

**YEARLY COMPILATION**



**IAS 2021**

**PRELIMS**  
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**CURRENT**  
**AFFAIRS**

**GENERAL SCIENCE,  
HUMAN HEALTH & DISEASE**

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## 1 The Fifth State of Matter

**Context:** Scientists have generated an exotic fifth type of matter in one of the coldest places in the universe- **the Cold Atom Laboratory**—aboard the **International Space Station** and are using it to explore the quantum world.

### About:

- There are four states of matter common in everyday life-
  - ▶ Gases
  - ▶ Liquids
  - ▶ Solids
  - ▶ Plasmas
- However, there is also the fifth state of matter — **Bose-Einstein condensates (BECs)**, which scientists first created in the lab 25 years ago.

### The 5<sup>th</sup> state of matter

- This chilly substance was initially theorised by **Albert Einstein** and **Satyendra Nath Bose** in the early 1920s as the fifth state of matter, following solids, liquids, gases and plasma.
- It is a supercooled gas that no longer behaves as individual atoms and particles, but rather an entity in a single quantum state.

### Cold Atom Laboratory (CAL)

- The Cold Atom Laboratory (CAL) was launched to the ISS in 2018 to investigate a strange kind of matter, known as a Bose-Einstein condensate (BEC).
- This suitcase-sized device chills atoms of rubidium and potassium in a vacuum chamber, using laser light to slow their movement.
- Magnetic fields then contain the resulting cloud of atoms, which is cooled to nearly absolute zero at  $-273^{\circ}\text{C}$ , producing a BEC.

### How is it made?

- When a group of atoms is cooled to near absolute zero, the atoms begin to clump together, behaving as if they were one big “super-atom.”

- These are created when a gas of bosons is cooled down nearly to absolute zero. At these extreme temperatures, matter begins to behave oddly and atoms become a single entity showing quantum properties.
- Bose-Einstein condensates straddle the boundary between the everyday world, governed by classical physics, and the microscopic world, which follows the rules of quantum mechanics.
- In the world of quantum mechanics, a particle can behave as if it were spinning in two opposite directions at the same time, or as if it existed in two or more locations simultaneously.

## 2 Fortification of edible oil with Vitamins A and D

**Context:** FSSAI is considering making it mandatory to fortify edible oil with vitamins A and D so that people of India can enjoy better immunity with good health.

### What is Oil fortification?

- Oil fortification is the process of adding micronutrients to edible oil to increase its nutritional value.
- It expected to achieve almost 99% penetration of the Indian population due to the widespread use of cooking oil.
- All kinds of edible oils (soybean, palmolein, groundnut, cotton seed, mustard, etc.) can be fortified.

### Health benefits

- **Vitamin A**
  - ▶ Good for healthy vision, bones, skin, and tissues
  - ▶ Fights cell damage
  - ▶ Works as antioxidant
  - ▶ Helps skin growth and repair
  - ▶ Formation and maintenance of teeth
- **Vitamin D**
  - ▶ Regulates the amount of phosphate and calcium in the body
  - ▶ Keeps bones, teeth, and muscles healthy
  - ▶ Facilitates normal immune system function
  - ▶ Regulates mood and prevents depression

### About FSSAI

- **Food Safety and Standards Authority of India (FSSAI)** is an autonomous body established under the Ministry of Health & Family Welfare, Government of India.
- The FSSAI has been established under the **Food Safety and Standards Act, 2006**, which is a consolidating statute related to food safety and regulation in India.
- FSSAI is responsible for protecting and promoting public health through the regulation and supervision of food safety.



## 3

## Scientists discover animal that doesn't breathe oxygen

**Context:** Scientists at Tel Aviv University have discovered a jellyfish-like parasite that doesn't need oxygen because it doesn't breathe.

### About:

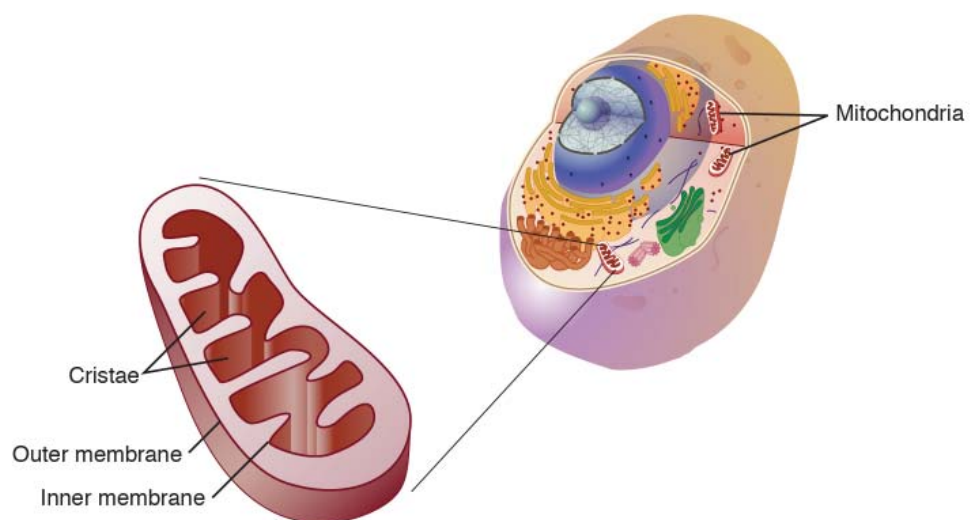
- The discovery was made by accident as the team was sequencing the genome of a common salmon parasite called **Henneguyasalminicola**.
- When they searched for a **mitochondrial genome**, they didn't find anything.

### The parasite

- Henneguyasalminicola is a myxozoan cnidarian — a type of animal-related to jellyfish and coral.
- It consists of less than 10 cells in its being. It lives inside salmon's muscles and leeches energy off its host. But it is not a harmful parasite, it can live the fish's entire life inside it.
- The environment inside its host is almost entirely free of oxygen. This meant that it didn't need the mitochondria anymore once it found another way to adapt. So it dropped its mitochondrial genome entirely, so as to save energy and not copy genes for multiplication. It gave up breathing.

### What is Mitochondria?

- Mitochondria are organelles that trap oxygen and help to break it down to provide energy for the cell.
- Mitochondria are membrane-bound cell organelles (mitochondrion, singular) that generate metabolic energy in eukaryotic cells needed to power the cell's biochemical reactions.
- Chemical energy produced by the mitochondria is stored in a small molecule called adenosine triphosphate (ATP).
- Mitochondria contain their small chromosomes. Generally, mitochondria, and therefore mitochondrial DNA, are inherited only from the mother.



4

## Scientists have synthesized a new high temperature superconductor

**Context:** A team of scientists performed theoretical and experimental research on a new high-temperature superconductor, **yttrium hydride (YH<sub>6</sub>)**

### About:

- Yttrium hydrides rank among the three highest-temperature superconductors known to date.
- The leader among the three is a material with an unknown S-C-H composition and superconductivity at 288 K, which is followed by lanthanum hydride, LaH<sub>10</sub>, superconducting at temperatures up to 259 K),
- Finally, yttrium hydrides, YH<sub>6</sub> and YH<sub>9</sub>, with maximum superconductivity temperatures of 224 K and 243 K, respectively.

### Superconductivity

- Superconductivity is a phenomenon whereby a charge moves through a material without resistance.
- In theory this allows electrical energy to be transferred between two points with perfect efficiency, losing nothing to heat.
- The main advantages of devices made from superconductors are low power dissipation, high-speed operation, and high sensitivity.
- Suggested uses for superconducting materials include medical magnetic-imaging devices, magnetic energy-storage systems, motors, generators, transformers, computer parts, and very sensitive devices for measuring magnetic fields, voltages, or currents.

5

## Particle Physicist confirms presence of Odderon

**Context:** Physicists at CERN's Large Hadron Collider (LHC) and the DØ Collaboration at Fermilab have found strong new evidence for the odderon, an elusive three-gluon state predicted almost five decades ago.

### About

- In 1973, two French particle physicists found that, according to their calculations, there was a previously unknown quasi-particle.
- The Odderon particle is what briefly forms when protons collide in high-energy collisions, and in some cases do not shatter, but bounce off one another and scatter.
- Protons are made up of quarks and gluons, that briefly form Odderon and Pomeron particles.

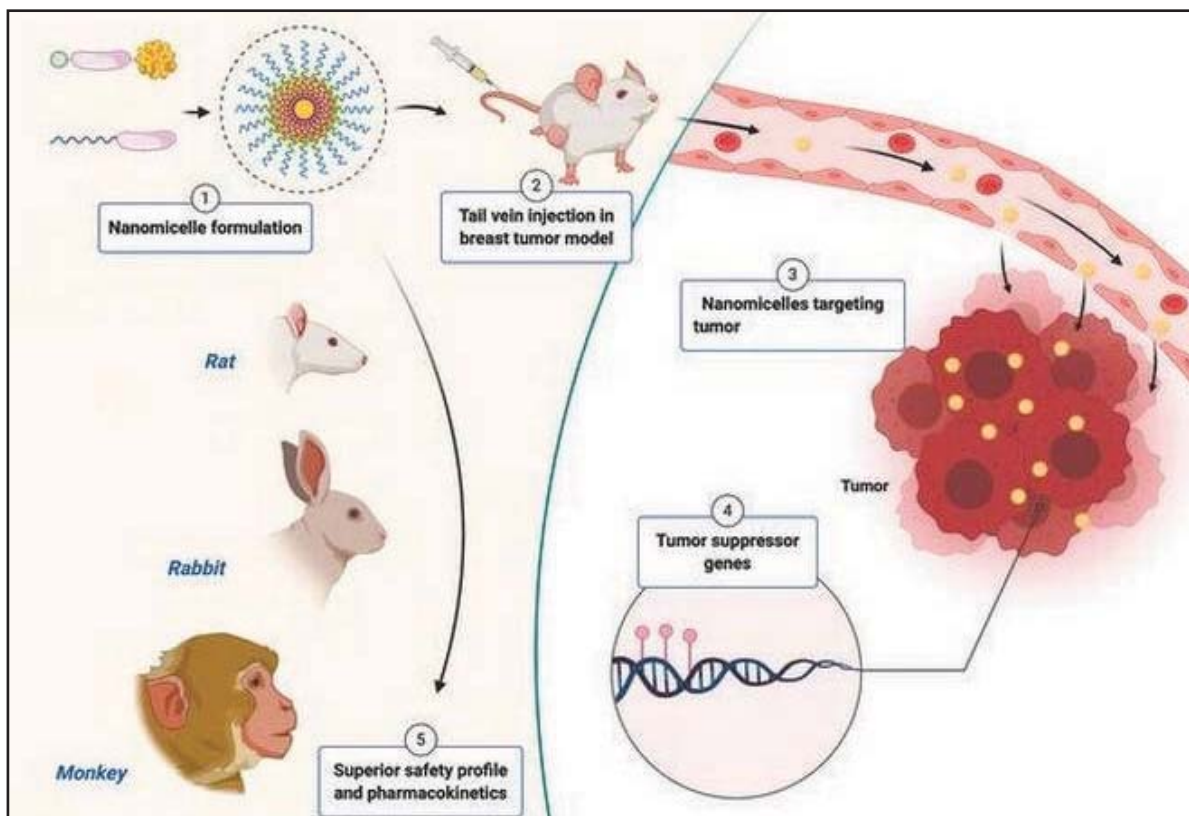
### What is the LHC?

