

# You & Technology Mar-2020



## ASPIRE IAS

*The Name Associated with Excellence*

# GOOD MORNING TIMES S&T (MARCH-2020)

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# You & Technology Mar-2020

## General Studies Paper-3 – S&T – March 2020

### 1) National Supercomputing Mission (NSM)

#### What is National Supercomputing Mission (NSM)?

It is being implemented and steered jointly by the Department of Science and Technology (DST) and Department of Electronics and Information Technology (DeitY). Implemented by the Centre for Development of Advanced Computing (C-DAC), Pune and the Indian Institute of Science (IISc), Bengaluru.

#### Focus of the mission:

- The Mission envisages empowering national academic and R&D institutions spread over the country by installing a vast supercomputing grid comprising of more than 70 high-performance computing facilities.
- These supercomputers will also be networked on the National Supercomputing grid over the National Knowledge Network (NKN). The NKN is another programme of the government which connects academic institutions and R&D labs over a high speed network.
- The Mission includes development of highly professional High Performance Computing (HPC) aware human resource for meeting challenges of development of these applications.

**Achievements:** The first supercomputer assembled indigenously, called Param Shivay, was installed in IIT (BHU) and was inaugurated by the Prime Minister. Similar systems Param Shakti and Param Brahma were installed at IITKharagpur and IISER, Pune. They are equipped with applications from domains like Weather and Climate, Computational Fluid Dynamics, Bioinformatics, and Material science.

#### Significance:

1. World-wide supercomputing facilities have enabled countries in their S&T capabilities in areas such as designing vehicles, aeroplanes, massive structures like high rise buildings and bridges, infrastructure, discovery of new life saving drugs, discovery and extraction of new energy sources including oil, natural gas etc.
2. Over the years, supercomputers have benefitted mankind in several ways. Weather prediction has reached accuracy of forecast as well as real time tracking of natural phenomenon. Timely warning of cyclones in the recent past have saved many lives and property. The Mission aims to further such capabilities beyond current levels.

### 2) Biofortification

Scientists of ARI, Pune develop biofortified, high protein wheat variety- MACS 4028.

- It is a semi-dwarf variety. It has shown the superior and stable yielding ability.
- It is resistant to stem rust, leaf rust, foliar aphids, root aphids, and brown wheat mite.

#### What is biofortification?

Biofortification is the process of increasing nutritional value of food crops by increasing the density of vitamins and minerals in a crop through either conventional plant breeding; agronomic practices or biotechnology. Examples of these vitamins and minerals that can be increased through biofortification include provitamin A Carotenoids, zinc and iron.

#### How are crops fortified?

Conventional crop breeding techniques are used to identify varieties with particularly high

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concentration of desired nutrients. These are cross-bred with varieties with other desirable traits from the target areas (such a virus resistance, drought tolerance, high yielding, taste) to develop biofortified varieties that have high levels of micronutrients (for example, vitamin A, iron or zinc), in addition to other traits desired by farmers and consumers. Agronomic biofortification entails application of minerals such as zinc or iron as foliar or soil applications, drawing on plant management, soil factors, and plant characteristics to get enhanced content of key micronutrients into the edible portion of the plant.

## Why biofortification?

Biofortification is one solution among many interventions that are needed to solve the complex problem of micronutrient malnutrition. It is considered one of the most cost-effective interventions for countries to employ in combating micronutrient malnutrition.

- Biofortification reaches rural consumers who have limited access to industrially fortified foods, supplementation interventions, and diverse diets.
- Biofortification combines increased micronutrient content with preferred agronomic, quality, and market traits and therefore biofortified varieties will typically match or outperform the usual varieties that farmers grow and consume.

## How does Biofortification differ from food fortification?

Biofortification has the increased nutritional micronutrient content imbedded in the crop being grown. Food fortification increases the nutritional value of foods by adding trace amounts of micronutrients to foods during processing.

### 3) GI tag

Madhya Pradesh government's struggle to join the elite 'basmati' league has failed once again as the Madras high court has dismissed the state's plea seeking geographical indication (GI) tag for basmati rice grown in areas falling under the state.

## What has the Court said?

Two GI certificates of registration for a same produce cannot be issued. The petitioners have an alternative and efficacious remedy available by filing an application to the registrar of trademark seeking to cancel or vary the GI certificate issued to APEDA.

## What's the issue?

In May 2010, GI status was given to basmati grown only in Punjab, Haryana, Delhi, Himachal Pradesh, Uttarakhand and parts of western Uttar Pradesh and Jammu & Kashmir. But, Madhya Pradesh demanded that its 13 districts be recognised as traditional Basmati growing regions. However, GI registry had rejected Madhya Pradesh's claim as being the original and unique basmati growing region. It had observed that the documents and evidence filed by Madhya Pradesh show the importance, special characters of rice cultivated in Madhya Pradesh but not the basmati cultivation in the traditional growing area.

## What's the concern now?

Madhya Pradesh says non-inclusion of the state in the basmati growing areas would have an adverse effect on the lives of farmers who mainly depend upon basmati cultivation and it will also affect the export potential, which will indirectly reduce the country's turnover from the export of basmati. About GI tag: What is it? A GI is primarily an agricultural, natural or a manufactured product (handicrafts and industrial goods) originating from a definite geographical territory.

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**Significance of a GI tag:** Typically, such a name conveys an assurance of quality and distinctiveness, which is essentially attributable to the place of its origin.

**Security:** Once the GI protection is granted, no other producer can misuse the name to market similar products. It also provides comfort to customers about the authenticity of that product.

**Who is a registered proprietor of a geographical indication?**

Any association of persons, producers, organisation or authority established by or under the law can be a registered proprietor. Their name should be entered in the Register of Geographical Indication as registered proprietor for the Geographical Indication applied for.

**How long the registration of Geographical Indication is valid?**

The registration of a geographical indication is valid for a period of 10 years. It can be renewed from time to time for further period of 10 years each.

**What is the difference between a geographical indication and a trademark?**

A trademark is a sign used by an enterprise to distinguish its goods and services from those of other enterprises. It gives its owner the right to exclude others from using the trademark. A geographical indication tells consumers that a product is produced in a certain place and has certain characteristics that are due to that place of production. It may be used by all producers who make their products in the place designated by a geographical indication and whose products share typical qualities.

**Who accords and regulates Geographical Indications?**

At the International level: Geographical Indications are covered as a component of

intellectual property rights (IPRs) under the Paris Convention for the Protection of Industrial Property. GI is also governed by the World Trade Organisation's (WTO's) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). In India, Geographical Indications registration is administered by the Geographical Indications of Goods (Registration and Protection) Act, 1999 which came into force with effect from September 2003. The first product in India to be accorded with GI tag was Darjeeling tea in the year 2004-05.

## 4) COVID-19

There is a large scale outbreak of COVID19 (Coronavirus Disease 2019) across the world.

### **Coronavirus and its origin**

- Coronaviruses are a large family of viruses that circulate among a range of animals, such as bats, cats, and birds. Sometimes these viruses make a jump over from animals to humans (known as Spill over) causing diseases known as Zoonotic diseases.

- o This spill over happens due to factors such as mutations in the virus or increased contact between humans and animals.

- The virus causes respiratory and gastrointestinal symptoms in humans with infectious diseases ranging from common cold to more severe diseases such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and CoVID-19.

- While the SARS coronavirus is thought to have evolved from infecting bats to civet cats to humans in the Guangdong province of southern China in 2002, the MERS evolved from bats to camels to humans in Saudi Arabia in 2012.

- Research suggests that the original source of the virus that caused COVID-19 was bats, and

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pangolins might have acted as intermediaries. The mutation and natural selection might have taken place either inside pangolins or in humans after transfer from pangolins. This virus was first identified in Wuhan (Hubei province), China in 2019.

