BioMer'21

Department of Biomedical Science

Acharya Narendra Dev College
(University of Delhi)

(Under the aegis of DBT-STAR College Scheme)

"COVID-19 Vaccine:From Bench to Bedside Amidst the Pandemic."

Special Thanks to
All the Students of
Biomedical Science and the
Members of Teaching and
Non-Teaching Staff !

BioMeR' 2021

The Biomedical Science Reporter

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"Cathexis"

The Student Society of Department of Biomedical Science

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Message from the Principal's Desk

It gives me immense pleasure to learn that the students and faculty members of Biomedical Science Department stayed undeterred with the trying times Covid-19 brought upon us and worked hard in putting together Department's magazine ***BioMer' 2021***. I can imagine the efforts and zeal taken to coordinate such activities and bring them to fruition.

Students' magazine is a wonderful opportunity and platform to showcase the talent and creativity of the students. Be it a solo act of writing a poem or an article or a group activity for laying out the content and the design, contribution of each kind is valuable and important. I am sure the experience earned during the process shall stay with all of you for a long time!

I extend my hearty congratulation to the contributors and the editorial team in this creative venture. My best wishes to all of you. Keep the spirit high and the momentum going.

Best wishes,

Dr. Ravi Toteja
Acting Principal,
ANDC

Message from Teacher In Charge

We turn 21 this year !

…amidst this extraordinaire période, when a tiny virus brings the world to a screeching halt with a tragic loss of human lives and crashing economy. But as they say, the show must go on! It is inspiring to witness the triumphs and challenges of Science and the human spirit. For the first time in history, research and development is bringing solutions in real time to a catastrophic event.

I extend my heartiest congratulations and appreciation to the entire editorial team of students for the immense efforts during this pandemic. The wonderful articles, showing laudable creative expression of thoughts and ideas and designing & editing of BioMer'2021 under the able guidance of teachers is gratifying indeed. Especially when writing on something new and less understood subject/experience could be a challenge. The magazine also compiles the various events organized in the past year leveraging the various online platforms.

This BMS Birthday shall be etched in our collective memory forever it seems. How we switched overnight to online classes and other academic activities with resilience and determination.

Happy Cathexis everyone!

Urmi Bajpai
TIC

Message from Guest Speaker

First of all, I congratulate the Department of Biomedical Science at Acharya Narendra Dev College for completing 21 years. I am very pleased to be a part of the Department function Cathexis' 2021. Having witnessed the journey and the growth of the department since its inception days, I am very happy to see the efforts put in by the students and faculty members to make it a sought-after undergraduate course.

With great pleasure, I congratulate the students, teachers and support staff at the Department of Biomedical Science a happy 21 birthday. Covid-19 pandemic has consolidated our faith in basic Science and its applications in managing diseases and healthcare. I believe students would put their efforts with greater determination and enthusiasm and make the most of the available opportunities to not only excelin biomedical science education, but also be responsible citizens and contribute to the scientific growth of the country and the world in the days to come.

With Best Wishes,

Prof. Daman Saluja
Director, Dr BR Ambedkar Center for Biomedical Research
Joint Director, Delhi School of Public Health
University of Delhi 110007

Message from Guest Speaker

21 years and counting. The Department of Biomedical Science at Acharya Narendra Dev College is now an adult and has so much to build on and so much to look forward to - —this has been an unprecedented year, but one thing that is now front and centre is the importance of science and technology.

The only reason we are able to look to the future with hope and confidence is because scientists like all of us have come together to solve problems at a scale and speed that we did not imagine was possible. By integrating the learning from traditional understanding of infectious diseases to cutting edge data algorithms, the scientific community has shown that through collaboration and sharing we can develop and use tools that enable us to address global catastrophes.

We must use this recognition of the importance of science to further enhance the promotion of science in all of our society. We have to build the next generation of leaders who will do more than we can imagine today, and this is why your advancement is essential to our collective future.

Wishing each one of you every opportunity for scientific growth!

Prof. *Gagandeep Kang*
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1.

Modus operandi of SARS-CoV-2

~Mrittika Adhikary (III Year)

What does it do in our body? How does it infect the organs and organ systems, and how does it cause harm to them?

The emergence of this novel coronavirus had caught the entire globe off-guard in 2020. While the alarm bells had started ringing in the December of 2019 itself, with a serious outbreak of pneumonia in Wuhan, China, few could have imagined the massive impact it will go on to have on the rest of the world. As of January 2, 2021, there have been 84,535,117 known cases worldwide, among which 1,834,963 cases have resulted in death. In India alone, the number of known cases were 10,305,788 with 149,218 deaths. However, it is far from unusual for microbes, in this case: viruses, to wreak such havoc in human lives over the history of mankind. Humanity has had to confront many such appalling pandemics and epidemics before, including the flu pandemics (influenza), HIV/AIDS pandemic, Bubonic plague, etc. So what is it about Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) that it is able to make its presence felt so profoundly at the present times?

SARS-CoV-2: Structure and genome

In order to understand the modus operandi of a criminal, one must be aware of the arsenal they have at their disposal. Similarly, a basic comprehension is required about the physical characteristics of the virus to see how it affects the human body.

Coronaviruses belonging to the family Coronaviridae are enveloped, positive-sense single-stranded RNA viruses. All of the highly pathogenic CoVs, including SARS-CoV-2, belong to the Betacoronavirus genus, group 2. The SARS-CoV-2 genome sequence shares ~80% sequence identity with SARS-CoV and ~50% with Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Its genome comprises 14 open reading frames (ORFs), two-thirds of which encode 16 nonstructural proteins (nsp 1–16) that make up the replicase complex. The remaining one-third encodes nine accessory proteins and four structural proteins: spike (S), envelope (E), membrane (M), and nucleocapsid (N). Spike mediates SARS-CoV-2 entry into host cells. It has a receptor-binding domain (RBD) that mediates direct contact with a cellular receptor, angiotensin-converting enzyme 2 (ACE2), and an S1/S2 polybasic cleavage site that is proteolytically cleaved by cellular cathepsin L and the transmembrane protease serine 2 (TMPRSS2).

- TMPRSS2 or Transmembrane protease serine 2 is a cell surface protein and an enzyme that gets “manipulated” into priming the Spike proteins and facilitates viral entry at the plasma membrane surface.
- Cathepsin L activates SARS-CoV-2 Spike in endosomes and can compensate for entry into cells that lack TMPRSS2.

Once the genome is released into the host cytosol, ORF1a and ORF1b are translated into viral replicase proteins, which are cleaved into individual nsps (via host and viral proteases: PLpro); these form the RNA-dependent RNA polymerase (nsp12 derived from ORF1b). Here, the replicase components rearrange the endoplasmic reticulum (ER) into double-membrane vesicles (DMVs) that facilitate viral replication of genomic and subgenomic RNAs (sgRNA); the latter are translated into accessory and viral structural proteins that facilitate virus particle formation.

Tissue tropism of SARS-CoV-2 : Respiratory tract

Tissue tropism is the cells and tissues of a host that support growth of a particular virus or bacteria. During both SARS epidemic and COVID-19, patients have often presented with respiratory-like illnesses that had advanced to severe pneumonia, This observation suggested that the lung is the primary tropism of SARS-CoV-2. Both coronaviruses were found to use the same entry receptor, ACE2.

Interesting to note here is that the Spike gene of SARS-CoV-2 is highly variable from that of SARS-CoV, sharing less than 75% nucleotide identity. The key mutations in the RBD of SARS-CoV-2 Spike make additional close contacts with ACE2, which correlates with higher binding affinity and justifies the supposedly higher infectivity of SARS-CoV-2. Another factor for increased human transmission events is the presence of a unique furin cleavage site at the S1/S2 junction of SARS-CoV-2 Spike, but there is much yet to be further investigated on this. The currently predominant variant of SARS-CoV-2 carries a D614G mutation that is absent from SARS-CoV and is associated with an increased viral load in the upper respiratory tract (URT) of patients with COVID-19, and an increase in human-to-human transmission efficiency.

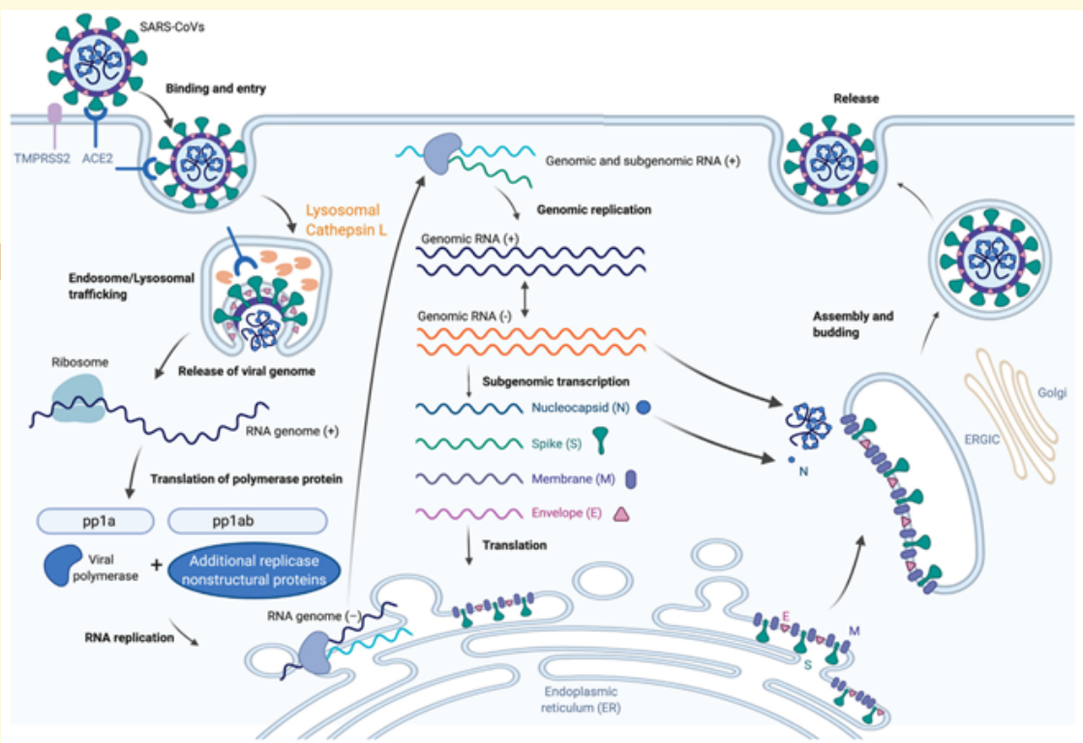


Fig. 1- The SARS-CoV-2 life cycle: The diagram above illustrates the process mentioned in this section into greater details. (Source: https://doi.org/10.1016/j.it.2020.10.004)

However, the D614G variant does not correlate with disease severity.

Once SARS-CoV-2 enters the host via the respiratory tract, it is suggested it mainly attacks type II alveolar cells (pneumocytes) with high expression of ACE2 and other proviral genes (virus genome that is integrated into the DNA of the host cell) for its productive replication. Just to remind the reader, there are two types of pneumocytes: type I covers 95% of the internal surface of each alveolus. These cells are thin and squamous and involved in the process of gaseous exchange. The type II cells are cuboidal and much less prevalent, they are found in between type I cells. These cells contain apical microvilli and characteristic lamellar bodies containing a surfactant that helps decrease the surface tension of alveoli.

However, ACE2 is weakly expressed on the surface of epithelial cells in the oral and nasal mucosa and nasopharynx. SARS-CoV-2 has the ability to efficiently infect the upper respiratory tract possibly due to its higher affinity for ACE2. This is something unique to SARS-CoV-2 compared to SARS-CoV. One edge that SARS-CoV-2 has over SARS-CoV is that unlike the latter, SARS-CoV-2 is not heavily dependent on target cell proteases (TMPRSS2/cathepsin L) for entry. SARS-CoV-2 Spike contains a unique insertion of RRAR at the S1/S2 cleavage site. This site can be cleaved by furin, which potentially extends its cellular tropism since proteolytically-active furin is abundantly expressed in human bronchial epithelial

CoV-2 and possibly other coronaviruses that rely on ACE2 take advantage of the immune system's natural defenses. It has been observed that the body responds to the viral infection by producing more interferons, which then upregulate ACE2 gene expression, enhancing the ability of the virus to attach more readily to the lung cells.

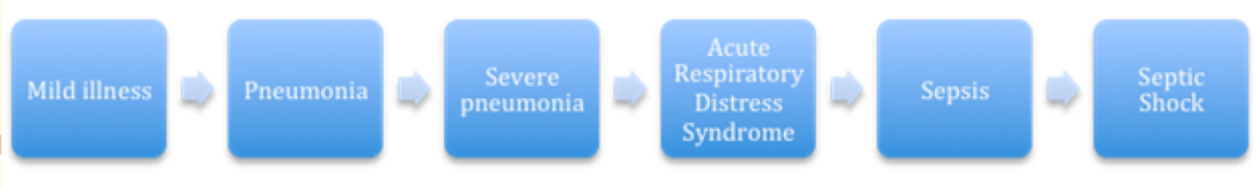
Rest of the body

While lungs are the primary target of SARS-CoV-2, make no mistake in assuming the virus would leave it at that. ACE2 and TMPRSS2 are abundantly expressed in extrapulmonary tissues such as the heart, liver cholangiocytes, stomach epithelial cells colon colonocytes, ileum, rectum.

Gastrointestinal illness has been frequently reported in patients with COVID-19. As the pandemic has progressed, it has become increasingly evident that COVID-19 can go onto have long-term consequences, such as myocardial inflammation. Most critically ill patients with COVID-19 also had multiple organ damage, including acute lung injury, acute kidney injury (AKI), cardiac injury, liver dysfunction, and pneumothorax.

If we take the example of kidney for instance, AKI and the subsequent clinical events such as haematuria and proteinuria have been observed in approximately 40% of the COVID-19 patients. This is connected with the expression of the ACE2 receptors in the brush border of proximal tubular cells.

Disease Progression: Clinical syndromes associated with COVID 19 in adults:



Although most patients will only experience mild symptoms of the disease, some patients will experience rapid progression of their symptoms over the span of a week. One study found that 17% of the patients developed Acute Respiratory Distress Syndrome (ARDS) and among these, 65% rapidly worsened and died from multiple organ failure.

There are several potential underlying mechanisms of SARS-CoV-2 induced multiorgan failure. Some are related to the direct and indirect pathogenic features of SARS-CoV-2. Yet another possible mechanism is organ failure induced by cytokine storm, which is the over-reaction of the immune system resulting in increased levels of inflammatory mediators, endothelial dysfunction, coagulation abnormalities, and infiltration of inflammatory cells into the organs. In fact, the findings are still far from conclusive, with evidence supporting conflicting information. For example, some evidence suggests that increasing ACE2 expressions facilitate COVID-19 infection, while others suggest potential beneficial effects of reducing lung injury. A few of these mechanisms are discussed below:

The first mechanism is centers around the protective function of ACE2 expression, which is directly in conflict to previous information mentioned. Remember, there is much yet to be known decisively about this novel coronavirus.

Experiments have shown that mere binding of recombinant SARS-CoV spike-Fc to human and mouse ACE2 could result in the downregulation of cell-surface ACE2 expression. Inhibition of ACE2 was shown to have a critical role in control of SARS-CoV infection-induced pathological alteration of the lung which leads to ALF and severe pneumonia. The same mechanism could possibly be projected in case of SARS-CoV-2.

Subsequently, there is an effect on the Renin-Angiotensin-Aldosterone system (RAS). The RAS is a complex network that plays an important role in maintaining blood pressure as well as electrolyte and fluid homeostasis, affecting the function of many organs, such as the heart, blood vessels, and kidneys. Angiotensin II (Ang-II), which is the key bioactive molecule in the RAS, widely participates in the progression of cardiovascular diseases, such as hypertension, myocardial infarction, and heart failure.

Normally in RAS, renin cleaves the substrate angiotensinogen to form angiotensin I (Ang-I), and then, ACE removes two amino acids at the carboxyl terminus of Ang-I to yield Ang-II. Two independent research groups discovered ACE2, a homolog of ACE, which can remove the carboxy-terminal phenylalanine in Ang-II to form angiotensin-(1–7). Angiotensin-(1–7), as a ligand, binds to the G-protein-coupled receptor MAS, which produces the opposite effect to that of Ang-II, and exerts a range of functions in multiple organs and organ systems. High Ang-II levels in the lungs can increase vascular permeability and cause pulmonary edema. Several studies have indicated towards the protective effects of the ACE2/angiotensin-(1–7)/MAS axis in the lungs. It alleviates lung inflammation, fibrosis and pulmonary arterial hypertension, as well as inhibits cancer cell growth, tumor angiogenesis, and tumor metastasis.

The significant downregulation of ACE2 and upregulation of Ang-II in COVID-19 results in RAS over-activation, and loss of the protective effects of angiotensin-(1–7) may lead to injuries in several organs including but not limited to heart, lungs, kidneys.

The cytokine storm theory explains the hyperinflammatory response of the body. Cytokines play a significant role in immunopathology during viral infection. A rapid and well-coordinated innate immune response is the first line of defense against viral infection. However, dysregulated and excessive immune responses may cause immune damage to the human body. Evidence from severely ill patients with COVID 19 have suggested that proinflammatory responses play a role in the pathogenesis of the disease. The increase in the symptoms of COVID-19 is correlated with enhanced concentrations of inflammatory mediators (e.g., TNF-α, IFNγ-induced protein 10, MCP-1, macrophage inflammatory proteins 1A, granulocyte colony-stimulating factor, ILs).

Factors associated to COVID-19 severity

It is well known that the disease does not affect every individual equally. According to the WHO, current research into COVID-19 severity indicates that as many as 80% of the cases are mild or asymptomatic, 15% of cases are severe (these patients usually require oxygen support) and 5% of the cases are critical (these patients require mechanical ventilation). Certain conditions make an individual more susceptible to show severe presentation of symptoms including older adults (65+), pregnant women, people with weakened immune systems, and people with underlying health conditions or comorbidities. It has also been observed in some studies that men are more likely to develop severe respiratory failure compared to women from COVID-19. In the following paragraphs we will briefly look into few of these conditions: old age, diabetes, hypertension, and sex of the patient.

It is generally accepted that the aging process predisposes individuals to certain infectious diseases. Moreover, lymphocytopenia, neutrophilia, elevated inflammation- related indices, and coagulation-related indicators have been consistently reported in older (≥65-years old) relative to young and middle-aged patients with COVID-19. At the cellular level, a lower capacity of CD4+ and CD8+ T-cells to produce IFN-γ and IL-2, as well as an impairment in T-cell activation from dendritic cells (DCs) in patients with acute COVID-19 (≥55-years old) could compromise an optimal adaptive immune response.

Patients with cardiac diseases, hypertension or diabetes are often treated with angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARBs). These drugs increase ACE2 protein expression. While studies have shown that increased level of ACE2 expression benefits the lungs, however the increase is not just only on just alveolar cells but also in beta cells in the pancreas and immune cells, so may increase inflammation and glucose levels in these patients. Inflammation and increased glucose levels make a vicious cycle. Same mechanism may also exist for the cells in lungs. The virus infects macrophages and leads to IL-6 production.

