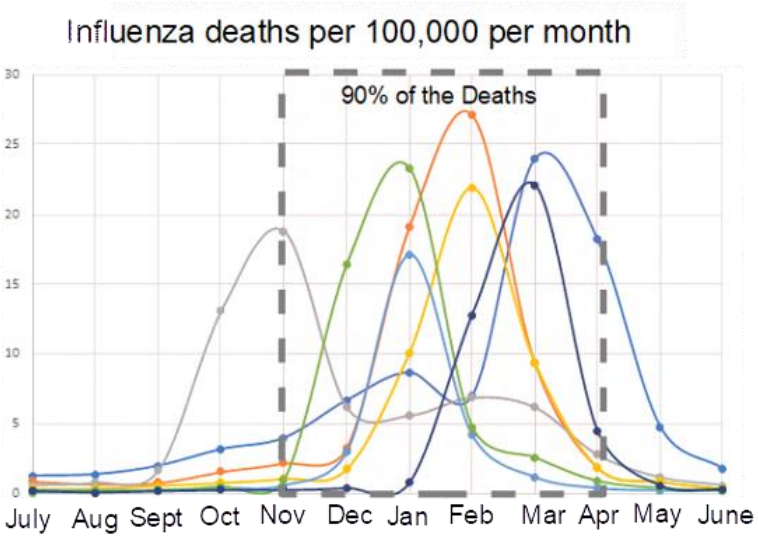
"If we knew what suppressed influenza to summertime levels, that would be a lot more effective than any of the flu vaccines we have."

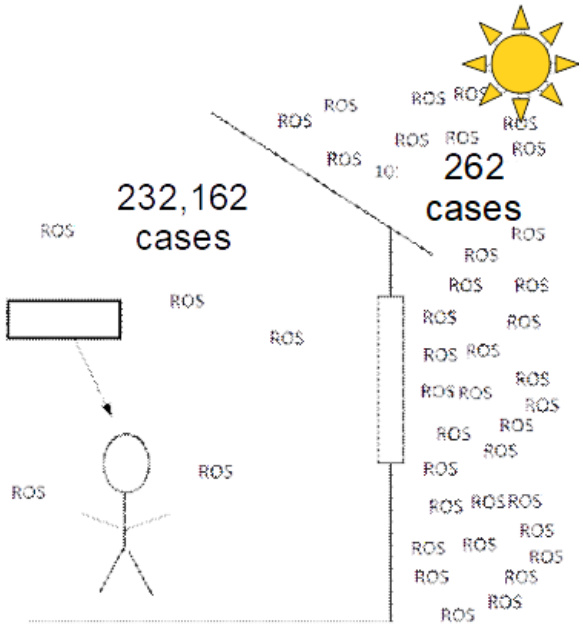
Dr. Scott Dowell, Vaccine Development, Bill and Melinda Gates Foundation



Influenza outbreaks 1940 to 1970 - CDC

"Just one coronavirus infection in every thousand cases occurs outdoors,…."

Contact tracing data from the Health and Protection Surveillance Centre



Dr. Dowell's quote is supported by the first figure showing typical seasonal death rates from influenza in the US during several outbreaks between 1940 and 1970 (CDC). COVID contact tracing studies show that we are 1000 times more likely to catch COVID indoors compared to outdoors.

https://www.irishtimes.com/news/ireland/irish-news/outdoor-transmission-accounts-for-0-1-of-state-s-covid-19-cases-1.4529036

Over 3,000,000 people have died from COVID. If the ratio is 1000 to 1 that would suggest that 2,997,000 of the deaths may have been preventable. This is true not only for COVID but also Tuberculosis which still kills over a million people every year. Recent Influenza and COVID seasonality data and the "AC bump" seen last summer all support the premise that nature is actively suppressing disease transmission on a massive scale. We are also faced with the paradox that many of the most modernized countries have some of the highest infection and death rates.

