



KNOW BEL

ENLIGHTENING THE NOBLES !

Issue No. 6 | June 2020



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Enlightening the nobles !



WELCOME !

To the sixth issue of KNOWBEL.

We are back with the sixth issue of Knowbel magazine to quench your curiosity with loads of knowledge and fun.

In the wake of the global pandemic we seek to revitalize your minds with entrancing games in this issue to boost up your ardour.

Let's fight off Coronavirus and break through the shackles of boredom.

Stay home & Stay safe !

SPECIAL THANKS TO

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WONDERELLA

NEVER STOP QUESTIONING

Image by Raman Oza from Pixabay

IQ - IS IT AN EFFECTIVE TOOL FOR MEASURING "INTELLIGENCE"?

IQ or Intelligence Quotient is a term that usually describes the fluid intelligence which is the ability to reason, and think logically /abstractly. It is widely recognised as a tool for identifying geniuses or intellectually disabled people. However, there are debates on whether this method actually works . An IQ test includes a lot of sections which not only test quantitative/ logical /analytical reasoning but also linguistics or language fluency. So, a person who is not fluent in a particular language might get a lower overall score on the test (it is thought that Richard Feynman , who is one of the greatest physicists of all time, scored low in this test because of the language section). Also the correlation between IQ and success in life is debatable. IQ seems to be the best parameter which we have right now to determine success in various jobs (for example it is said you must have an IQ of 120+ to succeed in science/engineering fields). However the correlation is about 0.4-0.5(which is not too high). To say that data actually signifies a trend (that is, greater IQ implies greater success), we have to have a strong correlation (at least 0.8 or 0.9). Another reason why IQ scores might not be considered legitimate is because nowadays , people are becoming more and more familiar with puzzles which are asked in IQ tests. This means they have experience in solving those questions, so the "raw" fluid intelligence can't be tested. It has also been observed that the average IQ has risen by about 3 points every decade since the 20th century. An IQ rise has been observed in Japan, South Korea and western European countries. Some studies seem to suggest a reverse flynn effect in Norway, Britain, France etc. However, if there is an increase in "intelligence" or intellect, it is not known.

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02 - NEWEST “LARGEST VOLCANO” IN HAWAII

Two hill peaks rise about 170 feet(52m) above sea level. However, these peaks are above a massive mountain of magma, called Pūhāhonu, the single largest volcano on earth. Pūhāhonu, which means “turtle rising for breath” in Hawaiian , is a part of the long chain of undersea mountains and volcanoes that stretch from the Hawaiian Islands to the eastern edge of Russia. Mount Loa, the gently sloped volcano that is located on Hawaii’s Big Island, was designated the world’s largest volcano before Pūhāhonu was given the title. From its base to its top, Mount Loa is about 9170 meters tall, making it taller than Mt. Everest. However, using sonar and gravity detectors, researchers have found that Pūhāhonu contains about 36,000 cubic meters of rock. This is twice the volume of Mount Loa. Only about 30 % of that volume is actually visible above the sea level. This volcanic mountain is so massive that it has actually caused the crust beneath it to sink by hundreds of miles since the volcano formed 14 million years ago. In a study, researchers collected and examined olivine from various parts of the volcano. Olivine is a mineral which forms when magma cools and crystallizes. Estimating the temperature of the volcano before the magma crystallised, a value of 1700 degrees Celsius was obtained, which is the hottest recorded magma temperature on earth.



IMAGE BY ADRIAN MALEC FROM PIXABAY



IMAGE BY PEXELS FROM PIXABAY

03 - VIRUSES - WHAT ARE THEY?

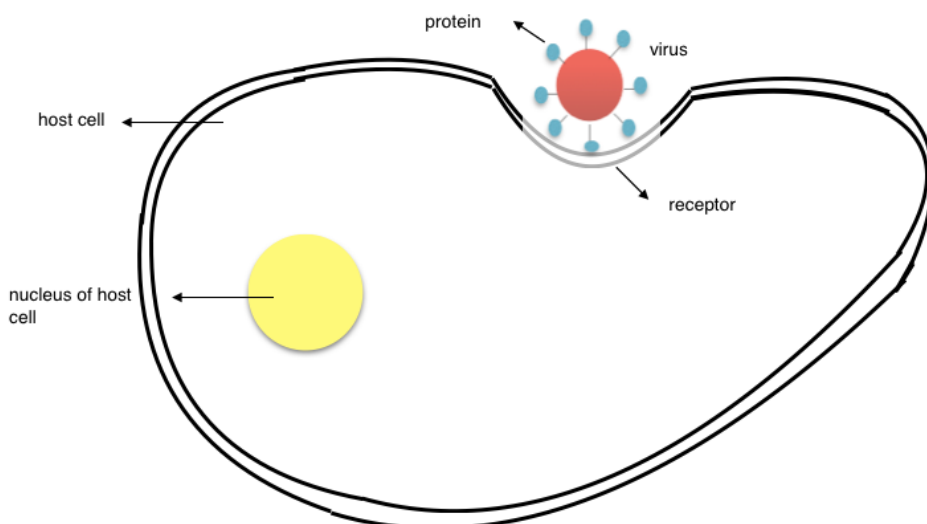
We all blame the corona virus for all the difficulties we are facing today. But, what are viruses? How do they live and die? Viruses are thought to be neither living or dead. This is because they are inactive till they have infected a host. Viruses were discovered by Dmitri Ivanovsky and were described as “non bacterial pathogens” that were found to infect tobacco plants. The origin of viruses is unknown, some think that they may have evolved from fragments of DNA , called plasmids, that can be transferred between cells. Some others believe that viruses may have originated from bacteria. When a virus isn't inside a host cell, it is an independent particle called a virion, which contains the genetic material (DNA or RNA) enclosed in a protective coat made of proteins. The stages of infection of a virus involve the following:

1) Attachment: This step involves the proteins in the protein coat of a virus. The virus attaches itself to a specific receptor of a cells outer boundary (see the diagram below). Think of it as a lock and key mechanism.

