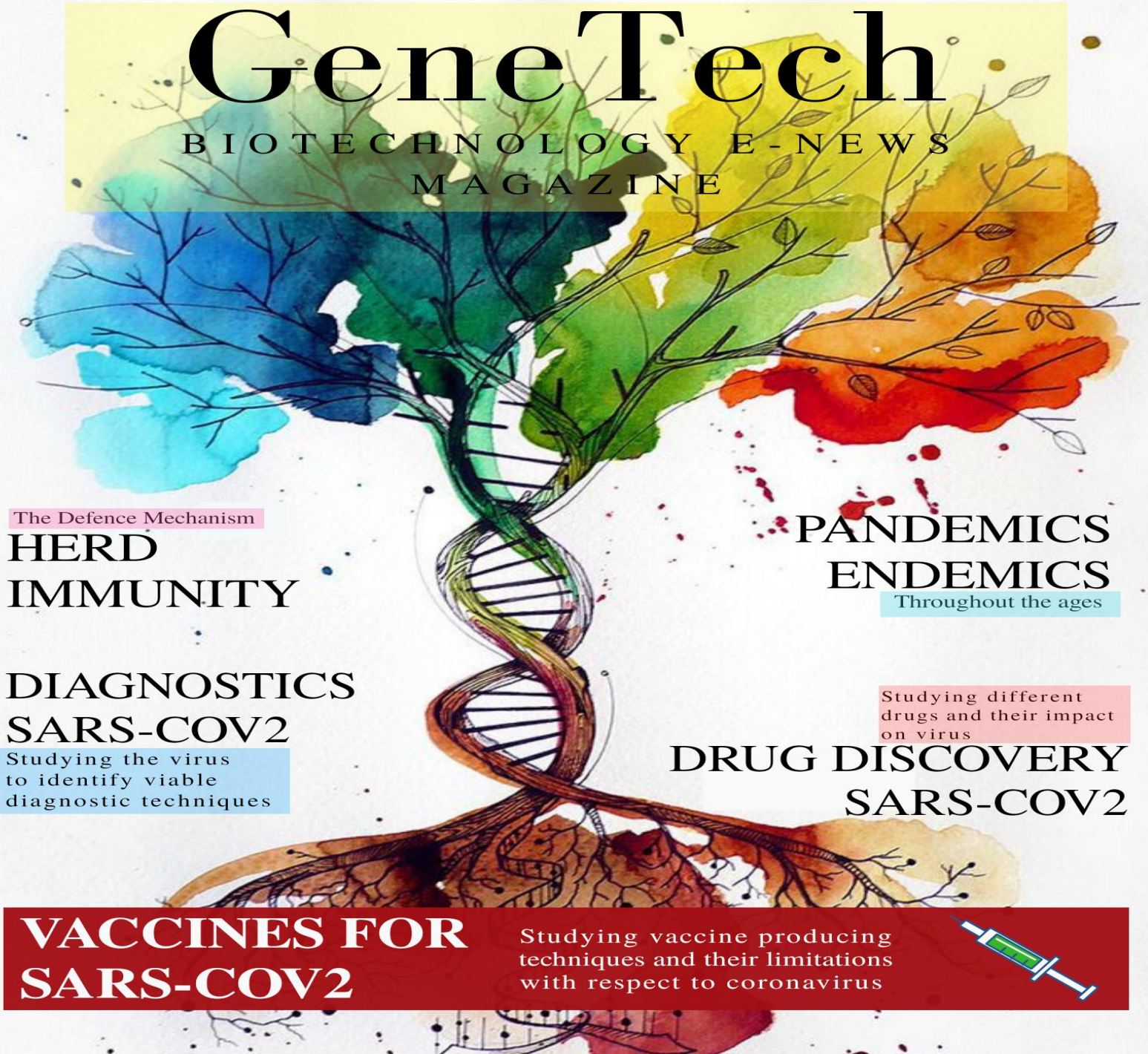
GeneTech

BIOTECHNOLOGY E-NEWS MAGAZINE



The Defence Mechanism

HERD IMMUNITY

PANDEMICS ENDEMICS

Throughout the ages

DIAGNOSTICS SARS-COV2

Studying the virus to identify viable diagnostic techniques

Studying different drugs and their impact on virus

DRUG DISCOVERY SARS-COV2

VACCINES FOR SARS-COV2

Studying vaccine producing techniques and their limitations with respect to coronavirus

FROM THE HOD'S DESK

It's my pleasure to write for the GeneTech, the first issue of the technical newsletter of the Biotechnology department. I appreciate the effort of the students and the encouragement of the faculty members behind it. I hope the journey of GeneTech will continue and it will enrich us with new information. Wish a happy journey to GeneTech. Bon Voyage.

-Dr. Srabanti Basu
Department of Biotechnology (HOD)

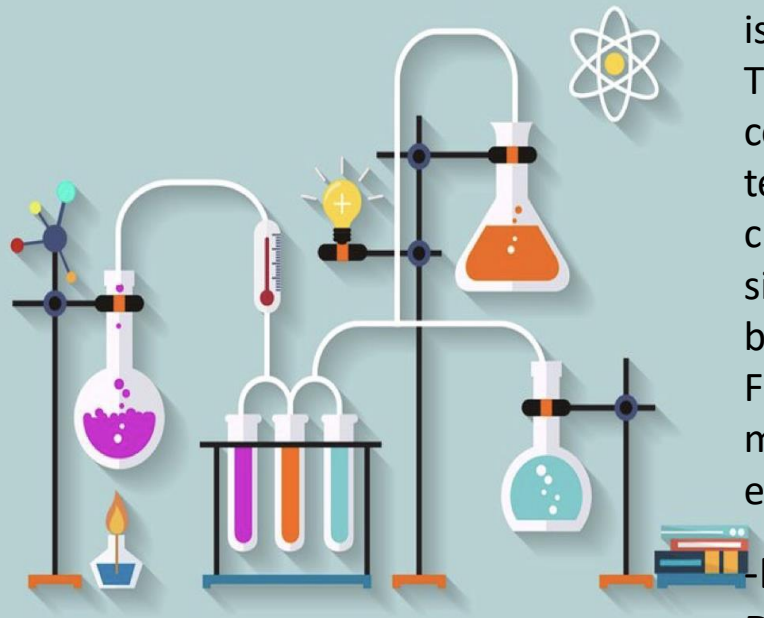
FROM THE CO-ORDINATOR'S DESK

In this COVID-19 condition, our department of BT is publishing for the first time its e-technical news magazine "GeneTech" October 2020 issue. This will be another place for our BT students to express their scientific and technological thinking and ideas.

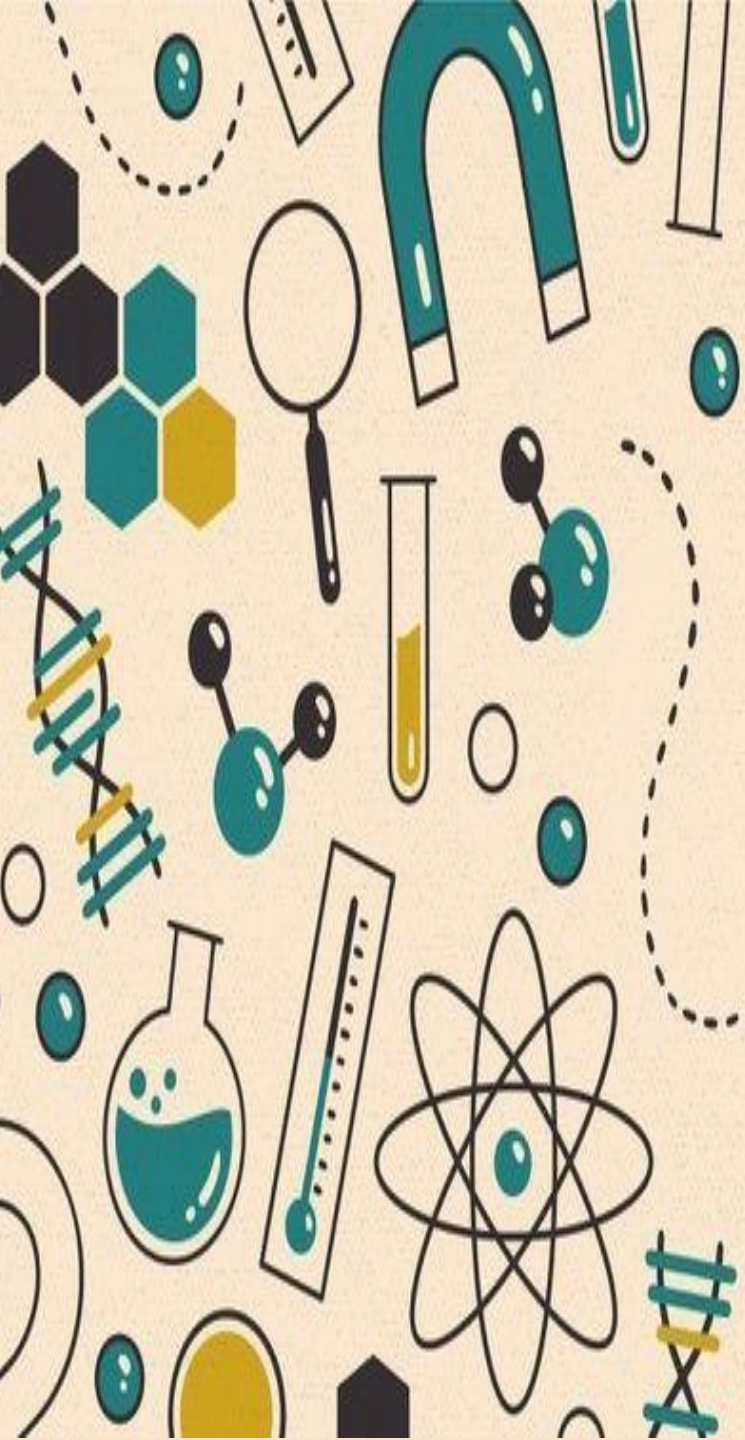
As coordinator of e- technical news "GeneTech", I have enjoyed the beautiful journey starting from the selection of students; team, name of the e-news, theme of the first issue and at the end to publish it.