Dilution is not the Solution

Despite the oft quoted verse, CFD studies suggest that dilution is **not** the primary factor even outdoors. As shown below dilution of particles emitted by a jogger outside remain localized for minutes allowing transmission to occur. In seconds particles from a person walking by are being breathed in by bystanders. Yet we know that outdoor transmission seldom occurs.

http://www.urbanphysics.net/Social%20Distancing%20v20_White_Paper.pdf

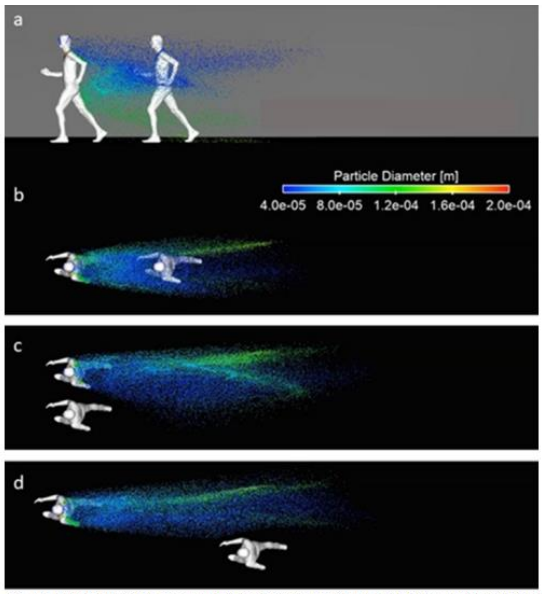


Fig. 12: Droplet spreading when running at a speed of 14.4 km/h when (a,b) running behind each other; (c)

Conversely, Indoor CFD studies shows a single sneeze uniformly fills a 6m x 6m x 3m room in less than 40 seconds based on walls and obstructions in the room. Clearly from the contact tracing data, we know that these CFD studies are incomplete.

All CFD models and ventilation equations assume air is just air and the viron hitching a ride on the particles modeled have infinite half-life. This is not the case, given NIAIH and DHS half-life data. To reduce disease spread by 1000X requires active suppression everywhere, not just in one room, at a desk, or on a cell phone case.

What we are doing now is not working

Despite marketing claims of 99.99% efficacy for everything from far UV to sprayed chemicals, we are not even close to reproducing what nature does without any of these elements. Presently, ASHRAE defines minimum air changes per hour (ACH) based on the same assumptions used in the CFD models.

Silas has proposed that nature is using a combination of sunlight and reactive oxygen species (ROS) generated by sunlight in the atmosphere during the day and nighttime emissions from microbes in the soil to suppress disease transmission.

As shown below well intended energy saving government mandates could be contributing to higher transmission rates indoors. From the virus's time and spatial scale most mitigations techniques are irrelevant.

Quantizing the Problem

Biological reactions like photons ultimately are discrete quantum processes. There are two basic rules.

Rule 1 a photon must be absorbed for a reaction to occur.

Rule 2 one photon reacts with one molecular bond.

Most biological processes involve an intermediate step containing one or more ROS. Often referred to as free radical chemistry, ROS (includes free radicals) have half-lives ranging from less than a nanosecond to days, unlike photons which have zero half-life. The ability to accumulate, store, circulate, and remove ROS is fundamental to life. The body produces ROS like hydrogen peroxide in the blood stream, airways, and nasal cells to kill pathogens like COVID. Nitric oxide localized in parts of the brain is necessary to enter REM sleep. We breath in copious amounts of ROS with every breathe that disinfects our airways and stimulates immune responses. Even the formation of Vitamin D in the skin requires an intermediate ROS reaction. As such the following addition to **Rule 2** is proposed.

Rule 2a one ROS reacts with one molecular bond.

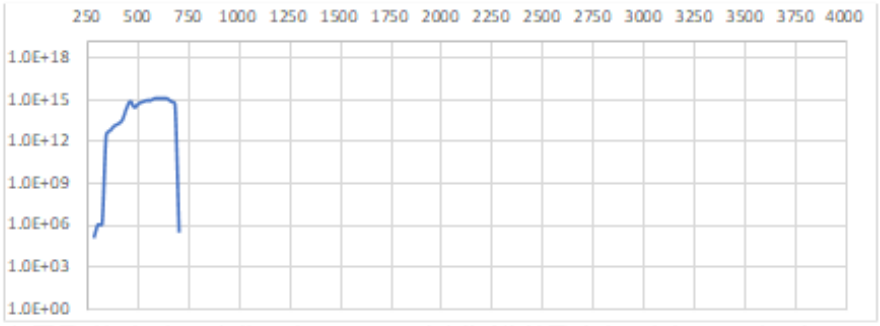
Following these rules make it possible to estimate the impact of sunlight and the ROS generated by sunlight on not only our body but also the virus.