2) Penetration: After the “key is inserted into the lock”, the virus enters the cell . The genetic material of the virus is released inside the cell. Plant and bacterial viruses have to penetrate the cell wall surrounding the cell (this feature is absent in animal cells).

3) Replication: The host cell begins replicating the viral DNA/RNA. Hence, multiple copies of the virus are created and released into the external environment (as the cell bursts releasing the daughter viruses). These progeny viruses then go on to infect other cells.

It is said that there are about 1031 types of viruses discovered on earth. If laid end to end , they'll make a line 100 million light years in length (i.e. light would take 100 million or 10 crore years to travel the line). Many viruses are bacteriophages, i.e. they infect bacteria. It is estimated that there are about 1028 bacterial species on earth (i.e. 1000 viruses for a bacterium), and that about 20-40 percent of those are killed by viruses!



04 - COVID-19 IN INDIA- WHAT JUST HAPPENED?

- India's COVID cases have grown swiftly to outgrow China's tally and as of 24th May, 2020, India has over 1,33,000 cases.
- The number of cases has been doubling almost every 13.3 days. However, due to the lockdown rules being relaxed, the rate of infection would most likely increase exponentially.
- India has performed over 3 million tests. However, there are much fewer tests per million (as 3 million tests for a population of 1.37 billion is far too less).
- Maharashtra remains the worst affected state followed by Tamil Nadu and Gujarat. Mumbai is the worst affected city.
- The death rate in India is around 3 percent. At the time at, which it overtook China (in terms of the total cases), India's death rate was lower than China.

The study will involve nearly 10,260 human volunteers. and has 3 phases:

1) PHASE-I : It began in April and involved a trial on healthy adult volunteers.

2) PHASE-II : A greater age range of people will be covered in this study. These age groups are:

- Between 5 to 12 years
- Between 56 to 69 years
- Over 70 years

3) PHASE-III: This phase will focus on how the vaccines work on people over 18 years of age. The adults in both this and the second phase will randomly receive ChAdOx1 nCoV-19 (in one or two doses) or a licensed vaccine called MenACWY. Professor Andrew Pollard, the head of the vaccine group at Oxford says "the clinical studies are progressing very well and we are now initiating studies to evaluate how well the vaccine induces immune responses in older adults, and to test whether it can provide protection in the wider population".

However, the researchers estimate that there is only a 50 % chance that the vaccine might be developed successfully as the cases of cover in Britain are dropping quickly, and hence there might not be enough people to test the vaccine on!



IMAGE BY GERD ALTMANN FROM PIXABAY

ALL GRAPHS BELOW ARE FROM <https://www.worldometers.info/coronavirus/>

LOCATION	GRAPH (FOR ACTIVE CASES)	CONCLUSION FROM GRAPH
USA	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • deaths have almost reached 100,000 • active cases have started to slow down in their rate of increase
BRAZIL	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • sudden burst of cases recently • the exponential growth phase has just begun • about 1.5 lakh people have recovered
RUSSIA	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • sudden exponential rise in the number of cases • number of active cases seem to be growing slow lately • low death rate at about 1.02 % (as of 25th May 2020)
SPAIN	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • active cases have been decreasing • about 57,000 active cases left • has begun lifting lockdown restrictions
ITALY	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • active cases decreasing • still has one of the highest death rates, at about 14.28 % (as of 25th May 2020)
INDIA	<p>Active Cases (Number of Infected People)</p>	<ul style="list-style-type: none"> • sudden growth of cases (about 6-7 thousand each day) as lockdown restrictions are being lifted gradually • needs to increase testing • death rates lower than countries with almost the same number of cases.

06 - COVID-19 VACCINES . . .

BY - DRUVANSHU PARMAR

The WHO declared the coronavirus outbreak to be a public health emergency of international concern on 30th January 2020. Speaking of notable symptoms, 80% have moderate ones while 20% have shown signs of pneumonia, acute respiratory distress syndrome (ARDS), sepsis and many more. Lastly, it has also taken lives of the ones with low immunity.

Severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2), the causative virus of the pandemic, belongs to genus *Betacoronavirus* (β -CoV) of the family Coronaviridae. SARS-CoV-2 harbors a linear single-stranded positive sense RNA genome, encoding 4 structural proteins [spike (S), envelope (E), membrane (M), & nucleocapsid (N)] of which S is a major protective antigen that elicits highly potent neutralizing antibodies (Nabs), 16 non-structural proteins (nsp1-nsp16) & several accessory proteins. As no antiviral drugs or vaccines are currently available, urgency in development of vaccines is necessary to curb the pandemic.



IMAGE BY GERD ALTMANN FROM PIXABAY

VACCINE STRATEGIES FOR COVID-19

Traditionally, vaccines pertaining to a given disease is made from the corresponding pathogen responsible for the disease. The pathogen (bacteria or virus) is cultured in laboratories. The pathogens are weakened by processes so that they don't have much effect on the host organism. Now there are four such mechanisms used to achieve this task:

1. **Altering the genes of the organism so that it replicates poorly.** For viruses, this is achieved by what is known as **cell culture adaptation**. In this process, the viruses are forced to grow in specialized cells cultured in lab, apart from their normal growing conditions. This forcing results in the changes in the genetic structure. Vaccines for measles, mumps, etc. were made by this approach.
2. **Destruction of the genetic material to avoid any replication.** Agents like formaldehyde are used for this purpose. This is how Polio vaccine was made.
3. **Usage of a part of the genome.** This makes the replication process inactive. Hepatitis B was treated via this process.
4. **Extraction of the generated toxins and successive purification.** The purification process makes the material harmless. This technique is preferred for those bacteria which causes diseases by toxin secretions apart from cellular replication.