This would not have been possible without the collaborative initiative taken by enthusiastic organizing team of BT 2nd year students in terms of their idea, creativity, technical skills, team work and patience. I sincerely thank all the contributors also whose work has been published.

First time presentation of such an e- technical news magazine by BT students, I am sure, everybody will enjoy the reading of it.



-Dr. Nandan Kumar Jana
Department of Biotechnology



WELCOME!

Dear Readers

The world has been going through a tumultuous time. Our daily lives have been transformed drastically by a pandemic, as we were all forced indoors. As the number of people infected kept reaching new highs everyday, the number of reliable information sources kept dwindling. Amidst all this chaos, mass panic was inevitable.

So how do we fight fear? We only fear what we don't understand. Thus, many virologists and epidemiologists have been working hard to learn

more about the disease COVID-19 as well as the virus that causes it. As students of biotechnology, we believe it is our duty to keep you informed about the extensive research conducted so far, as well as simplify a few concepts within an interactive format.

It is with this vision that the very first issue of GeneTech was formulated, guided by our beloved professors, our HoD Dr. Srabanti Basu and our GeneTech coordinator Dr. Nandan Kumar Jana. We owe the successful release of this issue to the eager participation of our classmates and seniors.

We hope this edition excites you as much as it excited us to create it.

Thank You

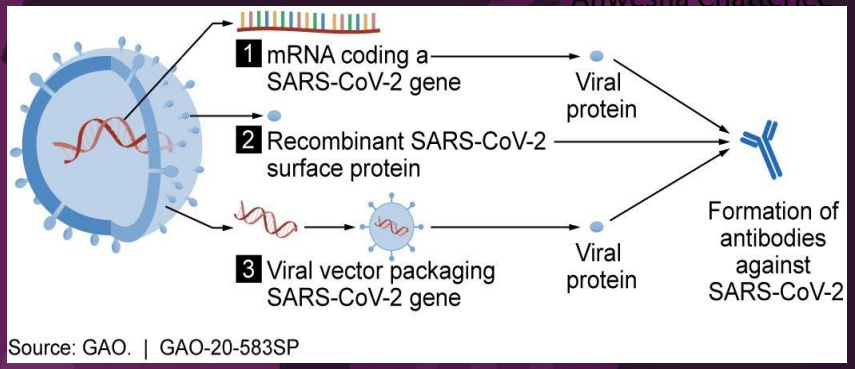
Editorial Team

CONTENTS

VACCINES FOR Sars-Cov2

- The causal agent of COVID-19 being SARS-CoV-2, is a part of the *Coronaviridae* family, whose members are named after their crown-like appearance under the electron microscope caused by the surface glycoproteins that decorate the virus. Vaccines are being rapidly developed but will likely come too late. SARS-CoV-2 vaccines will be essential to reduce mortality if the virus establishes itself in the population.
- A COVID 19 vaccine is a biotechnology product intended to provide acquired immunity against it. As of September-2020, there were 234 vaccines in development, with seven in Phase III like AZD1222, Ad5-nCoV,CoronaVac,mRNA-1273,BNT162a1,b1,b2,c2, Gam-COVID-Vac and 33 in Phase I–II trials.
- In general, the vaccine technologies being developed for COVID-19 are using "next-generation" strategies for precision on the COVID-19 infection mechanisms.Vaccine platforms in development are designed to address mechanisms for infection susceptibility to COVID-19 in specific population subgroups, such as the elderly, children, pregnant women, and people with existing weakened immune systems.

- BT Third ye
Anwesha Chatterjee



Platform of vaccine	Target	Advantages	Disadvantages
RNA	S protein	immunogenic, rapid production possible.	Safety issues with reactogenicity.
DNA	S protein	high heat stability, tested in humans for SARS-CoV-1, rapid production possible.	needs specific delivery devices to reach good immunogenicity.
Recombinant protein	S protein	adjuvants used to increase immunogenicity.	Antigen and epitope integrity needs to be confirmed.
Viral-vector based	S protein	excellent preclinical and clinical data for many emerging viruses,	Vector immunity might negatively affect vaccine effectiveness
Live attenuated	Whole virion	used in several licensed human vaccines,	Creating infectious clones for attenuated coronavirus vaccine seeds takes time because of large genome size.
inactivated	Whole virion	tested in humans for SARS-CoV-1, adjuvants can be used to increase immunogenicity.	Antigen and/or epitope integrity needs to be confirmed.

~ Anwesha Roy BT 3rd year

In-Silico Design And Characterization of Multi-Epitopes Vaccine for SARS-CoV2

In December 2019 group of patients from Wuhan city of China was found to have Pneumonia like symptoms and diagnosed with infection of beta coronavirus. COVID-19 is a disease caused by the novel coronavirus, SARS-CoV2.

Till date, no specific vaccine or drug has happened to tackle the infections caused by SARSCoV2. Coronavirus is a non-segmented positive-strand RNA virus with envelope. Here we designed a multi-epitopes vaccine from S Protein by In-silico design and characterization. The S protein is a novel structure present in all coronaviruses, targeting these S proteins as epitopes will also ensure immunity against future coronaviruses and hence is the hot topic of research. All the epitopes are useful in stimulation of humoral as well as cell-mediated immunity along with increased interferon-gamma response

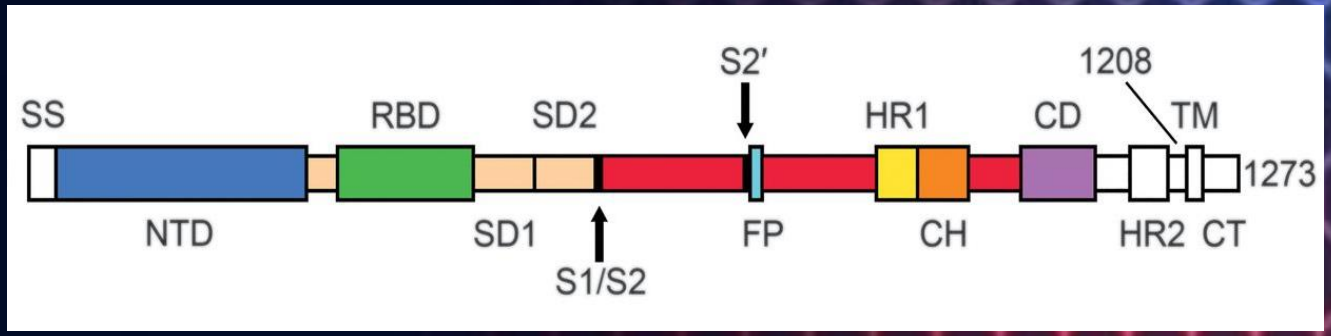
.

Identify potential epitopes for T and B-cells that will lead to a vaccine for prevention of COVID-19. From various epitopes predicted by the online server based on shared sequences and high score, three TCR and two BCR epitopes are selected as part of the COVID-19 vaccine candidate. Linker peptides link all five TCR and BCR epitopes.

To enhance the antigenicity of TCR/BCR linked epitopes peptide, adjuvant OmpA co-integrated with EAAAK linker sequence is used for a complete vaccine design. Adjuvant technology is crucial for vaccine design as half-life of the virus is too short to be persistent as an antigen in the body.

Interaction of S-protein with TLR2 increases the production of IL8 in human monocyte macrophages triggering a cascade of immune responses. Regular interaction of designed vaccine indicates the efficiency of vaccine for activation of TLRs, involved in dendritic cell activation, thereby subsequent antigen processing, and presentation on the surface of T-cells.

Discussion:- This vaccine codes epitopes form S protein of SARS-CoV2 virus for T and B-cell receptors. Advancement in the field of bioinformatics and molecular biology techniques have provided the opportunity of development of a vaccine with high efficacy, less time for development, low cost of production that may lead to supply at a large population.



Schematic structure of the spike protein.

Abbreviations: SP: signal peptide; RBD: receptor-binding domain;
RMB: receptor motif binding; FP: fusion peptide; HR1: heptad repeat domain 1;
HR2: heptad repeat domain 2;TM: transmembrane domain;
CP: cytoplasmic domain. Numbers indicate amino acid sequence.