IL-6 causes inflammation, increases LPS and glucose levels and produces insulin resistance. Much of this is still up for debate and hence no such decisive step has been taken on the usage of ACEI and ARBs, besides doctors being advised to monitor the patients using them.

As mentioned before, more men die of COVID-19 than women. It is suspected that genes encoded on X chromosomes, and sex hormones may explain the decreased fatality of COVID-19 in women. The angiotensin-converting enzyme 2 gene is located on X chromosomes. Men, with a single X chromosome, may lack the alternative mechanism for cellular protection after exposure to SARS-CoV-2. Some Toll-like receptors encoded on the X chromosomes can sense SARS-CoV-2 nucleic acids, leading to a stronger innate immune response in women. Both estrogen and estrogen receptor-α contribute to T cell activation.

There still remains much to be discovered about SARS-CoV-2 and the impact it has on the human body and its systems. Meanwhile science has already taken huge leaps, and by the beginning of 2021, several vaccines had already been declared for emergency use. Vaccines typically take years, if not decades, to reach people; the record previously was four years for the mumps vaccine. Great challenges still lie ahead of us, but the scientific community and health care providers stand undeterred, determined to see things through.

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2.

SARS-CoV-2 infects children?

~ Aastha Ahuja (III Year)

Children are seen to be less infected with SARS-CoV-2 and even if they are infected, they are observed to have mild symptoms of cold, cough and fever, that's why majority of them are never brought to hospitals and a very small population of children is affected severely with this virus. This ignites curiosity in minds of scientists and researchers; why are children being spared by virus from infection?

There are many reasons to state why this occurs:

• The alveolar epithelial cells (AE 1) expressing the receptor for the binding of virus - angiotensin converting enzyme 2 (ACE2) were observed to increase in number along with ACE2 receptor as the age increases, thus we can say that adults have more expression of AE1 cells and ACE2 receptors than children. Lesser the AE 1 cells; lesser the ACE2 receptor and hence, lesser the infection probability of SARS-CoV-2 in children.

• It is seen that some children (4-9 year old) who tested positive for SARS-CoV-2 also tested positive for other viruses of coronavirus family (E.g. human coronavirus (HCoV-NL63), which is associated with mild illness; and is expected to decrease the expression of ACE2 receptors.

Also, antibodies formed against this coronavirus(HCoV-NL63) provides cross immunity against SARS-CoV-2 as both of the virus are expected to bind to ACE2 receptors.

• Children are observed to produce antibodies against spike protein of the virus whereas adults have been noted to produce antibodies against both nucleocapsid and spike protein; antibodies for nucleocapsid are possible only when there is widespread infection. Thus, this indicates that children's immune system halts the virus from spreading in earlier stages by producing antibodies against the spike protein.

• Naive T cells present in children's blood are expected to neutralize virus in the earlier stages and thus preventing it to cause severe infection in children.

It is seen that children which test negative for COVID-19 when sample is collected from nasal tract, tested positive when the sample of feces is taken, this indicates that the virus tends to survive for longer time in the gastrointestinal tract than the nasal tract, and thus children can contribute to viral shedding for a long time even after they have tested negative for COVID-19 by RT-PCR test with the nasal tract sample. For this reason, it is suggested that children are to be vaccinated as a top priority since they are usually asymptomatic and secondly- they contribute a significant part of world population, thus immunizing them can help us in achieving the target of herd immunity. This is especially relevant in African countries as they have relatively more number of children than adults in their population .

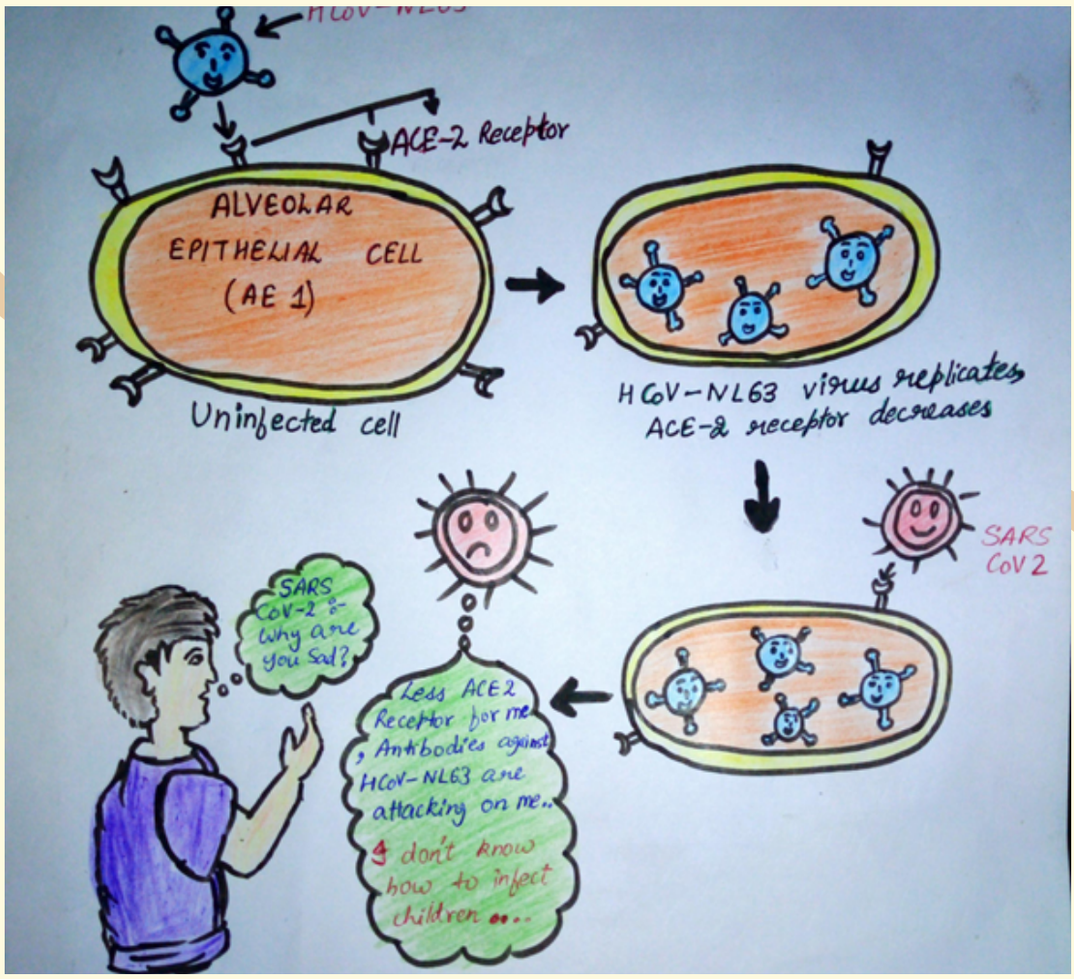

Fig. 2 - Doodle illustrating the CoV- 2 infection in children

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3.

COVID-19 and zoonotic diseases: What's the connection?

~Ankita Malakar (I Year)

Borders closed, lockdowns imposed, world economies spiraled downhill: The Coronavirus pandemic has stumped the entire world. It is considered as one of the worst pandemic of the 21st century, as millions of people have lost their lives and countless others have lost their livelihood because of it.

The COVID-19 first surfaced in a seafood market in Wuhan City, China in December 2019 and in a month, spread to all the countries faster than influenza. But how did COVID-19 emerge and from where? And why is it considered as a Zoonotic disease?

Zoonotic diseases or zoonoses are infectious germs that can jump from an animal to a human. Wild animals can sometimes carry harmful pathogens like viruses, bacteria, and parasites. When they come in contact with humans, they can jump from animal to humans. They can cause many illnesses in people and animals, varying from mild to severe illness and even death. Some of the common zoonotic diseases include rabies, dengue, malaria, HIV-infection, Ebola etc.

What is the connection with COVID-19?
Coronaviruses (CoVs) are a family of viruses that can infect animals and humans.

They are named "CoVs" because of the crown-like structure on their surface. CoVs can beclassified into four genera: alpha-CoV, beta-CoV, gamma-CoV and delta-CoV. From phylogenetic evidence, it has been found that bats and rodents carry mostly alpha-CoVs and beta-CoVs, and birds carry gamma and delta-CoVs. Usually, coronaviruses spread in animals but they have the potential to cross barriers and spread to humans. From there, the pathogens can jump from person to person.

Coronaviruses are known to cause mild respiratory disease and common cold. The sudden outbreak of severe acute respiratory syndrome (SARS-CoV) in 2002 in China and the Middle East respiratory syndrome (MERS-CoV) were linked to civet cats and infected dromedary camels, respetively. Epidemiologic investigations indicate that Horseshoe bats, genus Rhinolophus act as the natural reservoir of SARS causing coronaviruses.

Ongoing research on COVID-19 speculate the plausibility of emergence of COVID-19 or SARS-CoV-2 from bats. The role of an intermediate host such as snakes and pangolins haven't been elucidated yet. But how did the virus jump from a bat to a human? Humans and animals have coexisted together for millions of years.

We come in contact with animals every day in our homes, or while commuting, or during outdoor activities. The pathogens can spread through:

- Direct contact with wild animals or animals carrying germs.
- Indirect contact by coming in contact with surfaces contaminated with germs.
- Eating raw, undercooked, unpasteurised food.
- Insect bites.
- Drinking contaminated water.
- Wildlife trading

Similarly, scientific researchers speculate pangolins might be the possible intermediate host between bats and humans. And pangolins are the one of the most trafficked animals, and considered a delicacy in south Asian countries, so wet markets provide a perfect opportunity for the zoonotic pathogens to jump species and infect humans. Anyone can fall sick from a zoonotic disease, including healthy people. But aged people, children and people with a weak immune system are more vulnerable as it has been seen in the case of coronavirus. There are some ways to protect ourselves from zoonotic diseases such as:

- washing hands with soap and water after coming in contact with an animal.
- Being careful around animals and avoid getting scratches or bites.
- Avoid insect bites.
- Eating cooked and drinking clean water.
- Taking care of pets and getting vaccinated.
- Banning animal trading.

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4.

Why steroids are COVID-19 game changer?

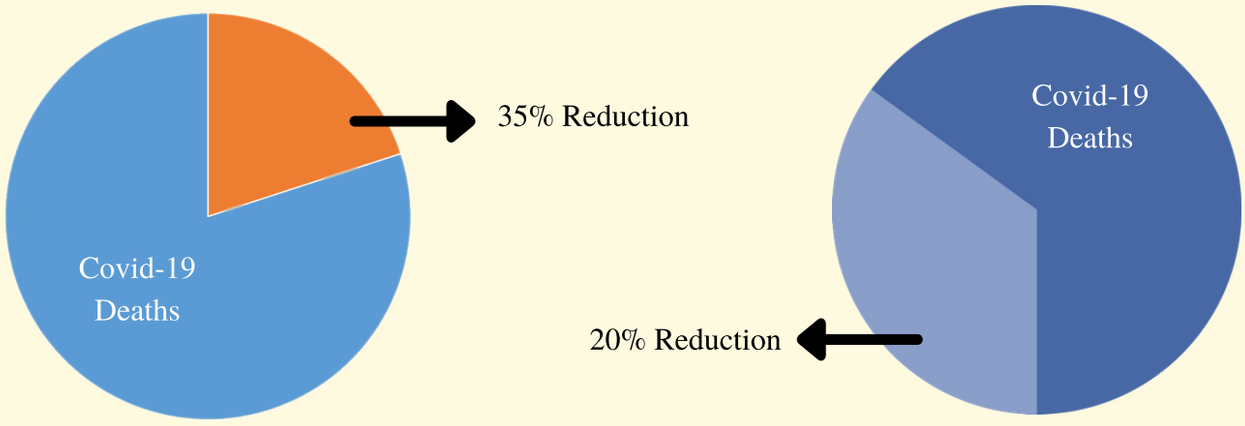
~Shrishti Singh (I year)

Throughout history, viral diseases have been a serious threat and have constantly jeopardized global public health, even though a great success has been achieved in developing effective vaccines and antiviral drugs for combating them. In the last decades, several natural and synthetic steroids have been reported as antiviral agents.

Before the spread of Covid-19, Corticosteroids (steroids) were administered to patients affected by the Influenza virus, especially the 'Avian Influenza virus'. In case of coronavirus infection, the virus migrates to the airway, replicates there and invades particular ciliated lungs cells. As these cells begin to die, they fill the airway with debris and fluid. During this time, the immune system kicks in, where immune cells help to repair the lung tissue. The response is limited and tightly controlled. But an over-reaction of the immune system proves to be quite harmful to the body. This over-reaction of the immune system is known as CYTOKINE STORM. In this case, immune cells such as lymphocytes and neutrophils are attracted at the site of infection in a level far beyond what's needed, resulting in extreme inflammation in the lungs. In cytokine storm, the healthy cells of liver, heart and kidneys get affected too.

In the absence of any particular vaccine, scientists and doctors started using 'dexamethasone', a common steroid to treat the Covid-19 patients. According to a recovery trial in the UK, >2100 patients received the drug for 10 days and >4300 patients didn't receive the drug. In the results, 21.6% of patients that received the drug and 24.6% of the patients that didn't receive the drug died within 28 days. Clearly, dexamethasone offered only a marginal improvement. However, if all patients were sub-divided into a critical, severe and mild category, the dexamethasone-linked survival rate becomes more noticeable in the serious patients. Based on the new evidence, the World Health Organization issued new treatment guidance, strongly recommending steroids to treat severely and critically ill patients, but not to those with mild disease. "Clearly, new steroids are the standard of care," said Dr Howard C. Bauchner, the editor-in-chief of JAMA, who published 5 papers about the treatment.

DEXAMETHASONE RESULT



Patients on ventilator

Patients on oxygen

In September, WHO updated the guidelines on the use of corticosteroids drugs in patients with Covid-19, based on findings from a study data analysis. The analysis of 7 international clinical trials showed that corticosteroids including hydrocortisone, dexamethasone and methylprednisolone were beneficial in the sickest patients.

The WHO updated its treatment guidelines, recommending the use of corticosteroids to treat patients with severe and critical Covid-19. However, it cautioned not to use corticosteroids in the treatment of patients with non-severe Covid-19 as 'The treatment brought no benefits and could even prove harmful'.

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5.

Vaccine for COVID-19

~Pallavi Saini (I Year)

COVID-19 is a contagious disease caused by the coronavirus.

It is an easily spreadable disease which now has become a global pandemic. But how does it spread?

The recent outbreak began in Wuhan, a city within the Hubei province of China. The first case of COVID-19 disease was reported in December 2019. The most common way through which it gets spread is the close contact with someone who has the infection (less than 6 feet). In severe medical complications, it can cause death too.

The common symptoms of COVID-19 are :-
1.Muscular pain; 2. Joint pain; 3. Headache; 4. Fever; 5. Fatigue; 6. Nausea; 7. Chills, etc.

Older people and people with medical problems like diabetes, respiratory illness and cardiovascular disease etc., are more susceptible to the disease.

Getting a COVID-19 vaccine can help as well as protect us by creating an antibody response in our body without having to become sick with COVID- 19.

The food and drug Administration (FDA) has given emergency authorisation to the Pfizer/BioNTech and Moderna COVID-19. Both of these use RNA (mRNA) technique for the synthesis of vaccine.

Some of the domestic pharma firms working on the COVID-19 vaccines in India are BHARAT BIOTECH, Serum Institute, Zydus Cadila, Panacea Biotec, Indian immunologicals, etc., showing hardship for the preparation of the Covid-19 vaccine.

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6.

Vaccine development and administration

~Bisakha Das (II Year)

Vaccine development is principally a long term process, spanning between 10 to 15 years. It consists of five major stages, each of which must be carefully observed. The pandemic of Coronavirus has forced institutions to accelerate the procedure.

1. EXPLORATORY: It is a research based part of the process, where different methodologies are used to form the trial vaccines.

2. PRE-CLINICAL: Scientists administer the trial vaccines on tissues or on subjects like animal models to study the efficacy of the vaccine.

3. CLINICAL TRIALS: The stage when the vaccines are tested on humans. It has 3 phases.

Phase I of the clinical trial is conducted on a small group of healthy individuals. It only indicates the ideal dosage required to be administered in the subsequent stages. This stage essentially provides evidence of the vaccine's ability to produce an immune response and its safety. The vaccine is not considered safe if it develops any major complications. However, a little headache and fever can be expected.

In phase II, the range of participants is expanded to a few hundred healthy participants to check the immune response system in the body and it also assesses the duration for which the antibodies last to provide immunity against the virus (check immunogenicity), dosages and immunization schedule.

Phase-III involves a very large group of people to explore and analyze its efficiency and safety among large population groups. Half of the population is administered the actual vaccine and therefore the other half are administered dummy vaccines (controlled trials with placebo group). Individuals administered with vaccines are checked on fixed intervals.

4. APPROVAL TRIALS: After vaccine is successfully tested, it would require regulatory approval before it can be produced in bulk quantities.

5. MANUFACTURING & DISTRIBUTION: The vaccine is produced in a bulk quantity and administered to the people under the proper guidelines of the Government.

'Herd Immunity', which is also known as 'Population Immunity', is the indirect protection from an infectious disease that happens when a population gets immune either through vaccination or immunity developed through previous infections. WHO supports achieving 'Herd Immunity' through vaccination but not by allowing the disease to spread through any segment of the population as this would end in unnecessary cases and deaths. Vaccines play an essential role in training our immune systems to create proteins that fight against diseases, known as 'antibodies', just as would happen when we are exposed to a disease but – crucially – vaccines work without making us sick. Vaccinated people are protected against the disease in question, breaking chains of transmission.

The two important objectives when it comes to vaccine drive are providing protection to those vaccinated and minimizing or at least retarding the rate of viral transmission.

Immunizing a billion people would be a staggering operational challenge for the country. The Government needs to ensure that there is enough awareness and availability of resources to fulfill the needs of the vulnerable sector.

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7.

Antimicrobial stewardship in the virus era

~Ankita Paty (II Year)

Antibiotics are a boon to the mankind. They have been saving lives ever since their discovery in 1928. The use of antibiotics increased tremendously towards the 1960s and at present, we have reached a point of misuse and overuse of antibiotics.

Antimicrobial stewardship (AMS) is a moral principle that encourages strategies to improve the use of antimicrobial drugs, with the aim to improve patient health, decrease unnecessary cost and reduce the cases of antibiotic resistance.

Antimicrobial resistance occurs when microorganisms change the way they respond to the medication that once used to cure the infection they caused but now, render them ineffective. Resistance occurs naturally, through genetic changes in the microorganism. However, sub-optimal dosage, inappropriate use and overuse of antibiotics accelerate the process. This has led to the emergence of several multi-drug resistant organisms like multidrug resistance Tuberculosis (MDR-TB), Vancomycin-resistance Enterococci, Methicillin-resistant Staphylococcus aureus and many more that have been decreasing the efficacy of antimicrobial agents.

In developing countries like India, unnecessary use of antibiotics has become rampant. Use of antibiotics to treat viral infections are common cases of misuse where there is no benefit from the treatment and rather, it adds to the load of antibiotic resistance. Accessibility of antibiotic drugs without a physicians' prescription has added to menace, leading not only to overuse but also, to the use of wrong antibiotics.