Having weakened the pathogens, these are injected into the human body. The organisms contains molecules known as antigens, which are detected by the immune system. By doing so, the immune system is trained to identify them as invaders; and thereby generates antibodies to destroy those cells. Thus, when the actual active virus/bacteria enters the body, the human body is capable enough to tackle it by generating appropriate antibodies.

But when it comes to novel COVID-19, scientists are adopting a new strategy called Vaccine Rapid Response Platform (VRRP). For this method, the genetic sequence of the virus is being extracted. After careful analysis of the sequence, a part of it is separated and injected into animals (lab rats).

In response to the sequence transferred, the animal body generates antibodies. The generated antibodies are then transferred to the human body.



IMAGE BY RICHARD DUIJNSTEE FROM PIXABAY

The VRRP works quite differently. Contrary to traditional methods, instead of the actual organism, the genetic instruction is transferred to the cells to generate antibodies. It relatively saves time, because you don't have to culture the entire virus in labs. Secondly, it's easier to combat mutations of the virus because mutant ones can be handled by changes in the sequence used.

Based on VRRP, multiple SARS-CoV-2 vaccine types such as DNA-, RNA-based formulations, recombinant-subunits containing viral epitopes, adenovirus-based vectors, etc. are under development -contrary to the traditional purified inactivated virus vaccines. VRRP vaccines are able to be produced owing to the online release of the genetic data of the SARS-CoV-2 virus by Chinese researchers. Thus, having discussed the approach used, hereby are mentioned the vaccines that are been suggested for treating coronavirus.

"POSSIBLE" VACCINES

1) Moderna Vaccine

The CEPI (Coalition for Epidemic Preparedness Innovations) has announced three programmes to develop the vaccine against COVID. The virus used by CEPI is the Middle East Respiratory Syndrome (MERS) coronavirus via VRRP to speed up the vaccine development. The Moderna labs have manufactured an mRNA vaccine in collaboration with NIAID (National Institute of Allergy and Infectious Disease) The vaccine synthesized in Moderna is called mRNA-1273. Scientists at Moderna and NIH, while working on the genetic data, isolated the sequence of a key protein called the Spike protein. The sequence of this protein was injected in the body via mRNA strands and the immune system is instructed to develop the Spike protein. The immune cells recognizes the protein and generates corresponding antibodies.

The biotech company had claimed that the trial conducted in March has yielded positive results on 8 people as they developed protective antibodies against the virus. The company is planning a wide scale trial to further test the efficacy of the vaccine which is slated to begin in July.

2) Inovio vaccine

Inovio is another CEPI project working on MERS virus which advances in generating the DNA vaccine INO-4800 via VRRP. Its working is similar to one of Moderna, except here the transfer agent is DNA. INO-4800 was also seen targeting the major surface of antigen Spike protein of SARS-CoV-2 virus. The vaccine is shown to generate efficient antibodies in mice and guinea pigs. INO-4800 is considered another promising COVID-19 vaccine candidate; clinical trials begun in April by dosing 40 healthy participants. After giving shots with a 4 week gap, the Inovio pharmaceuticals are expecting results to be out by end of June.

3) Queensland vaccine

This is the third CEPI project for COVID vaccine with University of Queensland which has developed the “molecular clamp” vaccine platform. When we consider enveloped viruses like Influenza, these have proteins on their surface that fuse to host cells during an infection. These surface proteins are antigenic in nature and are quite unstable. Hence, one vaccine approach is to synthesize these proteins on their own such that they elicit an immune response. However, they tend to change shapes when expressed on their own; this modification makes it different in appearance from the actual ones present on the virus. The modified form is called “post-fusion form”, and the original one is the “pre-fusion form”. Consequently, the immune response induced doesn’t produce efficient antibodies. Hence, to resolve this issues, polypeptides called molecular clamps are used. These polypeptides binds to the surface protein, and forms a quaternary structure with other viral proteins. This reduces the energy of the configuration, thereby making it difficult for the protein to change shape. The University of Queensland developed a process to synthesize such “clamped” proteins of SARS-CoV-2, which was purified and manufactured into a vaccine. Phase 1 clinical trials of this vaccine is being carried out.

4) Oxford vaccine

Oxford vaccine, called ChAdOx1 nCoV-19 is made from a virus named ChAdOx1 which is a weakened version of a common cold virus (adenovirus) that causes infections in chimpanzees. Genetic material has been added to ChAdOx1 construct, which is used to make proteins from the SARS-CoV-2 virus called Spike glycoprotein, which is important for the virus’s pathway. The virus uses its spike proteins to bind to ACE2 receptors on human cells and gain entry into the cells, infecting the cells.

Oxford has carried out trials to test their vaccine by using another vaccine called MenACWY as control. The MenACWY vaccine is a licensed vaccine against group A, C, W & Y meningococcus given to protect against meningitis and sepsis. Oxford researchers used this as control because they expected minor side effects from ChAdOx1 nCoV-19 such as sore arm, headache and fever. If not used MenACWY vaccine, the test subjects would be aware of the ChAdOx1 nCoV-19 vaccine given which the researchers claim would lead to a biased results.

Oxford has started preparations of a phase 2 of the clinical trials despite results of phase 1 not being out yet. The researchers at Oxford claimed to have successful results of their vaccine on six chimpanzees. But many researchers suspect the inefficiency of the vaccine. Based on a full report of the trial results, it was deduced that the vaccine actually didn't prevent the animals catching the virus but it reduced the severity of the virus.