## Structure and physiology of the virus

- Coronaviruses are spherical shaped and consist of a core of genetic material (RNA) surrounded by an envelope with mushroom shaped protein spikes. These spikes binds and fuses to human cells allowing the virus to gain entry and replicate itself inside the body.
- Each virus particle is just between 50–200 nanometres in diameter (human hair is 80000nm in diameter).
- The protein spikes gives the appearance of a crown or a halo around the Sun. Crown in Latin is called as “Corona” and this is how the virus also got its name.
- COVID-19 is caused by SARS-CoV-2 also known as novel coronavirus (n-CoV), as it is very similar to the one that caused SARS in 2002.
- The spike protein of the novel coronavirus shares 98% sequence identity with the spike protein of the SARS coronavirus.
- SARS-CoV-2 has spike proteins which contain a receptor-binding domain (RBD). The RBD facilitates the virus’ entry into target cells by binding with the cellular receptor called angiotensin-converting enzyme-2 (ACE-2) found in heart, lungs, kidneys and the gastrointestinal tract.
- Once inside, it hijacks the cell’s reproductive machinery to produce more copies of itself, before breaking out of the cell again and killing it in the process.
- However, unlike in the case of SARS, the spike protein of the novel coronavirus binds to the cell

receptor with much higher affinity — 10-to 20-fold higher. The RBD’s bonding affinity is increased due to mutation within the virus.

- This stronger bonding affinity partly explains the apparent high human-to-human transmissibility and COVID19’s faster spread as compared to SARS epidemic in 2002-2003 across 29 countries.

## Role of Live Animal Market:

- Live animal markets (also known as 'wet markets' in parts of Asia, such as the Huanan Seafood Market in Wuhan China) are an important risk factor for zoonotic disease spread.
- In the Huanan Seafood Market in China, live fish, meat and wild animals are sold putting people and live and dead animals - dogs, chickens, pigs, snakes, civets, and more - in constant, close contact. That makes it easy for a virus to jump from animal to human.

## Primary case and Index case in a disease outbreak

- The term primary case can only apply to infectious diseases that spread from human to human, and refers to the person who first brings a disease into a group of people—a school class, community, or country. For many outbreaks, the primary case will never be known—the worldwide HIV epidemic is one example.
- The index case (sometimes referred to as patient zero) is the first documented patient infected by a viral or bacterial disease in an outbreak within a population.
  - o The index case may or may not indicate the source of the disease, the possible spread, or which reservoir holds the disease in between outbreaks, but may bring awareness of an emerging outbreak.
  - o Even outbreaks of disease that is not spread from human to human, might have an index case.

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o Currently, we do not know the patient zero in the COVID-19 outbreak. The hypothesis that the outbreak started at the Chinese market and could have been transmitted from a living animal to a human host before spreading human-to-human is still considered the most likely, according to the World Health Organization (WHO).

- In some instances, the primary case is also the index case, but often they are not the same. Identifying who these people are can help address crucial questions about how, when and why it started. These can then help to prevent more people from getting infected now or in future outbreaks.

## **DIAGNOSIS**

**Currently following tests are available for identifying coronavirus infection in a person:**

**Serological Tests/Rapid Antibody Detection Tests:**

- These are blood/serum/plasma test carried out to determine whether an individual's body has IgM and IgG antibodies developed against the SARS-CoV-2.

o Immunoglobulins, also known as antibodies, are glycoprotein molecules produced by plasma cells (white blood cells). They act as a critical part of the immune response by specifically recognizing and binding to particular antigens, such as bacteria or viruses, and aiding in their destruction.

o IgM is the first antibody that the body makes when it fights a new infection and it does not stay for long while IgG can take time to form after an infection or immunization thus indicating an old infection.

- If antibodies are present in the sample, these bind to the antigen immobilised on the test strip and give a coloured reaction.

- These are carried out for symptomatic individuals and have to be confirmed by molecular tests.

- It is also helpful tool for scientist to determine the extent to which a disease has spread and how many have developed immunity to it.

**Molecular Test/ ReverseTranscription Polymerase Chain Reaction (RTPCR) test:**

- This identifies the presence of virus itself based on its genetic fingerprint.

**RT-PCR Test:**

- When a person is suspected to be suffering from COVID-19, an oral/nasal swab is taken.

- Viral Ribonucleic Acid (RNA) is isolated from these swabs using a variety of chemicals.

- Enzymes are then added to transcribe the RNA into DNA. This DNA is put into a real-time PCR (RTPCR) machine that xeroxes the DNA, making thousands of copies of any genetic material in the samples.

- Scientists then use sets of DNA fragments that complement fragments found in the coronavirus.

- If any viral genetic material is present, these fragments will bind to it.

- Chemical markers attached to the DNA release fluorescence when this DNA binding occurs.

- It's these flashes of fluorescence that scientists use to determine whether the virus is present in a sample.

**Pool Testing Method**

- Developed by German Red Cross Blood Donor Service in Frankfurt

- It involves simultaneously testing a combined sample from multiple people from a household or a local cluster to widen reach and speed up results. Suitable for expanded testing in larger population groups.

- In the case of a positive mini-pool result, individual testing is carried out in previously

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reserved samples. In the case of a negative result, all included samples have a reliable negative result.

- It was earlier used during large outbreaks and invisible community transmission, such as of HIV.

## India's Approach

- ICMR's initial strategy was of testing those with a travel history and showing symptoms, and those who have come in contact with persons having a travel history.
- Lately it was revised to test all pneumonia patients for novel coronavirus, hospitals across the country have taken to testing all patients admitted with severe respiratory illnesses.
- The new guidelines state asymptomatic direct and high-risk contacts of a confirmed case should be tested once between Day 5 and Day 14 of coming in to the contact of infected person.
- The testing strategy is reviewed and updated by the constituted National Task Force along with a member of the government think-tank, NITI Aayog.
- In India, it has been recommended by ICMR to conduct Rapid Antibody Detection tests in areas reporting clusters of COVID-19 cases, in large migration gatherings and evacuee centres. o HLL Lifecare Limited, a Central Government Enterprise under Ministry of Health and Family Welfare is the first public sector company in India to get approval from ICMR for manufacturing and supplying the Rapid Antibody kit for COVID-19 detection.
- Positive Test results from Rapid Antibody tests are confirmed by RT-PCR tests. o Pune based molecular diagnostic company Mylab developed indigenous RT-PCR based diagnostic test kits. It can test 100 samples and costs 1,200 rupees (a

quarter of the 4,500 rupees that India pays to import COVID-19 testing kits from abroad).

- Indian Council of Medical Research (ICMR) allowed all national research laboratories including those under the Council of Scientific and Industrial Research (CSIR) to conduct testing for the novel coronavirus.
- ICMR has suggested Pool Testing Method for the low prevalence areas, where the positive case rate is less than 2 percent. Here, about five samples are clubbed together for a single test. It is to be avoided in all areas where the positive case rate exceeds five percent.
- ICMR introduced Rapid Antibody and Pool Tests to Speed-Up Coronavirus Testing in India

## TREATMENT:

To date, there is no vaccine and no specific drug to treat COVID-2019. The most effective measure has been to isolate people who have tested positive, quarantine them and increase social distancing to contain the spread of virus.

## **Proposed and potential drugs:**

WHO has recommended four drugs and their combination under its Solidarity trial initiative to find out whether any can treat infection.

Those are:

- **Remdesivir:** It was previously tested as an Ebola treatment and generated promising results in animal studies for MERS and SARS.
- **Chloroquine and hydroxychloroquine:** are very closely related and used to treat malaria and rheumatology conditions respectively.
- **Ritonavir/lopinavir:** It is a licensed treatment for HIV.
- Ritonavir/lopinavir with Interferon beta-1a: Interferon beta-1a is a molecule involved in regulating inflammation in the body and is used to treat multiple sclerosis.

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## Convalescent Plasma Therapy:

The US Food and Drug Administration (FDA) approved use of blood plasma from recovered patients to treat severely critical COVID-19 patients.

- About plasma therapy o It seeks to make use of the antibodies developed in the recovered patient against the coronavirus.

- o The whole blood or plasma from such people is taken, and the plasma is then injected in critically ill patients so that the antibodies are transferred and boost their fight against the virus.

- o Either a blood fractionation process is used to separate the plasma from the donated blood or a special machine called apheresis machine can be used to extract the plasma directly from the donor.

- o WHO guidelines(2014) for plasma therapy:

- ✓ Donor's permission is mandatory before extracting plasma.