Indoors versus Outdoors

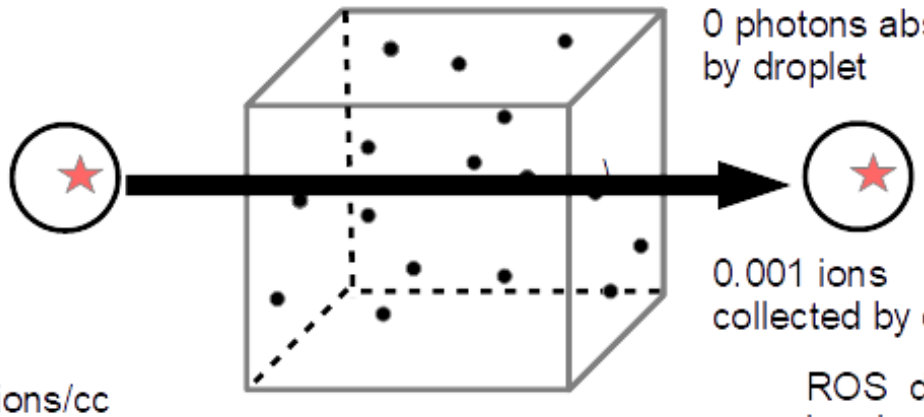
An order of magnitude comparison is provided below. Enveloped viruses like COVID are susceptible to UV and IR portions of sunlight and the naturally occurring ROS (H_2O_2, NO, O_3, etc.). The lipid bilayer surrounding the RNA is easily converted into lipid ROS which have long half-lives (7 seconds) and quickly accumulate in the virus. Our modern enclosed spaces tend to eliminate both the solar spectrum and ROS that inactivate the virus. A simple order of magnitude example of what a single droplet containing one virus particle might be exposed to in 1 millisecond on a typical sunny day both indoors and outdoors follows.

Indoor Example

232,164 COVID Cases Transmitted Indoors



LED lighting/displays and UV/NIR blocking windows



0 photons absorbed by droplet

0.001 ions collected by droplet

6000 ions/cc

ROS depleted in minutes

Natural and Artificial ROS rapidly consumed In enclosed spaces

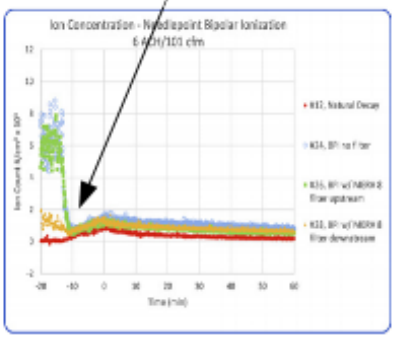


Figure 2: Ion concentration in the test chamber during MS2 in-air test at 6 ACH.

Consider a single 10 um diameter cough droplet containing 1 virus particle traveling at 10 m/s passing through 1 cc of indoor air. The droplet traverses the 1 cc in 1 millisecond. Indoors, LED Lighting/Displays and UV/NIR blocking window might allow 10^{10} photons to pass through the 1 cc of volume at this time scale. Based on the droplet size, roughly 10^4 photons interact with the droplet as it passes through the 1 cc. The droplet however has no real optical absorption to these visible photons (**Rule 1**) so no ROS is formed in the droplet (**Rule 2**). Interestingly, the food industry has shown that the combination of UV and IR is synergistic and effective at inactivating pathogens. Unfortunately, in our zeal to save energy we have blocked the important portions of sunlight and dramatically reducing the number of useful photons in our enclosed spaces.