- The Large Hadron Collider (LHC) is the world's largest and most powerful particle accelerator.
- It first started up on 10 September 2008, and remains the latest addition to CERN's accelerator complex.
- The LHC consists of a 27-kilometre ring of superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way.
- The beams inside the LHC are made to collide at four locations around the accelerator ring, corresponding to the positions of four particle detectors – ATLAS, CMS, ALICE and LHCb.

## 6 Genome Editing

**Context:** Gene editing is a rapidly developing area of biotechnology, it allow the precisely change the nucleotide sequence of the genome of living cells.

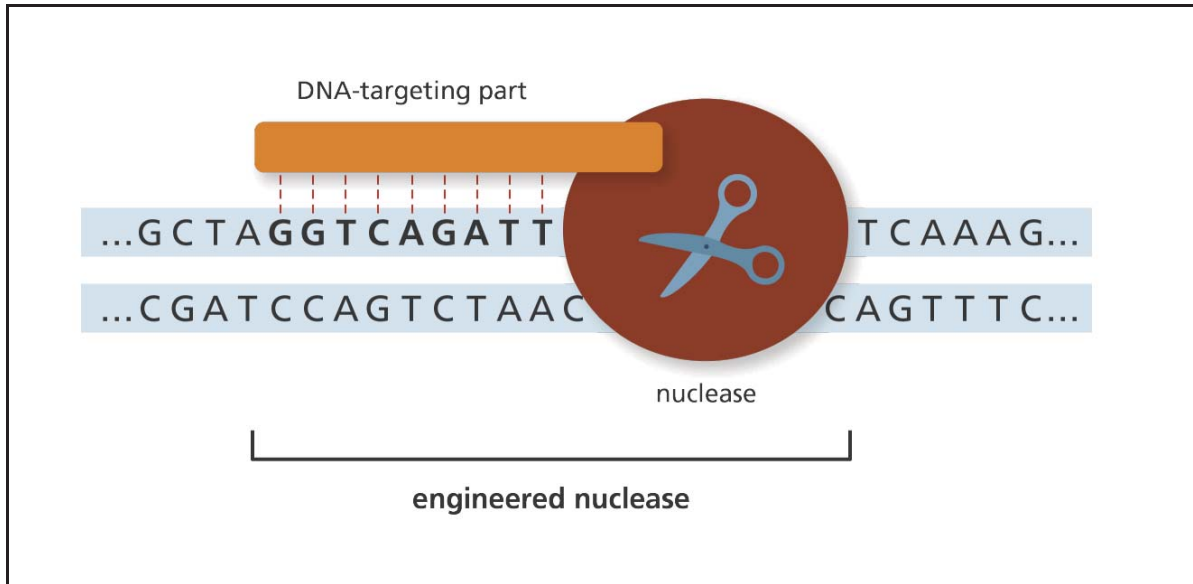
### What is Genome editing?



- Genome editing is a technique used to precisely and efficiently modify DNA within a cell leading to changes in physical traits, like eye colour, or disease risk.
- The technique involves making cuts at specific **DNA sequences** with enzymes known as 'engineered nucleases'.
- The technology can be used to add, remove, or even alter DNA in the genome.
- By editing the genome, the characteristics of a cell or an organism can be changed easily.

### How is it done?

- Genome editing uses a type of enzyme called an '**engineered nuclease**' which cuts the genome in a specific place.
- Engineered nucleases are made up of two parts:
  - ▶ **Nuclease part:** A nuclease part that cuts the DNA.
  - ▶ **DNA-targeting part:** A DNA-targeting part that is designed to guide the nuclease to a specific sequence of DNA.
- After cutting the DNA in a specific place, the cell will naturally repair the cut.
- Scientists can manipulate this repair process to make changes (or 'edits') to the DNA in that location in the genome.

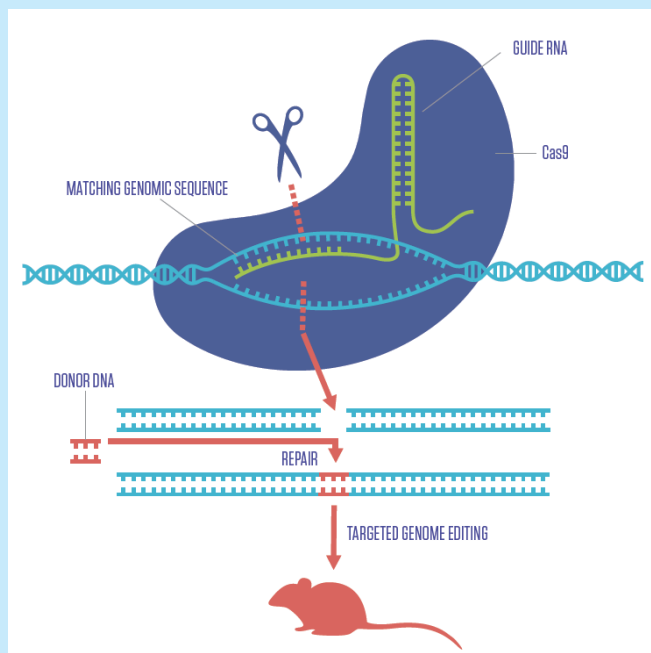


**Which genome editing technologies are currently in use?**

- Current genome editing technologies include **zinc-finger nucleases (ZFNs)**, **transcription activator-like effector-based nucleases (TALENs)** and **clustered regularly interspaced short palindromic repeats (CRISPR)**, with **CRISPR-associated nucleases (Cas)**.
- CRISPR-based genome editing is considered more precise (it is possible to target specific sequences of DNA), more efficient (it has relatively few off-target effects) and cheaper to use than other genome editing technologies.

**CRISPR-Cas9**

- CRISPR-Cas9 is the most common, cheap and efficient system used for genome editing.
- CRISPR stands for 'clustered regularly interspaced short palindromic repeats'.
- CRISPR is the DNA-targeting part of the system which consists of an RNA molecule, or 'guide', designed to bind to specific DNA bases through complementary base-pairing.
- Cas9 stands for CRISPR-associated protein 9 and is the nuclease part that cuts the DNA.
- The CRISPR-Cas9 system was originally discovered in bacteria that use this system to destroy invading viruses.



















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## 1 Trans fat intake: WHO warning to India

**Context:** WHO, in its report, underlined the need to strengthen regulations on Trans Fat in India.

### What are trans fats?

- Trans fats, or trans-fatty acids, are a form of unsaturated fat. They come in both natural and artificial forms.
- Natural, or ruminant, trans fats occur in the meat and dairy from ruminant animals, such as cattle, sheep, and goats.
- They form naturally when bacteria in these animals' stomachs digest grass.

Types of Fatty Acids	Examples of Sources	Health Impacts and Intake Recommendations
<p><b>Saturated</b></p>  <ul style="list-style-type: none"> <li>• No double bond</li> <li>• Straight structure</li> <li>• Solid at room temperature</li> </ul>	   <p>Beef      Butter      Coconut oil</p>	<ul style="list-style-type: none"> <li>• Increase risk of heart disease</li> <li>• Less than 20g of saturated fats per day (for a 2000 kcal diet)</li> </ul>
<p><b>Trans</b></p>  <ul style="list-style-type: none"> <li>• One or more double bonds in trans configuration</li> <li>• Straight structure</li> <li>• Semi-solid/Solid at room temperature</li> </ul>	   <p>Margarine      Cream soup with puff pastry      Chicken pie</p>	<ul style="list-style-type: none"> <li>• Increase risk of heart disease</li> <li>• Less than 2.2g of trans fats per day (for a 2000 kcal diet)</li> </ul>
<p><b>Monounsaturated</b></p>  <ul style="list-style-type: none"> <li>• One double bond in cis configuration</li> <li>• Bent structure</li> <li>• Liquid at room temperature</li> </ul>	   <p>Olive oil      Canola oil      Peanut oil</p>	<ul style="list-style-type: none"> <li>• May reduce risk of heart disease</li> <li>• Moderate intake of monounsaturated fats</li> </ul>
<p><b>Polyunsaturated</b></p>  <ul style="list-style-type: none"> <li>• Multiple double bonds in cis configuration</li> <li>• Even more "bent" in structure</li> <li>• Liquid at room temperature</li> </ul>	   <p>Soybean oil      Corn oil      Fatty fish</p>	<ul style="list-style-type: none"> <li>• May reduce risk of heart disease</li> <li>• Moderate intake of polyunsaturated fats</li> </ul>

## The Report

- Fifteen countries, including India, account for approximately two-thirds of the worldwide deaths linked to trans-fat intake.
- Of these, four countries -- Canada, Latvia, Slovenia, United States of America -- have implemented **WHO-recommended best-practice policies** since 2017, either by setting mandatory limits for industrially produced trans fats to 2% of oils and fats in all foods or banning partially hydrogenated oils (PHO).
- But the remaining 11 countries- Azerbaijan, Bangladesh, Bhutan, Ecuador, Egypt, India, Iran, Mexico, Nepal, Pakistan, Republic of Korea, still need to take urgent action.

