necessity and the nose physiology request the ideal minimum of 40% RH

Modern building's physics, building equipment and services are exclusively determining the indoor air quality, so these should be designed based on the latest knowledge, making indoor air conducive to health and performance.

The described processes have every day, practical consequences: the air humidification opens up a large, previously untapped prevention potential – and we all should use it! Because in the planning and building stage of public spaces, offices, homes, shops, etc. there is still freedom of choice – which is later not granted to the building's occupants, to the organ systems in their bodies. Hence the functions of the HVAC system – especially the humidification performance – are fundamental in the process of keeping us all healthy and performant, enabling our respiratory system, our own portable A/C system, to function efficiently and to keep us safe and vivacious throughout the cold season. ■