~ Soumen Bid
BT 4th year

HERD IMMUNITY

There goes an old saying – “There is strength in numbers”. Well it turns out that numbers may be our greatest defense against the spread of Covid-19; this mechanism is called “Herd Immunity”.
It is a form of indirect protection, and the way it works is, once a sufficient percentage of a population has become immune to an infection, whether through vaccination or previous infections, the likelihood of infections for individuals who lack immunity reduces. Thanks to vaccination, herd immunity has been effective in eliminating polio, smallpox, and until recently, measles.
Herd immunity could happen naturally as the corona virus makes its way through our communities; but that could be too risky because as we’ve seen, many people with the disease fall severely ill and for some, it can actually be fatal. We need to first understand how fast the virus infects other people. That reproduction rate is what scientists call the “R naught of the virus”, and for Covid it’s between 2 and 3. That means each person with the virus can infect about 2 or 3 others. The next factor of the herd immunity equation depends specifically on how many of us are already immune. In a world, where no one is immune to Covid and each one is at risk, the virus can spread like wildfire. There is actually a formula based on the reproduction rate of the virus. Knowing that, we can figure out the number of individuals required to be immune, to reach that sweet spot of herd immunity. For India, the R0 was calculated as 1.83 in April.
Right now, medical experts say, there’s no point in thinking that India has developed “herd immunity” and it’s vague to consider that this pandemic can be overcome solely by that. Hence the show stopper will be when most people can get vaccinated. As of now, we can all do our part to slow down the spread of Covid-19 by maintaining physical distancing.

~Rijula Batabyal
BT third year

FROM EPIDEMIC TO PANDEMIC

An epidemic is defined as the rapid spread of disease to large number of people in a given population within short period of time. Epidemics are generally caused by several factors:
1. A change in the ecology of the host population
2. A genetic change in the pathogen reservoir or the introduction of an emerging pathogen to a host population An epidemic may be restricted to one location; however, if it spreads to other countries or continents and affects a substantial number of people, it may be termed a pandemic; which happened in the case of the novel corona virus outbreak i.e ,COVID-19 . History of epidemic traces back to Plague during the period of 430 BC, when the Plague of Athens devastated the entire city's population; which originated in Ethiopia and spread to the Mediterranean region through Egypt and Libya. It is believed that communicable diseases existed even during mankind's hunter-gatherer days, but the shift to agrarian life 10,000 years ago created communities that made epidemics more possible. Malaria, tuberculosis, smallpox are some of the diseases which appeared during this period. The more civilized humans became, building cities and forging trade routes to connect with other cities, and waging wars with them, the more likely pandemics became. Few of the pandemics, prior to COVID-19,that, in ravaging human populations, changed history are as follows:
1. 11th Century- Leprosy
2. 1817- First Cholera Pandemic
3. 1889- Russian Flu
4. 2003- SARS

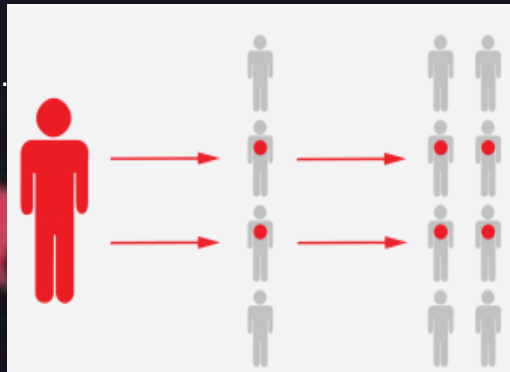
As every cloud has got a silver lining in it, so also joy and woes are woven fine in life. The only true sinusoid of this Universe is that there is a source of light at the end of the long travel through darkness in time. The efforts, initiatives of scientists, medicos throughout the world is leading to a convergence towards a bright sunny morning with theresonance of win and joy for the entire mankind.

~Aneshwa Chakrabarti
BT 3rd year

EPIDEMIC	PANDEMIC
Event in which the disease is actively spreading.	Relates to geographic spread.
Often used to describe problem that has grown out of control.	Describe disease that affects the whole country or entire world

“Herd Immunity” ~ ever heard about it?

Herd immunity is nature’s own defense mechanism to protect life on earth from highly contagious diseases. It is the immunity which is acquired when most of a population become exposed to contagious diseases and acquire adaptive immunity. This form of immunity provides indirect protection to healthy, non-infected individuals in a population.



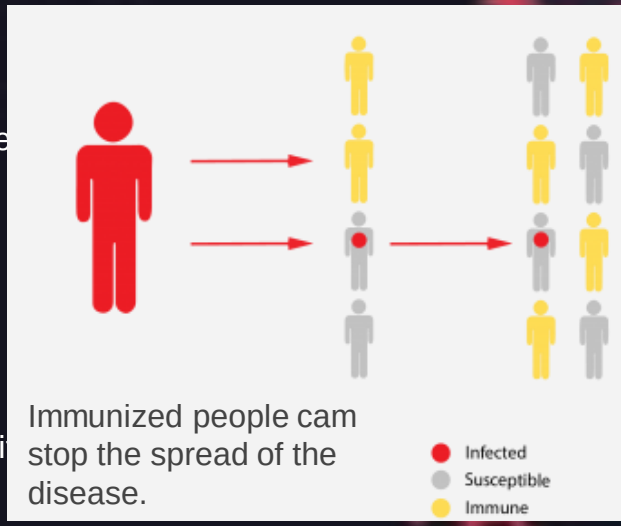
No immunity causes rapid transmission of disease

How Herd Immunity works?

The above diagram represents three stages of a population trying to achieve herd immunity. The population I represents early stage of a population where only few individuals are infected, say 20% and they can spread the disease to other individuals. Population II represents the middle stage where some individuals are immune due to their adaptive immunity and hence diseases cannot be spread to them. Population III represents the final stage where herd immunity is achieved. In this stage, more than 70% of the population has achieved adaptive immunity due to which probability of spreading of the disease from infected individual is reduced. This protects the healthy individuals from getting infected, since most of the population has attained immunity against the disease.

How Herd Immunity can be achieved?

Herd immunity can be achieved by exposing most of a population to infectious bacteria ,viruses,etc. This is a perilous approach as it may cause death of individuals who have weakened immunity like infants, elderly people or people suffering from co-morbidity like diabetes, hypertension. Another approach is through vaccination of maximum individuals.. This approach is safer but discovery of vaccine takes a lot of time. This approach had helped us to eradicate (almost) measles, small pox, mumps, etc.



Immunized people cam stop the spread of the disease.

Herd Immunity during Covid-19 pandemic

Scientists are working diligently to develop an effective vaccine against SARS-CoV-2. But in the meantime, alternate techniques of strict and relaxed social distancing are being followed to develop herd immunity. Life will not be able to be ‘normal’ again even i a vaccine can be developed or herd immunity can be properly achieved.

~ By Shuvayan Dasgupta, BT 3rd and Ruchira Banerjee, BT 3 rd

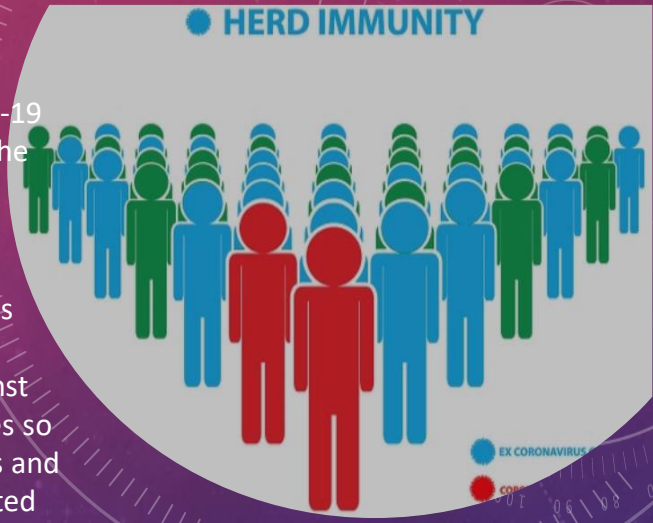
Biotechnology : A tool against Covid-19

Novel Coronavirus (2019-nCoV) is a ssRNA virus belonging to a family of betavirus, originated in Wuhan, China. Its genome (WIV04), sequenced by China encodes four structural proteins spike (S), nucleocapsid (NP), membrane (M) and envelope (E). It facilitates human body through angiotensin receptor 2 (ACE-2). Developing a Covid-19 vaccine is challenging as it mutates faster but the conservation of spike protein has become the target for vaccine production. National Institute of Allergy and Infectious Disease in collaboration with Moderna is developing a Covid-19 vaccine named mRNA 1273. The spike protein information of SARS-CoV2 is first isolated from whole genome from which mRNA is developed. Some nucleotides like uridine are modified. This step aims in making mRNA train our immune cells instead of attacking it and modified nucleotides are easily recognized by our body's ribosomes so that spike protein production becomes easier. The modified mRNA is wrapped in a lipid nanoparticle because it easily pass the hydrophobic cell membrane. Now the produced vaccine after entering in body passes the cell membrane and ribosome produces spike proteins from it. A part of the protein is represented by MHC II molecules on the surface of cell which is recognized by T cells. T cells triggers B cell response and antibodies are produced against spike protein. When SARS-CoV2 attacks the vaccinated person the antibodies recognizes spike protein, bind it and destroys the pathogen.