### WHO Recommendations:

- WHO recommends that trans fat intake be limited to less than 1% of total energy intake, which translates to less than 2.2 g/day with a 2,000-calorie diet.
- To achieve a world **free** of industrially produced trans fats by 2023, WHO has launched its **REPLACE** strategy

## FSSAI's Recent Regulation

- The Food Safety and Standards Authority of India (FSSAI) has capped the number of trans fatty acids (TFA) in oils and fats to 3% for 2021 and 2% by 2022 from the current permissible limit of 5% through an amendment to the Food Safety and Standards (Prohibition and Restriction on Sales) Regulations.

## 2 Health in India: MoSPI

**Context:** The **Ministry of Statistics and Programme Implementation** has released the report of a survey titled '**Health in India**', whose main objective was to gather basic quantitative information on India's health sector.

### About:

- The report is released by the **Ministry of Statistics and Programme Implementation**.
- It contains health information for separate religious communities, including estimates of their susceptibility to ailments.
- The report is based on information collected through **NSS Schedule 25.0 (Household Social Consumption: Health)** spread over the entire Indian Union.
- Data were collected through a sample survey of 1.13 lakh households covering 5.55 lakh persons.

### How 'healthy' is India?

- Around 7.5 percent of Indians reported that they were suffering from ailments.
- The difference in people suffering from ailments in rural and urban India was stark.
  - **rural India**- 6.8 per cent
  - **urban India**- 9.1 per cent

### Which religious group is the most prone to illness?

- The **Zoroastrian community** remains the most susceptible to ailments.
- This number for other communities is:
  - ▶ **Jains**- 11.2 per cent
  - ▶ **Sikhs**- 11 per cent
  - ▶ **Christians**- 10.5 per cent
  - ▶ **Muslims**- 8.1 per cent
  - ▶ **Buddhists**- 8 per cent
  - ▶ **Hindus**- 7.2 per cent

### Division in terms of sex

- Women remain more susceptible to suffering from ailments than men.
  - ▶ In rural India, 6.1 per cent of males said that they were suffering from ailments, while 7.6 per cent of rural women said the same.
  - ▶ While 8.2 per cent of urban males said that they were sick, 10 per cent of urban females said the same

Religion	Male	Female	Person
Hindu	65	79	72
Muslim	70	93	81
Christian	89	122	105
Sikh	94	127	110
Jain	109	115	112
Buddhist	45	113	80
Zoroastrian	257	359	311
Others	83	54	69
All	67	83	75

## 3 World Health Day

**Context:** World Health Day is celebrated every year on April 7 to spread awareness around maintaining good health and a balanced lifestyle.

### About:

- April 7 of each year marks the celebration of World Health Day.
- From its inception at the First Health Assembly in 1948 and since taking effect in 1950, the celebration has aimed to create awareness of a specific health theme to highlight a priority area of concern for the World Health Organization.
- Over 1 million people have been infected by the deadly contagion while more than 60,000 have lost their lives to Covid-19 infection.

### World Health Organization:

- On April 7, 1948, the United Nations established WHO by the constitution, putting it in charge of classifying diseases.
- WHO acts as the branch of the United Nations responsible for global public health.
- The organization's team, headquartered in Geneva, Switzerland
- Some highlights of WHO's long list of impacts on the world include:
  - ▶ Smallpox was eradicated in 1979 after WHO's 12-year vaccination campaign.
  - ▶ WHO developed a treatment plan for tuberculosis in 1995 that has saved more than 37 million lives.
  - ▶ The WHO Framework Convention on Tobacco Control was adopted in 2005, which prompted countries to establish smoke-free public spaces and print pictorial warnings on cigarette packages.

- ▶ In 2014, WHO sponsored thousands of health care workers to research and treat the Ebola virus. West Africa was officially Ebola-free by 2016.
- ▶ The WHO declared the coronavirus outbreak a pandemic on March 11, 2020.

## 4 Global Nutrition Report

**Context:** Malnutrition remains one of India's biggest challenges, according to the 2020 Global Nutrition Report released worldwide.

### Key-highlights of the Report

- Most people across the world cannot access or afford healthy food, due to agricultural systems that favor calories over nutrition as well as the ubiquity and low cost of highly processed foods.
- Inequalities exist across and within countries.
- Not one country is on course to meet all 10 of the 2025 global nutrition targets and just eight of 194 countries are on track to meet four targets.

### Global Nutrition Targets:

- In 2012, the World Health Assembly identified 6 nutrition targets for maternal, infant, and young child nutrition to be met by 2025.
- These require governments to:
  - ▶ reduce stunting by 40% in children under 5 and prevalence of anaemia by 50% among women in the age group of 19-49 years.
  - ▶ ensure 30% reduction in low-birth-weight and no increase in childhood overweight.
  - ▶ increase the rate of exclusive breastfeeding in the first six months up to at least 50%.
  - ▶ reduce and maintain childhood wasting to less than 5%.

### India's Nutritional Story

- Against global targets for 10 specific parameters set for 2019, three had no data, one showed "some progress", while six were marked "no progress or worsening."
- India is among 88 countries that are likely to miss global nutrition targets by 2025. India is also the country with the highest **rates of domestic inequalities in malnutrition**.
- The country is identified as among the three worst countries, along with Nigeria and Indonesia, for steep within-country disparities on stunting, where the levels varied four-fold across communities.
- However, the under-five mortality (per 1000 births) rate showed a clear decline from 43.6 per cent in 2015 to 36.6 per cent in 2018.
- Other statistics for India (2016 figures) show that it has 0.76 physicians, 2.09 nurses and midwives, and 0.58 community health workers per 1000 people.



5

## Nanomicelles: using nanoparticles for cancer treatment

**Context:** Researchers have created a nanomicelle that can be used to deliver a drug named docetaxel, which is commonly used to treat various cancers including breast, colon and lung cancer.

### About:

- Similar to nanoshells and nanovesicles, nanomicelles are extremely small structures and have been noted as an emerging platform in targeted therapy.
- Nanomicelles are globe-like structures with a hydrophilic outer shell and a hydrophobic interior.
  - ▶ The hydrophobic core interacts with hydrophobic drugs/agents, whereas the hydrophilic tail helps surrounding with water and enhances solubility.
- This dual property makes them a perfect carrier for delivering drug molecules.
- The nanomicelles are less than 100nm in size and are stable at room temperature.
- Once injected intravenously these nanomicelles can easily escape the circulation and enter the solid tumours where the blood vessels are found to be leaky.

5

## NIBEC, a DBT-supported facility for viral immunogenicity testing inaugurated

**Context:** The National Immunogenicity and Biologics Evaluation Centre (NIBEC) for assessing clinical immunogenicity of viral vaccines, especially the ones in the pipeline for Covid-19, has been inaugurated.

### About:

- Established jointly by Bharati Vidyapeeth University through its constituent unit Interactive Research School for Health Affairs (IRSHA) and BIRAC-DBT, Government of India through “Innovate in India (i3) program under **National Biopharma Mission**.

**Immunogenicity** refers to the ability of a drug to induce an immune response and is a concern for peptide and protein therapeutics. Preclinical immunogenicity is not predictive of immunogenicity in humans, but it helps to understand the findings in a toxicology study and therefore is an important factor in vaccine development

### What is National Biopharma Mission?

- This mission would aid in enhancing India’s innovation research and product development capabilities, especially by focusing on development of vaccines, biologics and medical devices for combating public health concerns.
- It is an Industry-Academia Collaborative Mission of Department of Biotechnology (DBT) for Accelerating Early Development for Biopharmaceuticals.
- The mission is implemented by Biotechnology Research Assistance Council (BIRAC).

### Innovate in India (I3)

- The program named Innovate in India (I3) is an industry- academia collaborative mission of Department of Biotechnology (DBT) in collaboration with World Bank for accelerating discovery

research to early development of Biopharmaceuticals and to be implemented by Biotechnology Industry Research Assistance Council (BIRAC).

### Biotechnology Industry Research Assistance Council (BIRAC)

- Biotechnology Industry Research Assistance Council (BIRAC) is a not-for-profit Section 8, Schedule B, Public Sector Enterprise.
- It is set up by **Department of Biotechnology (DBT)** as an **Interface Agency** to strengthen and empower the emerging Biotech enterprise to undertake strategic research and innovation, addressing nationally relevant product development needs.

## 6 Convalescent-Plasma Therapy

**Context:** The Convalescent-plasma Therapy was in spotlight to help in development of a new coronavirus drug derived from the blood plasma of people who have recovered from Covid-19.

### About:

- In the early 20th century, convalescent plasma treatment was used during outbreaks of diseases such as measles, mumps and influenza, **H1N1 influenza pandemic**, and again in 2013 during the Ebola outbreak in West Africa.

### How is blood plasma turned into an infection-fighting drug?

- Patients who have recovered from a disease have permanent antibodies generated by the immune system floating in their blood plasma.
- Plasma is harvested, tested for safety, and purified to isolate those protective antibodies.
- When injected into a new patient, the "**plasma-derived therapy**" — also known as convalescent plasma — provides "**passive immunity**" until the patient's immune system can generate its own antibodies.

### What is Convalescent plasma?

- Convalescent plasma refers to plasma obtained from an individual who has recuperated from an infection.
- During the infectious period, the individual's immune system would have mounted an attack on the foreign virus.
- By the time the virus is vanquished, the body would have developed ammunition specifically to beat the virus, which will be a type of antibody.
- These antibodies are suspended in the circulating blood, and can be separated out from one of the components of blood – the plasma.

## 7 Hydroxychloroquine now a schedule H1 drug

**Context:** Hydroxychloroquine is now a schedule H1 drug, and can be sold on prescription only. The drug has been deemed 'essential' to meet emergency requirements due to COVID-19.

### About:

- Hydroxychloroquine is a **antimalarial drug**. It treats malaria by killing the parasites that cause the disease

- It is classified as disease-modifying anti-rheumatic drug (DMARD).
- The drug is used to treat malaria, lupus erythematosus, and rheumatoid arthritis.
- Hydroxychloroquine can **modify the underlying disease process**, rather than simply treating the symptoms.

### Disease-Modifying Anti-Rheumatic Drugs (DMARDs):

DMARDs act by altering the underlying disease rather than treating symptoms.

- They are not painkillers, but they'll reduce pain, swelling and stiffness over a period of weeks or months by slowing down the disease and its effects on the joints.
- There are two types:
  - ▶ conventional DMARDs
  - ▶ biological therapies

8

## Infectious Diseases bigger global threat than climate change: WEF

**Context:** Infectious diseases topped the global risks chart, displacing climate change, according to the **Global Risks Report, 2021**.

