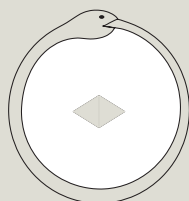


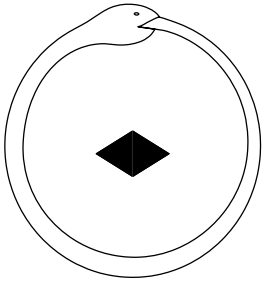
INVISIBILITY AND OMNIPRESENCE

COVID-19'S CASE

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notebooks
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To see is to perceive light with the eyes. The light our eyes see is made of photons; small packets of light that are at the same time particles and waves, whose dimensions vary between 400 and 700 nanometres. A nanometre is a billionth of a metre; 10^{-9} m for the mathematicians. Here are the dimensions of the lightwaves we see: 400 billionths of a metre for the ultraviolet, and up to 700 billionths of a metre for the infrared. The wavelengths we see in the form of visible light are an extremely narrow range – good old photons that bounce over everything enveloping us, then reach the photosensitive receptors in our retinas, at the back of our eyes, and inform us about the world around us.

However, when what we are searching for is smaller than visible light itself, it's no longer possible to see in the classical sense of the word. In concrete terms, everything that is twice as small as the shortest visible lightwave eludes high-performance optical microscopes. Everything that is smaller than 250 nanometres is literally invisible.

In the case of SARS-CoV-2 virus, causing COVID-19: it has a medium diameter of 125 nanometres, twice as small as the visibility threshold. It's not just that we can't see this virus, but that we cannot see it with visible light.

Nonetheless, it's possible to represent such minuscule entities – and indirectly turn them visible – by bombarding them, not with photons, but with electrons that are up to 100 thousand times smaller than photons in their wavelengths. That is what we call electron microscopy. The device captures the electron's rebound, the computer aids in the calculation of probable angles, and finally, it is possible to deduce and sketch the shape of the object that was bombed. Thanks to these sophisticated techniques, we can, for example, make visible the proteins that shape SARS-CoV-2 coronavirus shell. The images of the

virus, with which we ourselves were bombarded, are all sourced from electron microscopy.

These tools are admirable, but the understanding of the living world accompanying them is being left behind, and the case of viruses shows this very well. The first scientists deducing the existence of viruses, at the very end of the 19th century, showed that something considerably smaller than a bacterium could cross through a bacteria filter and transmit an illness. These small invisible things were called viruses, the Latin word for viscous liquid or poison. We imagined viruses as toxic substances. Smaller than the smallest known cells, never seen, they could not be considered living beings, let alone intelligent beings. Since the beginning of virology, viruses were thought of as small pieces of matter, with the tendency of harming us. Like poison.

It's true that the electron microscope was only invented in the 1930s, and that the shape of DNA and RNA molecules was only understood thanks to the electron microscope in the 1950s. In that period, the certainties had time to be put into practice. Viruses were not considered living beings because the definition of life required the presence of a cell and the capacity for self-reproduction. As viruses have neither, they found themselves on the wicked side of the dividing line, excluded from the world of living beings.

Today, due to the progressive improvement of electron microscopy, we have far more knowledge. A virus like SARS-CoV-2 acts in a very different way than poison does. For example, cyanide is a relatively simple molecule, containing a carbon atom linked to a nitrogen atom, binding to anything metallic. It easily enters in the cells and blocks the activity of the enzyme that is crucial for the oxygen to work in service for the cell. Cyanide is a molecular rod in the central and energetic functioning of all cells, which, deprived of energy and oxygen, end up dying. Cyanide is simply a substance, a molecule, a small mass of matter, but that doesn't stop it from blocking everything and causing death if it reaches certain places. It's an actual poison, if not one of the most effective.