Another approach taken by Oxford University and AstraZeneca namely ChAdOx1 is that a Chimpanzee Adenovirus vector causing common cold in Chimpanzees is modified to a harmless vector by removing disease producing parts and named it ChAdOx1 vector. On the other hand spike protein gene of SARS-CoV2 is isolated and inserted into the mentioned
vector. Now the developed ChAdOx1 n-CoV19 vaccine after injection triggers the basic immunological response in our body. Generally vaccine production takes 10-15 years but scientists are working heart and
soul to produce it within 1-2 years. Already they are under clinical trials. Let's hope that they succeed in their work and the deadly coronavirus escapes humanity .oon

~Debankona Marik
M.Tech 1st year

HERD IMMUNITY



Introduction:

Most of us may have encountered the term 'herd immunity' lately due to the ongoing COVID-19 pandemic But many of us might still be wondering what exactly is herd immunity. For them, the following discussion will be an eye-opener

What is herd immunity?

The rate of infection of a disease in a population decreases only when the population achieves herd immunity. When in a particular population, 60-70 percent of the population becomes immune to a disease; we say that the particular population has achieved herd immunity against that particular disease. In such a case, the number of persons immune to the disease becomes so very large that an infected person always remains completely surrounded by immune persons and can never come in contact to a non-infected non-immune person and hence gets totally isolated and the disease dies out.

How can a population acquire herd immunity?

Herd immunity is acquired immunity and not innate or inborn immunity. It can be acquired in two ways, natural and artificial. Naturally, herd immunity can be obtained when people are actually infected with the disease which is a form of active immunity and artificially, herd immunity can be obtained through vaccines. Vaccines can provide active as well as passive immunity. Active immunity can be obtained through vaccines when weak or heat-killed antigens of a disease are injected into the body and hence, antibodies are produced as a response. Passive immunity can be obtained through vaccines when antibodies are directly injected into the body for quick action. Herd immunity works through memory T-lymphocytes and memory B-lymphocytes which are produced in the body as a result of exposure to antigens. These cells may remain in the body for decades and recognize and attack the original antigens when they infect the body again. Every time the cells encounter the antigens, rapid proliferation of the memory cells occurs. This type of response is called the secondary immune response or 'booster response'. The number of antibodies produced in secondary response is much greater than that in primary response and consists mainly of IgG antibodies.

~ Souhardya Bandyopadhyay
BT 3rd

DRUG AGAINST COVID-19

~ Debankona Manik
Mtech first year

Covid-19 is an emerging pandemic disease caused by a previously unknown pathogen novel coronavirus2019n-CoV), a positive sense single-stranded RNA virus originated in Wuhan, China. Currently there is no specific treatment available to combat this contagious disease; hence lives of individuals are at stake worldwide. A study has been conducted to find out if the present antiviral drugs could effectively inhibit this infection. Antiviral efficacy of some FDA approved drugs have been checked namely ribavirin, penciclovir, nitazoxanide, nafamostat , chloroquine, remdesivir, favipiranavir against a clinical isolate of nCoV-2019 in vitro. Chloroquine is understood as a good anti-malarial drug which might inhibit 2019-nCoV by alkalinizing vacuolar and lysosomal pH and by interfering with terminal glycosylation process. Remdesivir a widely known drug used for the treatment of SARS/MERS-CoV and recently for Ebola virus was found to inhibit novel corona virus by interacting with viral RdRP through its nucleotide analogue GS-441524 thereby inhibiting the viral RNA polymerase. In presence of varying concentrations of medication, the cells were infected with a clinical isolate of nCoV-2019BetaCoV/Wuhan/WIV04/2019. qRT-PCR has been performed to quantify viral copy number in cells to see the efficacy. Assay has been performed with remdesivir & Chloroquine at full time . Cell supernatant and lysate were collected for Immunofluorescence microscopy and Western Blot analysis respectively. It has been found that top concentrations of Ribavirin, Penciclovir and Favipiravir were needed to scale back the infection and their cytotoxicity was high having low SI value. Nafamostat was inhibitive against the 2019-nCoV infection at a relatively lower concentration than the above three but had an occasional SI value. Nitazoxanide inhibited the 2019-nCoV at an occasional concentration. Remdesivir and Chloroquine effectively inhibited infection at a low micromolar concentration. Remdesivir also inhibited infection in human carcinoma Huh 7 cell line which is sensitive to 2019n-CoV. Remdesivir and chloroquine are cheap, easy to use and highly effective in the control of 2019-nCoV infection in vitro. Since these compounds are utilized in human patients with a security journal and shown to be effective against various diseases, they must be assessed in human patients laid low with 2019n-CoV together with clinical trials.

HERD IMMUNITY

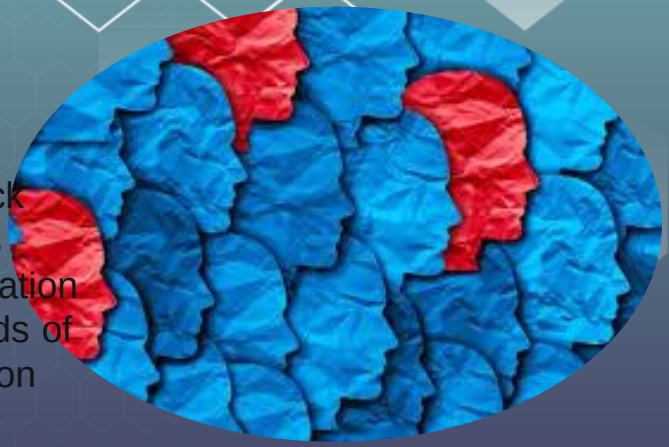
INTRODUCTION:

Herd immunity is the indirect protection from a contagious infectious disease that happens when a population is immunity either through vaccination or immunity developed through previous infection. Measles and smallpox are examples of infectious diseases that were once very common but are now rare because vaccines helped to establish herd immunity. Other viruses like flu mutate over time, so antibodies from a previous infection provide protection for only a short period of time.

COVID-19 AND HERD IMMUNITY:-

There are two ways to achieve Herd Immunity:

- The First, happens after a large percentage of population is exposed to a Virus
- or pathogen.
- The second is by getting protected vaccines.



EXPOSURE:

To get there through infection, majority of the population needs to get sick from the virus and develop antibodies that fight off the disease. But this method would be deadly. To gain Herd Immunity, 60% 70% of the population would have to be infected which would cause tons of death and hundreds of people getting hospitalized. Also there is no guarantee that broad infection would lead to eradication.

VACCINATION:

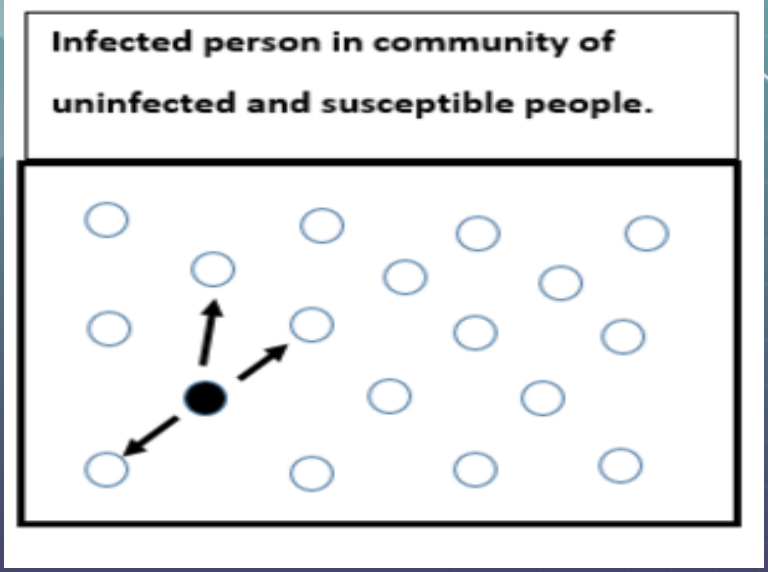
According to scientists, development of vaccine is the more efficient way to establish herd immunity against this virus in the future. That's how scientists eradicated smallpox. This would mean getting the SARS-CoV-2 in specific doses and making sure the majority of the world's population is vaccinated.