Today, the COVID-19 pandemic has reaped fear in the hearts of all. Isolation and social stigma have led to unnecessary and unguided use of antibiotics, to be taken as a precautionary measure or for the treatment of viral infections where these, as a matter of fact are of no benefit, and instead causing a rise in MDR organisms. One prominent example is the upsurge in the cases of gonorrhea superbug, that has become resistant to the first line drugs. Overuse and misuse of the antibiotic 'Azithromycin' is thought to be the cause for this.

If this continues, soon the first and second line of drugs would be ineffective. This would lead to a more frequent use of the harsh third line of drugs and shall require the discovery of new molecules for treatment.

Antimicrobial Stewardship is the most efficient way out of this. The key rule of antimicrobial stewardship is the right antibiotic, for the right patient at the right time, with the right dose and the right route, causing the least harm to the patient and to all the future patients as well. Strict implementation of the strategies of AMS will help the mankind in long run. This would require combined efforts of microbiologist, clinicians, epidemiologist and health care providers.

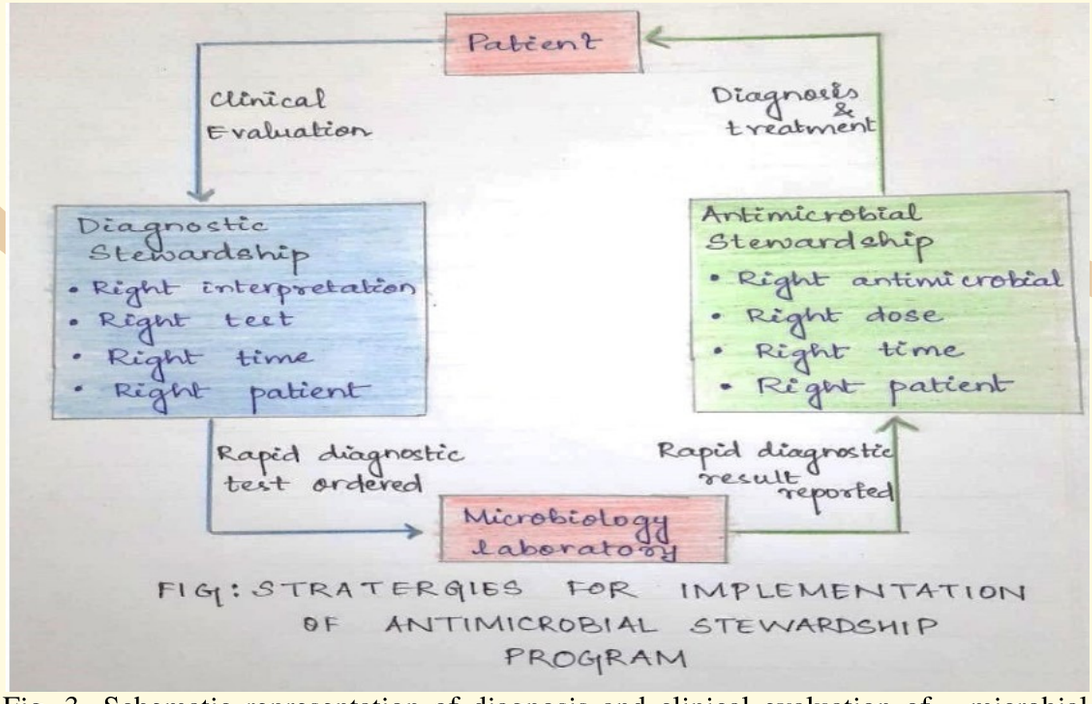

Fig. 3- Schematic representation of diagnosis and clinical evaluation of microbial infection in a patient

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8.

Effect of corona virus on human body and treatment strategies

~Dipesh Talukdar (III Year)

COVID-19 or Corona Virus Disease 2019, the virus outbreak that changed our very lives during this year or should we say "this pandemic". COVID-19 is a major health concern and fairly can be devastating especially in high-risk groups or communities. In India alone, over 10 million individuals and over 82 million individuals globally, were infected by the novel coronavirus but despite the fact it is said to be very serious, the recovery rate was quite high.

COVID-19 is caused by the SARS-CoV-2 virus where SARS stands for 'Severe Acute Respiratory Syndrome'. The spillover event of this zoonotic virus to humans from bats is what caused this disease to spread and nest in for human-to-human transmission. Tracing the path of the virus helps us to understand how SARS-CoV-2 affects the human body and what happens during this course of events.

If the infection occurs, in the initial 2-3 days, the inhaled virus travels through our respiratory tract and binds to epithelial cells or ciliated cells. These ciliated cells are responsible for clearing dust, debris, bacteria, viruses, or any foreign particle that are trapped in mucus secreted by mucosal cells out of our nasal cavity. The virus particularly binds to the receptor present on these cells called the angiotensin-converting enzyme 2 (ACE2) receptor.

This ACE2 receptor is found in many cells and tissue such as the kidney, small intestine, heart, lungs, and blood vessels. It plays an important role in regulating the cardiovascular system through Renin-Angiotensin System.

SARS-CoV-2 binds to the ACE2 receptor through its spike protein present on its surface. Upon binding, the virus fuses with the cell and releases its genetic material (single-stranded RNA) into the host cell to make copies of its genetic material using host machinery and replicate, increasing the viral load in the human body.

Within the next few days of infection, the virus migrates down the respiratory tract. As the viral load increases, a robust innate immune response is triggered during this event. In serious cases of Covid-19, the result is either pneumonia or severe lung inflammation. It is believed that our immune system is the actual problem rather than the virus itself.

Upon infection, the innate immune system recruits macrophages, neutrophils, and activated T cells to fight off the virus, hence infection should decrease. These immune cells release cytokines (CXCL10, IL-2, IL-1, IL-6, TNF) to attract or trigger other macrophages to counteract the infection efficiently. Release of these cytokines is what causes the inflammation and the patient experiences fever, cough, and other covid-19 symptoms. Under normal conditions the immune reaction is steady but the complication occurs in severe cases, when the virus infiltrates the central nervous system. The immune cells in CNS such as microglia, astrocytes also produce the pro-cytokines to counteract the virus. In this case, the immune system overreacts and a severe condition occurs called as 'Cytokine storm'. Cytokines from the CNS and epithelial cells contribute to this situation and increase the chance of fatality and lung failure. The flooding of cytokines into the lung tissues causes inflammation and makes it difficult for a patient to uptake oxygen.

Another condition is when patients develop pneumonia. As the virus reaches further down into the bronchi and to alveoli (a sac-like structure that helps exchange the oxygen from pulmonary blood vessels), the mucous on the epithelial lining keeps building up due to increased viral load. The virus settles in the alveolar spaces between alveoli and blood vessels causing inflammation of the epithelial lining that hinders oxygen intake. The fluid builds up in alveolar sacs due to inflammation, making it difficult to contract and relax for gaseous exchange. Eventually, the condition gets worse with time until pneumonia sets in.

Now let us discuss the treatment aspects of Covid-19. During the initial wave of the Covid-19 pandemic, there was no cure for this disease. The only way to treat this disease is to prevent the infection and to increase the immunity of the individuals. Treatment of patients with anti-inflammatory and anti-histamines medication can ease the situation as it helps in reducing the fever, cold and cough. Vaccines are another thing that most people are waiting for. Approaches that can be used to develop a vaccine include live attenuation, Inactivation, and mRNA technology. Fortunately, on January 3, 2021, Drug Controller General of India (DCGI) approved Covishield and Covaxin for emergency purposes. However, that does not mean the cure is fully here as it just enhances the immunity of the individuals.

Our humoral immunity depends on a type of immune cells called B-cells which produce different antibodies depending upon the pathogen it interacts with. These antibodies deactivate or kill the pathogen. B-memory cells are also there to prevent future infection by the same virus. One of the traditional methods of vaccine development is live attenuation where a live pathogen but weak enough not to initiate any infection, is injected so that B-cells will recognize the virus and produces antibodies against it. Another method of an inactivated vaccine involves the use of inactivated/killed virus that has lost the ability to replicate but is capable of initiating an immune response. Such a vaccine commands the cells to use virus proteins to generate an immune response. As the saying goes "Prevention is better than cure", knowledge of the complications and limitations of Covid-19 will help us to improve medical technology and use it to develop better treatment aspects for this disease.

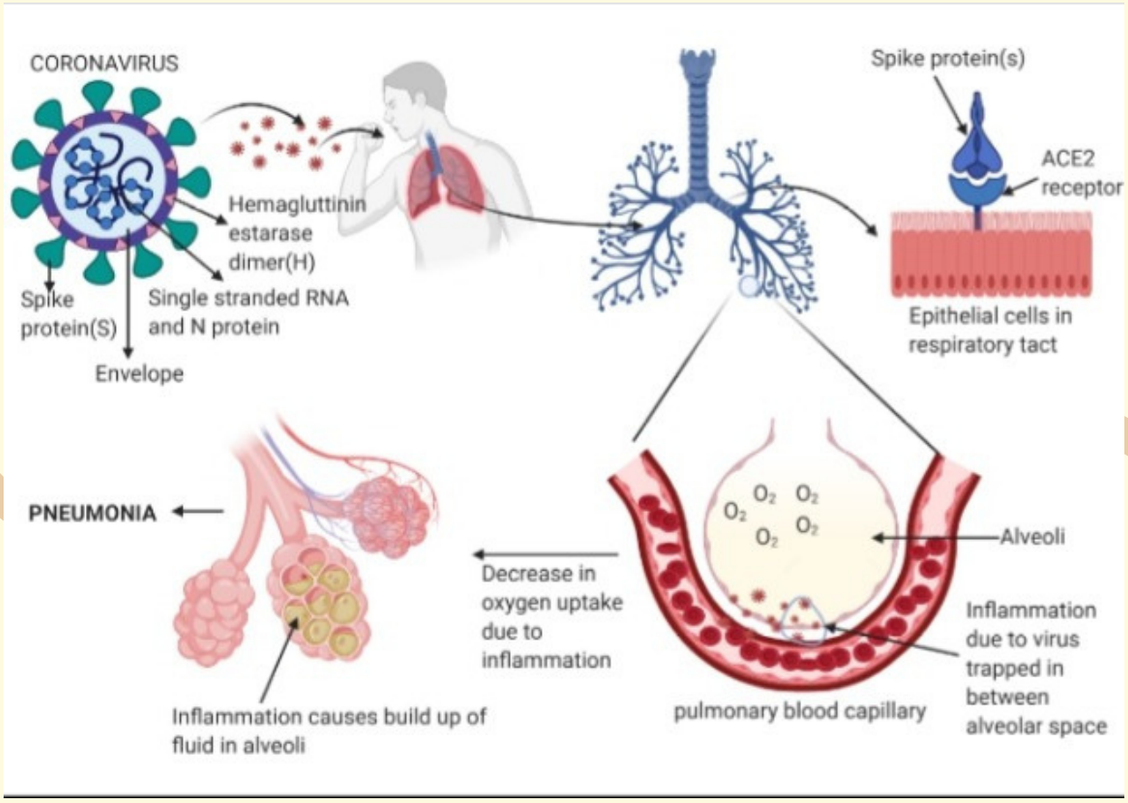

Fig. 4: -Coronavirus infection timeline. (created with biorender.com by Dipesh Talukdar)

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9.

PCR: Use in detection of SARS-CoV-2 and beyond

~Deeparati Datta (I Year)

The current world of biotechnology has much to owe to the invention of Polymerase Chain Reaction method that came as a flash of inspiration to Kary Mullis whilst driving to his cabin, he was building in Northern California in 1983.

The Polymerase Chain Reaction, commonly known by its acronym - PCR, even got Kary Mullis, the Nobel Prize in Chemistry in the year 1993. Since the development of PCR Machine (commonly referred to as a thermocycler), we have seen the machine undergo various changes, broadening the utilisation of Dr. Mullis' invention. It has become an indispensable part of current era's biotechnology lab, especially in the present scenario. Due to the ongoing pandemic; even one who is not in touch with the advances of biology probably found themselves coming across the word 'RT-PCR' or 'reverse transcription PCR', or perhaps even the term 'real-time reverse transcription PCR', a rapidly developed assay for the SARS-CoV-2.

The PCR machine amplifies certain strands of DNA i.e., it creates multiple copies of a gene or DNA of interest.

Amplification is important as it allows scientists to have a large quantity of the target sequence, making it easier to detect the required gene sequence. The main difference between a conventional PCR and real-time PCR is that in the latter, the amplified DNA product or amplicon, is measured as the reaction progresses in real-time- with product quantification after each cycle, whereas in the traditional PCR method it is detected in an end-point analysis.

A real-time reverse transcription-polymerase chain reaction (RT-PCR), was developed as an assay for the SARS-CoV-2 for rapid testing purposes. This real-time RT-PCR assay was more sensitive than a conventional RT-PCR assay or culture isolation and proved suitable to detect SARS-CoV-2 in clinical specimens.

Broadly, the PCR method occurs in three steps:

1. Denaturation - The sample is exposed to a high temperature which leads to the DNA separating into two complementary strands.
2. Annealing - Primers which are chemically synthesized oligonucleotides (short sequences of nucleotides) complementary to the DNA, attach to required sites and a thermostable DNA polymerase called Taq polymerase is added.
3. Extension - With the help of the Taq polymerase the primers are extended, using the free nucleotides provided in the reaction and using the genomic DNA as a template.

Then this process is repeated in cycles until a sufficient number of copies is obtained, though the standard is 35 cycles, a sequence is amplified to generate about 34.36 billion new copies.

This was the basis for the PCR reaction, but as we know the novel coronavirus is an RNA virus, so we have to go through the process of reverse transcription before undergoing PCR. What happens is that the virus infiltrates and incorporates its genome to take control and 'reprogramme' the host cells, turning them into virus-making factories. So, when we reverse transcribe and amplify the sequence extracted from the cells of one's nasopharyngeal swab, using specific primers for the virus, we get to see and detect; if present, the coronavirus (or its genome sequence) using the real-time PCR after each cycle.

To do this, in real-time PCR, we use a fluorescent reporter molecule in each reaction that occurs, which yields increased fluorescence with an increase in the amount of DNA product. Special fluorescence chemistries are employed to make DNA binding dyes or fluorescently labelled sequence-specific primers. These real-time PCR machines have specialized thermal cyclers equipped with fluorescence detection modules that monitor and detect the fluorescence signal as amplification occurs, helping us keep track of the reaction. The measured fluorescence is proportional to the total amount of amplicon, and hence the change in each cycle.

This fluorescence is often present as a background level, a threshold level/line(set by you), indicates a level when fluorescence is beyond the background level. This brings us to an important term, the Cq or Ct value -t is the PCR cycle number at which your sample's reaction curve intersects the threshold line. This value tells how many cycles it took to detect a real signal from the sample, in this case, the number of cycles it took to get a significant signal for the presence of the virus' sequence. The cycler's

software on the machine calculates and charts the Cq value for you. Hence, if you look carefully, your positive test sometimes comes with this information as the greater amount of virus present, the faster the fluorescence reaches the threshold value and the lower the Ct value (considering starting amount of genetic material same).

In hindsight as well as in foresight, for the Coronavirus testing, the PCR proves to be an indispensable method, which allowed us to combat this pandemic in 2020, unlike perhaps any other invention. Lehninger writes that "inspiration often leads to scientific advances" but Dr Mullis' invention, who sadly passed away in 2019, has served an immense role in controlling this pandemic (of many other illustrious achievements) which, no matter what; we all could have never been prepared enough for.

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10.

Can home remedies prevent us from corona?

~Yash (I Year)

Ayurveda is an alternate medicine system with historical roots within the Indian subcontinent. Ayurveda has been a life changing medicine for many people in this pandemic. Do you think we can fight corona with just changing our diet or with including some specific food items to our daily routine. Yes, you are right we can do so, there are some food items and some juices which boost our immunity and to some extent help our body to fight Corona virus. In the native districts of Haryana and Punjab, people consume 'KADA' (a potion with medicinal properties) to boost immunity which helps their body to fight many diseases. 'KADA' is a mixture of many substances which includes leaves and stems of Tinospora cordifolia commonly known as Giloy which mainly imparts medicinal properties to the 'KADA'. Giloy have some phytoconstituents that impart the medicinal values. Phytocomponents or phytochemicals are organic compounds produced by the plant itself which helps the plant to fight microbial attacks or to resist fungal or viral infections. Some of the major phytocomponents found in Giloy (*Tinospora cordifolia*) are Cordifolide, Diterpenoidfurao, Lactone, Tinosporine, Tinocordiside, Syringin, Heptacosanol, Tinosporide, Cordifolioside-A. Out of these Cordifolioside-A and Synringin are proven to possess immunomodulatory activity. The phytocomponents -Tinosporin and Diterpenoid- are proven to be beneficial for the treatment of viruses including retroviruses, HIV-1, HIV-2, Herpes Simplex Virus (HSV) and many other viral diseases.

The Tinocordiside rich extracts of Giloy would be another viable options for controlling COVID-19 entry into host cells and therefore, the general immunomodulatory nature of Giloy would enhance innate immunity against COVID-19 infections. Other than Giloy, KADA have other constituents also like Basil (Tulsi) leaves, ginger, black pepper, cloves, honey, Ashwagandha etc. All these components helps in increasing the innate immunity. There are many other ways also through which we can prepare our body to fight corona virus such as orange juice, which is high in vitamin C and can help boost the immune system. Vitamin C stimulates white blood cell production and works as a powerful antioxidant, protecting the organs from oxidative damage. Apple cider vinegar is also helpful in detoxing the body, boosting the immune system, clearing sinuses and increase the energy. Coconut water is a good alternative of water during Covid infection as it helps to washout the toxins from our body and help it to get rid of viruses. It is rich in potassium which maintains an adequate balance of fluids in the body.So, next time if someone rants at you about insignificance or inability of ayurveda to prevent or cure a disease (especially COVID-19) just give them a cup of kada and treat their lack of awareness with some real fact!

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11.

When you are tested COVID +

~Aastha and Bisakha Das (II Year)

Have you been tested COVID+, or are you COVID+ in this pandemic? If yes, then you are going to find this article relatable.

Our friend, Shefali, a bank manager, was also tested COVID+. During the lockdown, she worked from home, and after 'Unlock 2', she started working offline again. After working for about one month, one day, she got a fever along with a cough. A few days ago, her father was diagnosed with COVID-19 and was hospitalized due to his comorbid condition.

Even though confused about whether she has a common cold or COVID-19, she immediately isolated herself as a precautionary measure. Then she contacted the same hospital to which her father was admitted. After opting for home testing and understanding terms and conditions with the hospital staff, she kept her phone aside and took a deep breath. Fear and anxiety made her heart beat immensely fast.

Endless thoughts about her health, the rising number of cases around the world, scary articles and incidents of this virus spreading, on social media and what if she is infected with coronavirus or what harm could that virus cause to her, flooded her mind. She told everything to her parents through a video call and gained moral support.

The next day, COVID-19 warriors arrived wearing PPE kits and started the procedure of taking samples using cotton-swab from the nose and throat of Shefali, her mother, and her sister for RT-PCR testing. After a few stressful hours of waiting for the reports, she was found to be COVID+. Unfortunately, her mother was also infected with COVID-19 and was asymptomatic. Maybe she got infected from Shefali, and it was still the incubation period of the disease in her body.