In the Oxford monkey trial, the six vaccinated monkeys were exposed to the virus. With a control of three non-vaccinated monkeys, these were monitored for seven days. Three of the vaccinated monkeys showed increased breathing rates which is considered a COVID symptom; an autopsy confirmed the presence of virus in the lungs. But having shown zero signs of pneumonia, this vaccine is treated as partially protective one.

Despite negative results on animals, some experts have "cautious optimism" for Oxford vaccine, because they believe the test results to differ for humans. This optimism is owing to the production of antibodies within 28 days in animals, which being short in number are proving ineffective for completely curing the virus in the test subjects. Above all, the test results of human trials are still on wait.

5) Novavax vaccine

US-based Novavax with funding from CEPI developed the NVX-CoV2373 as its SARS-CoV-2 vaccine, of which human trials have been carried out. The vaccine is created using recombinant nanoparticle technology to generate antigen derived from the COVID spike protein & contains Novavax' patented saponin-based Matrix-M adjuvant to enhance the immune response & stimulate high levels of neutralizing antibodies.

Novavax based their vaccine production on an armyworm *Spodoptera frugiperda*. The Sf9 insect cell line can grow in apparent perpetuity after infected with baculovirus (BV). The BV virus can be engineered to carry one or more foreign genes of interest, so it can be used to 'program' (infect) Sf9 cells to efficiently produce the desired, correctly folded and biologically active proteins. Novavax researchers uses the Sf9 system to construct recombinant protein nanoparticle that have the potential to increased protection.

To make the vaccine, the genetic information of virus is analyzed to isolate a specific immunogenic surface protein. The protein is cloned into the BV, which infects the Sf9 cells forcing it to make the protein. The recombinant protein produced is modified and transported to the cell surface. Correctly folded and modified proteins are extracted and purified to maintain their 3D structure & biological activity, which is immunogenic molecule in the vaccine.

Phase 1 clinical trials of Novavax vaccine were taken in May, results are to be expected by July.

6) Sinovac vaccine

Beijing-based Sinovac Biotech Ltd developed the PiCoVacc vaccine, which has shown promising results in animal trials as it was successfully able to induce antibodies and make them completely free from the virus.

Sinovac commenced its vaccine production in January 2020 after the COVID outbreak. Researchers used a modified version of the full SARS-CoV-2 virus in its vaccine. To make the vaccine, Sinovac and others isolated SARS-CoV-2 strains from the Broncho alveolar lavage fluid (BALF) samples of 11 hospitalized patients. Specifically, a CN2 strain for purified inactivated virus was taken to synthesize the vaccine. The strain was chosen after a careful study of the phylogenetic tree of the SARS-CoV-2 populations. Sinovac conducted their first human trials on April 13, 2020 to check for the vaccine candidate's safety and immunogenicity.

7) Remdesivir

Remdesivir is a broad-spectrum antiviral medication developed by the biopharmaceutical company Gilead Sciences. Remdesivir (GS-5734) is a nucleoside analogue prodrug, which has inhibitory effects on pathogenic animal and human coronaviruses including SARS-CoV-2. Gilead has as of now has carried out up to 3 clinical trials following a 10 day course of the drug and has shown promising results. But owing to varied treatment times for patients (varying from 5 days to 10 days), it's still not licensed and approved globally.

8) Favipiravir

Indian pharmaceuticals Strides is about to start testing its drug Favipiravir which is considered a potential cure for COVID-19. It has been used in past in Japan to fight Influenza outbreak. Favipiravir, also known as T-705 or Avigan, is an antiviral agent which targets the RNA polymerase chain of RNA viruses thereby stopping its replication. It is also effective in rooting out certain strains of mutant influenza virus, apart from other RNA viruses such as bunyaviruses, filoviruses which have life threatening implications.

Although researchers strongly believe in effect of Favipiravir to cure COVID-19, it has been noted by Japanese health officials regarding its reduced effects on patients with severe symptoms.

BOTTOM LINE

Apart from the six above mentioned candidates, there are in general around more than 100 vaccines. Doctors are trying their best to treat the patients infected in their best possible way by various drug combinations. What we all can do from our own side is wait for the working vaccine to come up and until then practicing sanitization and social distancing to keep ourselves safe from the pandemic.



IMAGE BY AREK SOCHA FROM PIXABAY

FOR MORE INFORMATION SCAN THE QR CODE :



GOBBLE THE FACTS!

Get ready to guzzle down these interesting facts...

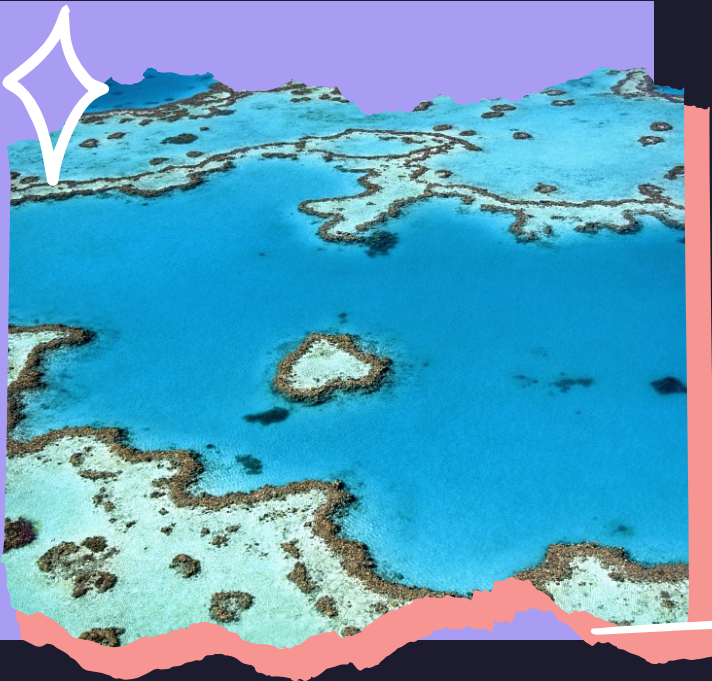


Image by Free-Photos from Pixabay

WORLD'S LARGEST LIVING STRUCTURE

The world's largest living structure isn't an enormous copse of trees or even a massive fungus—it's the Great Barrier Reef off the coast of Australia. The reef spreads out over an area of 133,000 square miles, and is so huge it can actually be seen from outer space.