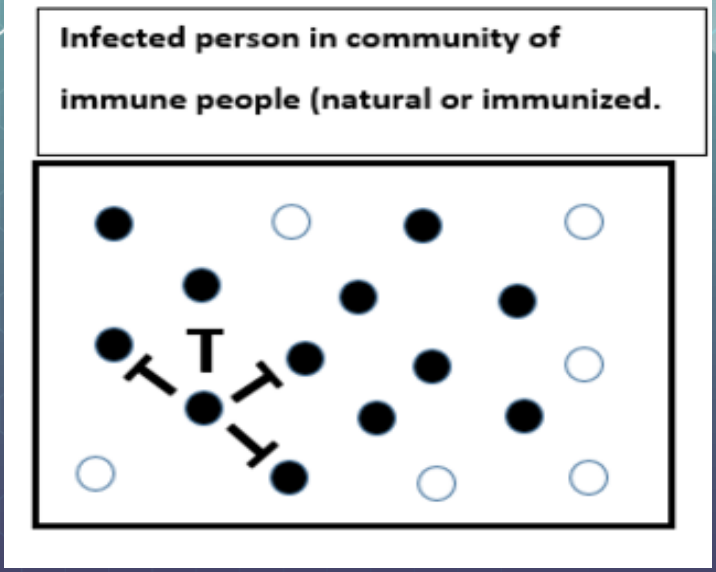
EXPERIMENT

Early research on chimpanzee showed that they made antibodies to the virus that protected them from a second infection. If the coronavirus is like flu, we can expect a few months of protection.

OBSTACLES FACED:

- The main obstacle to herd immunity to COVID-19 right now is that the virus which causes the disease is "novel," or new. That means it hasn't infected humans before and everyone is at risk of infection.
- There's no existing immunity to build on.
- Another potential barrier is that we don't know how strong the immune protection is or how long it will last in people who've had COVID-19.





~Kasturi Dey
BT 4th year

General steps of Drug discovery using CADD

Introduction:

This article focuses on the general workflow of CADD(Computer Aided Drug Design) to discover drugs against SARS-CoV2 using the drug repurposing approach. An emergent efficient strategy to tackle the COVID19 situation is drug repurposing . Along with this, due to powerful in silico techniques such as molecular docking and virtual screening, small molecule drug repurposing are a much more viable strategy in this global lockdown situation when anti-SARS-CoV-2 treatment needs to progress as fast as possible.

Target discovery and validation:

A target molecule is protein, receptor or gene which is responsible for the disease or is part of a biochemical pathway which helps in the spread of the disease. The main objective of drug discovery is identifying a viable target and then inhibiting the target with the drug molecule. The various techniques used for target discovery are:

- Disease mechanism
- Target type and druggability
- Functional genomics

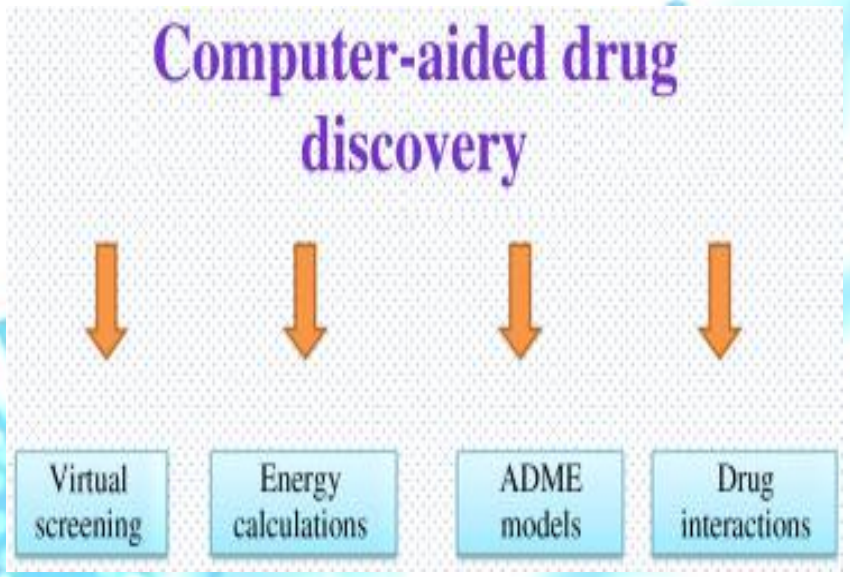
Further, we have to crosscheck and validate the target using the following techniques:

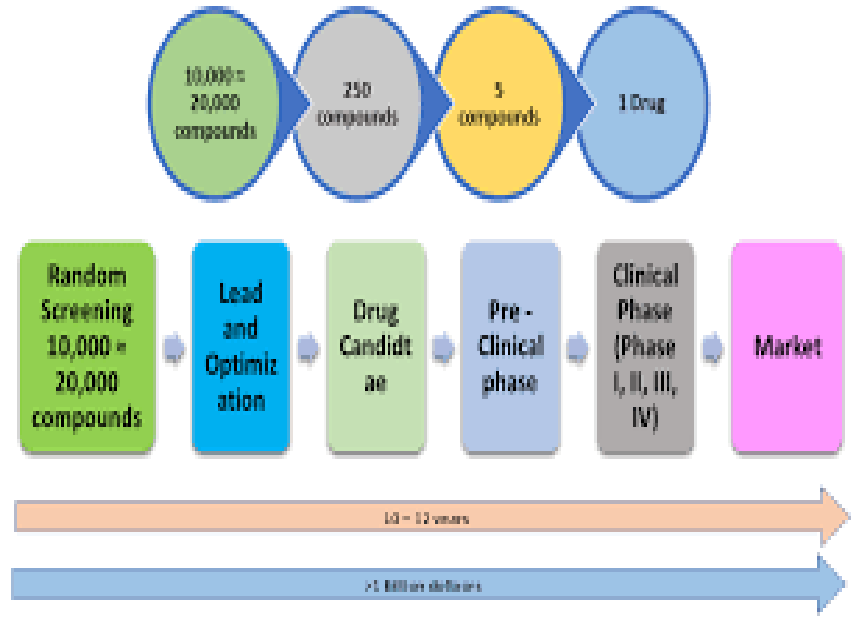
- Knock-out/knock-in models
- Pathways
- Clinical data
- Antisense DNA/RNA and RNAi

Few targets of SARS-CoV2 have been already identified like:

- S protein
- RNA-dependant RNA polymerase
- Papain-like protease.

Once the target has been identified, an in silico three dimensional model of the target is predicted on the basis of homology modelling and fold recognition, using softwares like Phyre2, I-TASSER etc. This predicted model is then treated as the target and drugs are discovered against it.





Virtual Screening and Hits to Lead:

Virtual screening is the process of analysing thousands of viable molecules present in small molecule libraries to identify the molecular inhibitors which is most likely to bind and inhibit the target.
Computational docking is a molecular modelling technique which is used to predict the binding interactions of a small molecule ligand and a large protein target.

ADMET Studies:

After the docking step and shortlisting of leads, the leads compounds are further studied based on their pharmacokinetic parameters.

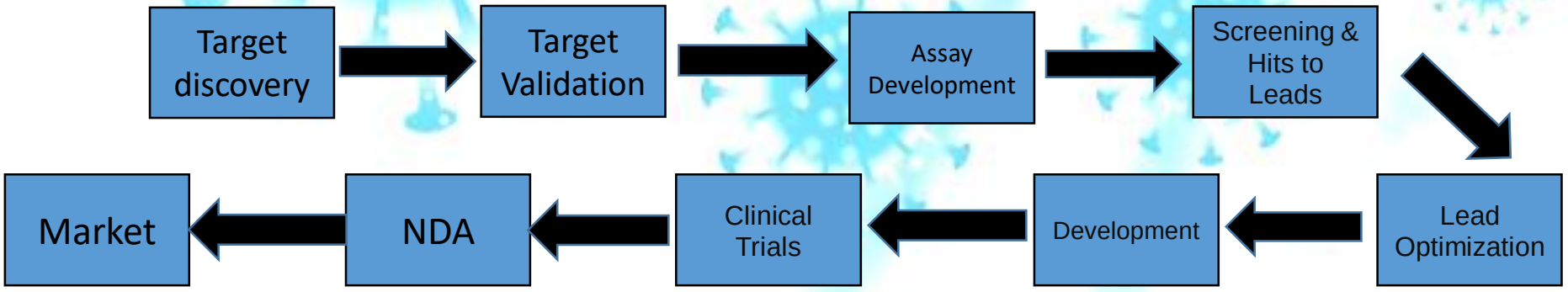
The toxicity of the drug is also predicted and expressed as the LD50 (mol/kg) value. LD50 is defined as the amount or concentration of the drug which can cause a lethal response in 50% of a population. Therefore, the higher the LD50 value, lower the toxicity of the drug.
An important rule of thumb used in pharmacokinetics is the Lipinski's rule of five which states that a chemical compound might be an orally active drug in humans if the drug has no more than one exception of the following criteria:

- No more than 5 H-bonds donors
- No more than 10 H-bond acceptors
- Molecular mass of less than 500 Da
- Octanol-water partition coefficient of less than 5

Conclusion:

In the current COVID19 situation, when normal wet lab workflow is hindered, in silico workflow which can be done from our homes is a boon for drug discovery for anti-SARS-CoV2 therapeutics.

~ BY ANUBHAV CHATTERJEE,
BT 4TH



General flowchart of drug discovery

Herd Immunity

Introduction

The term "herd Immunity" was coined in 1923. The term was not widely used until in recent decades its use stimulated by the increasing use of vaccines, discussions of disease eradication and analysis of the costs and benefits of vaccination programs. Herd immunity, also called herd effect is a state in which a large proportion of a population has become immune to an infection, either through vaccination or through previous infections, thereby lowering the possibility of infection for individuals who lack immunity.