However, her sister tested negative for COVID-19. Shefali opted for being home quarantined rather than getting admitted to the hospital. The notice put on the front door of her house made the society members aware of the situation. The neighbours showed concern and supported her family with daily needs. Shefali and her mother self-isolated themselves completely in separate rooms and started their quarantine days.

Since her family was in home isolation, they were in contact with the district or surveillance officer. She consulted her doctor for treatment, self-care and nutrition. Both Shefali and her mother kept themselves hydrated throughout their recovery period.

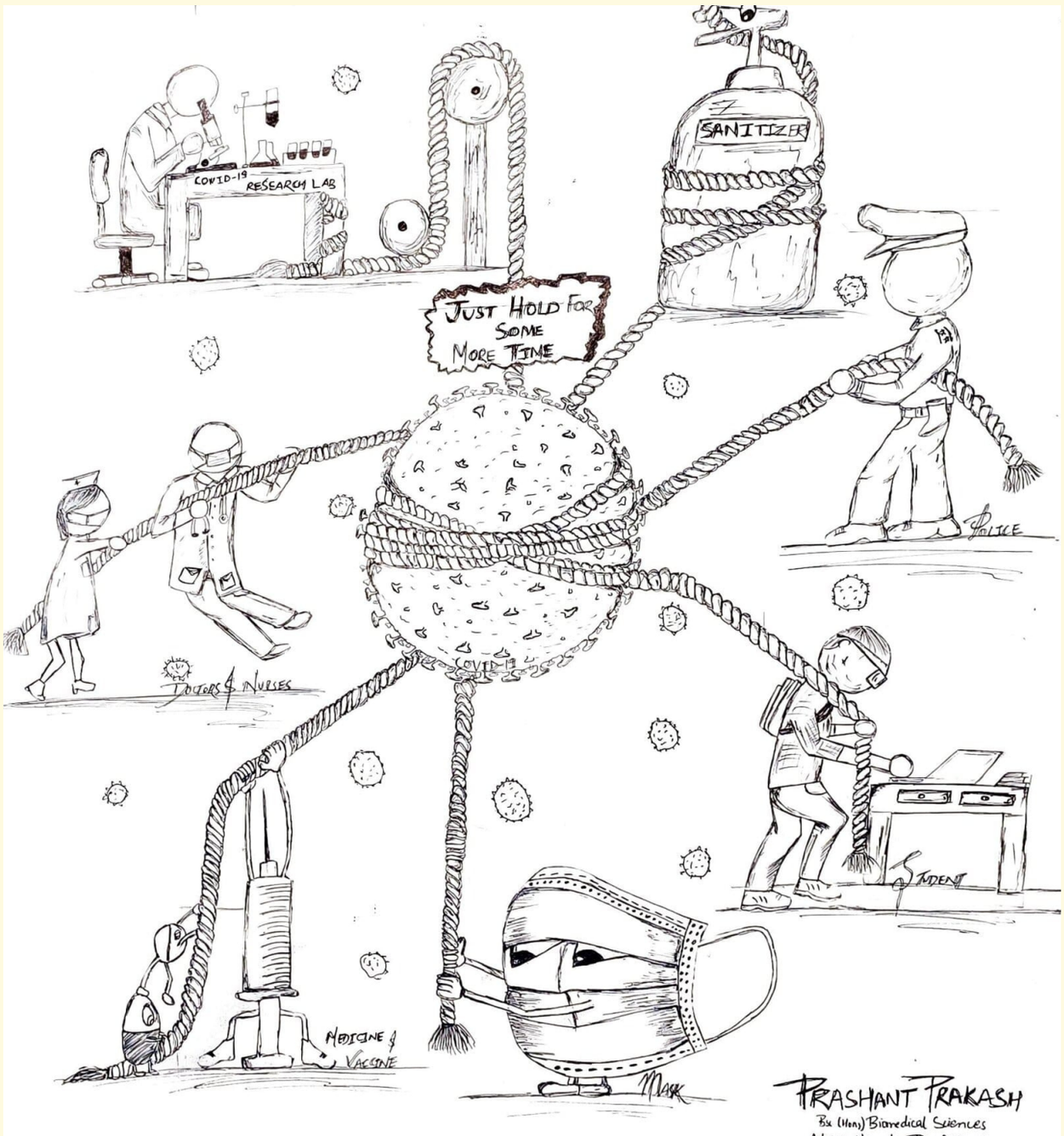
On the fourth day, she had a high fever. Her mother also started showing symptoms of the disease. As she struggled with her deteriorating health condition, loneliness, and worry for her father's health, she could not even get the warmth and touch of her mother's consolation. Both of them were going through one of the toughest phases of their lives. Talking to her family, friends, and indulging herself in some of her favourite recreational activities helped her go through those tough times. For her mother, talking to her parents and listening to spiritual songs helped her in alleviating the stress and pain. Her boss was kind enough to give her a month's leave and reduce her workload.

Although it was hard, Shefali's sister did her best in taking care of both her mother and Shefali. Her sister used to keep food, water, and fruits in front of their doors, and they used to take them according to the protocol. Family is the pillar of strength in one's life, and this pandemic has made us suffer and distanced us from our loved ones. Staying under the same roof but maintaining distance from the near and dear ones for the sake of their health is the test of perseverance.

After eighteen days of quarantine, finally, Shefali and her mother were tested negative, and soon her father also recovered and came back home. The family got the entire house sanitized, and they remained isolated for a few more days as a precautionary measure. Although they had recovered successfully, many people still hesitated to come near them that affected the family both socially and mentally. As much as this disease affects people physically, it also has a great impact on their mental health.

We all have suffered in this pandemic in some, or the other way, and the above story we shared is just one of them. We know that COVID-19 cases are increasing at an alarming rate and during these unprecedented times, we must provide help and emotional support to one another, especially COVID-19 warriors and patients.

Create a comfortable and safe environment and encourage them to talk about their experiences. With the arrival and administration of the vaccine, we hope for the situation to get better soon. Till then, wear a mask, maintain social distancing, and have a healthy diet.


COVID-19
RESEARCH LAB
SANITIZER
JUST HOLD FOR
SOME
MORE TIME
POLICE
DOCTORS & NURSES
COVID-19
STUDENT
MEDICINE &
VACCINE
MASK
PRASHANT PRAKASH
BSc (Hons) Biomedical Sciences

12.

Will the coming era be ruled by microorganisms?

-Anamika Binu (I Year)

The origin of life is considered as an unique event in the history of the universe.

Relatively speaking, the earth itself is only a speck. Life appeared on earth around 3.7 billion years ago, and the bacteria came around 3.5 billion years ago. Then eventually we humans evolved to become superior to others.

Years passed by and it is now evident from the medical point of view that these microorganisms, which we even can't see with our naked eyes, can attack us easily. We, humans, are superior and larger than them, yet somehow we are affected by the diseases they cause. And one such example we have is Corona virus in the present time.

Since the first diseases discovered and even now still more to be discovered are somehow caused by microorganisms, they are cosmopolitan. If we think for a while, we will wonder that in one way or the other, we are under the influence of these microorganisms. When we are born, we interact with the environment and come in contact with these microorganisms and at a certain age we start to take vaccination against them. Then a phase comes in our lives when we may suffer from diseases. Even after our death, they degrade our body.

So the microorganisms were there when we were not born and will be present after we are dead.

And one of the terrors created in each one of our minds is about the corona virus, which is currently fighting with us and may even conquer over us if we don't take preventive measures.

So this ribovirus, with RNA as it's genetic material, can cause diseases in mammals and even birds. It can range from mild to lethal and its lethal varieties can cause SARS, MERS and COVID-19. Now as we humans change our attitude with our needs and satisfaction, these clever viruses have also changed into a new strain. And our medical team is working hard for the preparation of vaccine and it's successful implementation.

Even a new bacterium Shigella has also accompanied its friend, Coronavirus, to cause disease in some parts of India.

But we all know science is always progressive in nature. And as we always say, Re-search is to discover more about the discovered. We all know if we want to defeat our enemies then we must know about its weaknesses. So, we are always thankful to our research centers all over the world for the production of vaccines, the medicines, and to make us all know about these microorganisms through microbiology.

At last the microorganisms from the tip of the nail to the end of the world... circle us all around.

And even if we people vanish from the earth they will continue to take over the reign.

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13.

Types of vaccine

- Prachi Arora (II Year)

Have you ever asked your parents that how many vaccines were given to you at the time of your birth? Maybe some of you don't even care. But after this covid-19 pandemic, even a small kid knows the importance of a vaccine. Since there had been a lot of deaths and infections, everyone around the globe is wishing for some kind of vaccine or a cure that can be used to get rid of this deadly virus which is creating a great chaos worldwide.

But it is a must that every person on this planet should know what a vaccine is, how it works and how many types of vaccines are there. It not only increases our knowledge but also help us to know about the importance of vaccine.

Basically, it is a biological preparation that provides the person with active acquired immunity to a particular infectious disease. It acts as way of prevention measure for a person from new pathogens against which we haven't acquired immunity yet.

Now comes how it works? So basically it is composed of small amount of viruses or bacteria that have been killed or weakened, and the body acquires memory or immunity(active) towards that pathogen and in future the person will not be affected by that pathogen or even if it attacks it causes mild symptoms as the response produced by our immune system will be more as compared to the previous one.

There are broadly two different types of live attenuated vaccines and inactivated vaccines and further classified as subunit, conjugate, toxoid and recombinant vaccines.

Starting with live attenuated vaccines which contains the whole pathogen that have been weakened so that they cannot totally affect the body or produce infection but able to produce an immune response. These vaccines don't work in people who lack strong immune system as weakened pathogen also have the ability to multiply in that body and might cause disease in these people. These include rotavirus, MMR, nasal flu, chicken pox, BCG and shingles vaccine.

Here comes the inactivated vaccines which contain the whole pathogen that have been killed or their proteins being removed won't be able to cause disease and since it contains killed pathogen, it provides advantage over live attenuated vaccines in weak immune systems. But it doesn't produce a long lasting and strong immune response as live attenuated vaccines do. So as to make it up to the bar, adjuvants like aluminium salts which help in strengthen and lengthen immune response are usually added to vaccine. These include rabies, polio and hepatitis A vaccine.

Subunit vaccines which are also called acellular vaccines, contain polysaccharides or proteins from the surface of pathogens which can cause the disease and can be recognized as "foreign" and referred to as " antigens " and can trigger body's immune response.

These are classified into toxoid, conjugate and recombinant vaccines—

Toxoid vaccines are the vaccines which can trigger a strong immune response by the recognition of toxins(poisonous proteins) released by the pathogens when they attack the body and some are made with inactivated versions of these toxins and are called “toxoids”. These include diphtheria, tetanus and pertussis vaccine.

Conjugate vaccines are those vaccines which contains polysaccharides or proteins from the surface of pathogen attached to toxoid protein or toxins and as immune response recognizes these proteins very easily, it generates a strong immune response and provides an advantage over subunit vaccines. Moreover,it also works well in babies and young children. These include Hib, MenC(combined with tetanus toxoid), PCV (combined with diphtheria toxoid) etc.

Recombinant vaccines, also known as biosynthetic vaccines are those which contain bacterial or yeast cells to manufacture the vaccine. A small piece of DNA or RNA taken from the pathogen and inserted into other cells to make large quantities of active ingredient for vaccine.

Taking an example of making of hepatitis B, part of hepatitis B virus is inserted into DNA of yeast cells and yeast cells are able to produce surface proteins from hepatitis B virus. These include hepatitis B, HPV and MenB (meningococcal bacterial vaccine) vaccine.

There are different types of vaccines available in the market in the way they are created, some of them try to smuggle the antigen into the body, others use the body’s own cells to make the viral antigen – whole virus, subunit, viral vector or recombinant vaccine. Everyone uses a different approach so to make it suitable for different individuals with differing immune systems.

Lastly I want to conclude that although we use different approaches to create different vaccines for various diseases, but it’s potential depends upon the pathogenicity of disease causing pathogen, it’s surface proteins and as well as on individual’s immune response to that pathogen.

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14.

Anti-vaxxers v/s global immunization

-Sarika (I Year)

After the optimistic nod of approval that India received from the National Drug Regulatory Authority to begin priority vaccination, it becomes impossible to overlook the growing anti-vaccination or "anti-vax" campaign that has been underway as well.

Anti-vaxxers, though small, are a vocal group of people that tend to show vaccine hesitancy. With the world's eyes set on researchers and scientists to find a way around this virus, anti-vaxxers meanwhile have managed to twist the uncertainties surrounding the pandemic to multiply disinformation on social media.

Anti-lockdown protests, conspiracy theories, and alignment of far-right ideologies have instigated anti-mask sentiments as these people continue to make a hue and cry about their breached individual freedom.

Recently, a similar movement in the USA resulted in a spike in highly infectious diseases that were eradicated long ago. The government found a list of scary-sounding chemicals, like phenoxyethanol, doing the rounds on social media. Unaware parents had succumbed to the widespread fear that the mercury-based chemicals caused autism and did not get their infants vaccinated with MMR (a vaccine used to prevent measles, mumps, and rubella).

In a country like India, where there are already taboos surrounding hygiene and sanitation, based on religious and political grounds, a situation like this to manifest itself does not sound far-fetched.

Wrongful notions such as the vaccine causing the very disease it is meant to prevent, conspiracy theories against the government to induce male sterility, or injecting the population with electronic chips are some of the absurd statements being forwarded on the notorious WhatsApp chats.

In my opinion, people's mistrust of their government and their skepticism in the face of science results in such dire situations. It is high time that the pro-vaccination fraternity takes a page from the anti-vaxxer's book and starts to advocate passionately about their vaccines to the masses, especially in India where hearsay easily influences people. Even though the population of anti-vaxxers is a minority, they are noisy, and this noise drowns out anything less loud.

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15.

Depression due to COVID-19

~ Nidhi Rai (I Year)

Of all the major illnesses, mental and physical, depression has been one of the toughest to subdue. Depression and anxiety are announced as special issues of "Mental health" especially during COVID-19 pandemic. Now, the question arises, what exactly depression is? Depression is a mood disorder that causes a feeling of sadness and low self-worth or guilt and a reduced ability to enjoy life. It is an incredibly real and serious problem with long-lasting adverse effects on both physical and mental health. Globally, more than 350 million people of all ages are suffering from depression.

COVID-19 has led to internal and external wart for the humanity There is a precipitous rise in degree of fear, worry, stress and concern in the population at large, especially among certain groups in particular, such as old, adults, care providers and people with underlying health conditions. The pandemic has become a major restriction on people's day to day routine and has addressed them by various external forces.

It has pushed out the world to worst economical situation in which people do not have any source of income or other support systems to feed their families and save their lives.

This pressure of being separated or losing their family has stepped them closer to acute fear, stress, loneliness, anxiety and ultimately to depression.

Depression affects our entire body, especially if left untreated. People with depression may experience appetite changes, which can cause unintended weight loss or weight gain, they may experience unexplained aches or pains, including joint or muscle pain, breast tenderness and headaches. Depression reduces a person’s motivation to make positive lifestyle choices, their risk of heart disease increases when they eat a poor diet and have a sedentary lifestyle. Research indicates that chronic stress and depression are linked to inflammation and may change the immune system. People with depression are more likely to have inflammatory conditions or autoimmune system disorders, such as irritable bowel syndrome (IBS), diabetes, and arthritis.

People with depression often report stomach or digestion problems, such as diarrhea, vomiting, nausea, or constipation. According to research published in 2016, this may be because depression changes the brains' response to stress by suppressing activity in the hypothalamus, pituitary gland and adrenal glands.

But what exactly happens inside the person suffering from depression? Though the exact reason is unclear, researchers have suggested that for some people, having too little of specific neurotransmitters in the brain could be the reason behind depression. Along with this, scientists have noticed that aberrations in brain cell growth and connections actually may play a larger role in pathophysiology of depression.

Depression drains our energy, leaving us feeling empty and fatigued. This can make it difficult to muster the strength or desire to seek treatment. The primary approach adopted for treatment procedure includes restoring the balance of specific neurotransmitters in the brain which could help alleviate symptoms. Various therapies such as psychotherapy are available which can improve overall mental health.

Even with the help of these interventions, depression is a highly complex condition to treat. What proves to be an effective treatment for one person with depression may not work for others. While psychotherapy is helpful for some, if there is a chemical imbalance in the brain, it may not be enough to address their symptoms.

To complicate treatment further, medication does not always work for people with depression. One study evaluating the effectiveness of currently available antidepressants found that these medications only work in about 60% of people with depression. Even if your depression is primarily linked to an imbalance of chemicals in the brain, depression affects both your internal and external life. Therefore, medication alone may not be sufficient to address all the ways in which depression can affect you and this leaves a room for improvement through management.

Depression is easily and well manageable. There are small steps which can give big impacts and manage depression symptoms. Getting into a routine, setting goals, regular exercise, meditation, healthy diet, getting enough sleep, sharing the problems with friends and family, challenging negative thoughts, enjoying the moments can help to fight against depression. Thus, addressing mental health during and after this global health crisis should be prioritized and placed into the international and national public health agenda to improve citizens' wellbeing.

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16.

The new normal: COVID-19 pandemic, An eye opener

~Mansi Arora (III Year)

Pragmatically every person we communicate with these days wants to erase the year 2020 for obvious reasons. Without a doubt it is very certain that 2020 will go down in history as an indelible year, as it is cogent enough to force us to adjust to the new normal. Dauntlessly saying 2020 was a blessing in disguise because now we are talking about those things which were ideally thought to be an endless asset from the nature. Academic discussions over global warming, air qualities, urban sprawl, waste production, pollution, sustainability, healthcare and R & D are taking place like never before.

The pandemic of 2020 has made us realize that why it is important to value those whom we have in our lives rather than chasing things which merely exist to give us candid happiness. It brought those children back to their parents, who were devoid of parental love and care in their busy schedules living away from their homes.

At last all of us are trying to redefine our relationships with our closed ones. Sustainability is the key to replenish this planets' soul, we need to sustain every important thing from energy resources to our lives and goals. Now, people are actually thinking about sustainability in everything they do, and once we start thinking about it consciously with scientific temperament, we can remodel a world which works on accountable manufacturing, consumption and adequate disposal

The corona virus pandemic is not a malediction; it is a much needed pause and an eye opener so that we can see the mess we have all created in the name of success, capitalism and socialism and find ways to help our planet heal and use the resources while keeping sustainability in mind. From research in technological fields and innovation, professional works, shopping procedures, academics, supply chain, entertainment; to tourism and hospitality we have observed changes in every business this year.

Hence, it is evident to say that the COVID-19 pandemic has brought about a new normal around the globe. From development in digital health technologies to contact-less doors to humanoid robots for the hospitals, innovation and technology has played paramount roles throughout the year in controlling the COVID-19 pandemic.

Certainly these technologies will become an indispensable part in our future to come. Work from home has had a trickle-down effect on many facets of supple businesses necessitating: nimble way of working and communicating with heads and colleagues; meetings being held virtually on 6" screens; unescorted by large infrastructure and massive time saving in daily transportation.

The pandemic forced the suppliers to change their ways of selling their products. Never before this pandemic have the retailers

thought about the decorum and guidelines issued by any authority directing their style of work or how customers should enter into the store, the distance that should be maintained between them, the sanitation requirements fulfilled by them using hand sanitizers/masks while shopping and usage of gloves to avoid any physical contact with any object or a safety kit for the frontline workers. Darwin's theory states "survival of the fittest", this concept has given a new perspective to academic institutions to walk shoulder to shoulder with the technologies available to facilitate the smooth running of the various courseworks.