THE OCEAN IS A MAGNET FOR HEAT.

"The ocean is the largest solar energy collector on earth," according to NOAA. The proliferation of greenhouse gases prevents heat from escaping our planet's atmosphere, and all that energy has to go somewhere—unfortunately, it goes straight into the oceans. As a result, ocean temperatures have rapidly risen over the past few decades.



Image by PublicDomainPictures from Pixabay

TSUNAMIS MOVE AT 500 MILES PER HOUR!

Tsunamis are triggered by seismic events and can, according to NOAA's Pacific Tsunami Warning Center, move across the ocean at speeds of 500 miles per hour when the ocean depth is 3.7 miles. These waves are usually unnoticed, as they are only a few inches above the surface. And as the waves move towards land—and the depths shrink—they pick up water and increase in above-surface size (but, thankfully, slow down)



Image by Elias Sch. from Pixabay

MOST OF EARTH'S VOLCANIC ACTIVITY HAPPENS IN THE OCEAN.

When it comes to volcanic activity, the oceans have the most going on by a wide margin. In fact, 90 percent of all the volcanic activity on the planet happens in the ocean, and the largest known concentration of active volcanoes is in the South Pacific. It's an area no bigger than the size of New York, but it contains a whopping 1,133 volcanoes.



Photo by Buzz Andersen on Unsplash

THE PLANET'S BIGGEST WATERFALL IS IN THE OCEAN.

The tallest waterfall you're going to see on land is Angel Falls in Venezuela (pictured), which has a drop of over 3,200 feet. But that's nothing compared to the Denmark Strait Cataract, which is an underwater waterfall in between Greenland and Iceland formed by the temperature difference in the water on either side of the strait. When the cold water from the east hits the warmer water from the west, it flows underneath the warm water, with a drop of 11,500 feet. According to the National Ocean Service, the flow rate of the waterfall is more than 123 million cubic feet per second, which is 50,000 times that of Niagara Falls.



Photo by Marie Rouilly on Unsplash

THERE'S AN INTERNET CONNECTION IN THE OCEAN.

For the past few decades, according to the Asia-Pacific Economic Cooperation, submarine cables buried deep within the oceans have carried more than 97 percent of intercontinental data traffic—meaning that overseas communication is made possible by ocean-based cables.



Photo by Thomas Jensen on Unsplash

JUNE 2020 | ISSUE NO. 6

THE QUIZOPEDIA

Are you ready to get your brain busted !

Quizopedia Reloaded

A brain-storming contest and a chance to become famous.

But hold your horses right there! Check out the instructions below before you begin :

Here we are with a new version of quizopedia to help you all enjoy your vacation with puzzles. Yes! We have upgraded the format of quizopedia to ease down your effort. Now all you need to do is fill up these boxes and send us a photo of completed crossword puzzle. Answers would be officially released via mail on 25/06/2020.

(Competition begins on 01/06/2020 at 6 pm)

The winners would be chosen based upon

1. No. of correct answers
 2. Time of submission
- Deadline : 20/6/2020

Quizopedia winner:

Unbeaten

Answers to the previous quiz have been mailed to the participants.

So let's begin...

Scan below or click on the QR code.



< D / CODE >

THERE IS ONLY ONE TRUTH !
BRING OUT THE SHERLOCK IN YOU.

D-CODE

Here is a chance to set the detective within you into motion! Rack your brains to decipher the code and arrive at the right answer. Your answer can be a single word or a phrase containing 2-3 words. Scan the QR code below to send us your findings. The top early-bird answers get a chance to be featured in our next issue and who knows, you might be one of them! **Competition starts on 01/06/2020, 6pm.**

Here comes the question:

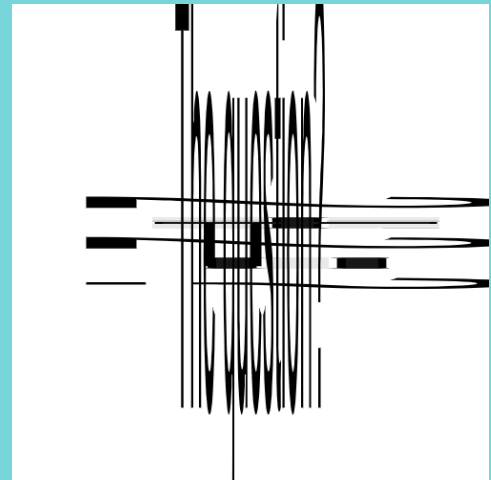
1.) The City?

1.)



2.) Try changing your angle of perception.

2.)



D-code Winner:

Unbeaten

Deadline: 20/6/2020

• QR code for hints : (Remember hints would be released 48 hours after the start of the contest)



• To submit your answer scan the following QR code :



INSPIRON



KNOWBEL

Enlightening the nobles !



MIND & SOUL



B. K. S. IYENGAR

*“My Body Is My Temple And
Asanas Are My Prayers”*



Illustration by Ritu

In the midst of the worldwide influenza epidemic in the year 1918, no one expected the frail, weak boy born in Belur to survive through infancy. You can't blame them as what could you expect from the eleventh child born to a woman ailing with influenza at the time of delivery?