- ✓ Plasma from only recovered patients must be taken,

- ✓ Donation must be done from people not infected with HIV, hepatitis, syphilis, or any infectious disease.

- ✓ If plasma needs to be collected again from the same person, it must be done after 12 weeks of the first donation for males and 16 weeks for females.

- o Previous usage of this therapy

- ✓ The United States used plasma of recovered patients to treat patients of Spanish flu (1918-1920).

- ✓ Hong Kong used it to treat SARS patients in 2005.

- ✓ In 2009, H1N1 patients were treated with plasma.

- ✓ Democratic Republic of Congo and Guinea used it to treat Ebola patients in 2014.

- ✓ In 2015, plasma was used for treating MERS patients.

## Genome sequencing of the coronavirus

- India has shared nine whole genome sequence data of the novel coronavirus (SARS-CoV-2) with the Global Initiative on Sharing All Influenza Data (GISAID). The sequences were shared by the Pune-based National Institute of Virology.

- Genome sequencing is figuring out the order of DNA nucleotides, or bases, in a genome that make up an organism's DNA. The human genome is made up of over 3 billion base pairs. 30,000 base have been identified in the genome of coronavirus.

- Genetic research would help scientists understand the nature and the evolution of the novel coronavirus, origin of the virus and how the virus has spread. This information will thus help in development of a vaccine and efficient treatment methodology.

- Since the coronavirus may be mutating and developing into new strains, it has been suggested that India needs to sequence more strains to understand it better.

## Global Initiative on Sharing All Influenza Data (GISAID)

- o It is a platform started by WHO in 2008 and hosted by the German government in partnership with nonprofit organization Friends of GISAID.

- o It promotes the international sharing of all influenza virus sequences, related clinical and epidemiological data associated with human viruses, and geographical as well as species-specific data associated with avian and other animal viruses,.

- o The Initiative through its database named EpiFlu ensures that open access to data is provided free-ofcharge and to everyone to help researchers

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understand how the viruses evolve, spread and potentially become pandemics.

## WHO Solidarity Trial Initiative

- It is an international clinical trial to help find an effective treatment for COVID-19, launched by the World Health Organization and partners.
- It will compare four treatment options against standard of care, to assess their relative effectiveness against COVID-19.
- Enrolling patients in one single randomized trial will help facilitate the rapid worldwide comparison of unproven treatments. This will overcome the risk of multiple small trials not generating the strong evidence needed to determine the relative effectiveness of potential treatments.

## India's approach

- Indian government has declared Hydroxychloroquine (HCQ) as a schedule H1 drug, that can be sold on prescription only as per the Drugs and Cosmetics Rules, 1945.
- ICMR has advised use of HCQ for high risk individuals like health workers and the asymptomatic household contacts of lab-confirmed cases to shield them from the infection.
- India has never used the Plasma Therapy before though India has facilities for removing 500 ml of plasma from a donor using aphaeresis. India is soon to begin two clinical trials of Convalescent plasma therapy.

## VACCINE DEVELOPMENT

- There are more than 20 vaccines currently in development with two in clinical trial phase involving human testing.
- Vaccines developed by Moderna and Oxford university are amongst eight candidates selected and funded by Coalition for Epidemic

Preparedness Innovations (CEPI), the world body coordinating the efforts against COVID 19. •

Other than the eight CEPI-funded vaccines, there are also 14 other institutions including two from India: Pune-based Serum Institute of India and Ahmedabad based Zydus Cadila, which are engaged in developing vaccine for this infectious disease.

- A Phase I safety trial of a recombinant adenovirus vaccine candidate manufactured by CanSino Biologics Inc. (Tianjin, China), called Ad5-nCoV, began in China.

## Vaccine Development Process

There are six stages of vaccine development which takes around 12-15 years to complete.

- **Exploratory:** This research-intensive phase of the vaccine development process is designed to identify “natural or synthetic antigens that might help prevent or treat a disease.”
- **Pre-clinical:** During this phase, researchers — usually in private industry — use tissue-culture or cell-culture systems and animal testing to determine whether the candidate vaccine will produce immunity. Many candidate vaccines don't move on to the next stage of development because they fail to produce that immunity or prove harmful to test subjects.
- **Clinical development:** At this point, a sponsor, usually a private company, submits an application for to an authorising agency like FDA of USA. This summarizes findings to date and describes how the drug will be tested and created. An institution that will host the clinical trial holds a review board for approval of the application. Once the proposal has been approved, the vaccine must pass three trial stages of human testing:
- **Regulatory review and approval:** If a vaccine passes through all three phases of clinical development, the vaccine developer submits a

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Biologics License Application (BLA) to the authorizing agency.

- **Manufacturing:** Major drug manufacturers provide the infrastructure, personnel and equipment necessary to create mass quantities of vaccines. They also reap the profits of successful or widely distributed drugs.

- **Quality control:** Stakeholders must adhere to procedures that allow them to track whether a vaccine is performing as anticipated. Multiple systems — including Phase IV trials (optional studies that can be conducted following the release of a vaccine), the Vaccine Adverse Event Reporting System (VAERS) and the Vaccine Safety Datalink — are designed to monitor the performance, safety and effectiveness of an approved vaccine.

## Types of Vaccines

### • Live Attenuated Virus (LAV):

- o Uses a weakened (or attenuated) form of the germ that causes a disease.
- o Because these vaccines are so similar to the natural infection that they help prevent, they create a strong and long-lasting immune response. Just 1 or 2 doses of most live vaccines are enough to give a lifetime of protection against a germ and the disease it causes.

- o Used in case of Measles, Rubella (MMR combined vaccine), Tuberculosis, Rotavirus, Oral Polio Vaccine (OPV), Yellow fever etc.

### • Inactivated vaccines:

- o Uses the killed version of the germ that causes a disease.

- o These vaccines usually don't provide immunity that's as strong as live vaccines so several doses over time (booster shots) is needed to get ongoing immunity against diseases.
- o Used in case of Polio (IPV), Pertussis, Hepatitis A etc.

### • Subunit and Recombinant vaccines

- o use only part of a target pathogen like its protein, sugar, or capsid (a casing around the germ) presenting it as an antigen on its own to provoke a response from the immune system.

- o It can also be created via genetic engineering. A gene coding for a vaccine protein is inserted into another virus, or into producer cells in culture. When the carrier virus reproduces, or when the producer cell metabolizes, the vaccine protein is also created. The end result of this approach is a recombinant vaccine: the immune system will recognize the expressed protein and provide future protection against the target virus.
- o Used in case of Haemophilus Influenza type B(Hib). The Hepatitis B vaccine currently used in the United States is a recombinant vaccine.

### • Conjugate vaccines

- o Similar to recombinant vaccines but are made using pieces from the coats of bacteria. These coats are chemically linked to a carrier protein, and the combination is used as a vaccine.

- o Conjugate vaccines are used to create a more powerful, combined immune response: typically the "piece" of bacteria being presented would not generate a strong immune response on its own, while the carrier protein would.

- o The vaccines currently in use for children against pneumococcal bacterial infections are made using this technique.

### • Toxoid vaccines

- o Uses a toxin (harmful product) made by the germ that causes a disease.

- o They create immunity to the parts of the germ that cause a disease instead of the germ itself.
- o booster shots are needed to get ongoing protection against diseases.

- o Used in case of Tetanus and Diphtheria.

### • RNA vaccine

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o Unlike a normal vaccine, RNA vaccines work by introducing an mRNA sequence (the molecule which tells cells what to build) which is coded for a disease specific antigen, once produced within the body, the antigen is recognised by the immune system, preparing it to fight the real thing.

o RNA vaccines are faster and cheaper to produce than traditional vaccines, and an RNA based vaccine is also safer for the patient, as they are not produced using infectious elements.

o Production of RNA vaccines is laboratory based, and the process could be standardised and scaled, allowing quick responses to large outbreaks and epidemics. o Most current research is into RNA vaccines for infectious diseases and cancer.

o No vaccine made from genetic material – RNA or DNA – has been approved till date.