### What are Infectious diseases?

- Infectious diseases are caused by **microorganisms** such as **viruses, bacteria, fungi and parasites**.
- Microorganisms that cause disease are collectively called **pathogens**.
- Infectious diseases can be spread from one person to another
  - ▶ **For example** through contact with bodily fluids, by aerosols (through coughing and sneezing), or via a vector, for example a mosquito

### What causes an infectious disease?

#### Viruses:

- Viruses are tiny infectious agents that replicate only in the living cells of other organisms.
  - ▶ Viruses have a very simple structure consisting of genetic material in the form of DNA or RNA within a protein capsule.
  - ▶ They can infect all types of life forms, from animals to plants and bacteria to amoebae.

#### Bacteria:

- Bacteria are single-celled microorganisms. They come in many shapes including ball-, rod- and spiral-shaped.
  - ▶ Most bacteria are not harmful and some are actually beneficial. Less than one per cent of bacteria will actually make person ill.

#### Fungi:

- Fungi are microorganisms characterised by cell walls made from a substance called chitin.
  - ▶ Fungi reproduce by releasing spores that can be picked up by direct contact or even inhaled.

**Parasites:**

- Parasites are organisms that live in or on another organism and benefit by getting nutrients at the expense of their host.
  - ▶ Parasites can be found in many different body sites, for example in the blood, liver, digestive system, brain and even the eyes.

**Key-highlights of the Report**

- Report is published by World Economic Forum
- Five of the top 10 global risks in terms of impact and likelihood remain from the environmental category.
- Extreme weather is the top-most climate-related risk because of the failure of climate change mitigation and adaptation.



- The category was ranked tenth in the previous report, which said extreme weather and failure of climate change mitigation and adaptation would be the most damaging for the planet over the next 10 years.

9

**Policy responses to smokeless tobacco (ST) in India during the COVID19 pandemic**

**Context:** Smokeless tobacco products use is increasingly becoming a serious health issue in India.

**What is smokeless tobacco?**

- ▶ **Smokeless tobacco (SLT)** is defined as a product that contains tobacco, is not smoked or burned at the time of use, and commonly consumed orally or nasally.
- ▶ Some of the popular products in India include *khaini*, *gutkha*, *zarda*, betel quid with tobacco, tobacco tooth powder, tobacco toothpaste, etc.
- ▶ These products can be placed in the mouth, cheek or the lip and are sucked or chewed.
- **Harmful Chemicals**
  - ▶ Smokeless tobacco contains nicotine, **carcinogens**, including very high levels of **tobacco-specific nitrosamines (TSNAs)**.
    - TSNAs are known to be some of the most potent **carcinogens** present in chewing tobacco, snuff and tobacco smoke.

- Other cancer-causing substances in smokeless tobacco are known to include:
  - ▶ Formaldehyde
  - ▶ Arsenic
  - ▶ Cadmium
  - ▶ Radioactive polonium-210

### WHO Framework Convention on Tobacco Control (WHO FCTC)

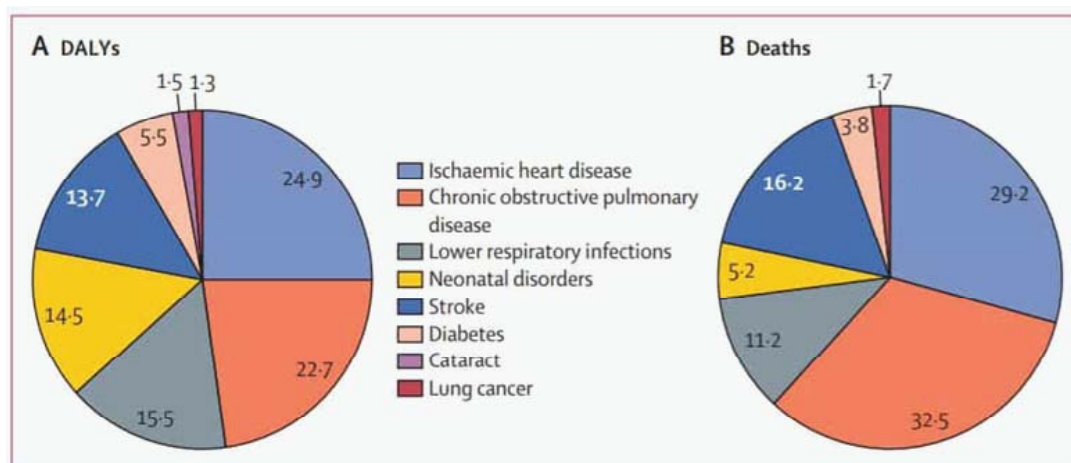
- The WHO Framework Convention on Tobacco Control (WHO FCTC) is the first international treaty negotiated under the auspices of WHO.
- The WHO FCTC represents a paradigm shift in developing a regulatory strategy to address addictive substances; in contrast to previous drug control treaties, the WHO FCTC asserts the importance of demand reduction strategies as well as supply issues.
- India has been a Party to the **WHO Framework Convention on Tobacco Control (WHO FCTC) since 2005.**

## 10 The India State-Level Disease Burden Initiative

**Context:** Some 1.7 million Indians died due to air pollution in 2019, according to a report by interdisciplinary journal *Lancet Planetary Health*.

### Key-findings of the Report

- The toll in India was 18 per cent of the total deaths in the country.
- The report has both good and bad news for India:
  - ▶ **Indoor, or household, air pollution** caused 64 percent fewer deaths in the last two decades (1990-2019).
  - ▶ **Outdoor air pollution, or ambient air pollution**, is not only increasing but also killing more. The death rate from outdoor ambient air pollution has increased during this period by 115 percent.
- **Premature deaths and morbidity:** India has lost 1.4 percent of GDP due to premature deaths and morbidity from air pollution.
- **Lung disease:** Of the total economic loss of \$36.8 billion, lung diseases caused by air pollution accounted for the highest share- 36.6 percent.



- ▶ 36.6% was from lung diseases, which included chronic obstructive pulmonary disorder (21.1%), lower respiratory infections (14.2%), and lung cancer (1.2%).
- ▶ The rest was from ischaemic heart disease (24.9%), stroke (14.1%), diabetes (8.4%), neonatal disorders (13.3%), and cataract (2.7%).
- **Economic Loss:** The economic loss due to air pollution as a percentage of the state GDP was higher in the northern and central India states, with the highest in Uttar Pradesh (2.2 percent of GDP) and Bihar (2 percent of GDP).
- ▶ Delhi had the highest per-capita economic loss due to air pollution, followed by Haryana in 2019.

Premature deaths (US\$ millions)	28799
Morbidity (US\$ millions)	8005
Total (US\$ millions)	36804
Per capita (US\$)	26.5

- **Indoor air pollution:** In term of economic losses attributable to indoor air pollution ranged, Goa had the least loss at \$7.6 million and UP the highest at \$1829.6 million.

## 11 Drug-Resistant Infections: The silent pandemic

**Context:** Antimicrobial resistance (AMR) threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi.

### What is antibiotic resistance?

- Antibiotic resistance occurs when bacteria change in response to the use of these medicines.
- **Bacteria, not humans or animals, become antibiotic-resistant.**
- The misuse and overuse of antibiotics has the potential to contribute to development of AMR globally.

### Evolution of Bacteria

- Exposure to antibiotics puts stress on bacteria and, like other living organisms, they defend themselves.
- This allows them to change quickly, readily obtaining the ability to make proteins and other molecules that block the antibiotic's effect.
- However, as we use ever stronger and more diverse antibiotics, new and more powerful bacterial defence options have evolved, rendering some bacteria resistant to almost everything – the ultimate outcome being untreatable **superbugs**.

- **Antimicrobial resistant organisms** are found in people, animals, food, plants and the environment (in water, soil and air).
- They can spread from person to person or between people and animals, including from food of animal origin.
- The main drivers of antimicrobial resistance include the misuse and overuse of antimicrobials; lack of access to clean water, sanitation and hygiene (WASH) for both humans and animals; poor infection and disease prevention and control in health-care facilities and farms; poor access to quality, affordable medicines, vaccines and diagnostics

## 12 Cord Blood Banking

**Context:** Recently, 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.

### Cord Blood:

- **Cord blood** (short for umbilical cord blood) is the blood that remains in the umbilical cord and placenta post-delivery.
- Cord blood has an abundance of **stem cells** and **immune system cells**, and the medical uses of these cells have been expanding at a rapid pace.

### Uses of Cord Blood

- 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.
- As these cells help the body re-generate tissues and systems, cord blood is often referred to as **regenerative medicine**.
- The fluid 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.

### 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.

## 13 What is meant by pandemic disease declared by WHO?

**Context:** The World Health Organization (WHO) declared the COVID-19 outbreak a pandemic.

### About:

- A pandemic is a measure of the spread of disease.
- When a new disease spreads over a vast geographical area covering several countries and continents, and most people do not have immunity against it, the outbreak is termed a pandemic.
- There is no fixed number of cases or deaths that determine when an outbreak becomes a pandemic.
- The Ebola virus, which killed thousands in West Africa, is an **epidemic** as it is yet to mark its presence on other continents.
- Other outbreaks caused by coronaviruses such as MERS (2012) and SARS (2002), which spread to 27 and 26 countries respectively, were **not labeled pandemics** because they were eventually contained.

## Outbreaks that have been declared pandemics in the past

- A major example is the **Spanish flu** outbreak of 1918, which killed between 20-50 million.
- Cholera pandemics have been declared multiple times between 1817 and 1975.
- In 1968, a pandemic was declared for **H3N2** that caused about a million deaths.
- The last pandemic declared by the WHO was in 2009, for H1N1.

The term **Public Health Emergency of International Concern** is defined in the International Health Regulations (2005) of WHO as “an extraordinary event which is determined, as provided in these Regulations:

- to constitute a public health risk to other States through the international spread of disease; and
- to potentially require a coordinated international response”.

## 14 India now has its own Brain Template & an Atlas

**Context:** An ‘**Indian brain template**’ for five distinct age groups as well as a ‘**brain atlas**’ to help accurate assessment of psychiatric illnesses and conduct neuro-surgical operations have been developed by neuroscientists at the **National Institute of Mental Health and Neuro Sciences (NIMHANS)**.