A complete transfer of teaching mode from classroom-based to online mode has compelled students and teachers to adopt new ways of learning and get ahead in this time. The pandemic has disarrayed the complete international supply chain system and the effect is evident on business procedures, consumer habits and the global economy. Although with many temporary yet suitable changes in transportation strategies, logistic operations, and supply chain management, any hard change is not expected for now.

Many countries have realized that they will have to come up with new technologies and their over-dependency on other countries for supply chain is not good for their survival. Never in history has the media and entertainment industry gone through such unexpected changes.

The entertainment industry and the audience that used to go to the concerts or theatres came to a standstill for some time, but yes OTT platforms aren't less than the source of Pollyannaism.

Nowadays, OTT platforms are the chief players benefiting from the situation because even in 2021, people are scared of visiting theatres. People now pay for the content differently and this will continue for a measurable period of time as per the situation. We will see a new era of virtual fruitful interactions and reduced travels post COVID-19.

Meetings will certainly be important for work and other professional services but human mind will definitely find better alternatives to minimize the in-person contact.

Studies say that post COVID-19 pandemic, people will still practice social distancing, wear masks, avoid shaking hands, and visit hospitals in hysteria for having flu-like symptoms. All these practices are slowly becoming a vital part of our new normal lives and these will stay around for a long period. This pandemic has been a revelation for all of us, now we have started considering what's important in life and why it is better to be well prepared for uncanny catastrophic emergencies.

Thank you for reading. Now you know that COVID-19 pandemic is not a malediction but an eye opener.

17.

The bright side of covid-19 pandemic

~Hirday Sehgal (I Year)

Can we uninstall 2020, this version has a virus in it”

We could easily end people saying this, but as every coin has its two sides, these stressful times or we can say 'pandemic time' also had many positive things in it. just we need to change our point of view and that is it! So let's change ourselves and try to see a silver lining in this scenario.

PRACTICING BETTER HYGIENE

People realized the importance of cleanliness and proper hygiene in their daily life. From sanitizing our hands after every touch to washing vegetables and fruits whenever we get them in our house, from covering our nose and mouth while getting out to maintain a proper distance while meeting someone. We all have had a lifestyle change for the good because we knew the consequences if we don't follow all these. Children played an important role in this. They took responsibility on their little shoulders to remind everyone to wash their hands and then enter and to take up the mask before stepping out.

DIGITAL EDUCATION AND WORK FROM HOME

Schools, colleges have been shut down in the time of crisis, but education is something that can't be stopped. Educational institutes have found a way to overcome this immensely challenging event. Classes have begun again, thanks to technology. Online classes and work from home have become the new normal. This makes the provider and the receiver more comfortable as they can do their work sitting in their comfort zone. This saves our time of traveling. We don't have to wake early and travel for long hours to our destination, rather than time could be given to ourselves or our family.

CLEANER ENVIRONMENT

During the COVID-19 pandemic and subsequent lockdown, the clear skies, and clean rivers have turned out to be a blessing in disguise for the millions affected due to pollution. In a lockdown, Delhi's air quality status achieved the ‘satisfactory’ AQI (50-100) or ‘good' AQI (10-50) category, which was like a dream for people residing in Delhi-NCR. Fewer people were commuting to work. Factories were closed. Flights were canceled. This reduced human activity and led to a huge cut in greenhouse gas emissions throughout the globe.

CULTURAL BENEFITS

Indian traditions are unique and a blessing for mankind. Originated from the ancient scriptures and text, they have also shown us a better way of life.

Namaste is one of them adopted by the whole world to greet anybody in this corona crisis. Even the Israeli PM Mr. Netanyahu asked their people to say Namaste which was a proud moment for Indians. From the early era, Indians use to clean their hands and legs before entering anywhere. These days many people started following Nani-Dadi's 'nuskhas' or home remedies like drinking 'kadha' oftentimes, adding herbs and spices into the diet. Yoga is something that helped many people to stay physically and mentally and active. Today our Indian roots are helping us to protect ourselves and maintain less fear of infection.

SOCIAL BENEFITS

People understood their duties towards the nation and fellow citizens. On a single call of Hon'ble PM, whole country realized the sensitivity of this issue and followed the rules and regulations to defeat this virus.

Whether any person suffering from disease or any labourer going back home, all countrymen showed kindness and stood together to help them. When the funds were required to recover this pandemic, many charity heroes came forward and donated their hard earnings. Doctors are considered not less than God in our tradition but this pandemic realized that even a normal sweeper who cleans our roads and streets before we wake up is also not less. Doctors, policemen, sweepers, NGO's volunteers risked their lives to protect the life of the citizens of our country.

VOCAL FOR LOCAL-AATMANIRBHAR BHARAT

Until the beginning of 2020, it was all about internationalization and globalization of business, but when the world hit this pause and the economy was getting low, something new called 'Vocal for local' or 'Aatmanirbhar Bharat' initiative arrived. In this, people were encouraged to buy local products, which strengthens ournation's economy and brings bread as well as recognition to our small craftsmen, traders and villagers with immense power and skills.

SCIENCE-A BOON IN CORONA TIMES

It is really difficult to imagine this pandemic without modern-day science. It was the gift of science that the whole of mankind was connected virtually. Birthday parties to formal meetings, hearings of Court of Law to religious festivals, consulting a doctor to watching a thriller movie, online classes to work from home, everything was going online using various digital platforms. Not just this but the cure of this pandemic i.e. a vaccine for this virus is also one of the greatest gifts of science to the world. Many pieces of research on new types of remedies are also going on. People realized the place of modern science in their life. The government also realized the importance of investment in the health and research sector to tackle any circumstance like this in the future.

CONCLUSION

Together we can beat anyone and a time of crisis is the best to test it. Whole humanity proved that if we strengthen our faith in each other and work in unity we can turn and make anything into our favor.

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18.

How does the enemy- SARS-CoV-2- looks like?

~Alisha Ansari (III Year)

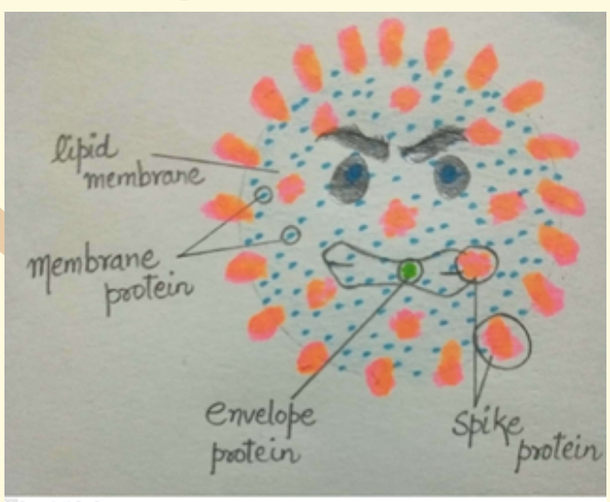
Structural components of SARS-CoV-2

1.Spike Glycoprotein (S)-

- Helps the virus to get into the cell.
- It is a transmembrane protein with a molecular weight of 150 kDa.
- It is found in the outer envelope of the virus.
- It forms homotrimers protruding from the viral surface and facilitates binding of envelope viruses to the host cells by binding to angiotensin-converting enzyme 2 (ACE2) receptor which is expressed in the cells of lower respiratory tract of the host body.

2.Membrane Glycoprotein (M)-

- It is the most abundant variant membrane protein.
- It is responsible for the transmembrane transport of the nutrients, the release/budding of the new virus particles (virions) , and the formation of a viral outer envelope.



3.Nucleocapsid protein (N)-

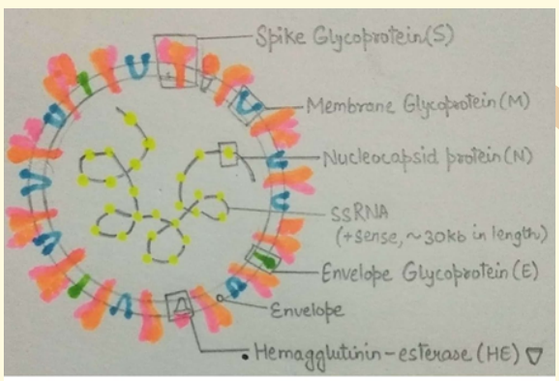
- It is involved in the formation of a nucleocapsid in the RNA genome.
- It also participates in regulating viral RNA synthesis and interacting with the M protein during viral budding.

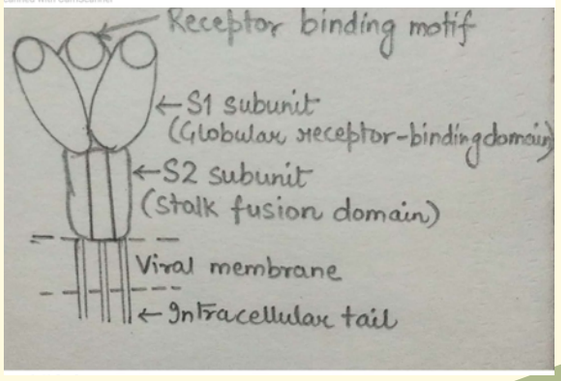
4.Envelope Glycoprotein (E)-

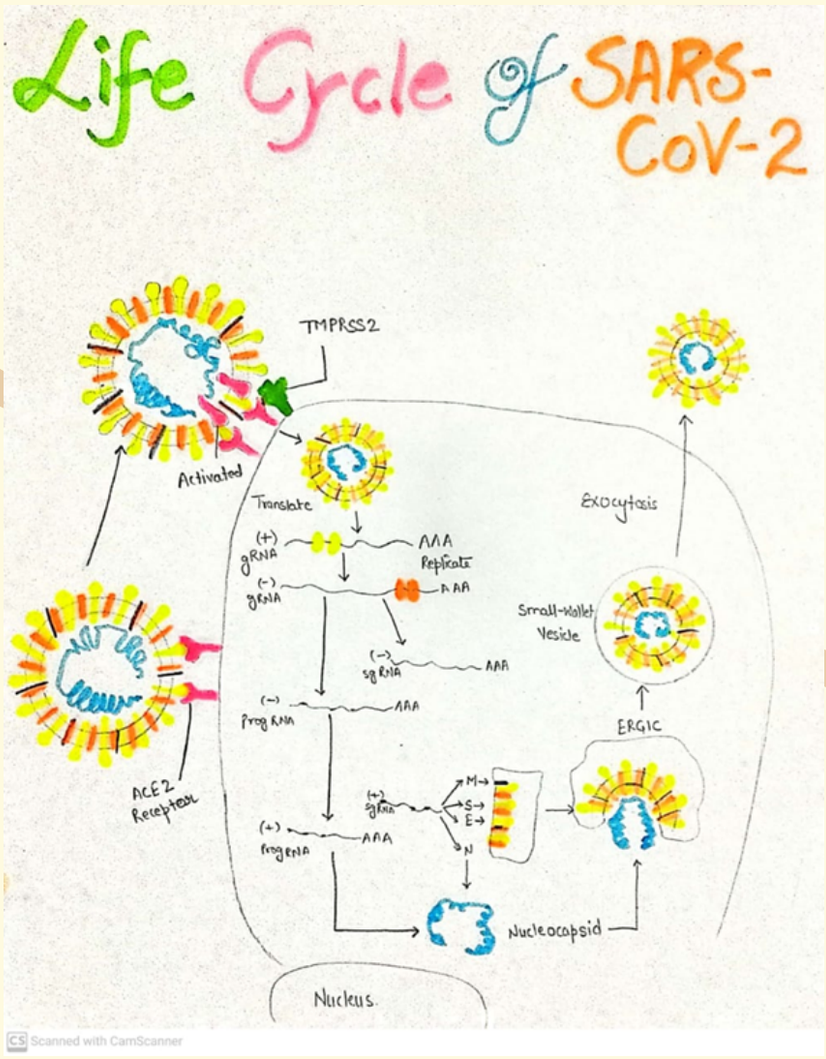
- It is the smallest and the most mysterious of all the components.
- It is expressed in large amounts in infected cells but only a small part is integrated into the envelope of the virion.

5. Hemagglutinin-esterase (HE)-

- It facilitates the virus to initially adsorb to the cell membrane.







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19.

One bug, many lives: The rise of *Klebsiella pneumoniae*

~ Ashwin Uday, Koyel Ray and Abhishek Chari (BMS Alumni)

Found among the top three ranks in WHO's priority list for pathogens, Klebsiella pneumoniae is one of those bacteria against which medical and scientific institutions around the world have struggled over the last few decades. In that time, it has evolved into some of the most virulent and antibiotic resistant microbes that infect humans. Some of these versions of K.pneumoniae, also called strains or genotypes, have been responsible for multinational disease outbreaks across the globe. Scientists and doctors around the world are also worried that microbes like K.pneumoniae might pose a greater risk to human health, after our struggles against COVID-19.

When the passenger starts to create trouble

In 1882, German microbiologist Carl Friedlander discovered K.pneumoniae. He identifiaed this microorganism in the lungs of patients who had succumbed to pneumonia. Eventually, the medical term for lung infections (pneumonia) became a part of this microbe's scientific name. Later studies unveiled other aspects of this organism, including the fact that it can colonise the mouth and other regions in the human gut or gastrointestinal tract.

While it does not seem to be directly harmful in the gut, it can cause havoc if it reaches other parts of the human body. People whose health is compromised due to pre-existing illness, are hospitalised and on long term medication with immunosuppressants or antibiotics, are particularly prone to such K.pneumoniae infections. These infections can happen in various organs such as the lungs, blood, liver, eyes and brain. This microbe can also initiate infections after colonising medical devices, such as catheters and endotracheal tubes.

Prolonged sickness can weaken the immune system, preventing the human body from fighting off attacks by opportunistic microbes like K.pneumoniae. Making a bad situation worse, such microorganisms can then goad the impaired immune system into making counter-productive responses, like sustained inflammation. Other pre-existing, chronic disease conditions like diabetes and alcoholism also allow K.pneumoniae to spread easily from the gut to other organs, such as the liver or lungs, and cause infections.

Along with spreading inside a person, there are two ways in which this bacterium can be spread between people: hospital-acquired and community-acquired. Hospital facilities that don't adequately clean or inappropriately reuse medical equipment, and maintain poor hygiene standards for personnel, can act as long-lasting sources of infection. Community-acquired infection happens if we come in contact with an already infected individual in public places like the subway or a market. But, regardless of how this microbe spreads, the outcomes of infection have become worse because of antibiotic resistance.

Antibiotic resistance raises the stakes

When used excessively, antibiotics can have two types of side effects. First, they can cause collateral damage by killing many kinds of beneficial microbes that live in the human body. Opportunistic pathogens like K.pneumoniae can become dangerous when they are not kept in check by competing beneficial microbes. Secondly, overuse of antibiotics can increase the populations of antibiotic-resistant bacteria. Such bacteria can no longer be killed or destroyed by certain kinds of antibiotics. Acting at the individual and community level, these two side effects make K.pneumoniae extremely dangerous.

While some strains of K.pneumoniae have become resistant to single antibiotics, others have become resistant to multiple antibiotics and are called multidrug resistant. Infections caused by such strains are very hard to cure and K.pneumoniae is a textbook example of the dangers of indiscriminate use of antibiotics.

But if antibiotic molecules are weapons, then resistance mechanisms are the defense, and all microbes can evolve resistance to antibiotics. They develop resistance mechanisms over time, and share them with other microbes in their vicinity. When antibiotics are used, the susceptible bacteria are killed and the resistant bacteria survive and increase in numbers. If used too frequently, no antibiotic can remain useful for very long. Seen from this perspective, antibiotics are a natural resource. We need to use them sparingly, to prolong their usefulness in combating disease.

As with all medicines, doctors prefer using antibiotics that are effective against microbes and safe for humans. But their ability to make such clear cut choices has started to crumble over time, when faced with antibiotic resistance. This sad transition is apparent in humanity's struggle against K.pneumoniae.

Many strains and many abilities

In the 1980s, some K.pneumoniae strains were found to be resistant to many beta-lactam antibiotics. This set of antibiotics, counted among the most commonly prescribed classes of medication, includes penicillin and its derivatives. By producing enzymes called beta-lactamases, these K.pneumoniae strains can chemically inactivate these antibiotics. This phenomenon heralded the first wave of antibiotic resistance observed in this microbe.

In order to cure infections from such resistant bacteria, a group of modified beta-lactam antibiotics called carbapenems began to be used. For a while, these modified antibiotics were effective. But this victory did not last long. Resistance to carbapenems was first observed in the United States of America in 1996, with the bacteria producing another enzyme called carbapenemase that triumphed over these antibiotics.

With regard to India, antibiotic resistance was brought into sharp focus with the discovery of New Delhi Metallo-ß-lactamase, a new antibiotic resistance mechanism in K.pneumoniae in 2009. The resistant bacteria were found in a diabetic patient who had surgery and a course of multiple antibiotics from a hospital in New Delhi. The scientists who discovered this also found a strain of E.coli, from the same patient, harbouring the same resistance mechanism. Genetic clues showed that the antibiotic resistance originated in K.pneumoniae and was then passed on to E.coli.

Such exchanges of resistance between different bacteria cause scientists and policy makers to worry about a post-antibiotic future. This scenario is only a step ahead of what's happening right now, where doctors are forced to compromise on the kind of antibiotics that they have to use for their patients.

The increased resistance of K.pneumoniae to common medications has led doctors to start using last-resort antibiotics that were previously abandoned.

Despite the toxicity that it produces in the human nervous system and kidneys, an antibiotic called colistin gained a second life as a drug to treat beta-lactam or carbapenem resistant K.pneumoniae. But, as early as 2010, some K.pneumoniae strains were also found to be resistant to colistin. And, just like that, another antibiotic 'bites the dust'. With multidrug resistance showing up in many bacteria, we seem to be quickly heading towards a time when most of the antibiotics we use right now might become useless.

While antibiotic resistance certainly makes K.pneumoniae hard to deal with, certain strains of the bacterium have developed other dangerous capabilities. Hypervirulence is another emerging problem associated with this microbe. It began around the year 1986, when cases of extremely severe K.pneumoniae infections were reported in Taiwan. Later, the same strains were also found in Asia, followed by cases popping up in Australia, North America and Europe. They can infect young, and otherwise healthy, individuals. Once established in a patient, they can spread from the primary site of infection to other parts of the body. In this way, the bacteria attack various bodily tissues and cause severe infections in skin, bones and liver. These hypervirulent K.pneumoniae bacterial strains are also able to withstand attacks from the human immune system. They manage this by producing a protective outer layer or covering for themselves, which is also effective against antibiotics.

Over the last fifty years, the threat that K.pneumoniae poses to humanity has grown by leaps and bounds. Initially, this bacteria could only cause a problem in already weakened patients and could be killed with many antibiotics. But as of today, there are strains of this bacteria that have become both hypervirulent and multidrug resistant. This combination of abilities means that they are no longer limited to attacking only people who are already weakened by other diseases. They can attack otherwise healthy people and, when they do this, they cannot be controlled with many commonly used antibiotics.