## Challenges with vaccines development in case of Pandemics

- Before a vaccine is available the pandemic will probably have peaked and declined.
- As soon as a vaccine is approved, it's going to be needed in vast quantities.
- In case of a pandemic, countries also have to compete with each other for medicines. The challenge is to make sure the vaccine gets to all those who need it.
- Because pandemics tend to hit hardest those countries that have the most fragile and underfunded healthcare systems, there is an inherent imbalance between need and purchasing power when it comes to vaccines. During the 2009 H1N1 flu pandemic, for example, vaccine supplies were snapped up by nations that could afford them, leaving poorer ones short.

## STEPS TAKEN BY INDIA TO DEAL WITH THE OUTBREAK

Indian government took multi-pronged and timely actions as the virus spread from China to many parts of the world.

### Quarantine, Lockdown, Social Distancing and Awareness Generation

- Suspending visas and quarantining all incoming travelers with subsequent International travel ban.
- Restrictions on International traffic through land borders.
- 21-day nationwide lockdown (Extended by 19 more days) involving closure of all non-essential public places, suspension of railways, intercity bus services and urban metros.
- Cluster containment strategy adopted in the states with high threat of community transmission. The strategy is to contain the virus in a defined geographic area, and help detect the cases at an early stage, break the chain of transmission and prevent its spread to new areas.
- Increasing awareness on importance of social distancing practices.
- Guidelines were issued on use of masks by public and self-quarantine measures.
- Information, Education, & Communication (IEC) material (posters and pamphlets) regarding coronavirus (COVID-19) are being prominently displayed for awareness of the general public in local languages at railway stations and in trains and are also being distributed to patients visiting hospitals and in railway colonies.
- Dedicated TV and Radio Spots (English & Hindi) disseminating information and precautionary measures for public.
- Comic book “KIDS, VAAYU and CORONA” for children by Ministry of Health and Family Welfare (MoHFW) to provide correct information about COVID-19.

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- Awareness material specifying Do's and Don'ts during COVID-19 outbreak by MoHFW in English and Hindi.

## **Legislative Actions For Better Coordination With States**

- Disaster Management Act 2005 under which powers conferred on Union Home Secretary were delegated to Secretary, Ministry of Health and Family Welfare to enhance preparedness and containment of the disease. COVID-19 was declared as a "notified disaster" enabling states to spend a larger chunk of funds from the State Disaster Response Fund (SDRF) to fight the pandemic.
- Epidemics Diseases Act of 1897, under which states were allowed to take appropriate measures that are needed to implement the prevention of infection, and anyone contravening the provisions is amenable to prosecution.
- Essential Commodities Act, 1955 under which masks (2ply & 3ply surgical masks, N95 masks) and hand sanitisers were declared as essential commodities to regulate their production, quality, distribution and logistics and to ensure prevention of hoarding, black marketing and profiteering of these items.
  - o An advisory was also issued under the Legal Metrology Act, 2009 for States to ensure that these items are not sold for more than their MRP.
- High level multi-disciplinary Central teams were deputed by Ministry of Health and Family Welfare to assist the States and State Health Department in activities pertaining to cluster containment plan and hospital preparedness (ICU & Ventilator management for COVID-19 patients).
- Emergency Response and Health System Preparedness package to the states aimed at boosting national and state health systems to

support the procurement of essential medical equipment and drugs, and the strengthening of surveillance activities.

- Lifeline UDAN an initiative of Ministry of Civil Aviation for air transport of medical cargo and essential supplies across India amid lockdown.

- 11 Empowered groups were set up for ensuring a comprehensive and integrated response to the COVID-19 pandemic.

## **Protecting Marginalized And Vulnerable Sections**

- Under the National Food Security Act (NFSA), 2013 government announced distribution of 5 kg of wheat or rice and one kg of preferred pulses free-of-cost every month over the next three months to 80 crore poor across the country to ensure availability food to poor people during lockdown due to COVID-19.
- Wage rates for unskilled manual workers was hiked across all states and Union territories under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) for the financial year 202021.
- Prime Minister's Garib Kalyan package of Rs. 1.7 lakh crore for a range of measures to alleviate the economic, health, and food-related distress of India's poor in the wake of the national lockdown to combat the spread of the novel coronavirus. (Details are covered under Schemes in news section.)
- Rs 50 lakh insurance cover per person for frontline health workers involved in managing the Coronavirus (COVID-19) outbreak would include sanitation staff, doctors, Asha workers, paramedics and nurses.
- Free cooking gas cylinders for 8.3 crore families living below the poverty line

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- Ex-gratia amount was announced for 3 crore senior citizens, the disabled and widows amongst the poor.

## Leveraging the Use of Technology

- PM Innovate challenge inviting applications from individuals, startups and companies to provide innovative technological solutions to fight the virus.

o For the first time, the government has released data sets for researchers, including those on genome sequencing, epidemiological data repository by Johns Hopkins University Center, Genetic Sequences related to COVID-19, etc.

- Fight Corona IDEathon a 2-day online ideathon to find accessible and affordable technological solutions that can contain the rapid spread of COVID-19 was held.

o It was organised by All India Council for Technical Education and MHRD Innovation Cell and other partners.

- Proposals were invited by Science & Engineering Research Board (SERB) as part of its Intensification of Research in High Priority Areas (IRHPA) scheme to ramp up national R&D efforts for new antivirals, vaccines, and affordable diagnostics.

- 'Samadhan' challenge launched by the Innovation Cell of the Ministry of Human Resource for student innovators, researchers, educators and startups to invite ideas and innovations that can help fight against the coronavirus outbreak.

- Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH) initiative of Department of Science and Technology to extend timely support to potential start-ups by way of the requisite financial assistance and fund deployment targeting innovations to control COVID-19 that

are deployable in the market within next 6 months.

- COVID-19 National Teleconsultation Centre (CoNTeC) is a Multi-modal Telemedicine Hub established by AIIMS, New Delhi, wherein expert doctors from various clinical domains will be available 24x7 to answer the multifaceted questions from specialists from all over the country for treatment of the COVID-19 patients.

o It has been conceptualised by the Ministry of Health & Family Welfare.

## OTHER STEPS

- To provide relief to the affected, a public charitable trust under the name of 'Prime Minister's Citizen Assistance and Relief in Emergency Situations Fund' (PM CARES Fund) was set up.

- Evacuations of Indians from various COVID-19 affected countries.

- Ban on the exports of personal protective equipment, including surgical masks, gloves and N95 respirators.

- Exemptions from basic customs duty and health cess on the import of ventilators, face masks, surgical masks, personal protection equipment (PPE), COVID-19 test kits.

- Incentive scheme to boost domestic manufacturing of active pharmaceutical ingredients (APIs),

- Allowing 'high quality' private labs to test for COVID-19 to increase testing capacity in India

- Quarantine facilities were set up by Indian Defence Forces.

- 30% pay cut for all members of Parliament and suspension of the Member of Parliament Local Area Development (MPLAD) fund for two years thus sending a message that the country should be ready for sacrifices in its fight against the COVID-19 pandemic and using these funds to strengthen

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the government's efforts in managing the challenges and adverse impact of COVID-19 in the country.