### About:

- The human brain is the largest brain of all vertebrates relative to body size.
- The brain makes up about 2 percent of a human’s body weight. It weighs about 3.3 lbs. (1.5 kilograms). Average volume of male’s brain is greater than female’s brain
- The largest part of the human brain is the **cerebrum**, which is divided into two hemispheres.
- Underneath lies the **brainstem**, and behind that sits the **cerebellum**.
- The outermost layer of the cerebrum is the cerebral cortex, which consists of four lobes:
  - ▶ frontal
  - ▶ parietal
  - ▶ temporal
  - ▶ occipital
- Like all vertebrate brains, the human brain develops from three sections-
  - ▶ the forebrain develops into the cerebrum and underlying structures
  - ▶ the midbrain becomes part of the brainstem
  - ▶ the hindbrain gives rise to regions of the brainstem and the cerebellum

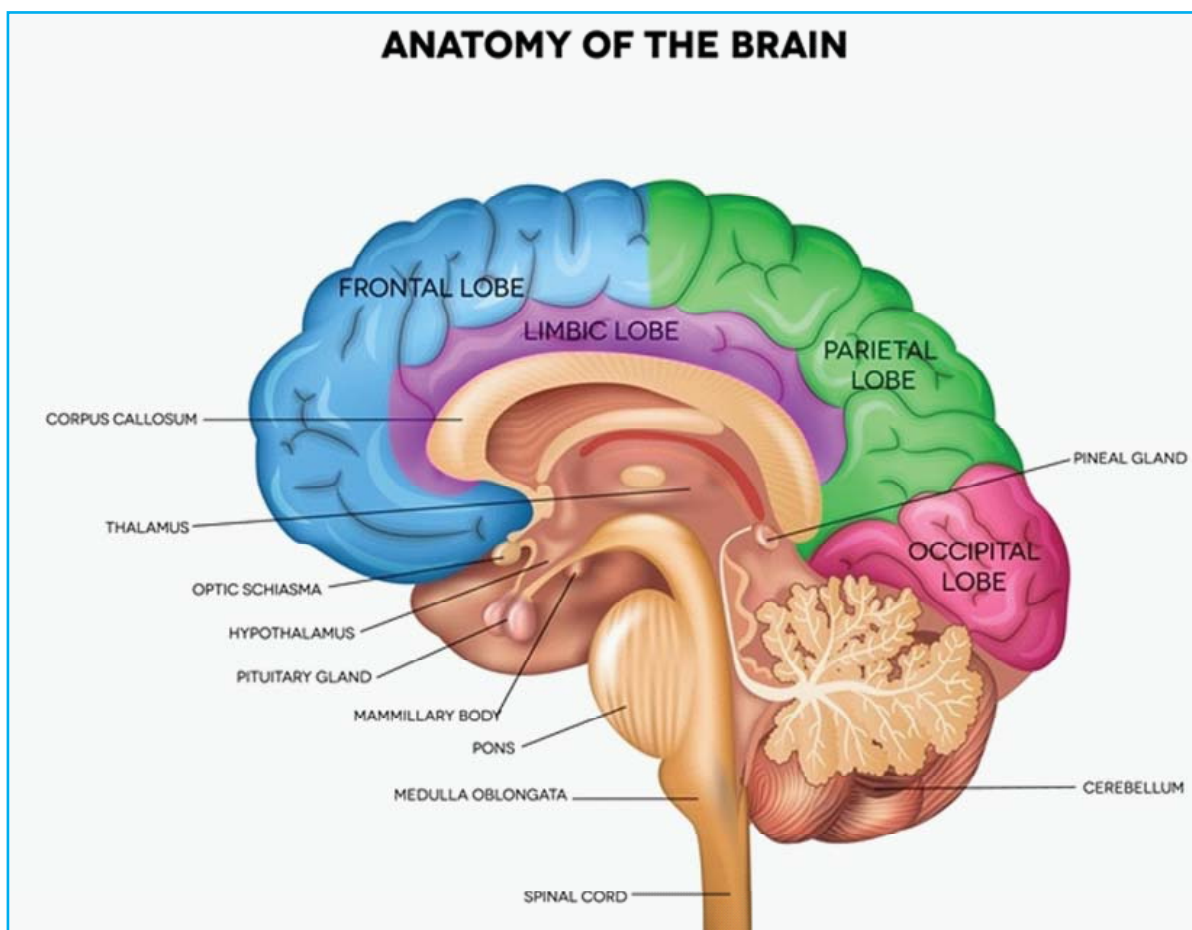
### Brain template

- Brain template is a gross representation from various brain images to understand brain functionality in diseased conditions.



### Brain atlas

- A brain atlas is composed of serial sections along different anatomical planes of the healthy or diseased developing or adult animal or human brain where each relevant brain structure is assigned several coordinates to define its outline or volume.



## 15 AJO-Neo

**Context:** Recently, the device called “AJO-Neo” is developed by researchers from **S.N. Bose National Centre For Basic Sciences (SNBNCBS)**, Kolkata for non-invasive screening of **bilirubin level** in new-borns.

### About:

- AJO-Neo is a “No-touch” & “Painless” device for non-invasive screening of bilirubin level in new-borns.
- The operation of the device is based on **non-contact and non-invasive spectrometry-based techniques** for measurement of neonatal bilirubin level as an alternative of **total serum bilirubin (TSB)**.
- The newly developed device (AJO-Neo) is reliable in measuring bilirubin levels in preterm, and term neonates irrespective of gestational or postnatal age, sex, risk factors, feeding behavior or skin color.

- The device is found to deliver an almost instantaneous report (about 10 seconds) to a concerned doctor.

### Significance of the achievement

- Detection of **neonatal blood bilirubin (Hyperbilirubinemia)** faster is extremely important for therapeutic management to avoid **Kernicterus** leading to **Neuro-psychiatry** problems in neonatal subjects.
- Careful screening of bilirubin levels in new-borns is mandatory to reduce incidents of a type of brain damage called kernicterus that can result from high levels of bilirubin in a baby's blood.
- Although the invasive capillary collection of blood and the subsequent biochemical test is considered a gold standard for jaundice detection in neonates, transcutaneous bilirubin measurement using non-invasive instruments has obvious added advantages.

#### Bilirubin

- It is a yellowish substance in the blood. It forms after red blood cells break down, and it travels through liver, gallbladder, and digestive tract before being excreted.
- It is a necessary process in the body's clearance of waste products that arise from the destruction of aged or abnormal red blood cells.

#### S.N. Bose National Centre For Basic Sciences (SNBNCBS)

- It is an autonomous research Institute under the Department of Science and Technology (DST), Government of India.
- The institute is also hosting one of the Technical Research Centres (TRC) funded by DST and in scientific collaboration with Nil-Ratan Sircar (NRS) Medical College and Hospital, Kolkata.

## 16 China publishes genome sequencing data

**Context:** China has released genome sequencing data for the Coronavirus responsible for a recent outbreak in Beijing, with the WHO and the **Global Influenza Data Initiative (GISAID)**.

### About:

- The Beijing genome data was based on three samples - two human and one environmental
- According to preliminary genomic and epidemiological study results, the virus is from Europe, but it is different from the virus currently spreading in Europe.
- It's older than the virus currently spreading in Europe.
- The first cluster of new coronavirus infections was traced to the Huanan seafood market in Wuhan.

#### Genetic Sequencing of SARS-CoV-2 virus

- The SARS-CoV-2 virus is primarily made of three important elements-
  - ▶ Spike proteins that help the virus bind to a living cell
  - ▶ Ribonucleic acid (RNA) strands that start replicating inside a living cell
  - ▶ Fatty envelop that holds all the components together

- The RNA strands can be thought of as a code that determines how the virus will behave. Coronaviruses have about 26,000 to 32,000 bases or RNA “letters” in their length.
- The virus multiplies inside living organisms’ cells by creating copies for the RNA.
- However, the process it uses to make these copies is not perfect and often introduces tiny errors in the sequence of ‘letters’.
- These errors are known as **mutations**, which can introduce slight variations in the behaviour of the virus.

## 17 Immunoglobulin G (IgG) ELISA test

**Context:** The Indian Council of Medical Research (ICMR) has advised states to conduct a ‘sero survey’ to measure the coronavirus exposure in a population by using the **Immunoglobulin G (IgG) ELISA test**.

### About:

- **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.
- Sometimes, the body may even mistakenly make antibodies against itself, treating healthy organs and tissues like foreign invaders. This is called an **autoimmune disease**.

### The types of antibodies are:

- **Immunoglobulin A (IgA):** It is found in the linings of the respiratory tract and digestive system, as well as in saliva (spit), tears, and breast milk.
- **Immunoglobulin G (IgG):** This is the most common antibody. It’s in blood and other body fluids and protects against bacterial and viral infections. IgG can take time to form after an infection or immunization.
- **Immunoglobulin M (IgM):** Found mainly in blood and lymph fluid, this is the first antibody the body makes when it fights a new infection.
- **Immunoglobulin E (IgE):** Normally found in small amounts in the blood. There may be higher amounts when the body overreacts to allergens or is fighting an infection from a parasite.
- **Immunoglobulin D (IgD):** This is the least understood antibody, with only small amounts in the blood.

### What is an ELISA test?

- ELISAs are designed specifically for screening large numbers of specimens at a time, making them suitable for use in surveillance and centralized blood transfusion services.
- It is an IgG Elisa-based test. This means that the test will be done to detect the Immunoglobulin G (IgG) antibody.
- The body produces Immunoglobulin M (IgM) and IgG antibodies to fight against a pathogen.
  - ▶ The **IgM** antibodies are produced in four-seven days after pathogens enter the body
  - ▶ The **IgG** antibodies are produced between 10-14 days of the pathogen’s appearance.
- If the IgG antibody is detected, it can be concluded that the person was exposed to SARS-CoV-2.

### Why sero-surveys?

- According to ICMR, sero-surveys help to understand the proportion of population which has been exposed to the SARS-CoV-2 infection including the asymptomatic individuals.