Types of herd immunity

Innate(inherent) Herd Immunity - It is genetically determined physiological changes with respect to antibody production or other defense mechanisms in a herd or community and does not depend on any previous exposure of herd with infection.

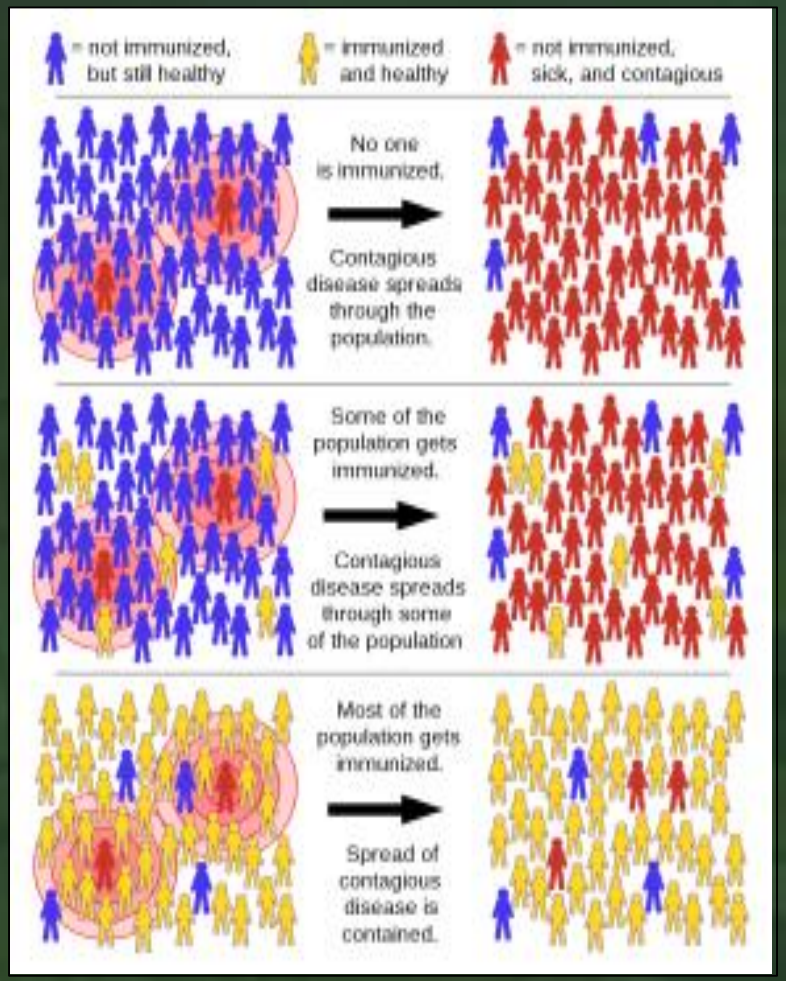
Acquired Herd Immunity - It is a type of herd immunity where a sufficient number of members of a population have been exposed to infectious agents during their lifespan.

Effects, Pros And Cons Of Herd Immunity

Individuals can become immune either by recovering from an earlier infection or by vaccination. The chance of becoming infected in a population decreases with increase in number of immune individuals. Few individuals cannot become immune because of medical conditions like immunodeficiency and immunosuppression and for this group herd immunity is a crucial method of protection. Herd immunity only works for contagious diseases, like measles, but it would not work in case of tetanus because tetanus is not a contagious disease. For infections without a vaccine, even if many individuals have developed immunity because of prior infections, the disease can still circulate among children and can still infect those with weakened immune system.

Conclusion

Individual immunity is such a powerful force that its consequences are felt beyond the individual at the population scale. So, herd immunity is an effective tool in the treatment and eradication of contagious diseases but it is useless without vaccination.



~ Subham Haldar
2nd year

HERD IMMUNITY

You might have come across the word 'Herd Immunity' in news articles / research papers especially during this period of lockdown when the whole world is fighting against a deadly pandemic and life has almost come to a near standstill So future biotechnologists, wondering what is Herd Immunity? Are you craving to know more about it? Confused between herd immunity and ring vaccination? Don't worry, the wait is finally over!

- **So, what is Herd Immunity actually**?

When a high percentage (>75%) of a population becomes immune to an infectious disease (through vaccination and/or proper illness), it provides indirect protection to less immune, new born and immunocompromised persons, thus making the spread of this disease from person to person unlikely. The immunity, thus developed, is called Herd Immunity.

- **Does Herd Immunity work for all diseases?**

Herd immunity is applied only to contagious diseases like measles. Tetanus, for example, is infectious but not contagious, so herd immunity doesn't apply.

- **Why is it important to vaccinate children if they can be protected with Herd Immunity?**

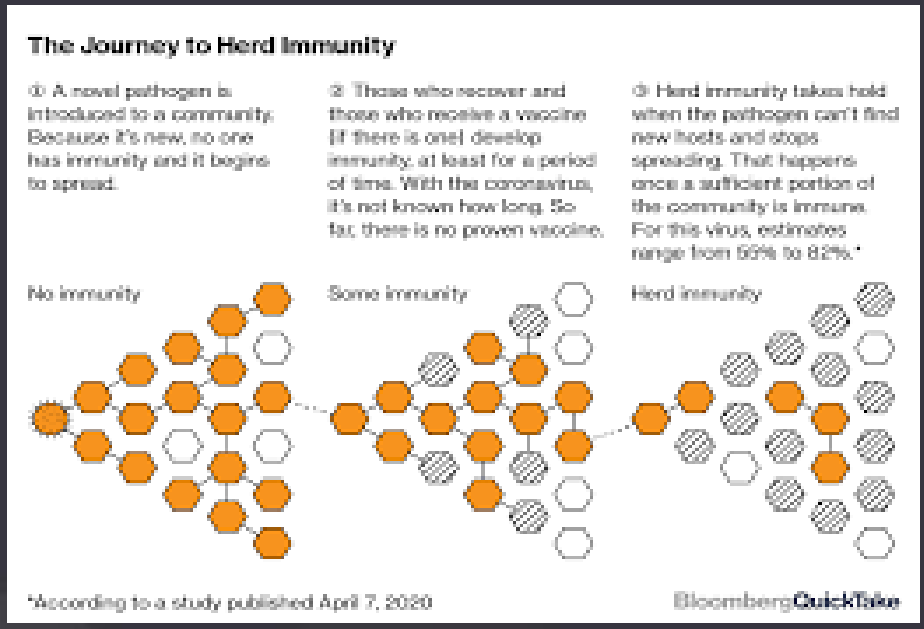
Children, being at a higher risk, must be vaccinated rather than relying on 'indirect' protection methods through herd immunity, which makes them highly susceptible. Also, young kids or those having a problem with their immune system, cannot be vaccinated. Moreover, herd immunity is less effective than vaccination.

- **Herd Immunity & COVID-19:**

As of September, 2020, India continues to record a high number of COVID-19 cases on a daily basis, with the countrywide infections tally now close to 57 lakh. Multiple surveys conducted to gauge the ground-level situation, especially in the 'hotspot' locations especially, in New Delhi and Mumbai, provided early indications of some population groups edging closer towards developing; herd immunity against the deadly virus. The survey conducted in Delhi revealed that 30% of the population developed COVID-19 antibodies, while the survey in Mumbai slums estimated that 57% population in three wards have developed antibodies against COVID-19.

How can herd immunity be achieved in India?

Out of 135 crore population to collectively achieve herd immunity, about 94 to 122 crore people will have to get infected with the virus and subsequently develop antibodies. In contrast, only a negligible fraction have built an immunity to the disease. Therefore, a countrywide herd immunity remains too long a shot, although this phenomenon may begin popping up in small areas, particularly in the hotspot zones with high population density.



Is herd immunity realistically achievable?

Experts have consistently warned that countries should not completely rely on herd immunity as a solution for the COVID-19 fight. Many hotspots areas are still far from achieving herd immunity. Herd immunity develops passively and for that, people are can't be allowed to get infected actively. Therefore, infection prevention control measures have to be taken at all levels. Herd immunity cannot be a strategic option for a country of India's size, and solution can only be achieved through immunization in the future.

- Subhrojyoti Ghosh
BT 3rd year

PANDEMIC

"Pandemic" is a Greek word where "pan" means "all" and "demos" means "people". It is basically an epidemic of any dangerous infectious disease spreading across a large region, for instance multiple continents or worldwide, affecting a substantial number of people. In human history, the first ever known pandemic was "**SMALLPOX"** and there after comes "**TUBERCOLOSIS"**. But the most fatal pandemic in recorded history is known as "**BLACK DEATH"** (also known as "**THE PLAGUE"**) which killed an estimated 75-200 million people in the 14th century.