## Significance of 21 Days Lockdown strategy

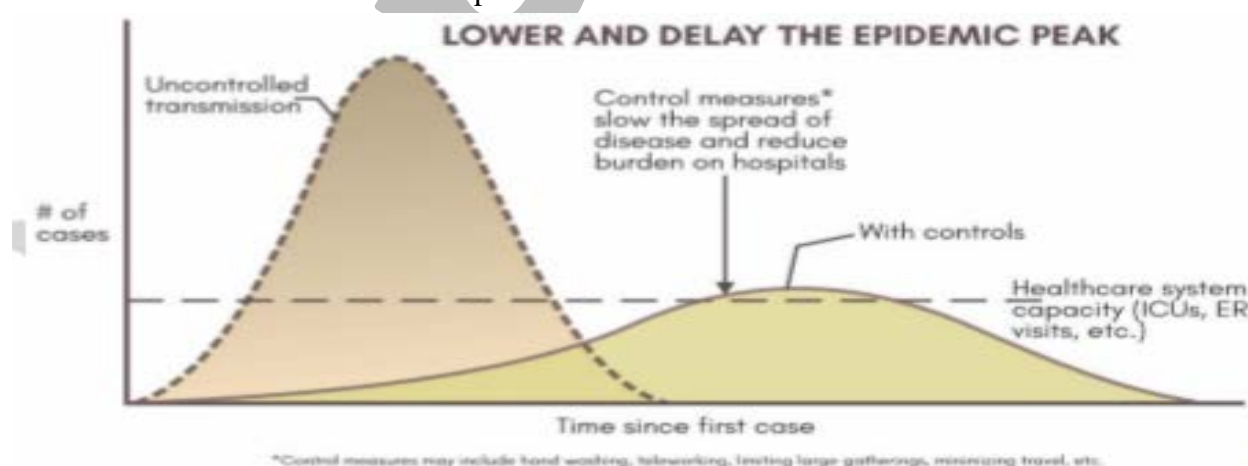
- There is a scientific basis and epidemiological meaning to this number.
- Its calculations are based on the incubation period of the virus in a human host. i.e. the time between the entry of virus to the onset of symptoms.
- The first 14 days is observed as the incubation period. The next 7 days is added for the residual infection to die out.
- As per the public health experts, this is the most effective way of preventing the spread of the infection from those already infected into the community and thus critical to break infection chain of Coronavirus.
- A recent study inferred that the median incubation period for COVID-19 is just over five days and 97.5% of people develop symptoms within 11.5 days of infection.
- A lockdown period also creates awareness of the situation, disinfection of all buildings, vehicles and surfaces are carried out in this period and the

period allows hospitals to prepare for the next phase of operations.

- Such a quarantine period has been discussed even in the context of Ebola.

## CONCEPT OF FLATTENING THE CURVE

- The WHO has repeatedly underlined the importance of "flattening the curve" in order to tackle the coronavirus outbreak, calling on countries around the world to impose sweeping public health measures.
- This approach is saving lives and buying time for the development of vaccines and treatments.
- In epidemiology, the curve refers to the projected number of new cases over a period of time.
- The idea of flattening the curve is to stagger the number of new cases over a longer period, so that people have better access to care.
- It explains why so many countries are implementing draconian policies, such as social-distancing guidelines, "shelter in place" orders, restrictive travel measures and asking citizens to work or engage in schooling from home.



- The above chart shows two curves with two very different virus reproduction rates.

- In the steepest curve, the virus reproduces quickly in a short period of time. In this scenario,

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emergency rooms, intensive care units and other parts of the health care system are overwhelmed. In an overwhelmed system, mortality rates can be high and those infected may not get the treatment they need.

- In the second, flatter curve, controls help slow the spread of the virus. Infections occur, but over a longer period of time. Since health care workers and facilities are not overwhelmed, those infected receive better treatment and fewer deaths occur.

## HERD IMMUNITY

Natural herd immunity was advocated for some time by the UK government as a strategy to contain the COVID19 pandemic in their country.

### **About the concept**

- It is the indirect protection from a contagious infectious disease that happens when a population is immune either through vaccination or immunity developed through previous infection.
- Vaccinated or immune people act as a buffer between the infected persons and people who aren't vaccinated, or in whom the vaccine doesn't trigger immunity.
- Once herd immunity has been established for a while, and the ability of the disease to spread is hindered, and can eventually be eliminated.
- Mass vaccination has been highly successful in inducing herd immunity for many diseases, protecting those that are unable to build up immunity, such as people with immune deficiencies or whose immune systems are being suppressed for medical reasons.
- Herd immunity was recognized as a naturally occurring phenomenon in the 1930s during the measles outbreak.
- It does not apply to all diseases, just those that are contagious, meaning that they can be transmitted from one individual to

another. Tetanus, for example, is infectious but not contagious, so herd immunity does not apply.

### **Challenges in creating Herd Immunity**

- Percentage of immune population
  - o The more infectious a disease, the greater the population immunity needed to ensure herd immunity.
  - o For example, measles is highly contagious and one person with measles can infect up to 18 other people. In this case around 95% of people need to be immune in order for the wider group to have herd immunity.
  - o The new coronavirus has a lower infection rate than measles, with each infected person passing it on to two or three new people, on average. For this, herd immunity should be achieved when around 60% of the population becomes immune to COVID-19.
- Natural herd immunity
  - o It is achieved through infection rather than vaccination.
  - o It can be challenging to induce it through unchecked infection as there would be a very high rate of serious illness and death, with health systems overwhelmed well beyond their surge capacity, even in high-income countries.
  - o This is why herd immunity is generally pursued through vaccination programmes.
- Mutation within the organism
  - o Even when vaccines are available, it is not always possible to achieve herd immunity for very long.
  - o Some viruses, such as seasonal flu, mutate frequently, evading the body's immune response.
  - o So immunity doesn't always last forever, which is why the flu shot is necessary every single year.
- Free Riders Problem
  - o When herd immunity is well established, however, some people choose to behave as 'free riders', essentially benefitting from everyone else

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getting vaccinated, while abstaining from vaccination either because they choose not to or are actively anti-vaccination.

o When a population has too many of these free riders, the overall immunity level is compromised and herd immunity can be lost, putting everyone at risk.

## **PANDEMIC DISEASE**

- In March, 2020 WHO publicly characterized COVID-19 as a pandemic:

- According to the World Health Organization, a pandemic is declared when a new disease for which people do not have immunity spreads around the world and between people sustainably beyond expectations.

- Declaring a pandemic has nothing to do with changes to the characteristics of a disease, but is instead associated with concerns over its geographic spread.

- The use of this term highlights the importance of countries throughout the world working cooperatively and openly with one another and coming together as a united front in efforts to bring the situation under control. However, if declaring a pandemic triggers global panic, this can defeat the purpose of trying to raise awareness.

- There is no threshold, such as a certain number of deaths or infections, or number of countries affected, that needs to be met in order to declare a disease as pandemic. For example, the SARS coronavirus, identified in 2003, was not declared a pandemic by the WHO despite affecting 26 countries. However, its spread was contained quickly, and only a handful of nations were significantly affected, including China, Hong Kong, Taiwan, Singapore and Canada.

- COVID-19 is the first pandemic known to be caused by the emergence of a new coronavirus. In

the past century, there have been four pandemics caused by the emergence of novel influenza viruses. As a result, most research and guidance around pandemics is specific to influenza.

- The last pandemic declared was in 2009 during the outbreak of H1N1 flu, commonly known as the swine flu which killed up to 575,000 people in the past decade.

- Pandemics of the past century were influenza-related and charted in six phases WHO used to make recommendations based on the severity of a disease's spread.

## **Public health emergency of international concern (PHEIC)**

- Earlier in January 2020, the World Health Organization declared the COVID-19 outbreak a "public health emergency of international concern" (PHEIC).

- PHEIC is a formal declaration by the International Health Regulations Emergency Committee of World Health Organization (WHO) of "an extraordinary event which is determined to constitute a public health risk to other States through the international spread of disease and to potentially require a coordinated international response", formulated when a situation arises that is "serious, sudden, unusual or unexpected".

- It is not only confined to infectious diseases, and may cover an emergency caused by a chemical agent or a radio nuclear material.

- Under the 2005 International Health Regulations (IHR), states have a legal duty to respond promptly to a PHEIC. • Emergency Committee (EC) under the IHR was developed following the SARS outbreak of 2002–03.

- PHEIC declarations so far: Since 2009 there have been six PHEIC declarations: the 2009 H1N1 (or swine flu) pandemic, the 2014 polio declaration, the 2014 outbreak of Ebola in

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Western Africa, the 2015–16 Zika virus epidemic, the ongoing 2018–20 Kivu Ebola epidemic, and the ongoing 2019–20 coronavirus pandemic.

- The recommendations are temporary and require reviews every three months.

EPIDEMIC VERSUS ENDEMIC	
 <b>EPIDEMIC</b>	 <b>ENDEMIC</b>
A widespread occurrence of an infectious disease in a community at a particular time	A regularly found disease among particular people or in a certain area
Cause a significant damage to the living organisms within a short period of time	Prevalent in a certain region or population
Rate of infection continuously increases	Rate of infection is constant
Ex: smallpox, H1N1, black plague	Ex: malaria, tuberculosis, chicken pox, etc.