With SARS-CoV-2, we're dealing with something quite different from this type of poison. To begin with, it is not a simple molecule. This virus is a capsule loaded with RNA information, presenting itself as a long serpentine-shaped molecule of 30 thousand letters. The DNA dou-

ble helix is made up of two complementary strands wrapped around each other, the main text and its backup. When DNA is transcribed so that its information can be utilised to make proteins, the transcript is a simple RNA molecule, in other words, a single strand, and not a double one, like DNA. RNA is a copy of the main text of DNA, but without a backup. SARS-CoV-2, like the other coronaviruses, is an RNA virus, meaning, it travels “light”, with no backup. The capsule containing this genetic information is made up of four different proteins. One of them, which constitutes the external spikes of the virus, serves to open very precise locks in our cells. These spike proteins have a molecular configuration at their tips that is used as a key to activate at least two specific cell receptors. The first – called ACE2 – will allow the virus to enter the cell.¹

There, the virus deconstructs itself, disassembling into separate pieces, each piece playing a different role in what comes next: the deliberate hijacking of the cell. The long RNA serpentine will be copied by a ribosome of its host, which mistakes it for native RNA, generating the amino acid chain in the indicated order by the RNA molecule instructions. It then produces a long chain of approximately 7 thousand amino acids, a kind of gigantic protein chain. The virus has precisely one protein enzyme, that cuts that chain as a tailor would, to produce around 25 different proteins, among which one serves to neutralise the cell’s alarm system (by binding to two specific proteins); another blocks the transcription of specific genes in the host cell; another is active in the assemblage of new viruses from the production of new separate pieces; and lastly, an enzyme makes RNA copies of the viral RNA. In short, all that is needed to produce multiple copies of itself, which, once well encapsulated, leave the cell through the membrane and infect other cells.²

Let’s recapitulate. The virus is a capsule that contains the instructions to make copies of itself. It is enveloped by four different types of protein, but it contains the information needed to make 25 types of other supplementary proteins, required for its reproduction. It enters by deceiving the cell, it disintegrates, and its proteins separate and perform distinct tasks: one switches the alarm off, another interrupts the

1. SCUDELLARI, 2020.

2. BURDICK, 2020.

cell's normal operations and specifically deletes the genes that produce antiviral proteins,³ and many others drive different apparatuses of the host cell to produce themselves new viruses identical to the one that penetrated the cell. Afterwards, hundreds of new viruses can go elsewhere in the body and infect other cells. If the host's immune system is unable to overtake them, these viruses will end up using a second key, which is supposed to block acetylcholine, a molecule in the body with many functions, including acting as a brake on the immune system when overloaded. In severe COVID-19 cases, it seems that what kills the patients is not the virus itself, but the rampant hiper-reaction of the immune system – the brake disabled by the second key.⁴

Let's talk about that second key. Situated on the tip of the coronavirus spikes, it is a piece of protein, or a sequence of amino acids that is exclusive to SARS-CoV-2, strongly resembling that of the two known blockers of acetylcholine receptors: the neurotoxic protein of the rabies virus and the neurotoxic protein of snake venom, in this case the Chinese cobra.⁵

To contract rabies, an animal must bite you and puncture your skin. For snake venom to block your nervous cell receptors, you also need to be bitten by a venomous snake. But to contract a viral and respiratory disease such as COVID-19, all it takes is a close conversation with a friend, and something as violent as rabies or a snakebite can fall on you.

Moreover, this virus spreads clandestinely, given that approximately 30% of infected people don't show any symptoms, at the same time, some hold the capacity to generate more viruses, being able to infect other people. This virus acts like no other known pathogen.

It is therefore an invisible, omnipresent, silent chicanery, capable of penetrating our respiratory tract and biting us like rabies or a snake would.

We might ask ourselves: how is it possible for this virus to suddenly appear, so well-equipped, and above all with proteins holding toxic sequences who appear to come either from a distant virus – rabies virus is not even a coronavirus – or literally from a neurotoxic protein in the snake venom? Could this be related to laboratory manipulation?

3. BEGLEY, 2020.

4. CHANGEUX et al, 2020; OLIVEIRA et al, 2020; VELASQUEZ-MANOFF, 2020; and DANCE, 2020.

5. FARSALINOS et al, 2020a and 2020b.

Well, not exactly. The viruses recombine their DNA or RNA all the time.

For example, the SARS coronavirus apparently moved from bats to civets (a type of wild mammal) in the early 2000s, in which it adapted a little, and then infected humans. What we call gene recombination occurs between viruses of different species when they meet inside the cells of the same host. The viruses exchange their genes, either DNA or RNA – they have enzymes for that. When the viruses are able to overtake the border of species, for example, going from bats to humans, passing through the civet, the results are often devastating. With SARS, 8 thousand people were infected, and 700 died. The only good news was that the disease was only transmitted when symptoms were visible, so SARS was relatively easy to contain. Another example is MERS, a bat coronavirus, which is thought to have adapted to camels and from there passed on to humans. The AIDS virus also crossed the border of species, coming from the chimpanzee and possibly being transmitted when a hunter field dressed one of these animals. As for the famous and devastating Spanish flu, it had an avian origin.

