

Carl's Contemplations on Carbon Dioxide

A friend of mine confided that he didn't like to wear his mask because of the buildup of carbon dioxide. Immediately I told him that was a myth. But how do I know?

You could ask Google, but Google tends to give you the answer you want to hear. If I ask Google, "Have we been visited by aliens" the top hit says, basically, "Yes!" And if I ask Google, "Are stories about alien visits a hoax", the top hit, says, basically, "Yes!"

Google tends to tell you what you want to hear. But if you ask it about face masks, it generally tells you that face masks are safe. So about that buildup of carbon dioxide.

I did advanced studies in human physiology early in my career. I completed a Master of Science at the Faculty of Medicine in the University of Toronto and even did most of a PhD, before deciding on a career change and going to McMaster to do my M.Div....

Your body gets energy by metabolizing food and producing waste. Food is basically a chain of carbon molecules whether it's a carbohydrate, protein, or fat. Your body runs the carbon chains through the Krebs cycle (also called the citric acid cycle). Enzymes chop up the carbon chains and the energy released is stored in NADH, producing carbon dioxide and protons. The carbon dioxide is waste, as far as the body is concerned. But the protons still have energy. So the protons are run through the electron transport chain, releasing more energy, which is stored in ATP. And the waste product of electron transport is spent protons mixed with oxygen: water. That's why you need oxygen. To pick up spent protons. To make water. To carry out the trash.

There. Now you don't have to take biochemistry.

Obviously, for this to work, you need to breathe in oxygen and get rid of the CO₂ (and do something with the water, which I usually do every two hours or so, all night long, but enough

about me...). These gases are really small. Hydrogen is the smallest with a molecular weight of 1. Carbon 12. Oxygen 16.

What's a molecular weight? Take the number 6, put 23 zeroes after it: that many hydrogen atoms weigh 1 gram. That many carbon atoms weigh 12 grams. That many oxygen atoms weigh 16 grams.

A virus particle is *millions of times bigger* than these gases¹. And a virus particle is small for an airborne particle. An N95 mask only stops about *95% of airborne particles*. Do you get a sense of the scale here? The best mask blocks about 95% of particles that are millions of times bigger than oxygen and carbon dioxide. Carbon dioxide and oxygen pass through the mask as if the mask is not even there.

So why is it difficult to breathe?

Now that you're read this, you might breathe more easily. And that's not to say that it was all in your head. It was in your chest, too.

¹ <https://link.springer.com/article/10.1007/s00216-019-01998-6>