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Coronavirus: A challenge that influenced nearly all fields of science

Aditya Anil Kadam

thesolarstepuniverse@gmail.com

Rajarshi Shahu Autonomous College, Latur, Maharashtra

ABSTRACT

While the world was busy in fighting over toilet papers, scrolling the memes down the social media, binge watching TV all day long and getting beaten up by police for getting outdoors, there were some people in white coats out there who were working for day and night in the laboratories all around the globe. It was first used in print in the year 1968 by an informal group of virologists in the journal Nature to designate a new family of viruses. The name refers to the characteristic appearance of virions (which is the infective form of the virus) by electron microscopy, which have a fringe of large, bulbous surface projections which make the structure of virus resemble the structure of solar corona or halo. This morphology in coronavirus is created by the viral spike peplomers, which are proteins on the surface of the virus. Out of the wide range of coronaviruses the one causing COVID-19 in humans and which also is the biggest challenge for science is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 or better said SARS-CoV-2. We are unaware of the reason, but the spikes on the surface of coronavirus are just the right shape to lock onto these ACE2 enzymes and bind tightly. Scientists of many fields have jumped in the race to defeat the coronavirus. But what is the use of this in the fight against coronavirus? The whole world is in the midst of a COVID-19 pandemic. When a safe and effective vaccine is found, COVAX have decided to facilitate the equitable access and distribution of these vaccines to protect people in all countries.

Keywords: Coronavirus, COVID-19, Viruses, Microbiology, Quantum Biology, Quantum Computers, Health, Pandemic

1. INTRODUCTION

Lockdown all over India got declared in March 2020 and everyone of us got locked in houses. Lives became like pet puppies , staying home all day long, getting said “No” whenever we get closer to strangers and getting too much excited about outdoor rides. There ‘used to’ exist a time when we used to eat cakes whose candles were blown by somebody else. Good times, weren’t they? Today we look at a simple sneezing person with gaze filled enormous amount of fear and doubt. Coronavirus changed our lives for true!

While the world was busy in fighting over toilet papers, scrolling the memes down the social media, binge watching TV all day long and getting beaten up by police for getting outdoors, there were some people in white coats out there who were working for day and night in the laboratories all around the globe. They were trying to find out what actually is this coronavirus which is causing the mayhem called COVID-19. Back in 1892, Dimitri Ivanovsky realised that some diseases are not caused by either bacteria , fungi or by protozoans, but they’re caused by some different infectious agents. He also observed that these infectious agents are submicroscopic i.e. we can’t see them even below a compound microscope. Then came a man in this show whose name was Martinus Beijerinck. He studied the mystery of that so called submicroscopic infectious agent and gave it the name VIRUS. He described it as “ *Contagium vivum fluidum* ” Meaning ‘Contagious Living Fluid’ The origins of the word VIRUS lie in the Latin word *vīrus* or Sanskrit term *viṣa* both meaning poison. The viruses are absolutely no less than poisons. Coronaviruses that affected animals were discovered back in 1920s, but the coronavirus that affected humans, was discovered in the year 1960.

The name “coronavirus” comes from Latin *corona*, meaning “crown” or “wreath”. This name was coined by June Almeida and David Tyrrell, who had first observed and studied human coronaviruses. It was first used in print in the year 1968 by an informal group of virologists in the journal Nature to designate a new family of viruses. The name refers to the characteristic appearance of

virions (which is the infective form of the virus) by electron microscopy, which have a fringe of large, bulbous surface projections which make the structure of virus resemble the structure of solar corona or halo. This morphology in coronavirus is created by the viral spike peplomers, which are proteins on the surface of the virus. The most recent common ancestor (MRCA) of all the coronaviruses on Earth is estimated to have existed as recently as 8000 BCE. Some models place the common ancestor as far back as 55 million years or more which employ long term coevolution with bat and avian species. Many human coronaviruses have their origin in bats, as bats provide them with an ideal natural gene pool. In a wide sense, coronaviruses are a group of related RNA viruses that cause diseases in mammals and birds. In humans and birds, they cause respiratory tract infections that can range from mild to lethal. Mild infections may include common cold. Lethal varieties may cause SARS, MERS and COVID-19. Yes, the third one you just read is the one which made us stay indoors for more than 4 months. In this essay we're focusing on COVID-19, because it has been declared as a scientific challenge. Out of the wide range of coronaviruses the one causing COVID-19 in humans and which also is the biggest challenge for science is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 or better said SARS-CoV-2. It was first identified in Wuhan, China.