We're only discussing hypotheses, since in all of these cases there are only clues, and not absolute proof. We would love to have certainties, but reality is complex, and won't easily bend to our wishes.

There is still a lot of unawareness with respect to SARS-CoV-2. Studies of its proteins indicate, for example, that this virus, which is necessarily parasitic, has a mechanism for building its proteins by mirroring those of the host in which it lodges. It uses the host's cellular machinery to build itself. And, based on this criterion, the choices made resemble more closely those carried out by the cellular machinery of a snake than any other animal.⁶

It is therefore possible that SARS-CoV-2, which undoubtedly originates from a bat coronavirus (96% of its genome is identical to that of a bat coronavirus), traded genetic informations with rabies virus, and then remained a while in a snake, where its toxic protein sequences would have gained a few folds, to reach an unknown intermediate host, possibly a pangolin, in which, incidentally, it would have acquired an

6. JI et al, 2020 and TIMMER, 2020.

even more effective version of its first key. And wow, from there it was equipped to pass on to a human.⁷

It's a possible scenario. But for now, we have no clue about the exact origin of SARS-CoV-2 genetic specificities. Meanwhile, one thing is certain: there is no need for the intervention of a malevolent human genius to create a virus as harmful as SARS-CoV-2; at this level, viruses are fully capable of managing on their own.

I think we made a mistake in believing that viruses were not alive. I believe we can seek inspiration from the Indigenous peoples of the Amazon, who have long claimed that every living form is imbued with intelligence, and that there are many invisible entities who are alive and intelligent, who are pathogenic and able to reproduce within the human body. These are the famous virotes, kinds of invisible arrows that the shamans fling from a distance.⁸

For the Amazonians, it's clear that the invisible world can be dangerous. Plants and animals can be just as dangerous. They don't have this notion of a protective and nurturing "nature". They see a vast array of beings, among which some are dangerous, with whom it is convenient to negotiate.

From my point of view, if we must fight against an intelligent entity, we can only gain from knowing that it is intelligent. That's one of the reasons why we should associate science with Indigenous knowledge.

P.S.: Viruses show themselves in all their shapes. They might resemble small batons, sculpted diamonds, satellites, or spaghetti. Some scientists estimate that hundreds of millions of virus species exist on this planet, but nobody has counted them. In fact, for the time being, scientists have mainly focused on the human disease-causing viruses, of which there are around 200 species, which is a tiny fraction of the world's viruses.

So it happens that many viruses play a fundamental role in regulating ecosystems. Viruses keep bacteria in check, as they are their main predators. In the oceans, the antibacterial activity of viruses allows for

7. LI et al, 2020.

8. CHAUMEIL, 2002.

the oxygen-producing plankton to thrive, providing half of the planet's oxygen.

In addition, viruses help control insect overpopulation. When one species becomes dominant, a virus will tend to emerge to push it back, creating space for all the rest to live. In this way, viruses help maintain biodiversity.

They (the viruses) also keep healthy microbiomes in the animals' bodies, including humans, which is essential for our health.

Finally, viruses hold the gift of inserting their genetic material into the genomes of other species. Up to 8% of the human genome has been accumulated in this way. The majority of these genetic transfers are harmless. However, sometimes, these genes of viral origin play new functions. For instance, a long time ago, a viral gene played a fundamental role in the development of the mammalian placenta, without which we might still be hatching eggs. By transferring genetic information across species, viruses act as evolution boosters.

Viruses are one of the most creative forces in life. They assist ecosystems functioning, control bacteria, contribute to healthy bodies, regulate overpopulation, maintain biodiversity, and accelerate evolution. They are an integral part of the biosphere living fabric. Without them, we wouldn't be here.

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Clara began manifesting through artistic expression, (Theatre, ceramics, installation), the path continued in the search for knowledge and experience in the areas of regeneration and agroecology. Now seeking to weave art, traditional ecological knowledge, education and community engagement through the co-creation of the project **CECAI, Centro de Convergências**.

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