## “Scitech Airon”

A new technology has been adopted by the Maharashtra hospitals in the fight of COVID-19 fight. The technology was developed by a Pune based Start Up.

- The product is named “Scitech Airon”. It is a Negative Ion Generator.
- The technology has been developed under the NIDHI PRAYAS program initiated by the Department of Science and Technology (DST).

## How it works?

1. The Scitech Airon ionizer machine generates negatively charged ions at approximately hundred million per 8 seconds (10 ions per sec).
2. The negative ions generated by the ionizer form clusters around microparticles such as airborne mould, corona or influenza viruses, mite allergens, bacteria, pollens, dust and so on and render them inactive through a chemical reaction by creating highly reactive OH groups called hydroxyl

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radicals and H O which are highly reactive and known as atmospheric detergents.

3. The detergent property generated by the ion generator helps in the breakdown of the outer protein of the allergens, viruses, and bacteria, which helps in controlling airborne diseases.

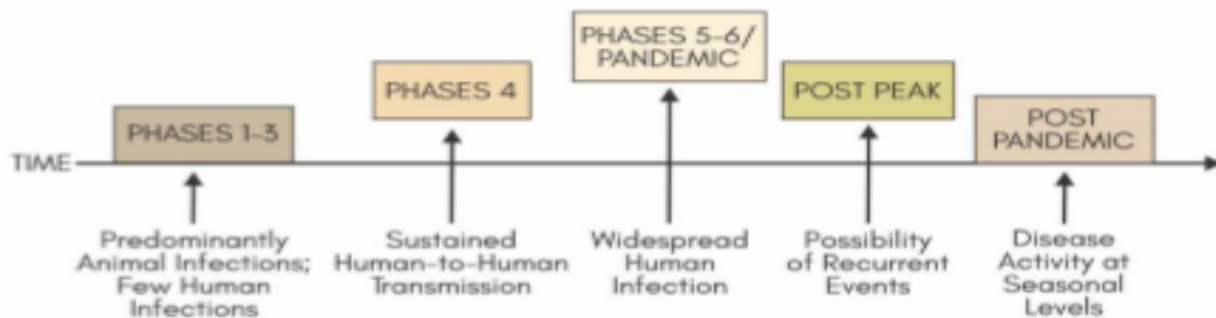
4. It increases the body's resistance to infections and harmful environmental factors. This resistance could be helpful for the next 20-30 days outside the ion atmosphere.

5. It also decomposes gaseous pollutants like Carbon Monoxide (1000 times more harmful than

Carbon dioxide), Nitrogen dioxide, and Volatile Organic Compounds.

**Significance of the technology:** It helps to control the virus, bacteria, and other fungal infections in a closed environment and could help purify the air and disinfect areas around COVID-19 positive cases and suspects. Hence it could ensure the wellbeing of the staff, doctors, and nurses who are working round the clock in quarantine facilities by enhancing their disease-resistance power and ability to fight the virus.

## PANDEMIC INFLUENZA PHASES (2009)



**Phase 4 to 6 involves four stages of a Pandemic that are:**

- **Stage 1- Imported cases** involving those who have travelled to virus hit foreign countries and have come back to a country.
- **Stage 2- Local Transmission** involving those cases who have come in contact with patients who have a travel history.
- **Stage 3- Community transmission** when a patient not exposed to any infected person or one who has travelled to any of the affected countries tests positive. Large areas get affected when community transmission takes place.
- **Stage 4-** This is the last and the worst stage where the disease takes the shape of an epidemic with no clear endpoint.

## What is NIDHI program?

Department of Science & Technology has launched a NIDHI program (National Initiative for Developing and Harnessing Innovations) under which programmes for setting up of incubators, seed fund, accelerators and 'Proof of concept' grant for innovators and entrepreneurs have been launched. Under NIDHI, PRAYAS (Promoting

and Accelerating Young and Aspiring innovators & Startups) programme has been initiated in which established Technology Business Incubators (TBI) are supported with PRAYAS grant to support innovators and entrepreneurs with grants for 'Proof of Concept' and developing prototypes. A maximum grant of Rs. 220 lakh is given to a TBI for establishing a PRAYAS Centre

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which includes Rs.100 lakh for PRAYAS SHALA, Rs. 20 lakh for operational cost of PRAYAS Centre and maximum of Rs. 10 lakh to one innovator for developing prototype. Funding for ten innovators is given to the TBI in a year.

## **How does soap use help in tackling COVID-19?**

Guidelines by the World Health Organization, to reduce the risk of SARS-CoV-2 infection, specify that one of the ways to reduce the risk of infection is by regularly and thoroughly cleaning one's hands with an alcohol-based hand rub or washing them with soap and water.

## **How does washing with soap help get rid of the coronavirus?**

Using soap is more effective in removing microbes on our hands.

- Viruses such as coronavirus, influenza-causing viruses, Ebola, Zika have their genetic material encased in a layer of fat called the lipid envelop.
- Soap molecules are pin-shaped with a head that is water-loving (hydrophilic) and a tail that is oil-loving (oleophilic). Being oleophilic, the tail portion of the molecule tends to have an affinity for and 'competes' with the lipids in the virus envelope.
- Since the chemical bonds holding the virus together are not very strong, the long oleophilic tail gets inserted into the envelope and tends to have a 'crowbar' effect that breaks the lipid envelope of the virus.
- The tail also competes with the bond that binds the RNA and the lipid envelop thus dissolving the virus into its components which are then removed by water.

## **Do all viruses have the lipid layer?**

No, certain viruses do not have the lipid envelop and are called the non-enveloped viruses. Rotavirus which causes severe diarrhoea,

poliovirus, adenovirus that cause pneumonia and even human papillomavirus (HPV) do not contain the lipid envelop. The oil-loving tail of the soap molecule also disrupts the bond that binds dirt and non-enveloped viruses to the hand. The dirt and viruses are surrounded by several tails making them remain as suspended particles. Rinsing with water washes away the suspended particles leading to clean hands.

## **How do alcohol-based hand sanitisers help get rid of coronavirus?**

Like soap, the alcohol present in hand sanitisers dissolve the lipid envelop, thus inactivating the virus. In addition, the alcohol also tends to change the shape or denature the mushroom-shaped protein structures that stick out of the lipid envelop. The mushroom-shaped protein structures help the virus to bind to special structures found on human cells and enter the cells. To be effective, the sanitisers should contain at least 60% alcohol. Unlike water, alcohol run does not remove the dead viruses from the hand. While a sanitiser can quickly reduce the number of microbes, it does not get rid of all types of germs, and is "not as effective when hands are visibly dirty or greasy".

**Primary precautions:** WHO cautions that using a mask alone will be insufficient to provide an "adequate level of protection". It should be combined with hand hygiene to prevent human-to-human transmission.

## **5) ONE HEALTH**

There has been an increased focus across the world on one health approach in the light of global outbreak of COVID-19.

- The term 'One Health' was first used in 2003–2004, in association with the emergence of severe acute respiratory disease (SARS) in early 2003

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and subsequently by the spread of highly pathogenic avian influenza H5N1, and by the series of strategic goals known as the 'Manhattan Principles'.

- It is a collaborative, multisectoral, and transdisciplinary approach — working at the local, regional, national, and global levels — with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.

- Successful public health interventions require the cooperation of Professionals in human health (doctors, nurses, public health practitioners, epidemiologists), animal health (veterinarians, paraprofessionals, agricultural workers), environment (ecologists, wildlife experts) along with other relevant players including law enforcement agencies, policymakers, agriculture, communities, and even pet owners.



- One Health issues include zoonotic diseases, antimicrobial resistance, food safety and food security, vector-borne diseases, environmental contamination, and other health threats shared by people, animals, and the environment.

## Relevance of one health

In recent times, many factors have changed interactions between people, animals, plants, and our environment and have led to the spread of

existing or known (endemic) and new or emerging zoonotic diseases:

- Climate and land use change: The earth has experienced changes in climate and land use, such as deforestation and intensive farming practices. Disruptions in environmental conditions and habitats can provide new opportunities for diseases to pass to animals. o Animals also share our susceptibility to some diseases and environmental hazards. Because of this, they can sometimes serve as early warning signs of

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potential human illness. For example, birds often die of West Nile virus before people in the same area get sick with West Nile virus infection.