Yes, Bellur Krishnamachar Sundararaja Iyengar suffered from health problems that would plague him for much of his childhood. He was prone to the diseases endemic to the area and suffered multiple bouts of typhoid, malaria, and tuberculosis. "My poor health was matched, as it often is when one is sick, by my poor mood," Iyengar wrote in his book 'Light on Life'. "A deep melancholy overtook me, and at times I asked myself whether life was worth the trouble of living." Iyengar's situation was worsened by the death of his father from untreated appendicitis when Iyengar was nine. The young boy did poorly in school, and he failed a critical English-language examination. The exam result brought his schooling to an end, and Iyengar's family began to wonder how the still sickly young man might make a living.

01. ENCOUNTERING THE CROSSROADS

Nevertheless, destiny had other plans. Shriman Tirumalai Krishnamacharya, Iyengar's brother-in-law, worked as a yoga teacher and scholar in the employ of an Indian noble family in the city of Mysore. When Iyengar was 16 years old, Krishnamacharya invited him to temporarily move to Mysore to look after the family while he was away conducting yoga classes in other parts of the region. This was when things began to change for the boy. Iyengar stayed on in Mysore and took yoga lessons from Krishnamacharya. In the beginning, he was anything but 'built for yoga' - he could barely get himself to reach his knees, much less his toes. Krishnamacharya's harsh teaching regime did not endear him to his students,

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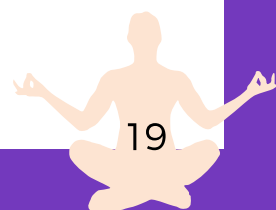




Illustration by Ritu

“

Yoga teaches us to cure what need not be endured and endure what cannot be cured.

”

who often sneaked away from their classes, and Iyengar, at first, was as unenthusiastic as the others. Though Iyengar had very high regard for Krishnamacharya and occasionally turned to him for advice, he had a troubled relationship with his guru during his tutelage. In the beginning, Krishnamacharya predicted that the stiff unhealthy teenager would not be successful at yoga. He was neglected and tasked with household chores. Only when Krishnamacharya's favourite pupil at the time, Keshavamurthy, left one day did serious training start. At one point, Krishnamacharya forced him to do a split-leg exercise for which he was unprepared and tore a ligament. Krishnamacharya began teaching a series of challenging postures, sometimes telling him not to eat until he mastered a particular pose. But Iyengar noticed that, for the first time in his life, he was growing stronger, and he persisted in his training.

02. A STRONG BACKING

As time passed, Iyengar took to taking independent yoga classes. At first, he had few pupils, and there were days when he subsisted on little more than rice and tea. Nothing would dissuade him, however, from his hours of daily practice. Iyengar's family, anxious to see him in a more settled existence, arranged his marriage to a 16-year-old girl named Ramamani. Initially, he refused to do more than meet her briefly, but the relationship flowered into marriage on July 13, 1943. Ramamani became a strong backer of Iyengar's enthusiasm for yoga, and the marriage was a long and happy one.





By Drümmkopf on flickr

03. A LIVING EMBODIMENT

Iyengar's unique ways of yoga teaching set him apart from other gurus. He believed that yoga was not a practice to be restricted to specialists but could benefit anyone, and he began to incorporate aids such as ropes, belts, and blocks into yoga routines for those who needed them. Over the years, many elderly people would flock to Iyengar's classes and accomplish feats of which they would not have believed themselves capable. Iyengar was, in fact, a living testimony to the idea that yoga could benefit the cure of even serious health problems.

04. THE UNUSUAL MEETING

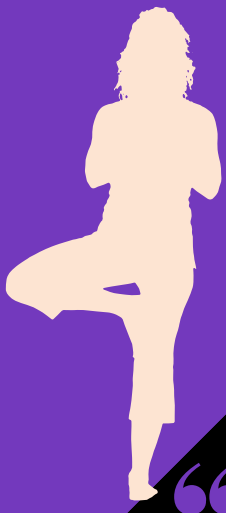
In 1952, Iyengar befriended the violinist Yehudi Menuhin, and this gave him the opportunity that transformed Iyengar from a comparatively obscure Indian yoga teacher into an international guru. At the meeting, Menuhin said he was exhausted and could spare only five minutes. Iyengar told him to lie down in Savasana (on his back), and he fell asleep. After one hour, Menuhin awoke refreshed and spent another two hours with Iyengar. Menuhin came to believe that practising yoga improved his playing, and in 1954 invited Iyengar to Switzerland. At the end of that visit, he presented his yoga teacher with a watch on the back of which was inscribed, "To my best violin teacher, BKS Iyengar".

“

Yoga does not just change the way we see things, it transforms the person who sees.

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“

*Yoga is a light, which
once lit, will never dim.
The better your
practice, the brighter
the flame.*

”



Illustration by Ritu

05. AN ETERNAL LEGACY

Even at the age of 90, Iyengar continued to practice 'asanas' for 3 hours and 'pranayama' for an hour daily. He also found himself performing non-deliberate 'pranayama' at other times. Iyengar died on August 20, 2014, in Pune, aged 95. Both his eldest daughter Geeta and son Prashant have become internationally-known teachers in their own right. To date, 'Iyengar Yoga' is practised all over the globe, and Iyengar's fond memory will remain etched in our hearts forever.