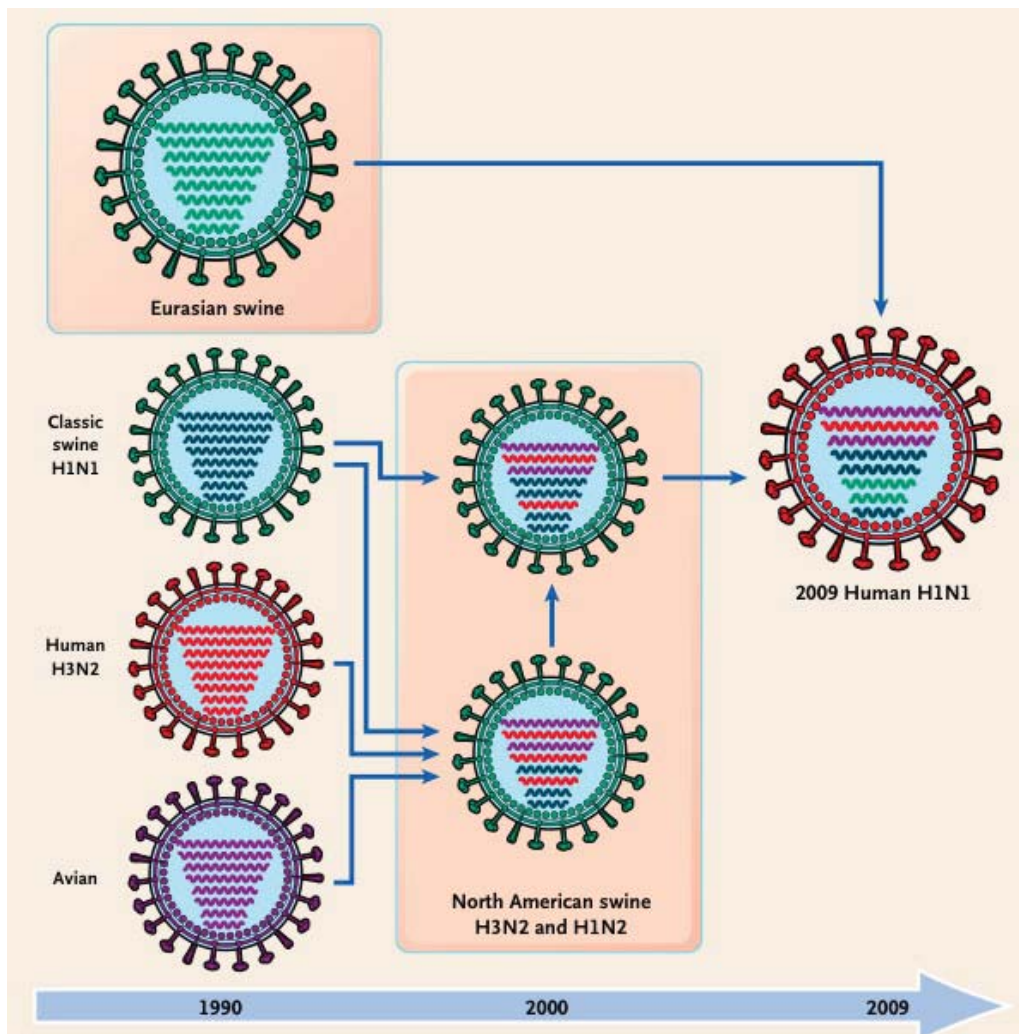
18

## Scientists identifies new 're-assorted' influenza virus with pandemic potential

**Context:** Scientists have identified a new 're-assorted' influenza virus from pigs in China that have pandemic potential. The virus has shown 'increased human infectivity' in swine industry workers.

### What is reassortment?

- Reassortment is the process by which influenza viruses swap gene segments.
- This genetic exchange is possible due to the segmented nature of the viral genome and occurs when two different influenza viruses co-infect a cell.
- The viral diversity generated through reassortment is vast and plays an important role in the evolution of influenza viruses.
- Re-assortants between the swine EA H1N1 virus and human pandemic/09 H1N1 virus have been sporadically detected in pigs in China and other countries, some of which have caused human infections in China.



### About the new flu strain

- The virus, which the researchers call **G4 EA H1N1**, can grow and multiply in the cells that line the human airways.
- Tests also showed that any immunity humans gain from exposure to seasonal flu does not protect G4.
- Current flu vaccines do not appear to protect against it, although they could be adapted to do so if needed.
- The new flu strain that has been identified in China is similar to the 2009 swine flu, but with some new changes.

## 19 Feluda

**Context:** Scientists at Delhi's CSIR-IGIB have developed a paper-based test strip for Covid-19 and named it after the fictional detective created by Satyajit Ray.

### About:

- The 'Feluda' test strip has been invented at the Council of Scientific & Industrial Research's Institute of Genomics and Integrative Biology (CSIR-IGIB).
- The simple paper-based test strip could also reduce Covid-19 testing costs — the real-time polymerase chain reaction test (RT-PCR) used currently requires machinery worth lakhs of rupees, but the 'Feluda' test could cost as little as Rs 500.

### How does it work?

- The strip will just change color and can be used in a simple pathological lab. The most important part is it will be 100 per cent accurate.

### CRISPR Technology:

- Feluda uses cutting-edge gene-editing CRISPR-CAS-9 technology to target and identifies the genomic sequence of the novel coronavirus in suspected individuals
- CRISPR technology recognizes specific genetic sequences and cuts them in a short time.
- The CRISPR reaction is specific and can be done in 5-10 minutes. It is a powerful technique that worked in detecting the Zika virus too.
- How Feluda is different from others?
- Unlike Stanford and MIT, which use CAS-12 and CAS-13 proteins to detect the presence of the novel coronavirus, Feluda uses CAS-9 protein technology. And unlike the PCR test, there is no need for probes.

\*\*\*\*\*

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1

## Depletion of particular brain tissue linked to chronic depression, suicide: Study

**Context:** In a recent research, a common characteristic has been found in the brain structure of people who died by suicide. There was a sharp fall in the density of '**Astrocytes**', a particular nerve cell throughout the brain.

### What is Astrocytes?

- It is a type of supportive nerve cells, look like the end of a frayed rope.
- Astrocytes are **highly heterogeneous neuroglial cells** with distinct functional and morphological characteristics in different parts of the brain.
- They are responsible for maintaining a number of complex processes needed for a healthy **central nervous system (CNS)**.
- The density was five times lower in the **mediodorsal thalamus** and **caudate nucleus** and half in the **prefrontal cortex** in the subjects who had died by suicides.
- Astrocytes can strongly modulate most facets of neuronal activity, including neuronal firing, neurotransmitter synthesis, neurotransmitter reuptake and synaptic transmission.

### How reduction in astrocytes have negative effects?

- With fewer astrocytes, the neurons in this circuit (important for decision making and emotional regulation, functions) may not function as well as they otherwise would.
- Abnormalities in the prefrontal cortex also seem to be connected to impulsivity, which may play a role in suicide in some cases.

Three regions of the brain that are considered to be responsible for emotion regulation were studied — **dorsomedial prefrontal cortex, dorsal caudate nucleus and mediodorsal thalamus**

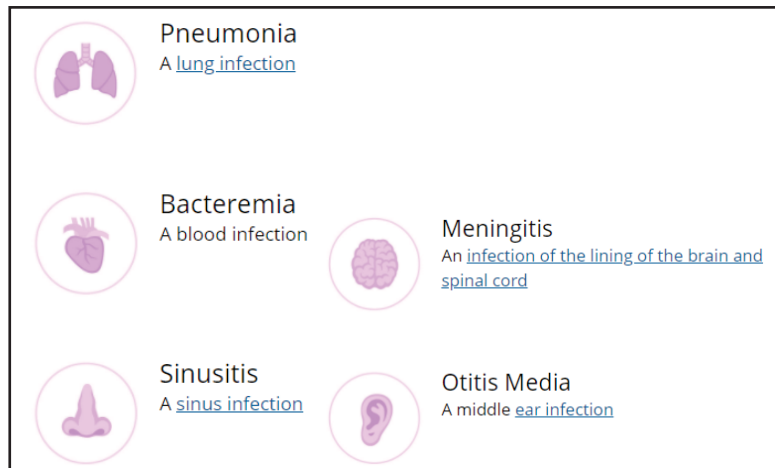
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## India's 1<sup>st</sup> Indigenously Developed Pneumococcal Vaccine "Pneumosil"

**Context:** The Government launched the **country's first pneumococcal conjugate vaccine "Pneumosil"** developed by **Serum Institute of India** in collaboration with partners like the Bill and Melinda Gates Foundation.

**About:**

- Pneumococcal disease is a name for any infection caused by bacteria called **Streptococcus pneumoniae, or pneumococcus**.
- Pneumococcal infections can range from ear and sinus infections to pneumonia and bloodstream infections.
- There are vaccines to help prevent pneumococcal disease.
- Bacteria called **Streptococcus pneumoniae, or pneumococcus**, can cause many types of infections. Some of these infections can be life threatening.

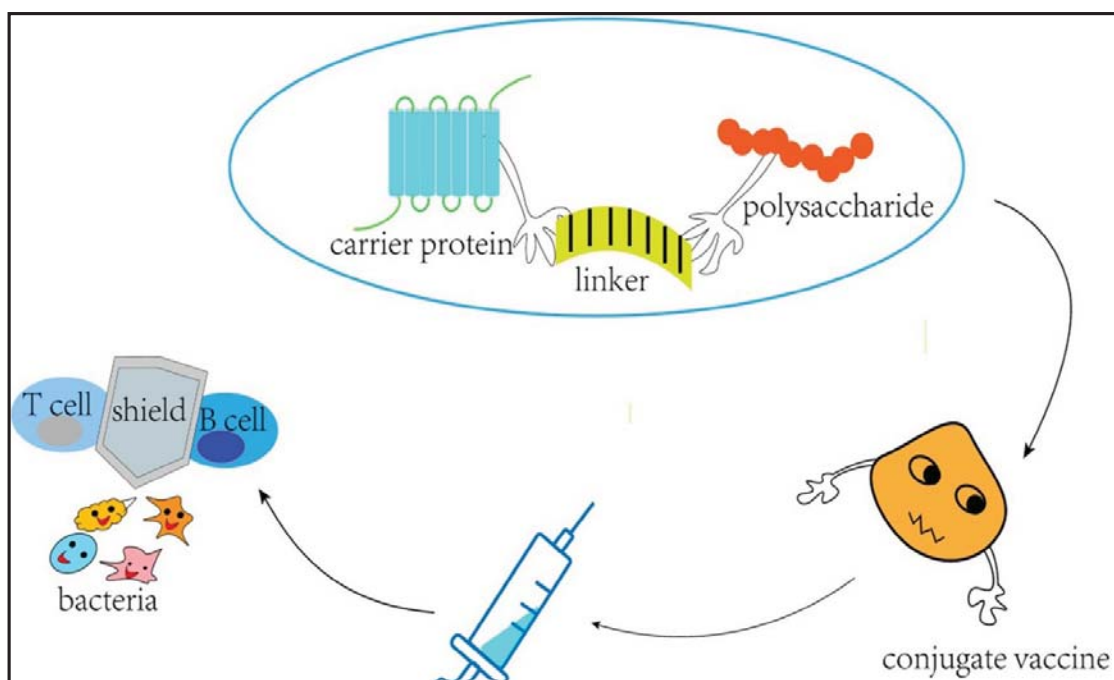


**About Pneumosil**

- PNEUMOSIL is a **Polysaccharide Conjugate Vaccine** which is sterile suspension of saccharides of the capsular antigens of Streptococcus pneumoniae serotypes.