Simultaneously, as the cough droplet traverses the 1 cc volume it collects artificial and naturally occurring germicides from the air. Like a wet scrubber commonly used to remove VOCs and particulates from exhaust streams, the cough droplet accumulates whatever is in the air with high efficiency especially in humid environments. But unlike outdoor air, indoor air is not an infinite reservoir and is quickly depleted of both artificial and naturally occurring ROS on a time scale of seconds. This is especially true around an infected host (coughing, sneezing, and breathing) within an enclosed space where virus carrying droplets can travel over 10 meters in less than a second.

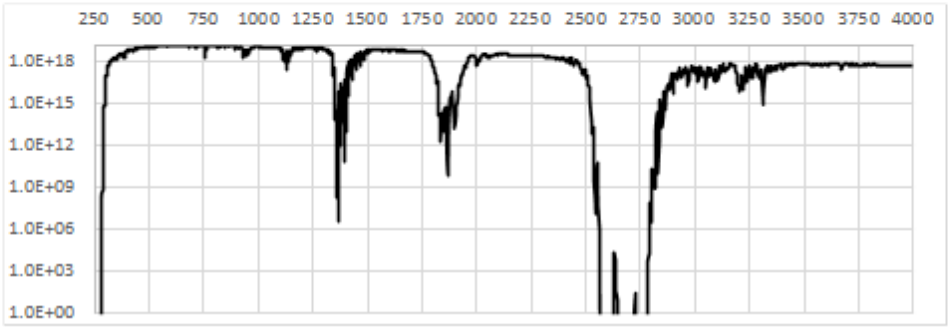
Assuming only BPI in room (No other ROS)

As an example of the time scale, a recent Trane BPI study generated 6000 ions/cc in an enclosed space. A 101 cfm air stream was introduced into the room and in a matter of minutes the ions/cc dropped to zero (**Rule 2a**). As is illustrated within the 1 cc volume the probability of an ion interacting with the droplet is low compared to other contaminates. This example is only meant to illustrate the size and time scales at play, not the effectiveness of BPI. Similar examples using HPV, UV, and Ozone can be shown. In general, artificial disinfection techniques are very load factor sensitive and cannot respond on a time scale sufficient to prevent a sneeze from one person infecting another person in the room.

https://www.jp.trane.com/content/dam/Trane/Commercial/global/about-us/wellsphere/Technology%20Whitepaper%20-%20Bipolar%20Ionization.pdf

Outdoor Example

262 COVID Cases Transmitted Outdoors



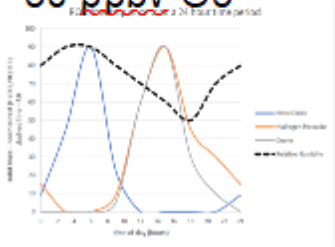
280nm to over 3000nm

100,000,000 photons UV/IR absorbed generating 1,000 ROS in droplet

60 ppbv NO
4 ppbv H2O2
30 ppbv O3

1,000,000 ROS collected by droplet

ROS Reservoir Replenished Day and Night



Sunlight at the surface of the earth extends from 280nm to over 3000nm as shown. On a typical summer day over 10^{14} photons can pass through the 1 cc volume in 1 millisecond. The UV and IR portions of sunlight interact with the cough droplet such that roughly 10^8 photons are absorbed (**Rule 1**). Based on ESR data we know that just the UV portion forms over 10^3 ROS in the mucus and water that make up 99.99% of the droplet in 1 msec. The virus particle in the droplet is approximate 100 nm in diameter and the RNA inside the virus particle makes up about 1% of that volume. As photons do not have brains allowing them to search out RNA (**Rule 2**) most of the RNA damage occurs indirectly as ROS accumulates in the droplet (**Rule 2a**).