Pandemic affects economic status worldwide. The COVID-19 pandemic is expected to have profound effect on global effect, potentially for years to come, with substantial drops in GDP accompanied by increase in unemployment rate around the world. This slowdown of economic activities during this pandemic reduced the level of pollutant emission and greenhouse gases .The reduction of air pollution, economic activity associated with it during Pandemic was first documented by **ALEXANDER – F MORE** for Black Death plague showing the lowest pollution levels in last 20000 years during that pandemic, due to it 40 to 60% death rate throughout Eurasia.

Bubonic Plague

- Known as "The Black Death"
- Bubonic Plague killed one third of the population in Europe
- Hit the city dwellers the hardest due to severe overcrowding and lack of sanitation

The basic strategies in control of outbreak are **containment** and **mitigation.** A key part of managing an infectious disease outbreak is trying to decrease the epidemic peak known as "**flattening the epidemic curve**". This help to decrease the risk of health services being overwhelmed, and provides more time for the vaccine and treatment to be developed. **Non-pharmaceutical interventions** may be taken to manage the outbreak.

The main idea of controlling the pandemic is-

"DON'T PANIC" & "STAY HOME"

"MAINTAIN SOCIAL DISTANCING"

"MAKE PEOPLE AWARE OF THIS DISEASE"

- MADHURIMA KOLEY
BT 3Rd YEAR

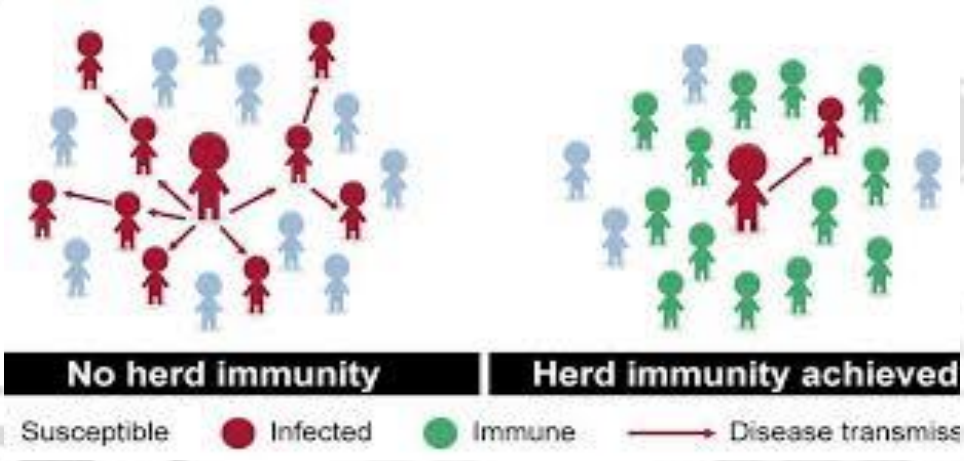
HERD IMMUNITY

Herd immunity is a way of achieving immunity by means of infections(especially viral infections) in 60 to 80% of the population . It actually gives indirect protection to the population which is not infected yet.

If 80% of a population is immune to a virus, four out of every five people who encounter someone with the disease won't get sick (and won't spread the disease any further). In this way, the spread of infectious diseases is kept under control making the spread from person to person unlikely. Depending how contagious an infection is, usually 50% to 90% of a population needs immunity to achieve herd immunity.

DIAGRAMATIC EXPLANATION OF HERD IMMUNITY

Herd immunity depends on the contagiousness of a disease . If we talk about measles as it spreads easily, it needs much number of immune individuals to obtain herd immunity. Herd immunity protects the most vulnerable members of our population. If enough people are vaccinated against dangerous diseases, those who are susceptible and cannot get vaccinated are protected because the germ will not be able to "find" those susceptible individuals.



HERD IMMUNITY AGAINST COVID 19

As COVID-19 has been declared pandemic all over the world in almost every country possible thus a large percentage of the population will need to be immune against the disease (through infection or vaccination) before herd immunity will be achieved. It is not possible to assume yet that when will herd immunity be obtained but it still will totally be dependent on how many of the COVID-19 infected individual obtain so called acquired immunity in themselves , how soon a COVID-19 vaccine is available for generating artificial immunity, how many vaccine doses will be available for distribution, and how manvaccine doses will be available for distribution, and how many people get vaccinated.

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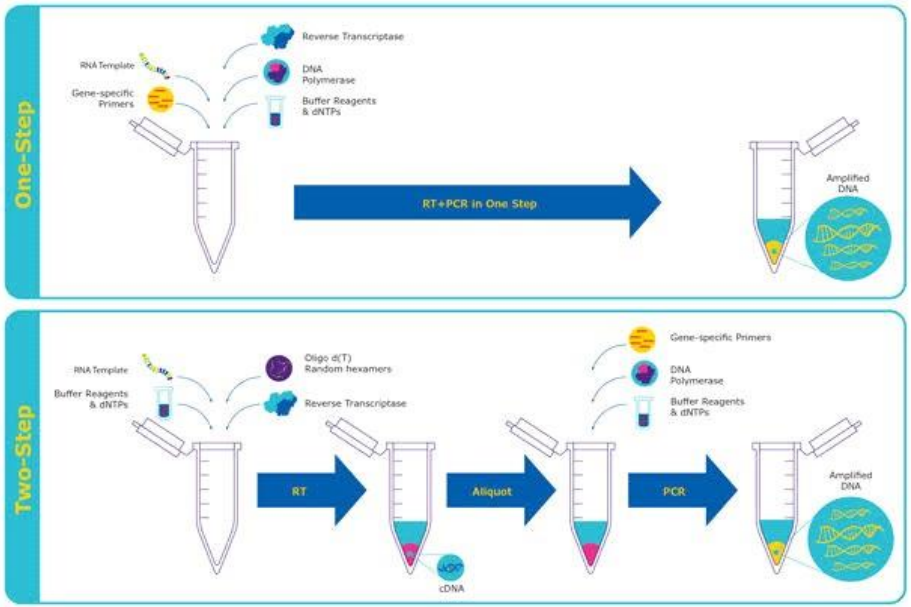
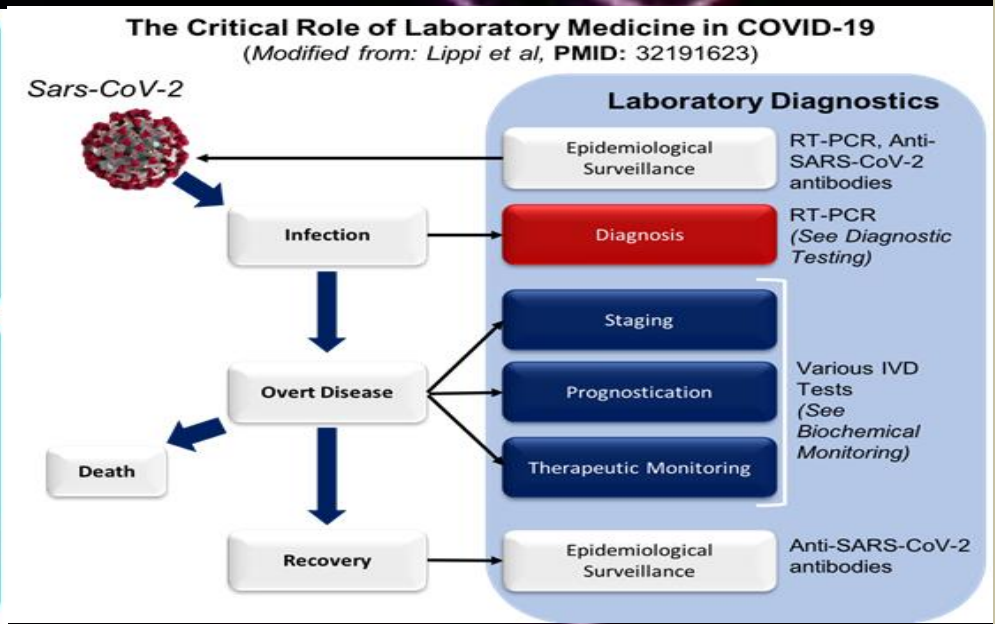
~Anuvab Dey
BT 3rd year