**Polysaccharide Conjugate Vaccine**

- The polysaccharide conjugate vaccine adds the positive characteristics of protein antigens to the polysaccharide antigen, thereby improving the immunogenicity of the polysaccharide antigen, solving the problem that the polysaccharide vaccine cannot be effectively applied in toddler or children.





3

## Tobacco behind more than a quarter of India's cancer cases

**Context:** As many as 27 per cent of cancer cases were caused due to tobacco consumption, according to a new report released by the **National Cancer Registry of India (NCRI)**.

### Cancer

- Cancer is when the cells start to grow out of control.
- The cancer cells keep on growing and making new cells. They crowd out normal cells. This causes problems in the part of the body where the cancer started.
- Cells become cancerous due to the accumulation of defects, or mutations, in their DNA. Certain:
  - ▶ **Inherited genetic defects** (for example, BRCA1 and BRCA2 mutations)
  - ▶ **Infections**
  - ▶ **Environmental factors** (for example, air pollution)
  - ▶ **Poor lifestyle choices** -- such as smoking and heavy alcohol use can also damage DNA and lead to cancer

### Tumor

- Most cancers form a lump called a tumor. But not all lumps are cancer.
- Lumps that are not cancer are called benign. Lumps that are cancer are called malignant.
- There are some cancers, like leukemia (cancer of the blood), that don't form tumors. They grow in the blood cells or other cells of the body.

### Types of Cancer

- **Carcinoma** is a cancer that starts in the skin or the tissues that line other organs.
  - ▶ **Lung cancer:** A cancer that begins in the lungs and most often occurs in people who smoke.
  - ▶ **Breast Cancer:** A cancer that forms in the cells of the breasts.
  - ▶ **Prostate cancer:** A cancer in a man's prostate, a small walnut sized gland that produce seminal fluid.
- **Sarcoma** is a cancer of connective tissues such as bones, muscles, cartilage, and blood vessels.
- **Leukaemia** is a cancer of bone marrow, which creates blood cells.
- **Lymphoma** and **myeloma** are cancers of the immune system.
- **Brain and spinal cord cancers** – these are known as central nervous system cancers

### National Cancer Registry of India

- The Indian Council of Medical Research set up the National Cancer Registry Programme (NCRP) in 1982.
- The programme is overseen by the ICMR National Centre for Disease Informatics & Research (NCDIR), Bengaluru.
- A network of population and hospital-based cancer registries (PBCR, HBCR) systematically collect data related to cancer incidence, mortality and clinical aspects to estimate burden, trends, survival and management.

## Is Cancer a notifiable disease?

- Majority of states in India have not declared cancer as a notifiable disease.
- So far, only nine States in India have cancer as a notifiable disease so far either as administrative order or Gazette notification, including Karnataka.
- A notifiable disease is any disease that is **required by law to be reported** to government authorities. The collation of information allows the authorities to monitor the disease, and provides early warning of possible outbreaks.

## How Tobacco is killing people?

- Poisons in tobacco smoke can damage or change a cell's DNA.
- Toxic gases damage the cilia, while Tar, the solid particle in tobacco smoke coats lungs like soot in a chimney. Some chemicals in your cigarette are:
  - Ammonia** – commonly used in toilet cleaners
  - Cyanide** – used as rat poison
  - Formaldehyde** – used in laboratories for preservation of dead specimens
  - Nicotine** – habit forming, addictive drug

## 4 African Swine Fever

**Context:** China, the biggest consumer of pork in the world, has banned the import of pigs and wild boars from India to prevent the spread of the **African swine fever (ASF)**.

### About:

- African swine fever (ASF) is a severe viral disease affecting domestic and wild pigs.
- This **transboundary animal disease (TAD)** can be spread by live or dead pigs, and pork products; furthermore, transmission can also occur via contaminated feed and fomites (non-living objects) due to the high environmental resistance of ASF virus
- There is **no approved vaccine** against ASF.
- Humans are not susceptible to the disease.
- Symptoms:** Symptoms include fever, loss of appetite, lack of energy, abortions, internal bleeding, with haemorrhages visible on the ears and flanks. Sudden death may occur.

### Outbreaks:

- It was **first detected in Africa in the 1920s**.
- More recently (since 2007) the disease has been reported in multiple countries across Africa, Asia and Europe, in both domestic and wild pigs.

Since February 2020, African swine fever (ASF) has killed over 17,000 pigs in Assam and an unknown number in Arunachal Pradesh. This is the first time India has reported the disease, and since ASF hasn't been to India before.

## 5 Shigella infection

**Context:** A number of cases of shigella infection have detected in Kozhikode district of Kerala.

## What is shigella infection?

- Shigellosis or Shigella infection is a contagious intestinal infection.
- **Caused by:** It is caused by a genus of bacteria known as **Shigella**.
  - ▶ The same bacteria is also understood to be the prime reason for the occurrence of diarrhea especially among children in the African and South Asian countries.
  - ▶ The lethal bacteria enters the body through ingestion and harms the epithelial lining of the colon resulting in severe inflammation and subsequent damage to the cells.
  - ▶ The bacteria is so lethal that only a minute number of bacteria can cause havoc in a person's body.
- **Transmission:** It gets transmitted from person to person after the bacteria has been ingested by the person accidentally.

## What are the symptoms?

- People with shigellosis may start experiencing symptoms within one or two days of the entry of germs in the body.
- The common symptoms are:
  - ▶ diarrhea (often bloody and painful)
  - ▶ stomach pain
  - ▶ fever
  - ▶ nausea
  - ▶ vomiting
- There have been cases too where people don't experience any signs of the bacterial infection.

## 6 Need action to avert Measles and Polio epidemics

**Context:** The UNICEF and World Health Organization (WHO) called for action to avert measles and polio epidemics as the novel coronavirus disease (COVID-19) continued to disrupt immunisation services across the world.

### About:

#### • Measles

- ▶ Measles is caused by a virus in the **paramyxovirus family**. It is serious for small children.
- ▶ The disease spreads through the air by respiratory droplets produced from coughing or sneezing.
- ▶ **Symptoms:** They include cough, runny nose, inflamed eyes, sore throat, fever and a red, blotchy skin rash.
- ▶ **Prevention:** It is easily preventable by a **vaccine**.
- ▶ **Treatment:** There is **no treatment** to get rid of an established measles infection.

#### • Polio

- ▶ Polio, or poliomyelitis, is a disabling and life-threatening disease caused by the poliovirus.
- ▶ The virus spreads from person to person and can infect a person's spinal cord, causing paralysis.
- ▶ Most people who get infected with poliovirus will not have any visible symptoms.
  - About 25% people with infection will have flu-like symptoms that may include: Sore throat, Fever, Tiredness, Nausea, Headache and Stomach pain

- ▶ A smaller proportion of people with poliovirus infection will develop other, more serious symptoms that affect the brain and spinal cord:
  - **Paresthesia** (feeling of pins and needles in the legs)
  - **Meningitis** (infection of the covering of the spinal cord and/or brain) occurs in about 25%
  - **Paralysis** or weakness in the arms, legs, or both, occurs in about 1 out of 200 people with poliovirus infection.

### The current situation of the disease

- Poliovirus transmission is expected to increase in Pakistan and Afghanistan and in many under-immunised areas of Africa.
- Pakistan and Afghanistan are among the two countries where polio is still endemic.

## 7 Eluru Mystery Disease

**Context:** A 'mystery disease' has left 450 patients in Eluru, Andhra Pradesh with seizures, nausea, dizziness and headaches. Among tentative reasons being blamed are organochlorides.

### What are organochlorines?

- Organochlorines (OC) are a group of **chlorinated compounds** that belong to the class of **persistent organic pollutants (POPs)** with high persistence in the environment.
- OC **insecticides** were earlier used to control malaria and typhus; they were later banned in most countries.
- They are widely used as **pesticides**.
- They are relatively cheaper as a result **Dichlorodiphenyltrichloroethane (DDT)**, **hexachlorocyclohexane (HCH)**, **aldrin** and **dieldrin** are among the most widely used pesticides in developing countries of Asia.

### How can these pesticides affect human health?

- **Short-term exposure:** Exposure to organochlorine pesticides over a short period may result in convulsions, headache, dizziness, nausea, vomiting, tremors, confusion, muscle weakness, slurred speech, salivation and sweating.
- **Long-term exposure:** Long-term exposure to organochlorine pesticides may damage the liver, kidney, central nervous system, thyroid and bladder

## 8 Cytokine Storm

**Context:** Of all the possible compounding effects of COVID-19, the disease caused by the novel coronavirus, the **cytokine storm** is one of the most feared.

### About:

- Cytokines are small proteins released by many different cells in the body, including those of the immune system where they coordinate the body's response against infection and trigger inflammation.

- Sometimes the body's response to infection can go into overdrive.
  - ▶ For example, when SARS -CoV-2 – the virus behind the covid-19 pandemic – enters the lungs, it triggers an immune response, attracting immune cells to the region to attack the virus, resulting in localised inflammation.
  - ▶ But in some patients, excessive or uncontrolled levels of cytokines are released which then activate more immune cells, resulting in hyperinflammation.
- Cytokine storms are a common complication not only of covid-19 and flu but of other respiratory diseases caused by coronaviruses such as SARS and MERS.
- The phenomenon became more widely known after the 2005 outbreak of the avian H5N1 influenza virus, also known as “**bird flu**”, when the high fatality rate was linked to an out-of-control cytokine response.
- They could also be the reason why younger people are less affected, as their **immune systems are less developed** and so produce lower levels of inflammation-driving cytokines.