An interview with the trio,
Dr. Umakant Rapol, Dr. Sunil Nair
and Mr. Nilesh Dumre
from IISER Pune



Interview by
Knowbel Magazine

ASK THE EXPERTS

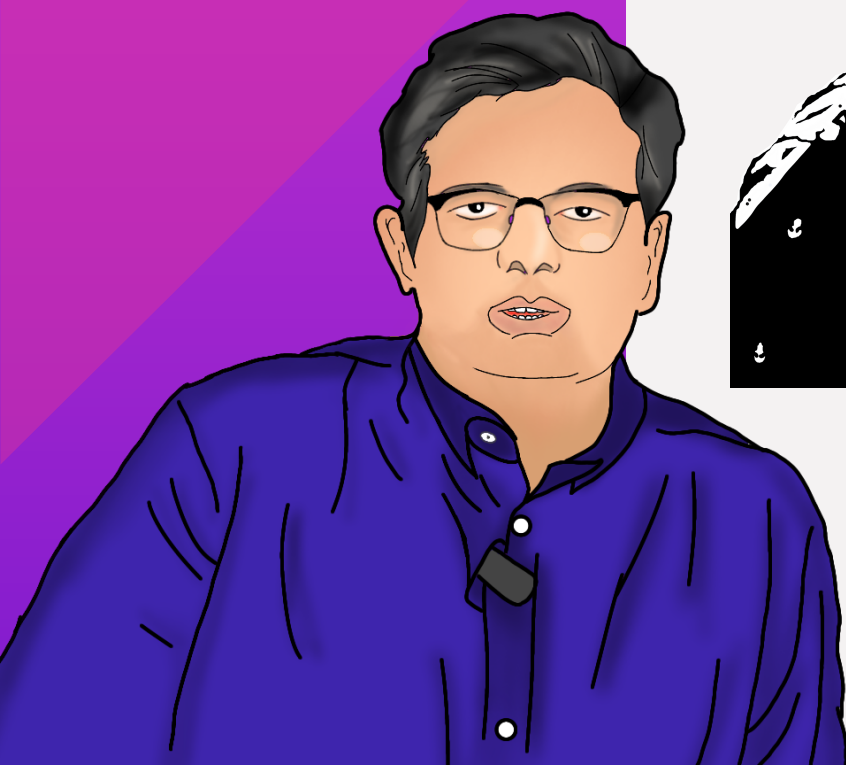


Illustration by Ritu



Illustration by Prajwal and Pradeep

In the midst of the COVID-19 pandemic, the trio of Dr. Umakant Rapol, Dr. Sunil Nair and Mr. Nilesh Dumre from IISER Pune was able to come up with a ventilator design that could reduce the price of ventilators from a few lakhs to less than 50,000 rupees!

They were generous to spend a few moments with our KNOWBEL team via video call. Here's what they had to say!



Illustration by Ritu

Most low-cost ventilator models seem to be lagging in some way when compared to the industrial models. Why do you think that is the case and what is the technical difficulty in developing something economical?

SN: The technology governing ventilators is quite well-established with a mainstream industry running on it. Hence, I don't really see a major challenge in the technological aspect. If adequate time and resources are available, one can build a ventilator model comparable to the commercial ones. The obstacle we faced, especially in this time of pandemic and lockdown, is that of time and resources. Besides, it also depends on the goal - Are you trying to make a really basic model or a little-more sophisticated one? How many products are you aiming to manufacture? All of these questions need to be considered. We started off with the MVM and Florida prototypes of ventilators. It is a long yet inevitable process - from designing an effective model to using it on a live patient. The MVM ventilator was approved in a record time of 40 days.

UR: A ventilator works on several complicated mechanisms. More importantly, it is a device capable of saving lives. This means that all the components - from the external design to electrical safety, from reliability to endurance - have to meet certain basic standards. However, in extreme situations like the current pandemic, most of the ventilator manufacturing firms do not have the capacity to meet the rising demand for ventilators. Hence, you need to select the essential features necessary for supporting a patient. In addition, the knowledge of the COVID-19 was limited at the time of the onset of its spread. Now, it is proven that the patients affected by COVID-19 do require the sophisticated features of the ventilator. Since their lungs are affected, their breathing is hindered and as a result, air needs to be artificially pumped in and out of their lungs. A ventilator is said to be in 'mandatory mode' when the function of inhalation and exhalation is completely taken over by it. However, COVID-19 patients do make an effort to breathe despite their weakened lungs. In such cases, the ventilator is built to sense whether the patient is inhaling or exhaling and accordingly assist in breathing. We now need these features in ventilators for COVID-19 patients. Nevertheless, one factor that subsides the cost is the endurance of the ventilator. Usually, the progress in a patient's condition is determined within a week and a ventilator is needed only in that particular span of time. Moreover, most regulatory agencies have realised the importance of rapid approvals and this has significantly speed up the production of ventilators. It is now specified that a ventilator must be capable of operating continuously for five days. All that said, we must ensure that we do not compromise on the essential aspects of the ventilator. You certainly don't want the ventilator giving up before the patient!

A unique feature of your model is that it can be remotely controlled using one's phone. This can help in reducing the burden on hospital staff. How did you come up with this idea?

UR: These ideas have been previously thought about by people. Even the MVM design had a remote-monitoring feature. We merely put it into implementation.

SN: This is a rather simple idea and executing it was quite easy. Honestly, we are amused by the kind of attention it is receiving. Anyone in this field of research would agree that this isn't a very difficult thing to do.

UR: The IoT revolution that notably contributed to the development of these facets.

SN: Especially in situations like the one we are in now, this feature is useful because the number of health-care workers is not enough to really take care of the incoming patients. We recently visited a hospital which had put up a huge screen displaying the various parameters of the patients. Doctors could monitor them without needing to move a lot. The new feature takes this one step ahead and now, you don't need to move at all to keep tabs on your patient's parameters.

On an average, the regular ventilator costs around Rs. 1.5 lakhs while your model, if mass-produced, can bring down costs to as low as Rs. 50,000. How did you manage to bring about this drop in price?

UR: We tried to procure the best available components from the local manufacturers. It just turned out to be economical. Lowering the cost wasn't our primary aim! Now, even if we implement the next level of improvisation (the 'pressure control mode'), it won't increase the cost significantly. One reason commercial ventilators are costly is that they hold several intellectual property rights over some critical components developed through research and development by companies. I can tell you first hand, as I myself worked in a multinational company before joining IISER Pune, that a lot of effort goes into development of these components.