Meet the challenge with policy and research

The problems posed by K.pneumoniae, and other bacteria like it, are being dealt with in two ways: policy initiatives and new research. Policy initiatives that are widely implemented across national and private-public divisions can have the fastest effects. The focus would be towards two results: control the spread of disease causing bacteria and slow down their development of resistance to antibiotics.

Global policy changes have been driven by lessons learnt in the past. Following a nationwide outbreak of carbapenem resistant K.pneumoniae in its hospitals in 2006, Israel successfully managed to contain and control the spread of the microbe. Israel's strategic infection control measures contributed to WHO's global guidelines in 2017 for combating similarly resistant microbes.

In order to control the emergence of antibiotic resistance, we need to ramp up stewardship of treatment plans against all medically significant, disease-causing bacteria.Since 2013, the Indian Council of Medical Research (ICMR) has been running the Antimicrobial Resistance Surveillance and Research Network (AMRSN) to guide the use of antibiotics against many disease causing bacteria.

India's relatively recent inclusion into WHO's Global Antimicrobial Resistance Surveillance System (GLASS) serves to increase the nation's level of engagement and allow the international cooperation and information exchange needed to effectively deal with this problem. So, in recent years, India has been moving forward with some of the changes needed to help identify and control outbreaks of antibiotic-resistant bacteria like K.pneumoniae.

Ultimately, lowering the rate of human contact with disease causing microbes is probably the best way to limit antibiotic use. Improving community hygiene and sanitation can definitely help reach this goal. To complement this preventative approach, we need to invest in more research on vaccines that can help our immune system to fight off such microbes. But neither sanitation or vaccination are easy targets to coordinate, especially at the national or global levels. In this situation, it might be best to develop and use several therapeutic and diagnostic tools to fight such microbes.

Researchers have identified viruses, known as bacteriophages, that specifically target and destroy certain bacteria, including K.pneumoniae. Popularly known as phages, these viruses are strictly host-specific i.e., tend to infect specific bacterial species, leaving human cells unharmed. Phage therapy has a long history and possibly a bright future in helping combat antibiotic resistant bacteria. Even developing resistance to phages might make bacteria more susceptible to antibiotics or alter them in other ways that make them easier to control. So, combination therapies that include antibiotics and phages might form a resilient defense against bacterial diseases in the future.

Gene sequencing techniques that can quickly identify the genetic make-up of bacteria, and their associated capabilities, can support the best implementation of such next generation combination therapeutics.

In order to future-proof India's healthcare, we need to continue making fundamental and interacting improvements in infection surveillance, treatment methodologies, auditing procedures and community hygiene in a fine-grained manner across the whole country. Better enforcement to prevent unregulated sales and over the counter usage of antibiotics can also help to keep preferred antibiotics useful for longer. The need for such efforts to be integrated at the national level acquires even more significance in the midst of other crises such as COVID-19.

Various strains of K.pneumoniae have been spreading around the globe for many years and are responsible for multinational disease outbreaks. They do not become less harmful simply because we now have COVID-19 to deal with. On the contrary, K.pneumoniae infections could even complicate the treatment and prognosis of COVID-19 patients, by producing ventilator-associated pneumonia and other forms of infection. In our haste to declare victory against COVID-19, we must not allow other diseases to flourish. Whatever the disease, it is still human lives that are lost or saved.

Dr. Kamini Walia, the programme officer for antimicrobial resistance at the Indian Council of Medical Research (ICMR), recently advised against actions during COVID-19 that could jeopardize India's ability to fight bacterial diseases in the future, such as overprescribing antibiotics.

In our world, as it is today, we cannot afford to underestimate the impact of disease causing microbes like Klebsiella pneumoniae. If we do not marshal our forces and coordinate our efforts, even one bug can lead many microbial lives and end many human ones. Looking beyond governmental efforts and expert interventions, every concerned member of the public can help in this situation. Even as a patient or a caregiver there are important things you can do, such as taking care to fully complete prescribed courses of antibiotics. Not completing the full course of prescribed antibiotics is just as bad as taking such medicines without a prescription. Other beneficial choices you can make are not sharing your leftover antibiotics with others, as well as maintaining personal and interpersonal hygiene. Coming together at the societal and global level, even these seemingly minor individual actions can have significant positive effects. Against microbial diseases, as with many other problems, we must all fight together to secure a better future for humanity.

References

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20.

Taking center stage: The age of the bacteriophage

Muskan Gupta, Rohit R. Gokhale (III Year) and Abhshek Chari (BMS Alumni)

Disease-causing bacteria have always been a thorn in humanity's side. Our helplessness against them in the distant past can be measured in the many millions of human lives that were lost to diseases like plague, syphilis, cholera, tuberculosis and other similar horrors. But over time, we have rallied and fought against them, with only a few but trusted weapons. While vaccines and improved sanitation have proven to be a great help in keeping some of them at bay, their use is limited to prevention rather than cure. For curative ability against bacterial diseases, we haven't had a better therapeutic weapon than antibiotics.

For more than fifty years, the use of antibiotics has made many of us feel almost invincible against a wide range of such maladies. But, with the emerging problem of antibiotic resistance, it looks like we might soon be facing the horrors of the pre-antibiotic era – again! Bacteria can become resistant to not just one but many different types of antibiotics and, amazingly, can even spread this resistance to other species of bacteria.

To overcome the dangers of antibiotic resistant bacteria and the diseases they cause, we may need the help of a lesser known, and entirely different kind of therapeutic weapon: bacteriophages.

About 50% of the drugs currently being used to combat bacteria were discovered in the 1950s and 60s – which can be thought of as the 'golden era of antibiotics'. Since then, over prescription and lack of patient compliance in completing antibiotic courses, have contributed to the evolution of new strains of bacteria that cannot be killed with these antibiotics. Popularly called 'superbugs', these bacterial strains have become a source of great concern for doctors and researchers across the globe. Annually, drug resistant infections lead to at least 700,000 deaths worldwide, and this number could rise to 10 million deaths per year by 2050.

But we do not have to panic just yet! The human race is working on another strategy to counter the effect of pathogens, by focussing on bacteriophages.

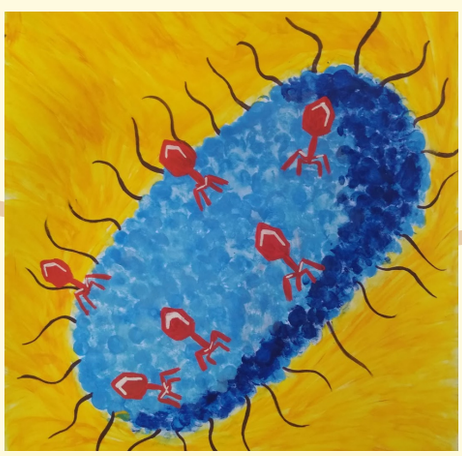


Fig. 5:- Artistic rendering of bacteriophage attached to a bacterial cell. [Image by co-author Muskan Gupta and friends (K.M. Kanika, Pulkit Singh, Sachin Sharma and Siddharth Mehdiratta); CC BY-SA 2.0]

Ironically, more than a decade before antibiotics were discovered, scientists already knew about phages. The contrasting development of these two revolutionary healthcare technologies represents an interesting paradigm of how biology was and has been driven by rapid success, expectations, geopolitical tensions and war. When phages first came under scientific scrutiny around the beginning of the 20th century, microbiologists were quick to espouse phage-based therapy to control bacterial diseases. The excessive enthusiasm that followed led to many far-fetched assertions about phages when, in reality, not much was known about them!

In the midst of all the hype came the landmark year 1928, when penicillin – the first antibiotic – was discovered. While some researchers in the West did continue working on phages, the overall focus shifted towards developing more antibiotics, as their potency became apparent (starting in World War II).The brisk developments of antibiotics and their astounding efficacy in curing bacterial infections swiftly displaced the concept of phage therapy from the western world. Meanwhile, the application of phage therapy was widely explored in countries like Georgia and Poland in Eastern Europe, besides the erstwhile USSR. Historically, this proved to be quite significant. As the Cold War continued, and the West cut off access to new technologies (including some required for manufacturing antibiotics), the Soviet Union had access to phages as therapeutic agents and could treat diarrhoea, typhoid and bacterial infections of wounds with some success.

But how exactly do bacteriophages kill bacteria? To understand what phages can do, we need to look closely at what they are. From the viewpoint of molecular biology, phages are natural nano-machines that are quite diverse in terms of their size, shape and genomes. But, the most basic structural features common to all the known phages seem to be the presence of a genome packaaged inside a protein coat. The detailed visualization of bacteriophages has been made possible with the use of electron microscopy along with other techniques, like X-ray crystallography and cryo electron microscopy, which have been used to study the overall shapes and structures of phages and the bio-molecules they are made of.

While all viruses, and therefore phages too, are composed of biological molecules, it is a bit difficult to think of them as complete living organisms. This is because viruses show some but not all the properties of life. They cannot even reproduce on their own, requiring the biological machinery of a host system (be it bacteria, plant or animal) to reproduce and increase in number. Bacteriophages have this same requirement, categorically depending on different species of bacteria to host them. Bacteriophages are also highly specific, so particular phages can successfully infect only certain bacterial species. This specific relationship of phage and bacteria is pivotal: without an exact match between viral and bacterial proteins, phages cannot even attach themselves – by adsorption – to their favourite bacterial hosts. But once phages successfully attach themselves, they can drive two very different kinds of infections in their target bacteria.

Phages have two modes of replication: Lysogenic and Lytic. After adsorbing onto the bacterial cell surface, they puncture the bacterial cell membrane to create a hole through which the viral genetic material is injected into the cell. If the phage is lysogenic, then its viral genes will integrate into the bacterial genome and the bacterial cell continues to live and reproduce normally. The phage genome that is successively inherited in this way by each of the bacterial progeny cells can make them resistant to phage superinfection. But, if the phage is lytic, things get more interesting: its genes will seize control of the bacterial cell machinery – to replicate and create more copies of the same phage. Phages also have the ability to switch from the lysogenic to the lytic mode under favourable conditions, thereby 'getting activated' and rapidly increasing in number. The 'new born' viruses that are formed then burst out of the bacterial cell, killing it in the process. This ability of phages to destroy bacterial cells makes them potential weapons for use against disease causing bacteria.

With the emergence of a growing number of multidrug resistant (MDR) bacterial strains, researchers have been forced to look beyond antibiotics for alternatives to treat such infectious diseases. The early 2000s saw phage therapy being taken up more enthusiastically and with a greater sense of purpose by the research community.Recently, therapeutic and prophylactic applications of bacteriophage therapy for hospital-borne and gastroenterological infections have been tested in which either a specific bacteriophage or a phage cocktail has been used.

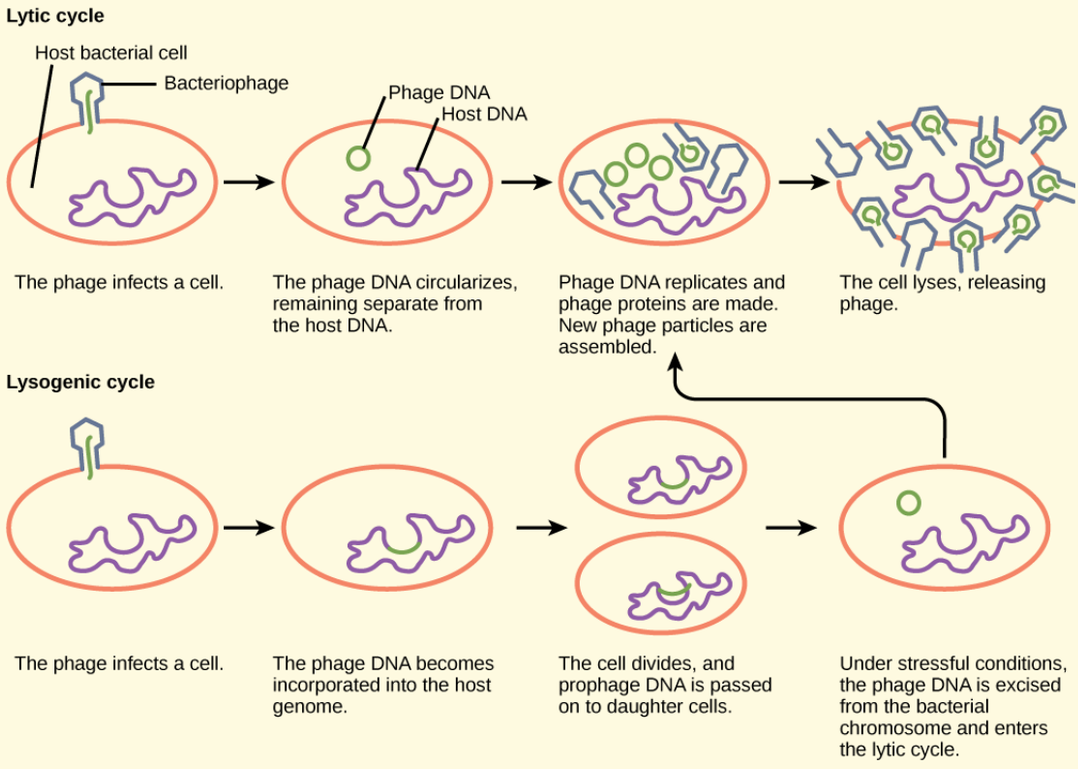


Fig. 6:- Lytic and lysogenic cycle of bacteriophage [Image by CNX OpenStax; (CC BY 4.0)]

S. aureus, E. coli, Streptococcus spp., P. aeruginosa, Salmonella spp., and Enterococcus spp. are some of the bacteria on which human clinical trials are going on in Poland – with encouraging results being obtained even for MDR strains. Most recently, a 15 year old cystic fibrosis patient who developed a disseminated Mycobacterium abscessus (MABS) infection – a MABS infection that spread to other organs besides the lungs – was successfully treated with a three-phage cocktail therapy. Breakthroughs like this encourage researchers to believe that phage therapy can be used to target other chronic bacterial diseases like tuberculosis and leprosy in the future. Working to improve phage therapies, researchers are also testing ways to continually future-proof them against bacterial resistance.

Bioengineering is an indispensable part of modern-day biological research and development. Till very recently, researchers used natural phages to kill bacterial cells. However, this may not be enough with the bacteria constantly evolving resistance mechanisms. To get the ball back in our court, genetic engineering is being used to create therapeutically useful modifications in phage genomes. Techniques such as bacteriophage recombineering of electroporated DNA (BRED) can create point mutations that have the potential to match bacterial changes as small as a single base pair of DNA. Such methods could enhance the bacteria-killing abilities of phages in many ways. Increasing the host range of bacteria that phages can target and making them work synergistically with antibiotics are just two of the tantalising possibilities on offer.

Is this all that bacteriophages have to offer? Definitely not! Using phages to fight bacterial diseases in humans is just one aspect of phage therapy. These multifaceted entities are being manipulated to act as vehicles for carrying genes, proteins or antimicrobial chemicals of our choice.

Fig 4. Artistic rendering of a T4 bacteriophage attached to its bacterial host. [Image by co-author Muskan Gupta and friends (K.M. Kanika, Pulkit Singh, Sachin Sharma and Siddharth Mehdiratta). CC BY-SA 2.0]

Modified adequately, they can provide efficient drug delivery, gene therapy and even biocontrol of diseases beyond those that affect just the human body, such as agricultural plant diseases caused by bacteria. Bacteriophages also show promising effects in tests that have used them in bioimaging, bio-sensing, enzyme display and nanomaterial design.

With so many possibilities on the table, you may be wondering why these amazingly talented organisms called bacteriophages are not being used very actively at present. Well, that is what got us thinking too! Historically, there have been several difficulties in bringing phages to the clinic. A huge advantage that antibiotics enjoyed is that they can target and destroy a large spectrum of bacterial species, while phages are strain-specific.

Besides this, many biologically important characteristics of phages were not well known. Inadequate purification, processing and storage protocols resulted in low concentrations of the active phage populations and contamination of their cultures often made matters worse. Even today, there are unanswered questions such as the optimal dosage of phage cocktails, their time of action and safe usage. The development of new medications is a stringent process: potential therapeutics have to be thoroughly tested in different model organisms before they can be tested on humans. At the moment, phage research is in its infancy, but enormous research efforts are underway to bring safe and effective versions of them, in the near future, to your neighbourhood pharmacy.

If bacteria can develop resistance against powerful weapons like antibiotics, do you think they will allow the tiny phages to steal their thunder this easily? Bacteria and phages have continuously been at war for survival and are in an arms race to gain any advantage they can over each other. Bacteria are known to have evolved adsorption-blocking mechanisms that prevent phages from even attaching to them. Over time, bacteria have also developed multiple enzymatic defense mechanisms against phages, including the adaptive immune response known as the CRISPR-Cas system, popularly called CRISPR. This system is currently also used as a genome editing tool in biotechnology applications-inspired by the bacterial defense against phages. Bacteria possess six known kinds of CRISPR systems that can be thought of as molecular scissors which chop up the incoming genetic material from invaders such as phages.

However, some phages also have a trick up their sleeve! They use anti-CRISPR (Acr) proteins which interact with distinct mechanisms to counter-attack the bacterial defense system. Both the CRISPR and Acr systems are the result of evolutionary processes and the ‘by-products’ of the ancient war being fought between two of the deadliest creatures on earth – bacteria and phages.

Looking to combine the best abilities of bacteria and phages, the Marraffini and Lu labs at Rockefeller University and Massachusetts Institute of Technology, respectively, are focussing on engineering CRISPR-wielding phages. Soon, bio-engineered phages, besides bacteria of course, will have the ability to use this high-precision genetic ‘machete’. In this way, scientists are planning to hijack the arms race between bacteria and phages to benefit humans. High selectivity and the protection of commensal bacteria that are useful to us are the key ideas behind the development of such futuristic biotechnologies.

The emergence of bacteria that are resistant to multiple classes of antibiotics has given a much-needed push to bacteriophage research and, if expert opinions are to be believed, ‘the ship has just set sail’. The historical image of phages as the ‘heavyweights’ of the biological world is now becoming a reality. The time is near, when people will know about “bacteriophage medicines” as well as they know about antibiotics in 2020! This coming age of bacteriophages is likely to propel many transformational advances in healthcare, agriculture, industry and other aspects of human life in the decades to follow.

References

This article was originally published on IndSciComm: https://indscicomm.blog/2020/07/19/one-bug-many-lives-klebsiella-pneumoniae/

21.

The 12 gifts by COVID

~Manas Singhal (I Year)

The first gift of this year that COVID gave to me
A virus to every country.

The second gift of this year that COVID gave to me
Two latex gloves,
And a virus to every country.

The third gift of this year that COVID gave to me
Three hand sanitiser bottles,
Two latex gloves,
And a virus to every country.

The fourth gift of this year that COVID gave to me
Four COVID tests,
Three hand sanitiser bottles,
Two latex gloves,
And a virus to every country.

The fifth gift of this year that COVID gave to me
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to
every country.

The sixth gift of this year that COVID gave to me
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The seventh gift of this year that COVID gave to me
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The eighth gift of this year that COVID gave to me
Eight months of lockdown,
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The ninth gift of this year that COVID gave to me
Nine films on digital,
Eight months of lockdown,
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The tenth gift of this year that COVID gave to me
Ten million cases,
Nine films on digital,
Eight months of lockdown,
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The eleventh gift of this year that COVID gave to me
Eleven months of unemployment,
Ten million cases,
Nine films on digital,
Eight months of lockdown,
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

The twelfth gift of this year that COVID gave to me
Twelve zoom call meetings,
Eleven months of unemployment,
Ten million cases,
Nine films on digital,
Eight months of lockdown,
Seven kg weight gain,
Six feet of distance,
Five different masks,
Four COVID tests,
Three hand sanitizer bottles,
Two latex gloves,
And a virus to every country.