- Geographic expansion of human habitats: Human populations are growing and expanding into new geographic areas. As a result, more people live in close contact with wild and domestic animals, both livestock and pets.

## Manhattan Principles

- These were derived at a meeting of the Wildlife Conservation Society in 2004, which clearly recognised the link between human and animal health and the threats that diseases pose to food supplies and economies.
- These are the set of 12 principles as a vital step in recognising the critical importance of collaborative, cross-disciplinary approaches for responding to emerging and resurging diseases, and in particular, for the inclusion of wildlife health as an essential component of global disease prevention, surveillance, control, and mitigation.

## 6) Cord Blood Banking

Poona Citizen Doctors' forum dispels beliefs on commercial cord blood banking. It has warned to-be parents against falling prey to the emotional marketing tactics by stem cell banking companies.

### What's the issue?

Over the past decade, stem cell banking has been aggressively marketed even as its use is still in experimental stages. But these companies charge enormous fees from parents to preserve cells.

- The concern here is that it is merely by emotional marketing that companies convince parents to bank the cells for several years promising future therapeutic use.
- Private companies who have forayed into this field offer packages anywhere between ₹50,000

and ₹1 lakh to store and preserve the cells in right conditions.

- So far there is no scientific basis for preservation of cord blood for future self-use and this practice therefore raises ethical and social concerns.

**Regulation in India:** The Indian Council of Medical Research (ICMR) does not recommend commercial stem cell banking.

### What is Cord Blood?

Cord blood (short for umbilical cord blood) is the blood that remains in the umbilical cord and placenta post-delivery. It contains special cells called hematopoietic stem cells that can be used to treat some types of diseases.

### What is Cord blood banking?

Cord blood banking is the process of collecting the cord blood and extracting and cryogenically freezing its stem cells and other cells of the immune system for potential future medical use. Globally, cord blood banking is recommended as a source of hematopoietic stem cell transplantation for haematological cancers and disorders where its use is recommended. For all other conditions, the use of cord blood as a source of stem cells is not yet established.

### What Can It Be Used For?

The umbilical cord fluid is loaded with stem cells. They can treat cancer, blood diseases like anemia, and some immune system disorders, which disrupt your body's ability to defend itself. The fluid is easy to collect and has 10 times more stem cells than those collected from bone marrow. Stem cells from cord blood rarely carry any infectious diseases and are half as likely to be rejected as adult stem cells.

## 7) What is ExoMars?

Launch of ExoMars rover delayed to 2022.

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## About the rover:

- The European-built Rosalind Franklin rover, named for the famed British chemist and X-ray crystallographer whose work contributed to DNA research, recently passed final pre-launch thermal and vacuum tests at an Airbus facility in Toulouse, France.
- Rosalind Franklin is the first European Mars rover.

## About ExoMars:

It is a joint endeavour between ESA and the Russian space agency, Roscosmos. The primary goal of the ExoMars programme is to address the question of whether life has ever existed on Mars.

## Components of the mission:

The programme comprises two missions.

- The first launched in March 2016 and consists of the Trace Gas Orbiter (TGO) and Schiaparelli, an entry, descent and landing demonstrator module.
- TGO's main objectives are to search for evidence of methane and other trace atmospheric gases that could be signatures of active biological or geological processes. The Schiaparelli probe crashed during its attempt to land on Mars.
- The second, comprising a rover and surface platform, is planned for 2022. Together they will address the question of whether life has ever existed on Mars.

## Other Mars Missions:

Despite the delay in the second ExoMars launch until 2022, three other Mars missions remain scheduled for launch during this year's planetary launch window in July and August. 1. NASA's Perseverance rover, formerly known as Mars 2020, will take off in July from Cape Canaveral. 2. A Chinese Mars rover is also being prepared for launch later this year. 3. The United Arab Emirates' Hope Mars orbiter is slated to launch on a Japanese H-2A rocket this summer.

## 8) Coalbed methane (CBM)

India's CBM potential:

1. India has the fifth-largest coal reserves in the world, and CBM has been looked at as a clean alternative fuel with significant prospects.
2. India's CBM resources are estimated at around 92 trillion cubic feet (TCF), or 2,600 billion cubic metres (BCM).
3. The country's coal and CBM reserves are found in 12 states of India, with the Gondwana sediments of eastern India holding the bulk.
4. The Damodar Koel valley and Son valley are prospective areas for CBM development.

## What is coalbed methane (CBM)?

It is an unconventional form of natural gas found in coal deposits or coal seams. CBM is formed during the process of coalification, the transformation of plant material into coal. CBM can be used:

1. In Power generation.
2. As Compressed natural gas (CNG) auto fuel.
3. As feedstock for fertilisers.
4. Industrial uses such as in cement production, rolling mills, steel plants, and for methanol production.

## Challenges and concerns:

1. Methane is a greenhouse gas emitted through CBM extraction. Global methane emissions from coal mines are projected to account for approximately 8 percent of total global methane emissions.
2. Disturbance of lands drilled and its effect on wildlife habitats results in ecosystem damage.
3. CBM production behaviour is complex and difficult to predict in the early stages of recovery.
4. Another concern is the effect water discharges from CBM development could potentially have on downstream water sources.

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5. Disposal of the highly salinized water that must be removed in order to release the methane creates a challenge, as its introduction into freshwater ecosystems could have adverse effects.

## **9) Potential Fishing Zone (PFZ)**

The Indian National Centre for Ocean Information Services (INCOIS) has reported that Oceansat Satellite data are used to prepare the Potential Fishing Zone (PFZ) advisories on the potential rich fishing areas and provide to the sea faring fishermen in all states.

### **How are these zones identified?**

This methodology utilizes data on chlorophyll concentration (Chl) obtained from ISRO's Oceansat-2 satellite and the sea surface temperature from National Oceanic Atmospheric Administration (NOAA / USA satellites).

### **About Oceansat-2:**

- Launched in 2009, it is designed to provide service continuity for operational users of the Ocean Colour Monitor (OCM) instrument on Oceansat-1.
- The main objectives of OceanSat-2 are to study surface winds and ocean surface strata, observation of chlorophyll concentrations, monitoring of phytoplankton blooms, study of atmospheric aerosols and suspended sediments in the water.

Gagan Enabled Mariner's Instrument for Navigation and Information (GEMINI) device: For seamless and effective dissemination of emergency information and communication on disaster warnings, Potential Fishing Zones (PFZ) and Ocean States Forecasts (OSF) to fishermen, the Government today launched the Gagan Enabled Mariner's Instrument for Navigation and Information (GEMINI) device. The GEMINI device receives and transfers the data received

from GAGAN satellite/s to a mobile through Bluetooth communication. A mobile application developed by INCOIS decodes and displays the information in nine regional languages.

## **10) National Mission on Interdisciplinary Cyber Physical Systems**

Department of Science and Technology (DST) has sanctioned Rs 7.25 crore to IIT Mandi to establish a Technology Innovation Hub (TIH) at the Institute. DST has sanctioned the funds under its National Mission on Interdisciplinary Cyber-Physical Systems (NMICPS).

### **Main tasks of the Technology Innovation Hub (TIH):**

1. The TIH will develop tools, education material, hands-on experiments with specialised tool kits, connecting with existing innovation ecosystems.
2. It will inter-link with different stakeholders and connect with other initiatives of the Government of India by providing an innovation platform for schools, colleges and advanced technical training institutes in the targeted areas.

The deliverables include:

3. Technology Deliverables: To develop technology interface for challenges concerning landslides, environment (including climate change), air pollution, agriculture, cybersecurity, defence forces, healthcare, and forensics.
4. Human Resource and Skill Development Deliverables: To generate skilled manpower in HCI area at graduate, post-graduate, doctoral, post-doctoral and faculty level by organising workshops and seminars.
5. International Collaborations Deliverables: To develop and sustain existing and new collaboration with universities and organisations in India and abroad.