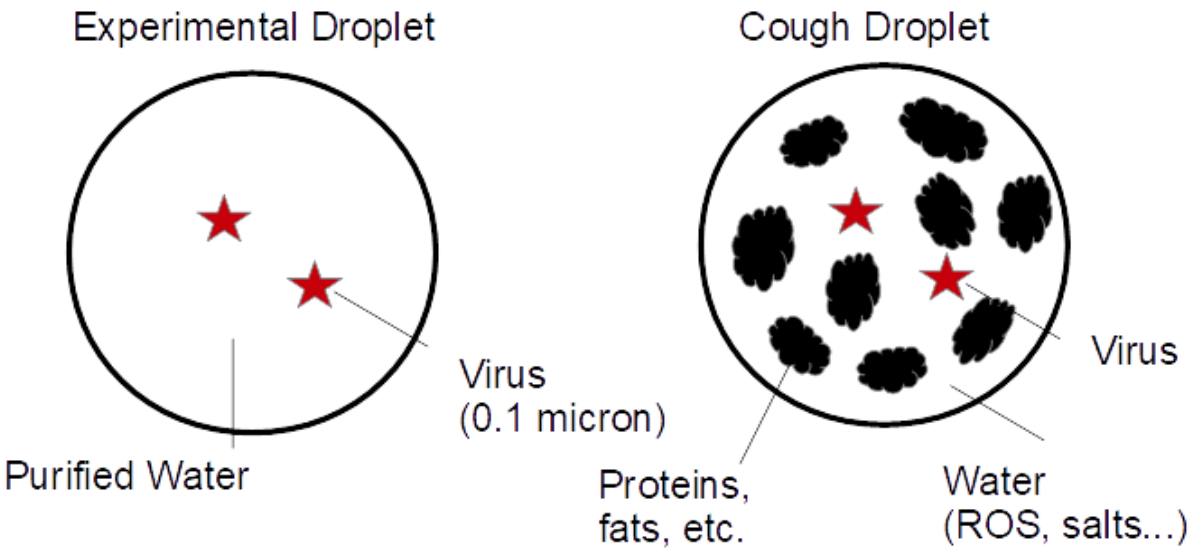
Simultaneously the droplet moves through the 1 cc volume containing up to 10^{14} ROS throughout the day and night (H2O2, O3, NO) as previously posted. The 10 um droplet could accumulate up to 10^6 ROS in the 1 millisecond.

From the virus's perspective

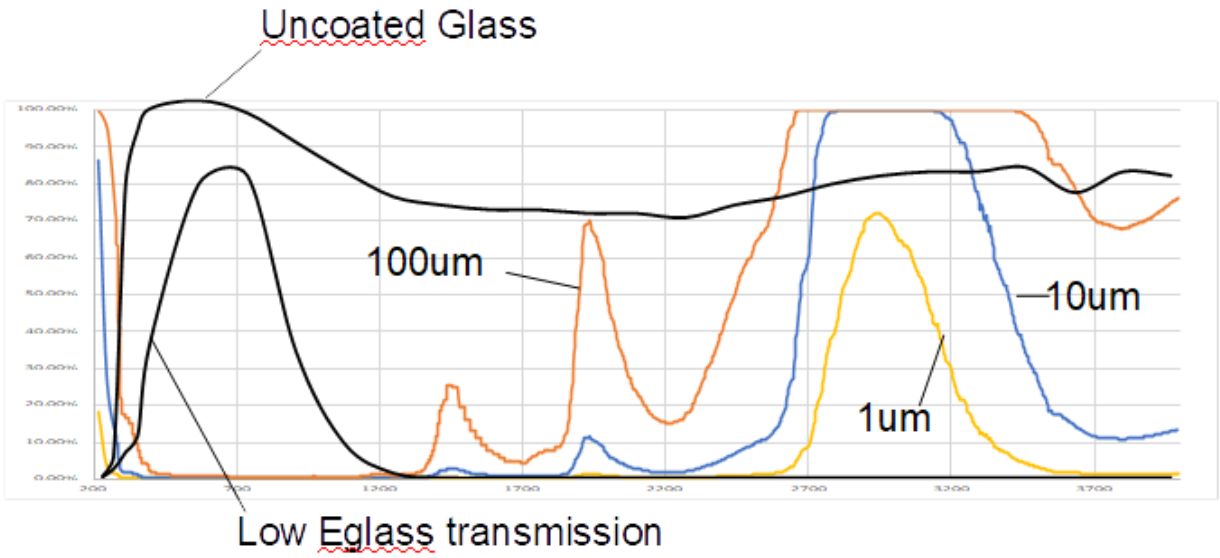
Outdoors is a hostile place for viruses. As illustrated above the formation by sunlight and collection of ROS via droplet motion occur on a time scale sufficient to inactive the virus to prevent transmission. Enclosed spaces however quickly consume local ROS levels and block the portions of sunlight that droplets and the virus can absorb. As ROS is depleted over time each breathe is more likely to infect other occupants in the room in second not hour time scales.