The SARS-CoV-2 is just 120 nanometres across. You could fit a hundred million viral particles on the head of a pin and yet you'd only need to be exposed to a few hundred to get infected. If you'd get exposed and the symptoms show up, then the disease you get is called "COVID-19". Its core is a simple single strand of ribonucleic acid (RNA). This RNA stores all the genetic information needed for the virus to reproduce. We may describe it as an instruction manual to make COVID which is just 30,000 letters long. A human-building manual, if you compare, comes in form of DNA and is 6.4 billion letters long. This is just because of the level of complexity. We're large, we're complicated and clever. Coronavirus isn't. Yet it has us on the run! It is nearly controlling our lives! When the pandemic broke, first thing advised was the use of mask. Indeed, the virus possesses superpower of travelling through air. The way the virus spreads is mainly through coughs and sneezes. If somebody who is currently infected with the virus, sneezes or coughs near you, out will come a cloud of viruses. If you're unlucky enough to inhale just a few hundred particles, then they could get into your nose and in no time, will start looking for cells to invade. The positive side is that our body has evolved numerous defences to protect us against just such threats; but the bad news is that our body has a fatal flaw. On the surfaces of many cells of our body there is an enzyme named ACE2. These enzymes play crucial role in controlling the blood pressure. There do exist some drugs which control blood pressure by inhibiting these enzymes (ACE Inhibitors). They do so by binding ACE2 enzymes on the surface of blood vessels, causing them to relax and resulting into fall in blood pressure. We're unaware of the reason, but the spikes on the surface of coronavirus are just the right shape to lock onto these ACE2 enzymes and bind tightly. It's just like inserting a key into a lock and turning. By this, the human cell opens up and the virus slips in. These kinds of enzymes, which in some sense, act as gates for the entry of coronavirus, are found throughout the body, including lungs, throat, eyes and nose. This is why you should wash hands whenever you've been outside and resist the urge to touch your nose or rub your eyes before doing so.

Scientists of many fields have jumped in the race to defeat the coronavirus. Quantum computing is an area of computing which is focused on developing computer technology based on the principles of quantum theory (which explains the behaviour of energy and material on the atomic and subatomic levels.) General computers that we use today can only encode information in bits that take the value of 1 or 0, resulting with limitations in their ability. Quantum computing, on the other hand, uses quantum bits (qubits) It harnesses the unique ability of subatomic particles that allows them to exist in more than one state i.e. a 1 and a 0 at the same time. Superposition and entanglement are two features of quantum physics on which these supercomputers are based. But what is the use of this in the fight against coronavirus? The quantum phenomena of physics might be observable in the messy world of living systems is historically a fringe idea. While quantum theories accurately describe the behaviour of the individual particles making up all matter, scientists have long presumed that the mass action of billions of particles jiggling around at ambient temperature drowns out any strange and weird quantum effects. By billion particles we mean the coronavirus too. If we assume the human body as a mechanical system, our physiology and internal mechanisms have a lot of variables. In general, we test the vaccines developed by us on the guinea pigs or mice to predict their effects if they are to be used on us. We can't use real living human being to test the vaccine. But what if somehow we become able to imitate the human body itself by virtual means? Quantum computers have been able to advance the building of "Virtual Humans" and they've developed complete simulations of human body such as HumMod which have more than 1500 equations and 6500 variables which represent body fluids, circulation, electrolyte, hormones, metabolism and skin temperature. If we'd use these virtual humans to predict the effects of the vaccine, this would not only shorten the time taken to conduct the clinical trials but would also improve their quality and accuracy. We will be able to gain useful insights into the results too. If we talk fundamentally of nature, it is all quantum mechanical from photosynthesis to nitrogen fixation in plants. So, in order to tackle molecules such as the viruses there can be no other better way to model the problem on a quantum computer and conduct extensive research on the same, isn't it?

The whole world is in the midst of a COVID-19 pandemic. World Health Organisation and partners have been working together on the response since more than an entire year. They track the pandemic, advise on critical interventions, distribute vital medical supplies to those in need and for sure, they are racing to develop and deploy safe and effective vaccines. We all know various vaccines discovered on various diseases save millions of lives every single year. Vaccines work by training and preparing the body's natural defences, which is scientifically termed as the immune system, to recognize and fight off the viruses and bacteria they target. If the body is exposed to those disease-causing germs later, the body is immediately ready to destroy them, preventing illness.

There are currently more than 60 COVID-19 vaccine candidates in the race of clinical development and over 170 in the race of pre-clinical development. WHO is working in collaboration with scientists, business, and global health organizations through the ACT accelerator (Access to COVID-19 Tools Accelerator; A Global Collaboration to Accelerate the Development, Production and Equitable Access to New COVID-19 diagnostics, therapeutics and vaccines) to speed up the pandemic response. When a safe and effective vaccine is found, COVAX (led by WHO, GAVI and CEPI) have decided to facilitate the equitable access and distribution of these vaccines to protect people in all countries. People most at risk will be prioritized. While we work towards rolling out a safe

and effective vaccine fairly, we must continue the essential public health actions to suppress transmission and reduce mortality. Pfizer and BioNTech's BNT162b2/COMIRNATY Tozinameran (INN) vaccine which works by using Nucleoside modified mRNA is the first vaccine approved by WHO against COVID-19.

At the end, we believe that this hard time of will pass too. This was not merely a pandemic but also a lesson for humanity. Along with vaccine, periodic washing of hands with soap or handwash for 20 seconds, use of masks that cover nose and mouth properly and maintaining social distancing when we get outdoors in crowded places are the habits and in some sense, weapons against the Coronavirus that will protect us from the pandemic.

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