DIAGNOSIS OF SARS-COV2

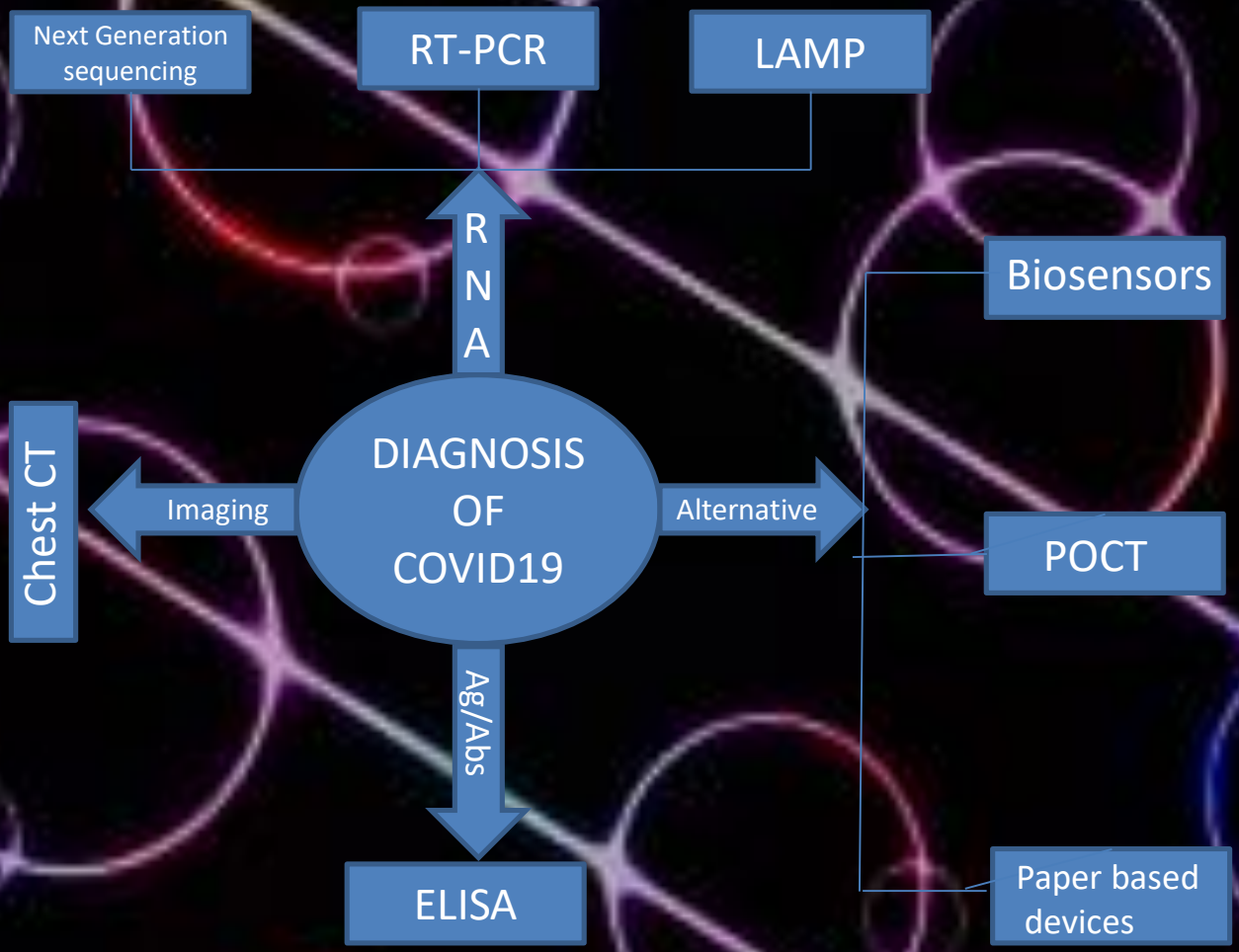
In December 2019, the outbreak of the novel coronavirus disease in China spreads worldwide caused by SARS-CoV-2. Diagnosis , quarantine and supportive treatments are essential to cure patients. It is a RNA virus which has at least six open reading frames and many other accessory genes. The COVID 19 infected patients have their primary symptoms as fever and cough and also shortness of breath. For the diagnosis of the virus usually the nasopharyngeal swab is collected but sometimes it is not accurately detected. In those cases, the lower respiratory tract specimen such as sputum , bronchoalveolar lavage (BAL) is collected. The sample must be transported in triple packaging system. For the diagnosis of the virus – IMMUNOLOGICAL ASSAY and NUCLEIC ACID TESTING ASSAY is widely used.

Immunological Assay is used to detect the presence of antibodies produced in the host body's immune response against the virus infection or measures the protein of Covid-19 virus present in the respiratory specimen. The antibody detection test is not for the identification of active cases of SARS-CoV-2 infection but various reports documented that the detection is valid for serological diagnosis. A study in china found that the serodiagnosis of COVID-19 based on IgM and IgG ELISA have great specificity for diagnosis of COVID-19. In confirmed COVID 19 patients the sensitivity and specificity of detection of IgM were 77.3% & 100% and for IgG detection were 83.3% and 95.0% respectively .Thus the detection of both IgG and IgM with higher specificity makes it reliable and helps in the diagnosis of COVID 19 patients. While using this type of antigen detection assay one should keep in his mind that due to sampling variability and low viral load in the infected person , there must be inaccuracy in the result.





n Nucleic acid Testing Assay, RT-PCR is widely used to detect the causative viruses . It is one of the best and accurate laboratory methods for detecting, tracking and studying the coronavirus. It detects the presence of specific target genetic material. Nowadays various fluorescent dyes are used as marker to detect the specific genetic target. PCR assay the viral RNA is measured by the cycle threshold (Ct) . The data is interpreted based on the Ct value which means that the number of cycles required for the fluorescent signal to cross the threshold and become detectable. If the value is less than 40 it is clinically reported as PCR positive. In most cases this process maintains 100% accuracy.



COVID19 Diagnostic Approaches

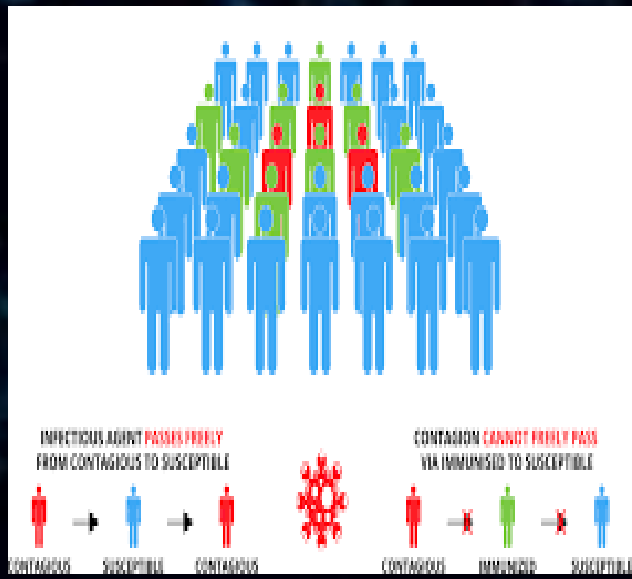
By -Diya Ghosh
BT 4th

HERD IMMUNITY

Herd immunity also known as population immunity is a form of indirect protection from infectious disease that occurs when a sufficient percentage of a population has become immune to an infection, whether through vaccination or previous infections, thereby reducing the likelihood of infection for individuals who lack immunity. Certain people can't become immune by vaccination due to immunosuppression or immunodeficiency, for them, herd immunity is the only option to get protect

This phenomenon is applicable only for contagious diseases i.e. those that are transmitted from one person to another. Now, why do we use the term 'Herd'? In the present scenario, the term is widely used because it is expected that when the level of immunity passes a certain threshold, the infection will gradually decrease. After all, there will not be enough people to infect.

R is the number used to denote how many individuals can get affected by one individual. For Coronavirus, it is around 3.



$$R=Ro.X$$

Where Ro= average no of secondary cases produced in a susceptible population.

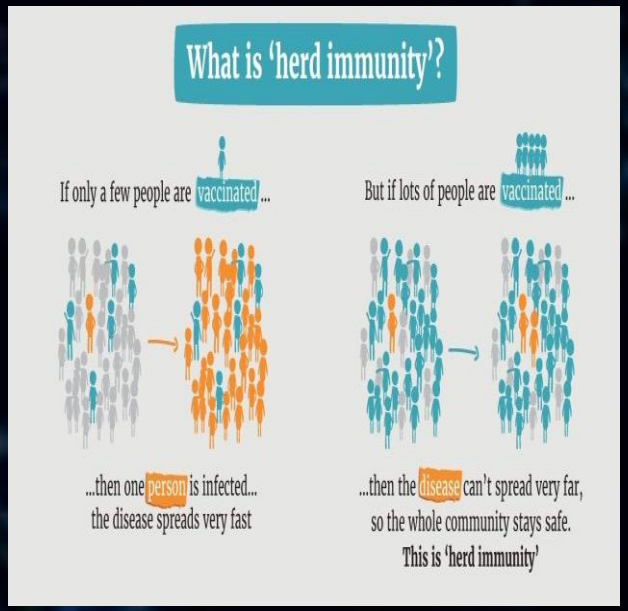
X= fraction of the population that is susceptible.

Since every individual will not be susceptible, some will be immune due to prior infection, therefore, R will be different from Ro.

For the elimination of disease, R needs to be less than 1.

Herd immunity threshold is given by the formula,

$$HIT= 1-1/Ro$$



HIT for a country like India having a population around 138 crores will be very large and one must not wait for it to happen. Instead, we must continue taking precautions until the vaccine is made available.

By ~ Debasmita Sarma Chaudhuri BT 3rd year

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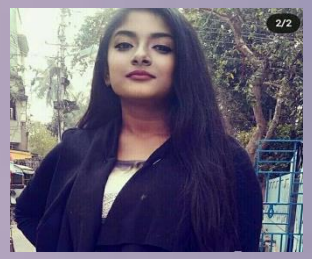

Aishe Mukherjee

THANK YOU!

Thanking you for all your informative and well written articles
This would not have been possible without your contributions and constant support. Thank you!