Spectrum Matters

As previously shown government mandates regarding window glazings and LED lighting block or do not emit the wavelengths that droplets and the virus particles absorb.



Low Eglass blocks the wavelengths droplets containing virus particles absorb

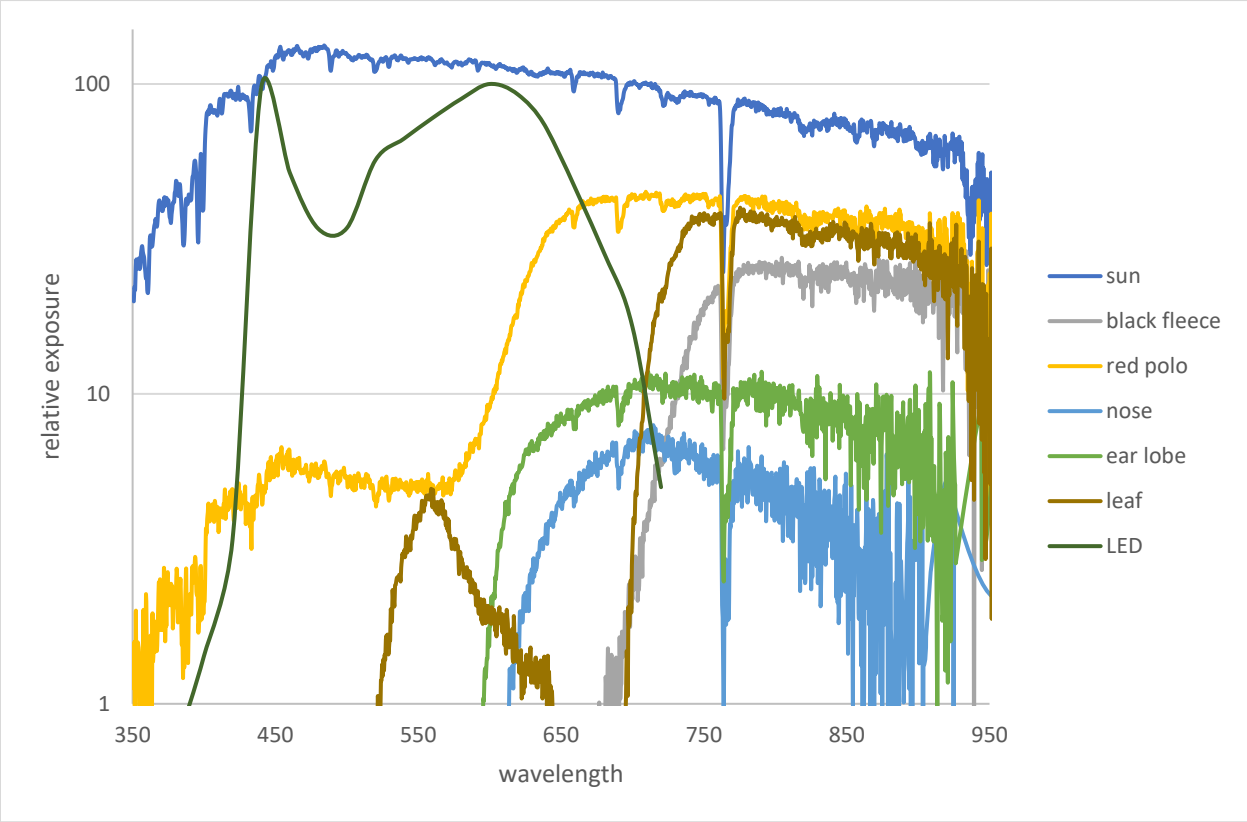


Visible only LED lighting and displays may look like and claim to be equivalent to sunlight, but they are not from a biochemistry standpoint.