22.

Break the chain: The campaign to combat corona

~Anamika Binu (I Year)

As the alarm rings to wake us up
To move on in life with our heads up,
The pandemic seems to arrest us all,
But we are not ready to fall.
And to bring back the happy rain again...
Let's break this pandemic chain...

To accept these changes is a big task,
Now our smiles hide under the mask.
Together in this sudden strangeness,
We are fighting this illness
With the hope to win this down the lane...
Let's break this pandemic chain...

The year we passed was the time
That felt as sour as lime,
But with the courage to fight in the coming years
We bravely held the hands of our dears,
To challenge this micro enemy and win over its game...
Let's all break this pandemic chain…

To all our real super-heroes who stood by us every time
Working hard for the world day and night,
A big salute to our medical teams
Who are working for the world's dreams,
Pouring their dedication to introducing the vaccine mainly
To let us live healthily and happily,
Trying to establish a fearless life again...
Let's break this pandemic chain...

Finally, we learned in this pandemic,
To spread the essence of love enough,
And To spread positivity is now not as tough.
We should choose not to dwell in our past but to enter the new future,
Let's all take a step for ourselves to nurture...
To bring those colourful flowering blooms of happiness again...
Let's all break this pandemic chain...

23.

तमहरता

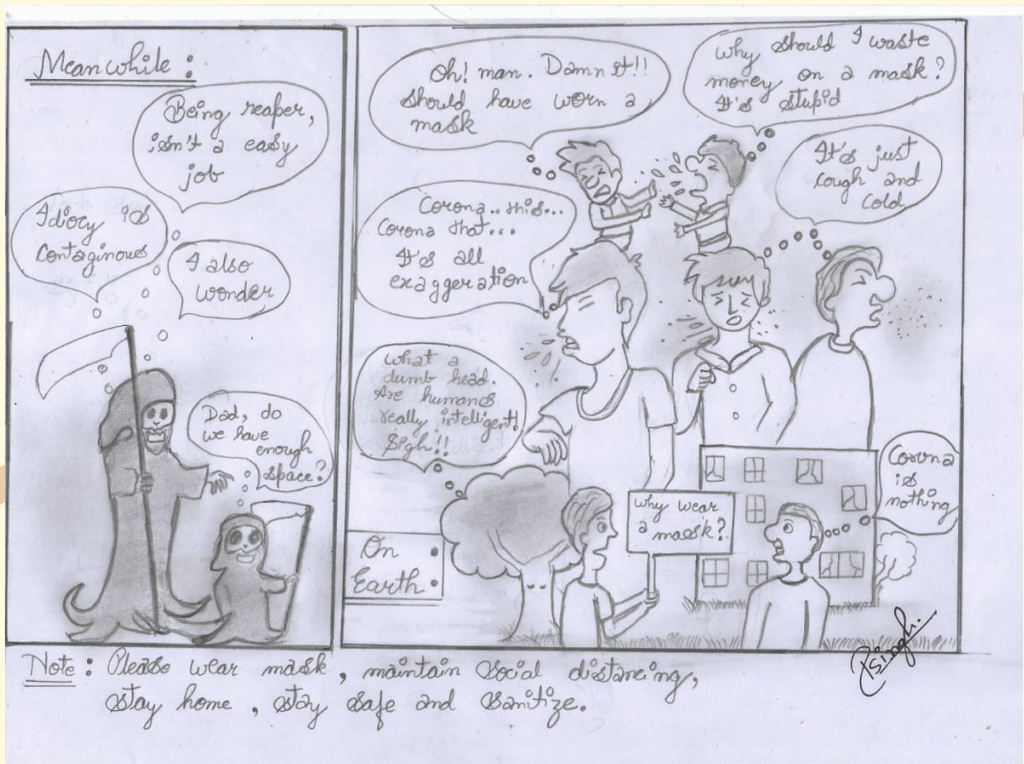
~अनिरुद्ध कुमार "निर्वाण"

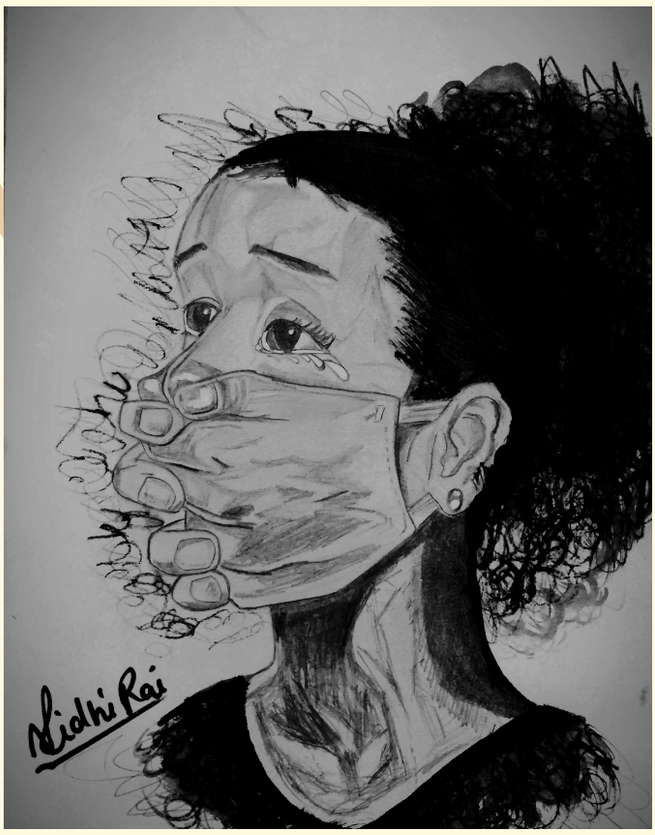
कुछ दुश्मन अनदेखे, कुछ दुश्मन अनजाने
जीवंतों को अक्सर बना जाते वीराने...

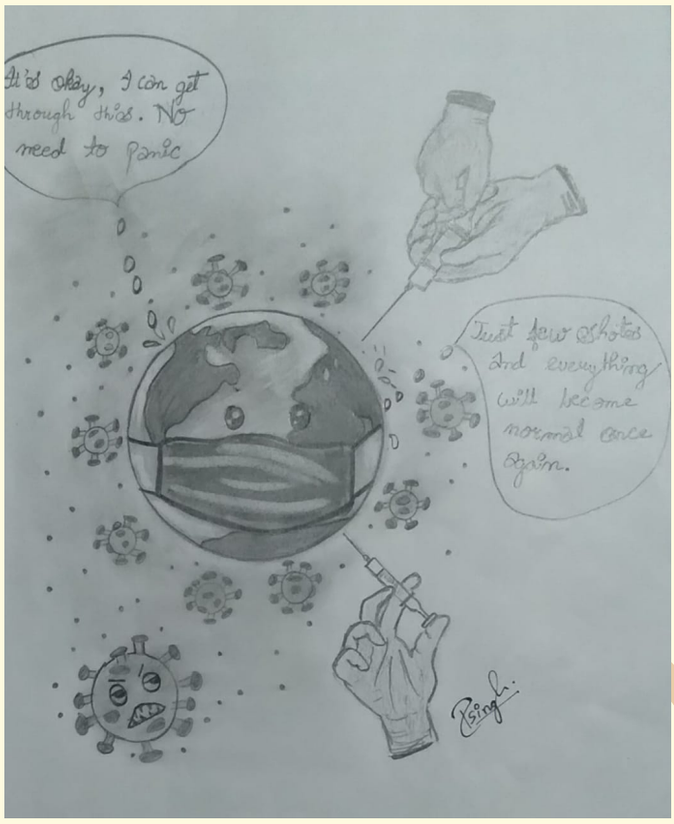
किसने सोचा था हवा संग मौत लहराएगी
इंसान द्वारा इंसान को प्रसाद सरीखी बांटी जाएगी
पूरी कायनात अनदेखे दुश्मन के सामने हारेगी
चीज ये पूर्व की सबको स्वास से मारेगी
वो मजदूर बहुत रोया जिसे कोई नहीं जानता
उसका बेटा था गांव में सांसे आख़िरी गिन रहा
पैदल मीलों वो चला सोया चित्थड़ों में लिपटा
लेकिन फिर भी बच्चे को अपने विदाई आख़िरी ना दे पाया
वो दुकानें छोटी-छोटी कहीं गुम सी हो गईं
वो रेढ़ी खिलौनों की ना जाने कहां खो गईं
अब सुनाई ही नहीं देता उन मेलों का शोर
वो टिक्की के ठेले ना जाने गए किस ओर
गए तो एक तरह से वो भी हैं
जो रोने को पीछे है रह जाते
अगर इंसानियत बची होती थोड़ी
तो शायद इंसान भी बच जाते
ये हलाहल क्या कलि है कलियुग का
या धरा की वो प्रचंड गुहार है
उस मतलबी मनुष्य की लाशों का
लगाया जो इसने बाज़ार है
मालूम सबको है
कि एक दिन सब गहरी नींद सो जायेंगे
पर किसने सोचा था कि
आज मरने पर चार कंधे भी
नसीब न हो पाएंगे
लेकिन कंधे कुछ अनजान
कभी-कभी दिख ही जाते हैं
मुसीबतें ना जाने कितनी ही हो
वह कंधे नहीं कतराते हैं
उन सूरजों ने लौ कम होने ही नहीं दी
और शायद इसीलिए निर्वाण कुछ इंसानियत बच गई
तो क्या हुआ जो दुश्मन अनदेखे हैं
तो क्या हुआ दुश्मन है अनजाने
दिये तम अक्सर वहीं हरते हैं
दिये तम अक्सर वहीं हरते हैं
जहां अंधेरे खंडहर हों वीराने
जहां अंधेरे खंडहर हों वीराने ।

i.

DOODLES


Meanwhile :
Being reaper, isn't a easy job
Idiocy of Contaginous
I also wonder
Dad, do we have enough space?
Oh! man. Damn it!! Should have worn a mask
Why should I waste mercy on a mask? It's stupid
It's just cough and cold
Corona.. this... Corona that... It's all exaggeration
What a dumb head. Are humans really intelligent! Sigh!!
On Earth
Why wear a mask?
Corona is nothing
Note : Please wear mask, maintain Social distancing, stay home, stay safe and Sanitize.


Nidhi Rai


It is okay, I can get through this. No need to panic
Just few shots and everything will become normal once again.

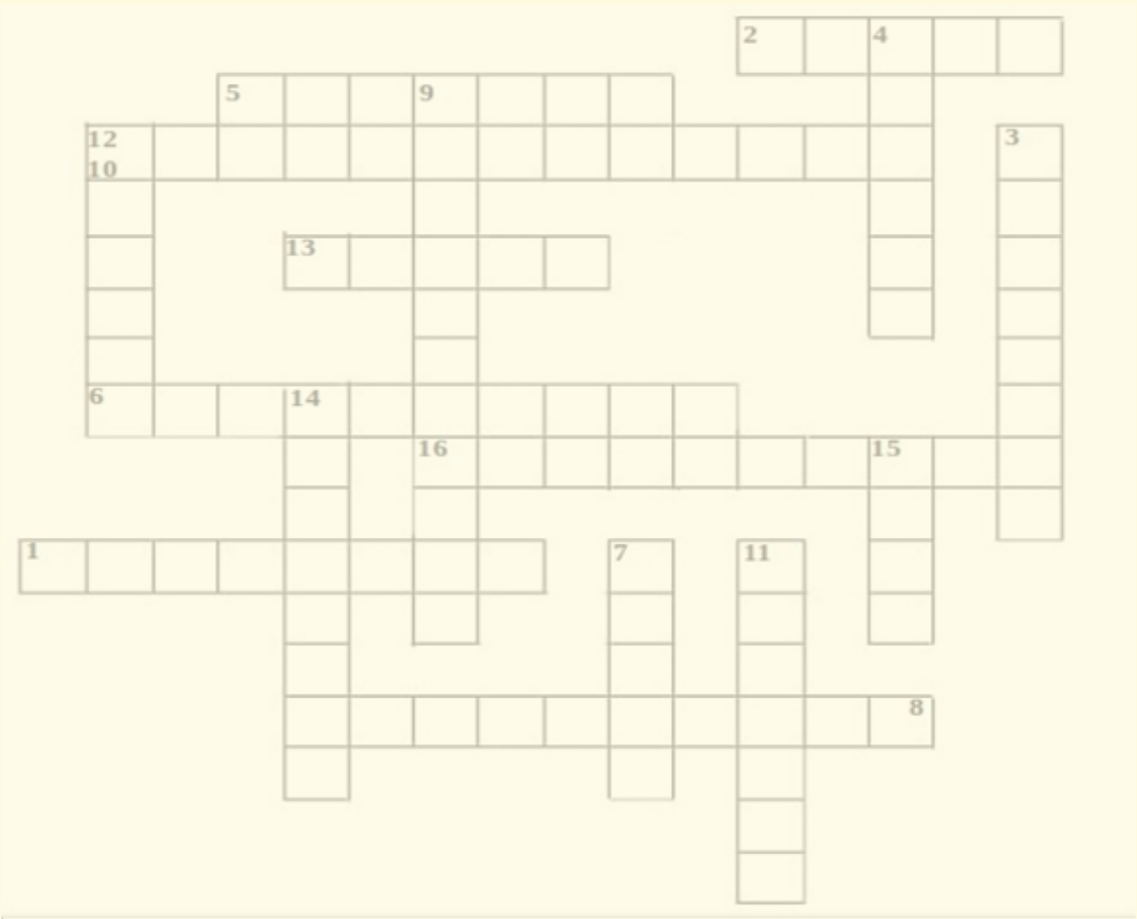

SARS CoV2 virus V/S EARTH
Powered by sanitizer .... brought to you by Humans
2020
SARS CoV2 shots... a SARS CoV2 shot...
Oh!! Match is pretty intense
Hell yeah!! It's a safe
Stay home
Wear mask
Social distancing
Safe!!
Phew!
EARTH
6 feet
R Singh


COVID 19
&
VACCINATION
2K21
Kalyani Kumari

ii.

COVID WORD GAME (CROSSWORD)

~Navodita Seth, BMS (III Year)



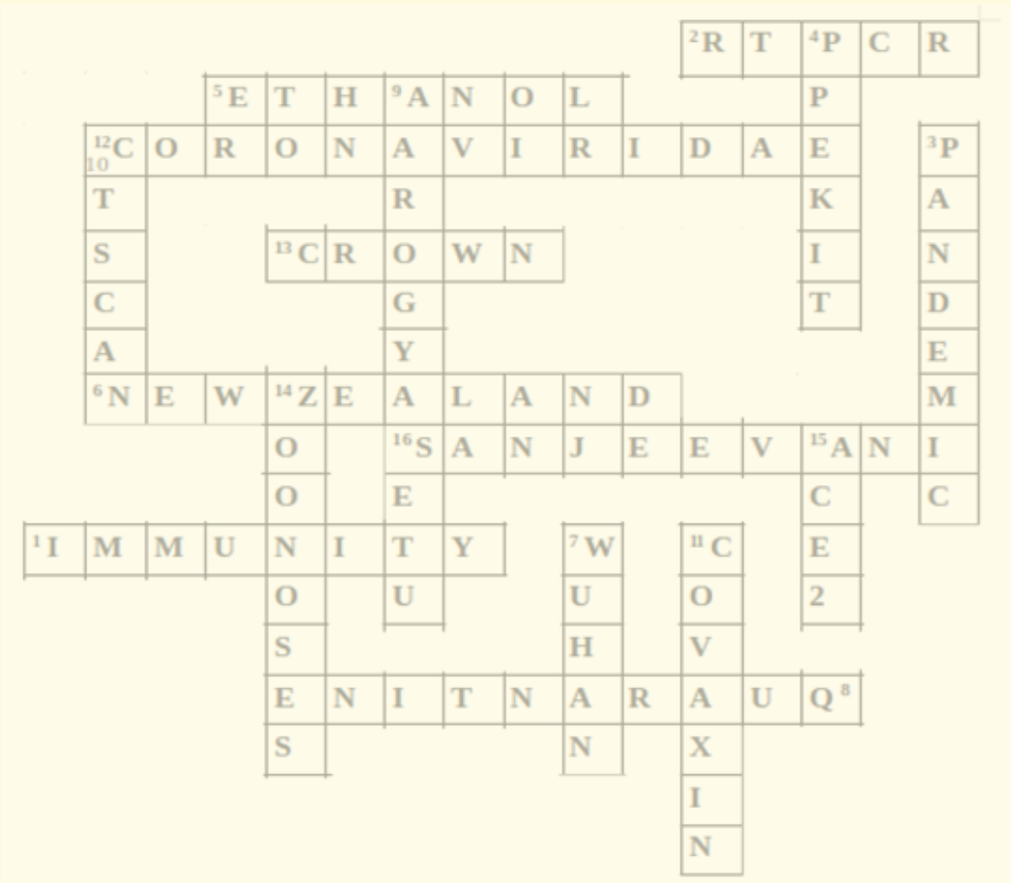
Across

1. A biological system that provides protection from infectious disease.
2. Molecular test to confim COVID 19.
5. is the major component of Sanitizer.
6. Country declared free from COVID-19 from June 2020 till present.
8. A period of time when a person or animal that has or may have an infectious disease must be kept away from other people or animals.
12. Name of the family of virus that causes COVID-19.
13. What does the word Corona in corona virus means.
16. Operation started by Indian Air Force to deliver medicine and hospital equipments in Maldives.

Down

3. Worldwide spread of a new disease.
4. A personal protective equipment designed to protect the wearer's body from injury or infection.
7. First city to be detected for the COVID- 19.
9. An Indian mobile application for COVID–19 "contact tracing, syndromic mapping and self-assessment" activities.
10. Technique used for monitoring lungs in COVID-19 infected patients.
11. India's indigenous COVID-19 vaccine developed by Bharat Biotech.
14. Diseases that are caused by micro organisms that spread between animals and humans.
15. Receptor that mediates the invasion of COVID-19 in host.