Materials must have been hard to procure during the times of lockdown. How did you receive support? Did you have to use substitutes for materials that were unavailable?

UR: Strictly speaking, we did not use substitutes. We surveyed what was available during the lockdown and inquired with the respective vendors. Once it was clear that the project was possible, we began our work.

Our institute was very supportive in terms of funds and resources. In spite of having the necessary documents and permissions, it was indeed a risk to move around for the components during the pandemic but fortunately, it turned out to be worth the effort.

ND: We started looking for components once the decision of working on the model was made. In fact, some manufacturers turned us down outright. However, there were many who were extremely supportive of our venture as they saw the acute necessity of such ventilators. Due to the restrictions imposed by the lockdown, I had to accompany the vendor from his house to the shop and back to his house for acquiring every necessary component. SN : As a matter of fact, Nilesh stayed in the Guest House during those two weeks, despite having his house located on the campus, as a preventive measure. The attitude of vendors varied greatly. There was one vendor who refused to charge us for the component supplied! On the other hand, some vendors instantly cut all ties with us once they came to know that we were working on a project involving COVID-19.

A significant issue faced by most low-cost ventilator designs is their tendency to cause barotrauma, which ultimately does more harm to the patient's lungs than good. How does your model counter that issue?

SN: So Barotrauma basically refers to the condition when the pressure in the lung is higher than it should be or higher than what that lung can comply with. For example, the lung compliance of an ARDS (Acute Respiratory Disorder Syndrome) patient is much different than that of a healthy adult. Now that per se is dealable. However most of the elementary ventilator designs don't possess the required features to take care of this issue. On the other hand, more sophisticated electronic ventilators like the ones we are making, do possess adequate safeguards so as to ensure that the pressure which goes into the patient's respiratory canal is monitored carefully.

UR: So a ventilator's job is to control the patient's parameters and ensure that their values don't exceed a set extreme value. In case these extreme values are reached, you get an alarm. For example, in case the pressure in the lung exceeds the extreme value, a pop-up valve may release some air to reduce the pressure. Such a feature is called the 'closed-loop control' and only those ventilators possessing this feature are capable of adequately countering barotrauma.

What is the next step in the project? Are there any improvements you wish to make in the design?

SN: We are now in touch with clinicians. We visited hospitals where the doctors showed us the setup and that helped us understand the features we need to incorporate in the next round of modifications. This is critical as it is ultimately the clinician who is going to operate the ventilator and they are the ones who know the 'hierarchy' of operations. It was indeed a wonderful learning experience and we have now begun implementing the suggested features.

UR: Most of these modifications are with regard to the interface - attempting to make the design user-friendly. Apart from these additions in the software, we are working on the electronic pressure regulator. As we eventually proceed for the mass-manufacture of the machine, it will become more compact.

Ventilators usually come to the fore in a 'life or death' situation. So how does one effectively test such instruments?

UR: So there are these calibrated test lungs which are basically bags/balloons to which the contraption is attached and constant pressure is applied. One can measure the volume of air inside these lungs as well as the pressure using which one can calibrate the ventilator to the requisite standards. Of course, there are more expensive test lungs which cost around 40,000 USD and are capable of giving feedback to the ventilator as well. In short, you are first basically trying to simulate an actual human lung and then calibrate and test your instrument to the standards required for certified use in hospitals.

SN: As far as regulatory mechanism is concerned, there are currently 5-6 certified labs in India who can certify when a ventilator is ready to be in use. For us however, all that comes at a much later stage. Currently, the mode of testing is basically performing on test lungs as Umakant was mentioning earlier.

How has experimental research and especially lab work been affected due to the implementation of social distancing and lockdown measures? Has there been any weird social scenario which has arisen because of these conditions?

SN: The labs are shut!! All the PhD students have gone back home. Experimental research has hit a complete standstill. The physics lab currently has only the faculty members working inside and most of us aren't even working on our usual fields of research. Me and Umakant are working on the ventilators. Others are working on something else. All of us are trying to counter COVID-specific issues.

UR: We (faculty scientists) are still busy with these COVID specific projects. However, the most severely affected group are the senior PhD students who were writing their doctoral thesis or waiting for the last bit of experimental data to finish their work. With lab beings closed, their research has completely stopped. As for us, the routine business i.e writing papers and reports etc. has gone to the backseat as a result of the pandemic and this ventilator project.

So you have helped solve a significant problem in the medical stream. In that context, could you comment on the interdisciplinary nature of current scientific research and problem-solving?

UR: I feel that a significant amount of training, facilities and interest is lacking in the area of instrumentation science. It is a field that remains underrated while people take pride in talking about so-called 'sophisticated' ideas. We need to wake up and start acknowledging the contribution of experimental science to research as a whole. It broadens your perspective and prepares you to tackle any kind of situation.

SN: I completely agree with Umakant. There are several reasons for instrumentation not being high on people's priority lists - including long developmental periods. However, the set of skills one acquires are extremely valuable. Besides, why do we need to import everything from outside? We face problems merely because we are not manufacturing enough components ourselves and the root cause points to lack of instrumental experts.

Even while designing the ventilators, did you have to encounter certain basic social issues while working in the lab?

SN: Not really, there were only the three of us in the lab! So if any one of us gets tested positive, all three of us will be infected because we have been there together for weeks now! (laughs)

Would you like to share any memorable incidents of your journey these last few weeks?

SN: It has been a lot of fun. This is very different from our regular work. With work and meetings consuming a lot of time, we seldom tinker with instruments in the lab. This project gave us an opportunity to rediscover our student days. Moreover, this was not a standard research project with a fixed set of parameters. The modus operandi here was quite different and we had to have a working model in the end.



Thank you for reading our sixth issue. Hope you enjoyed it. To know more stay tuned to -

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