What is the spectrum of sunlight?

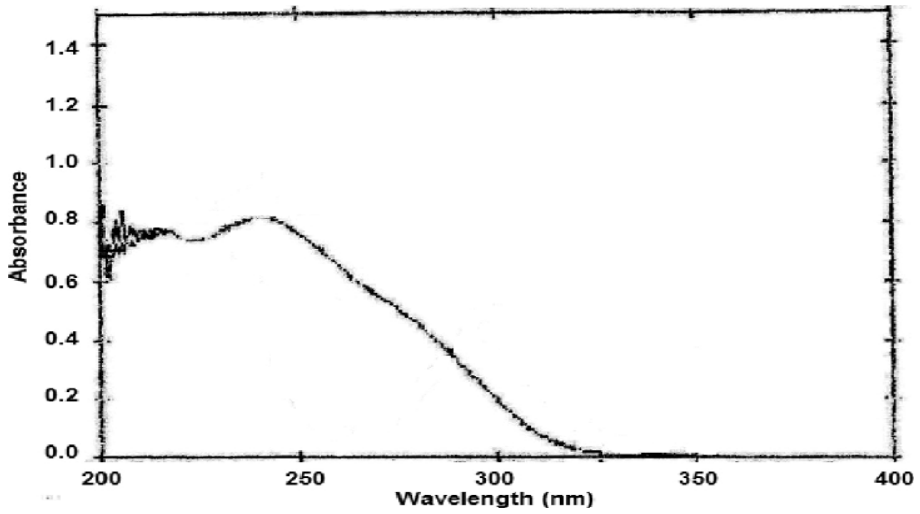
What matters is the total energy absorbed by the body. The graph illustrates how sunlight transmits through clothing, skin, etc. When clothing and our surroundings are included over 90% of the photons from sunlight absorbed by our body are in the NIR. The function of NIR in the human body is to stimulate blood

flow by generating nitric oxide compounds (ROS) in our blood vessels for waste removal and repair of the damage caused by higher energy UV/VIS photons. Even a black fleece transmits strongly in the NIR (gray trace). Visible only LED Lighting emits no NIR as shown and as such **always increases oxidative stress** in the body compared to sunlight. Unfortunately, well intentioned government mandates have made us more vulnerable to disease transmission.



Here we go again

Recently it has been suggested that we should release huge amounts of calcium carbonate into the atmosphere to cool the atmosphere. As shown below calcium carbonate strongly absorbs in the UVC. Before we do that, we might want to consider the unintended consequences regarding disease spread that might occur.



Many of our worst pandemics throughout history occurred after large volcanic eruptions. The third most prevalent emission from an eruption is sulfur dioxide. As previously posted air pollution especially sulfur dioxide strongly suppresses hydrogen peroxide and other beneficial ROS.

https://schoolpartnership.wustl.edu/calendar_event/volcano-eruptions-climate-change-and-deadly-historic-pandemics/

The best way to stop a pandemic is to prevent it from happening in the first place. As variants, superbugs, bio-terrorism and breakthrough cases increase, understanding how to reduce viral load in our enclosed spaces should be a priority. Blocking the UVC from generating ROS in our atmosphere may not be the best choice. Instead reducing air pollution (especially sulfur compounds) which consumes good ROS and designing smart ventilation systems might be a better choice.

Conclusion (Making Vaccines Obsolete)

If we can understand how nature is 99.9% efficient at stopping disease spread outside and learn how to mimic those mechanisms in our enclosed spaces, the contact tracing data suggests that we could eliminate the need for a new vaccine every time a new disease pops up. The goal should be to eliminate the need for vaccines by preventing infectious diseases from reaching pandemic levels. The data indicates that we can do that without the use of UVC or toxic levels of gases or chemicals.

Author's note:

For over a year numerous attempts have been made to get the NIAID and DHS to re-run COVID half-life tests using real world air and sunlight conditions. They refuse. That data is critical to the HVAC industry discovery process. While the Gates Foundation's total focus on vaccines is understandable, it is puzzling why getting a few simple tests that mimic real world conditions is being blocked by government agencies.