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6. Entrepreneurship and Startup Deliverables: To create a startup ecosystem by working with the technology-business incubator of IIT Mandi, Catalyst, with an approach of Knowledge Generation Technology Development Technology Translation Technology Commercialisation.

## How the TIH will work on Cyber Physical Systems (CPS)?

The TIH will also work on the development and evaluation of interfaces of IoT-based Cyber-Physical Systems (CPS), where CPS contains physical elements (sensors) for collecting data and cyber elements (analytics and visualization software) for alerting/ educating people for directed action.

### What is it?

Cyber Physical Systems (CPS) are a new class of engineered systems that integrate computation and physical processes in a dynamic environment. CPS encompasses technology areas of Cybernetics, Mechatronics, Design and Embedded systems, Internet of Things (IoT), Big Data, Artificial Intelligence (AI) among others.

About National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS): To harness the potential of this new wave of technology and make India a leading player in CPS, the Union Cabinet approved the launch of National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) in 2018. It had a total outlay of INR 3,660 crores for a period of five years.

### The mission implementation would develop and bring:

1. Cyber Physical Systems (CPS) and associated technologies within reach in the country,
2. adoption of CPS technologies to address India specific National / Regional issues,

3. produce Next Generation skilled manpower in CPS,
4. catalyze Translational Research,
5. accelerate entrepreneurship and start-up ecosystem development in CPS,
6. give impetus to advanced research in CPS, Technology development and higher education in Science, Technology and Engineering disciplines, and
7. place India at par with other advanced countries and derive several direct and indirect benefits.

### Implementation:

1. The Mission aims at establishment of 15 numbers of Technology Innovation Hubs (TIH), six numbers of Application Innovation Hubs (AIH) and four numbers of Technology Translation Research Parks (TTRP).
2. These Hubs & TTRPs will connect to Academics, Industry, Central Ministries and State Government in developing solutions at reputed academic, R&D and other organizations across the country in a hub and spoke model.

### 11. How will in-flight WiFi work?

Union government recently issued a notification to announce that all airlines operating in India can now provide in-flight wi-fi services to its passengers.

- The Civil Aviation Ministry specified that the availability of the Wi-Fi during flights will be broadly subjected to two conditions:
  - o The main captain will have the authority to switch on or switch off the Wi-Fi in flights, and the captain will be required to follow certain guidelines on this matter. For example, Wi-Fi would be switched on only when the plane is at the cruising speed and not during take-off or landing.
  - o Each plane that offers in-flight Wi-Fi will have to be certified by

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DGCA for this purpose before fliers in it can enjoy connectivity.

## How does Inflight Wifi work?

There are two operating systems for airplane WiFi: Air-to-ground WiFi System

- It works in a similar way to a cell phone.
- Airplanes have an antenna located underneath their body, which links up with cell towers on the ground.
- As the aircraft travels, it simply connects to the nearest transmitter/towers on a rolling basis.
- The airplane becomes a hotspot, so passengers can access internet.
- However, this system can't work when the plane is flying over large expanses of water or particularly remote terrain, like on transatlantic routes.

## Satellite based WiFi System

- It uses a network of orbiting satellites to allow a connection.
- Information is passed between the ground and the plane via the satellite.
  - o The satellite is linked to ground stations.
  - o The airplane connects to the satellite using a satellite antenna on the top of the fuselage.
- Wi-Fi signal is distributed to plane passengers via an on board router.
- The plane uses whichever satellite is nearest as it travels and thus can operate over large expanses of water or remote terrain as well.
- Satellite WiFi operates on two different bandwidths: narrowband and broadband. Both allow passengers full Internet access, although the narrower options are less suitable for streaming movies.

## Wi-fi

- The term Wi-Fi stands for wireless fidelity.
- It is a radio transmission technology and is built upon a set of standards that allow high-speed and

secure communications between a wide variety of digital devices, access points, and hardware.

- The typical range of a standard Wi-Fi network can reach up to 100 meters in the open air.
- They transmit at frequencies of 2.4 GHz or 5 GHz.

## Hotspot

A hotspot is a physical location where people can access the Internet, typically using Wi-Fi, via a wireless local area network (WLAN) with a router connected to an Internet service provider.

## 12) SUN SPOT CYCLE

Researchers from IISER Kolkata identified Sunspots that herald the start of a new Sun Spot cycle.

## What are Sun Spots?

- Sunspots are areas that appear dark on the surface of the Sun and are cooler than other parts of the Sun's surface.
- They form at areas where magnetic fields are so strong that they keep some of the heat within the Sun from reaching the surface.

## What is Sun Spot cycle?

- Sun Spot's number waxes and wanes as the amount of magnetic flux that rises up to the Sun's surface varies with time in a cycle called the solar cycle. This cycle which lasts 11 years on average is referred to as the sunspot cycle.
- So far, astronomers have documented 24 such cycles, the last one ended in 2019. Recent observations point to the signs that 25th cycle has just begun.
- Solar activities affect space weather, which can have an impact on space-based satellites, GPS, power grids and so on.
- Sunspot Cycle was discovered in 1843 by German astronomer Samuel Heinrich Schwabe.

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## 13) SUPREME COURT LIFTS CURBS ON CRYPTOCURRENCIES

Recently, Supreme Court has set aside an RBI's April 2018 circular banning regulated financial institutions such as Banks and NBFCs from trading in virtual currency/cryptocurrency.

### **What is Cryptocurrency?**

- Cryptocurrency is a type of digital currency that uses cryptography for security and anticounterfeiting measures.
- It is normally not issued by any central authority, making it immune to government interference or manipulation.
- The control of each cryptocurrency works through distributed ledger technology called blockchain.
- Examples include Bitcoin, Ethereum, Ripple etc.
- Various benefits of cryptocurrencies include:
  - o Difficult to counterfeit as compared to physical currency.
  - o There aren't usually transaction fees for cryptocurrency exchanges because the miners are compensated by the network.
  - o Benefits for customers: The rise of cryptocurrencies offers ordinary people the rare opportunity to choose among multiple currencies in the marketplace.
  - o Blockchain technology can be used for enhancing the efficiency of the financial system.

### **Arguments for banning of cryptocurrencies by RBI**

- Financial stability: Lack of any underlying fiat and excessive volatility in their value was seen as an immediate threat to financial stability. Its far-reaching potential impact on the effectiveness of monetary policy itself was unknown.
- Investor protection and security risks: There were risks and concerns about data security, consumer protection and their use for speculation.

o Theft of cryptocurrencies from exchanges soared in the first half of this year to three times the level seen for the whole of 2017.

- Use in illegal activities: Concerns were raised that anonymous nature and lack of a central regulator in cryptocurrency transactions can lead to funding of a host of illegal activities such as child pornography, drug dealing, gun supplies etc.
- o Their anonymous nature goes against global moneylaundering rules.
- International examples: Countries like China have also unleashed a regulatory crackdown.

### **Why ban was Challenged?**

- Virtual Currencies are not legal tender but tradeable commodities and therefore that they fell outside the RBI's regulatory ambit.
- Even assuming VCs were amenable to regulation by the RBI, RBI's directive violates the freedom of business, trade and profession under Article 19(1)(g).
- o Petitioner had argued that trading in cryptocurrencies in the absence of a law banning those was a "legitimate" business activity under the Constitution and RBI could not have denied them access to banking channels to carry on such business.

### **Supreme Court Observation**

- Supreme Court held that Virtual Currencies eluded precise definition so ban did not pass the "proportionality" test and lifted the curbs imposed by the RBI on regulated entities.
- o Doctrine of Proportionality postulates that the nature and extent of the State's interference with the exercise of a right must be proportionate to the goal it seeks to achieve.
- Also, bench noted that the rules governing the matter would depend on what Parliament decides, based on the currently pending draft Banning of Cryptocurrency and Regulation of Official Digital Currency Bill, 2019.

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- It added that the RBI and the central government would have a monopoly on the creation and circulation of any official digital currency whenever such a situation arose.

- o The bench, however, said that virtual currencies are neither good nor commodities and can't be regarded as real money.

- o Once virtual currencies are accepted as valid payments for the purchase of goods and services, the activity falls squarely within the RBI's purview.

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