ANSWERS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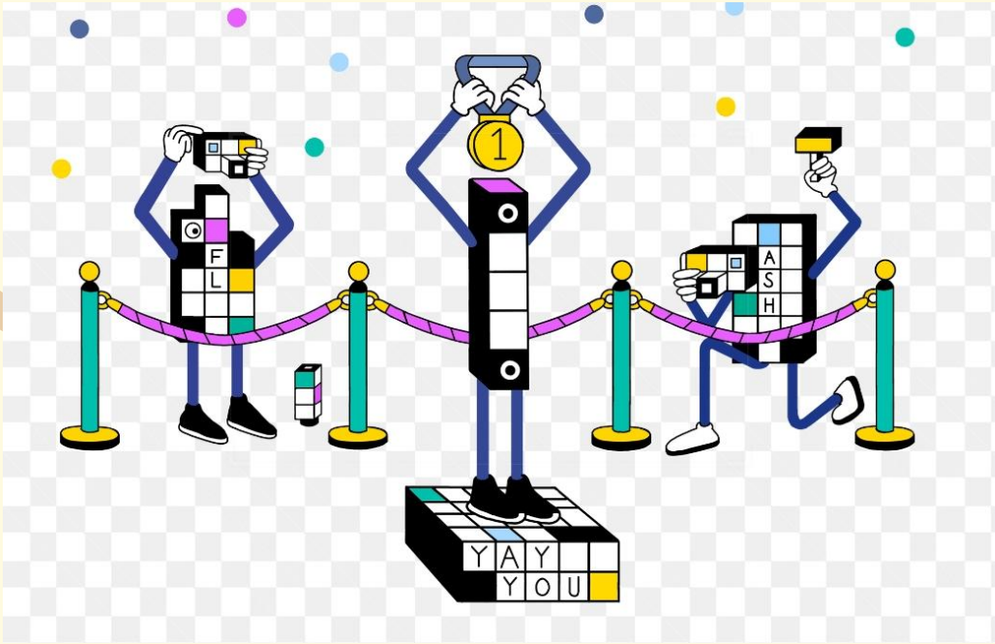
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iii. Glimpse of Cathexis 2020

It was a wonderful chance of luck that Cathexis 2020 barely got saved from the pandemic and had a chance to reach its tremendous glory and hype through an offline celebration in January. Unaware of how such an offline gathering would be craved in a few months, it was a blast with a lot of fun games, educational but not boring talks and the fiery zeal of all the students of Biomedical Science to arrange the best ever fest of our college.

Such a wonderful gathering, without the constriction of the pandemic safety guidelines, brought everyone from our department together for some healthy competition through games, with teachers taking an active part as well. We celebrated 20 years of the department of Biomedical Science on that day with alumni of our department. Overall, it was a refreshing day to connect with the entire BMS family and spend some cherished moments together.


20
20 Years of Biomedical Sciences

iv.

Transition Due to COVID: a shift from offline to online classes

The impact of COVID-19 pandemic has been observed in every sector around the world.

From grocery shopping to retail buying, recreational restaurant eating to frequent doctor visits - almost every sector has been deeply impacted and has taken a dramatic shift from offline to online. Moreover, education all over the world is also affected by this pandemic. The usual way of conventional learning has been changed completely as well . Earlier methods of teachings included delivering the topics in physical classrooms and laboratories through various hands-on practicals and activities. However, nowadays, education is imparted virtually to the students through internet platforms such as Google classrooms, Microsoft teams and Zoom meetings.

Online education or E-learning has proven to be a great alternative for gaining knowledge in these strange times when social contact could potentially cost us our life. This also led to emergence of freely available educational content, virtual labs and MOOC's which universities up till now were considering as future endeavors.

This development might also be useful for certain people, such as those with physical disability that limits their movement or even those who can not afford education in well-reputed universities due to geographical and economical constraints. Online education has also provided time flexibility to the students and increased the access and reach of the classes, as now students can attend their classes sitting anywhere in the world as long as they have a device and internet connectivity. With emergence of such remote learning opportunities, students can avail education easily without any additional financial constraint of living in an unknown urban city.

The most eminent advantage of online classrooms is that it also stimulated teachers to think out of the box, learn new technologies and use audiovisual aids for better receptivity. This, in-turn has also inspired students explore the content available over the internet, refer to multiple sources, like reference books and animated videos to enhance their understanding.

However, our glass half-full attitude in this case cannot make us ignorant about the fact that long hours of online classes cause a lot of health issues; ranging from minor back-aches to severe head-aches. In order to attend online classes, students are clung to the electronic devices for prolonged hours, which prove problematic for them. Moreover, online classes lack student-teacher interactions and not everyone feel comfortable interacting with unfamiliar teachers or fellow-mates over a computer screen.

Several types of research have shown that humans perceive the concept imparted faster and better when in a complementary and

environment, but e-learning takes away all physical interactions which would have been possible in offline classrooms. Apart from all this, network issues, technical glitches and distractions from social media platforms hinder the learning process in online classes.

As evolutionary biology has given us numerous examples of 'survival of the fittest' and 'adaptability in the changing environment', it seems we are again in a similar situation where we are exposed to striking changes and all the usual patterns have been impacted suddenly. So, we should act along with the advantages and make the best out of such difficult times.

v.

Deciphering the language of DNA

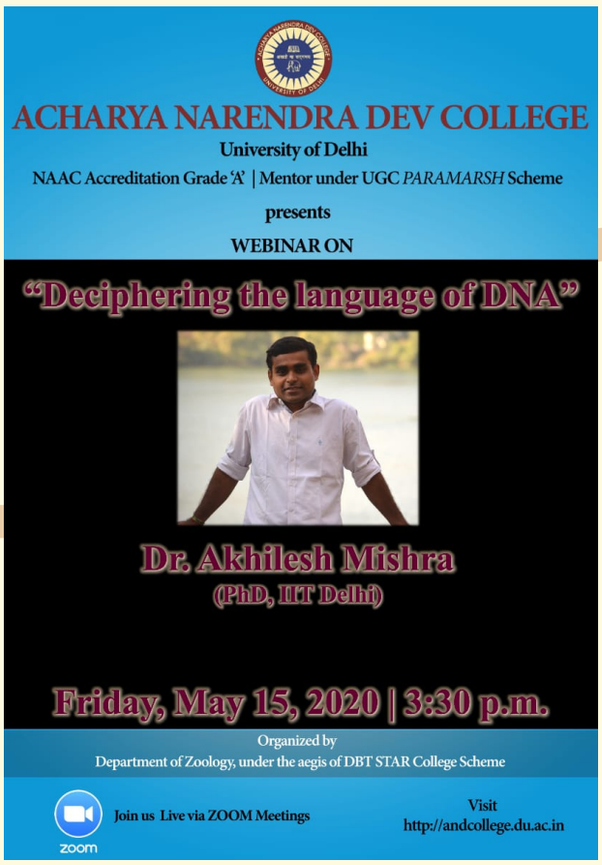
By:- Dr. Akhilesh Mishra (PhD, IIT Delhi)

Convenor:- Dr. Prashant Pradhan

The webinar began with a general introduction and proceeded with the elucidation of the topic by Dr. Akhilesh.

He began with a demonstration of how DNA – the cellular blueprint sits in the cell, shared across all living organisms and how it produces the diversity of life on earth.

Then, he enlightened the students about the recent technological breakthroughs in the ability to sequence DNA and the computational tools available to quantitatively study the genome. The session proved to be very insightful and knowledgeable for the students as they were informed of such a typical topic with practical demonstrations and easy examples. This interactive and informative session instilled quite an interest among the students to further explore and advance in the topic.



vi.

Nucleic Acid based detection of COVID-19

Developed by IIT-Delhi
Organised by
Department of Biomedical Science (ANDC) & Department of Zoology (DBC) under the aegis of
DBT STAR College Scheme

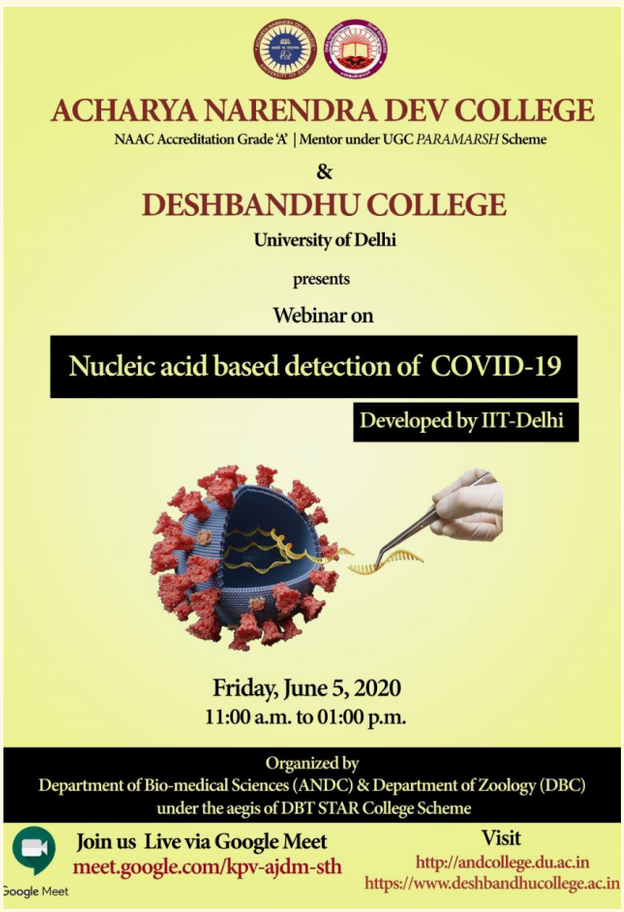
Department of Biomedical Science of Acharya Narendra Dev College and Department of Zoology of Deshbandhu College organised a webinar of two hours on 'Nucleic acid based detection of COVID-19 on June 5, 2019. Heartfelt gratitude to respected principals, Dr. Ravi Toteja of AND College and Dr. Rajiv Aggarwal of Deshbandhu College, and also Dr. Urmi Bajpai and Dr. Ranjana Seth, the Teachers in charge for organising such mind-opening webinar.

The students had the honour to hear from Dr. Vivekanandan Perumal, Associate Professor, IIT-Delhi and also have a panel discussion with Dr. Prashant Pradhan, Dr. Akhilesh Mishra, Dr. Parul Gupta and Dr. Ashutosh Pandey. These PhD and post-doctoral scholars and professors of IIT Delhi's Kusuma School of Biological Sciences, under the guidance of Dr. V. Perumal contributed a great deal during this pandemic outbreak by working on nucleic acid based detection of COVID-19 and finally launching the cheapest test kit, Corosure.

Dr. V. Perumal, briefed the students about the COVID-19 virus and their teams' journey of working on the virus' strain which was further elucidated by his team members. He explained how and why their test, which is a probe free-based test was different from the other tests which were probe-based. Each speaker on the panel, spoke about how each member, though from different branch of Science, worked together as a team to get the end result.

They emphasized on how bioinformatics played a key role in developing the nucleic acid based detection kit for COVID-19, from discovering the extremely unique parts of the COVID-19 virus to primer designing and comparative sequence analysis.

Overall it was an insightful and educational webinar for the students who attended. Many of the participants expressed how resourceful it had been to hear from the scholars and were grateful towards them for shedding some light on the details of the virus as well, which has caused havoc in their lives. Also, their success stories helped students realise the vast potential in the field of science and how their studies could contribute for the betterment of mankind.



vii.

Online Python Workshop 2020

Ms. Shruti Gupta

Mr. Alok Anand

Online workshop on python-based programming was conducted by our two alumni pursuing PhD and MSc in Computational Biology and Complex System from School of Computational & Integrative Science, Jawaharlal Nehru University.

The workshop, designed as a 20 hour tutorial, was conducted on weekends in November 2020 and focused primarily on undergraduate students with no computer programming experience. Data analysis and programming skills are at the core of any research area and and with the vast data generated in biological research, learning a programming language has become a necessity.

The workshop taught the fundamental concepts of computer programming and develop algorithmic approach to solve problems. Study material and assignments were given to participants for writing complete programs and to solve problems related to introductory molecular biology and physical science.

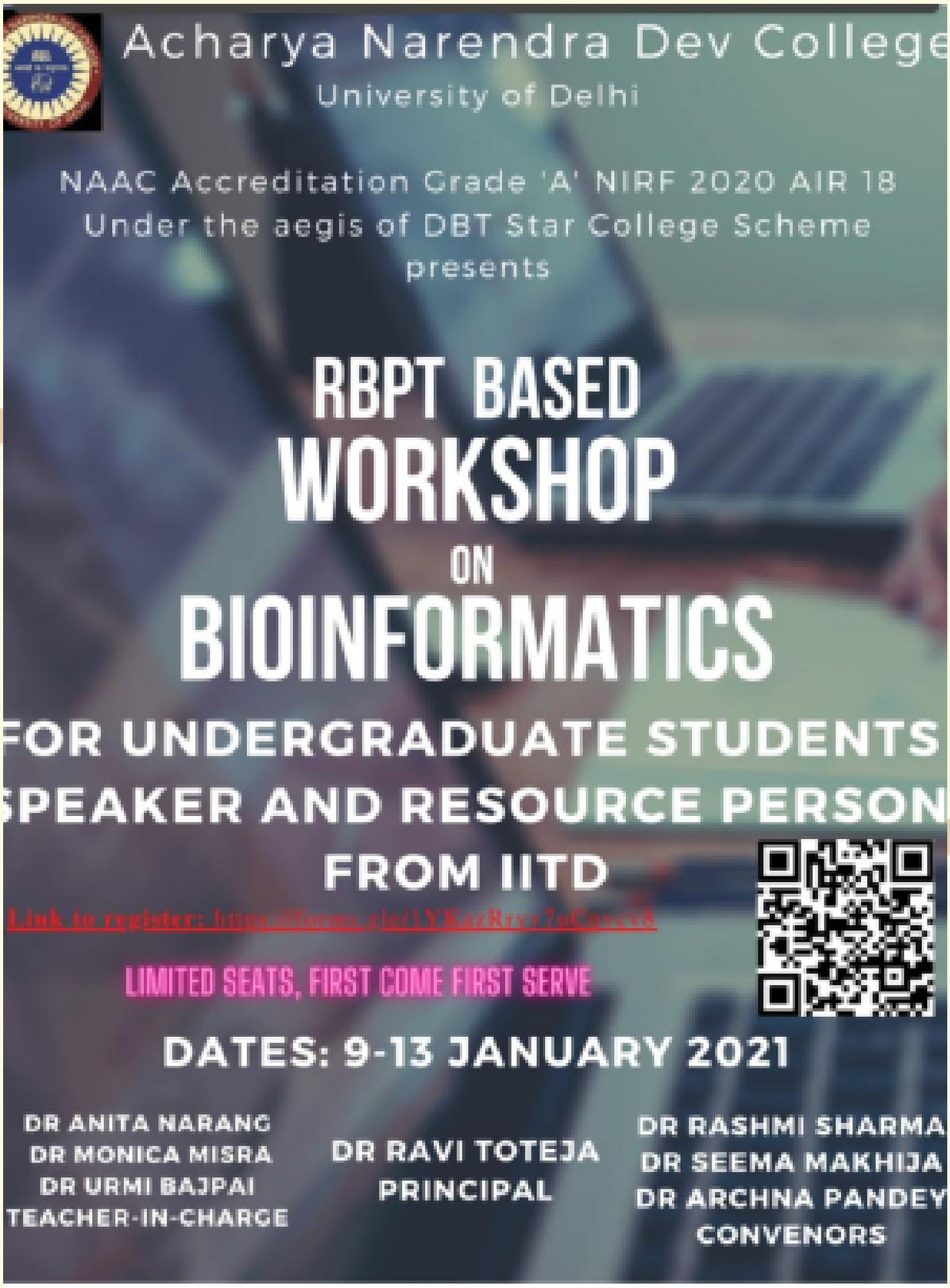
viii.

Online workshop on bioinformatics for undergraduate students

Acharya Narendra Dev College organised a five days online workshop, held from 9th -13th January 2021 for a period of two hours each day.
Hearty thanks to our respected principal Dr. Ravi Toteja, and also to Dr. Rashmi Sharma, Dr. Seema Makhija, Dr. Archana Pandey - the convenors; Dr. Anita Narang, Dr. Monica Misra, Dr. Urmi Bajpai - the Teachers-in-Charge, for organising such an enlightening and resourceful workshop.
The speaker and resource person of the workshop was Dr. Akhilesh Mishra, PhD, IIT Delhi who is a member of the research team that developed Corosure. On the first day of the workshop, the students received the golden opportunity to hear from Prof. B Jayaram, IIT Delhi who gave a brief overview on SCFBio software, and the need and importance of Bioinformatics in the field of science

On the following days of the workshop, our speaker Dr. Akhilesh Mishra, briefed us about Bioinformatics, introduced us to NCBI, ENSEMBL, BLAST, Sequence alignments, tools used in Multiple Sequence alignments, Phylogenetics, Gene annotation and many more. Hands on practicals were also conducted on softwares related to the aforementioned topics.
Students also received assignments at the end of each day to test how much they have learnt from the lessons taught.

Towards the end, he also spoke about his work and goals which was motivating and inspiring for the participants. About 60 students, from different departments of the college, as well as from other colleges actively participated in the workshop
Throughout the workshop, Dr. Akhilesh Mishra was amiable and receptive towards the students. He ignited the spark of curiosity to explore more of Bioinformatics, in the minds of many who attended the workshop.
It was an ecstatic learning experience for many students who were overjoyed to be a part of the workshop and they expressed their anticipation of attending such educational and mind-opening workshops in the future as well.



For queries email:
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BSC BioNEST Bio-Incubator

ix

Farewell 2020

COVID-19 brought such situations into the picture, which we never thought would be a part of our reality.

A pompous farewell is one such thing that every senior expects by the end of graduation from their juniors. The lockdown and social distancing did put everyone apart, but batch 2018-21 and 2019-22 seized the opportunity by throwing an online farewell celebration for their seniors-batch 2017-2020.

The online celebration, organized on 21st June 2020, had fun and interactive games and activities, followed by an informal student-teacher interaction.

Seniors joined the online event, all dressed up, and with the same cheer that an offline event would have had. The juniors took their seniors down the memory lane and made them relive their carefree days once again.

Each senior received a unique title, and everyone wished them good luck for their future endeavors. In conclusion, it was a memorable evening for everyone, and fortunately, distances did not bring our joyous spirits down.

x.

Teacher's Day

It is granted that technology has opened the door of new learning and has also changed the course of education. But, the efforts added by a teacher are not like a candle that consumes itself to enlighten her students, but brightens up by pulling them out from the darkness of ignorance to the light of knowledge.

So, to honour our teachers and make them feel special, the students of BMS decided to celebrate Teachers' day. As to go on with the current pandemic situation, the Teachers' Day celebration was done virtually through Google meet. The programme was held on 5th September 2020.

The programme started by welcoming all the teachers. A short virtual celebration, through a pre-recorded video, was organised for the teachers by the students, in which they engaged themselves, showing admiration and respect to their teachers through song and by conveying regards from their homes.

Teachers enjoyed & participated enthusiastically in the fun activities. Students were also cheering for them. Teachers were pleasantly surprised and mesmerised by the efforts of their dear students.

BIOMER 2021 TEAM MEET

BIOMER 2021 TEAM MEET

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Bisakha Das (Editorial Team)

BIOMER 2021 TEAM MEET

Meeting ID – xcz-yeig-sjq 00:25:34

Mansi Anand (Designing Team)

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Anirudh Kumar (Editorial Team)

Mehak (Editorial Team)

Deeparati (Editorial Team)

Harinandana (Editorial Team)

Lekshmi (Editorial Team)

Manas (Editorial Team)

Suravi (Editorial Team)

Thank you all!

~Anirudh Kumar (I Year)

Thank you all!
The police, medical staff
and even those making policies,
The scientists, door-to-door servicemen
and those zero charge bakeries.
To the army protecting us,
even in this poisonous air,
To all those whom we haven't even seen
and still for us, they care.
To the companies
making disinfectants,
To all the heroes out there,
showing zero reluctance.
To all the bricks,
of this protective wall,
Words are really less to express,
But, thank you all!