### Role of inflammation in immunity

- Inflammation has an important protective function. The release of inflammatory mediators increases the blood flow to the area, which allows larger numbers of immune system cells to be carried to the injured tissue, thereby aiding the repairing process.
- However, if this inflammatory response is not regulated, very dangerous consequences can follow.
- This is when a ‘**cytokine storm**’ can be triggered. The damage to the surrounding cells can be catastrophic, leading to sepsis and potentially, death.

9

## Can bacille Calmette-Guerin be a cure for Coronavirus?

**Context:** The **Bacillus Calmette-Guerin (BCG) vaccine**, administered to millions of Indian children soon after birth to protect against tuberculosis, could be a “game-changer” in the fight against the deadly coronavirus.

### About:

- BCG, or bacille Calmette-Guerin, is a vaccine for tuberculosis (TB) disease. BCG vaccine has a documented protective effect against meningitis and disseminated TB in children.
- It is 70-80% effective against the most severe forms of TB, such as TB meningitis. However, it is less effective in preventing the form of TB that affects the lungs.
- The vaccine prevents infant deaths from a variety of causes, and sharply reduces the incidence of respiratory infections.
- It does not prevent primary infection and, more importantly, does not prevent reactivation of latent pulmonary infection, the principal source of bacillary spread in the community. The impact of BCG vaccination on transmission of Mtb is therefore limited.

### India & BCG:

- The BCG vaccine is part of India's universal immunisation programme and administered to millions of children at birth or soon after it.
- It is the live weakened form of mycobacterium bovis -- the causative agent of tuberculosis in cattle -- related to mycobacterium tuberculosis, the bacteria which causes tuberculosis in humans.
- India, with the world's highest TB burden, introduced BCG mass immunisation in 1948.

## 10 Acute Encephalitis Syndrome (AES)

**Context:** Bihar government fearing outbreak of AES again

### About:

- Locally known as **Chamki Bukhar**, it has claimed the lives of more than 500 children in the previous decade.
- It is characterized as acute-onset of fever and a change in mental status (mental confusion, disorientation, delirium, or coma) and/or new-onset of seizures in a person of any age at any time of the year.
- **Symptoms:** AES complications may include memory loss, coma and even death. The signs and symptoms typically include:
  - ▶ High Fever
  - ▶ Headache
  - ▶ Vomiting
  - ▶ Confusion
  - ▶ Seizures
  - ▶ Sensitivity to light
  - ▶ Stiff neck and back
  - ▶ Memory loss
  - ▶ Problems with speech or hearing
  - ▶ Drowsiness
  - ▶ In some severe cases, paralysis and coma
- **Who is affected?** It mostly affects people below 15 years.
- **Hotspot:** AES has its endemic zones covering the Gangetic plain like states of Bihar, Assam, east UP, West Bengal and some parts of Tamil Nadu.

## 11 Multi-System Inflammatory State

**Context:** Doctors have picked up a slight rise in the number of children of all ages needing intensive care treatment for a condition called "**multi-system inflammatory state**".

### About:

- Multi-system inflammatory state is a severe immune response that can affect the body in multiple ways, most importantly by making the blood vessels leaky, similar to the condition called Kawasaki disease.
- This leads to low blood pressure and a build-up of fluid in the lungs and organs. It is extremely serious.
- Patients need urgent intensive care to support the heart, lungs and sometimes other organs such as the kidneys.

### Symptoms:

- The children have overlapping symptoms of two diseases:
  - ▶ **Toxic Shock Syndrome:** TSS is where bacteria gets into the body and releases harmful toxins that cause a temperature and flu-like symptoms, as well as nausea and vomiting and a loss of consciousness in severe cases.

- ▶ **Unusual Kawasaki Disease:** A rare vascular condition that is the main cause of acquired heart disease in under-18.
- But other symptoms have also been observed in children, including **abdominal pain, gastrointestinal problems and heart inflammation.**

## 12 China reports Hantavirus infection

**Context:** Reports have emerged of another virus, termed the Hantavirus, surfacing in China, at a time when the country was on a path to recovery from the novel coronavirus disease (COVID-19) outbreak.

### About:

- The Hantavirus comes from a family of viruses that spreads mainly from rodents and can cause a range of diseases.
- The term 'hantavirus' refers to a genus covering several tens of species or genotypes globally; differing in their virulence to humans.
- **Symptoms:** The symptoms of the infection are fatigue, muscle ache and fever.
  - ▶ The affected person can also experience stomach pain, diarrhoea, vomiting and headache.
  - ▶ In more serious cases, it can lead to kidney failure and lung disease.

## 13 Classical Swine Fever

**Context:** Amid Coronavirus outbreak, 1300 pigs died of Classical Swine Fever (CSF) in Assam.

### About:

- Classical swine fever (CSF), also known as **hog cholera**, is a contagious viral disease of domestic and wild swine.
- It is caused by a virus of the genus **Pestivirus** of the family Flaviviridae, which is closely related to the viruses that cause bovine viral diarrhoea in cattle and border disease in sheep.
- There is only one serotype of CSF virus (CSFV).
- CSF is a disease listed by the OIE World Organisation for Animal Health (OIE) Terrestrial Animal Health Code and must be reported to the OIE (OIE Terrestrial Animal Health Code).

### Transmission and spread:

- **Direct contact:** The most common method of transmission is through direct contact between healthy swine and those infected with CSF virus. The virus is shed in saliva, nasal secretions, urine, and feces.
- **Contact with contaminated items:** Contact with contaminated vehicles, pens, feed, or clothing may spread the disease.

## 14 Deconstructing SARS-CoV-2 virus

**Context:** The **novel coronavirus disease (COVID-19)** caused by **severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 virus)** has affected more than half-a-million people across the globe.

**About:**

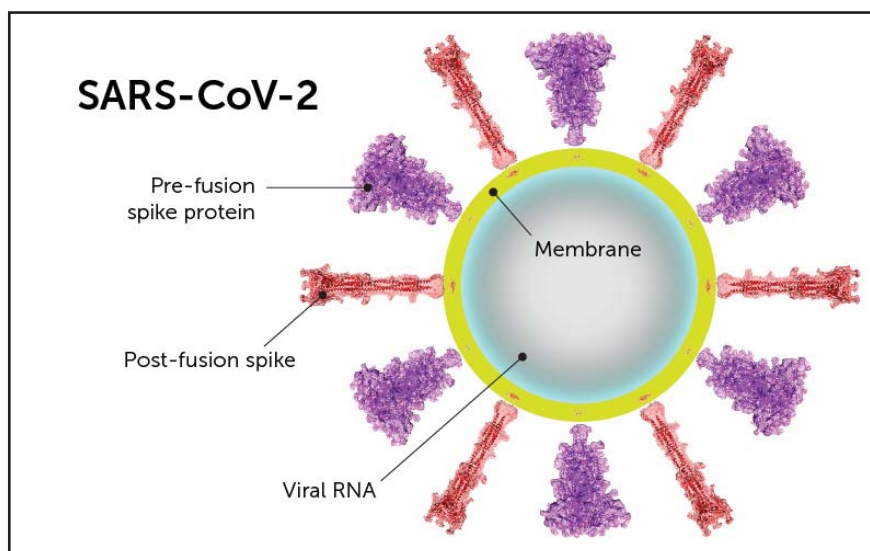
- SARS coronavirus (SARS-CoV) – virus was identified in 2003. SARS-CoV is thought to be an animal virus from an animal reservoir, perhaps bats, that spread to other animals (civet cats).
- It first infected humans in the Guangdong province of southern China in 2002.

**How RBD facilitates the virus?**

- 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 **angiotensin-converting enzyme-2 (ACE-2)** found in heart, lungs, kidneys and the gastrointestinal tract.
- The mutation (if any) increases the RBD's bonding affinity with the ACE-2 of target cells in humans, ferrets and Malayan Pangolins.
- This bonding is stronger in SARS-CoV-2 virus than it was in SARS-CoV virus, which caused the SARS [Severe Acute Respiratory Syndrome] epidemic in 2002-2003.
- The stronger bonding affinity partly explains CoVID-19's faster spread.

**What is spike protein?**

- The presence of S proteins on the coronaviruses is what gives rise to the **spike-shaped protrusions** found on their surface.
- S proteins of coronaviruses can be divided into two important functional subunits, which include the N-terminal S1 subunit, which forms the globular head of the S protein, and the C-terminal S2 region that forms the stalk of the protein and is directly embedded into the viral envelope.

**15** **Huntingtin Disease**

**Context:** A team of scientists from National Centre for Cell Science (NCCS) observed that the **pathogenic Huntingtin protein** causes a decrease in the overall protein production in cells.

**About:**

- Huntington disease (HD) is a progressive genetic disorder affecting the brain that causes uncontrolled movements, impaired coordination of balance and movement, a decline in cognitive abilities, difficulty in concentrating and memory lapses, mood swings and personality changes.



- It is caused by a mutation in a gene called **HTT**. The HTT genes are involved in the production of a protein called huntingtin.
- HTT genes provide the **instruction** for making the protein. When the genes mutate, they provide **faulty instructions** leading to production of **abnormal huntingtin proteins** and these form into clumps.
- The clumps disrupt the normal functioning of the brain cells, which eventually leads to the death of neurons in the brain, resulting in Huntington disease.
- While it is known that the clumps formed by the abnormal huntingtin protein disrupt several cellular processes, it is not known whether they also influence the key process in the formation of other proteins in the cell.

## 16 ICMR warns India of 'Cat Que Virus'

**Context:** Even as the world is still grappling with the COVID-19 pandemic, the Indian Council of Medical Research (ICMR) scientists have found another virus, the 'Cat Que Virus,' reported mainly in China.

### What is Cat Que Virus?

- CQV belongs to the **Simbu serogroup** and infects both **humans** and economically important **livestock** species.
- One of the arthropod-borne viruses (arboviruses), the CQV may cause febrile illnesses, meningitis, and paediatric encephalitis among humans.
- **Natural host:** Its natural host is a mosquito. Domestic pigs are the primary mammalian host of CQV.

### Antibodies against the virus

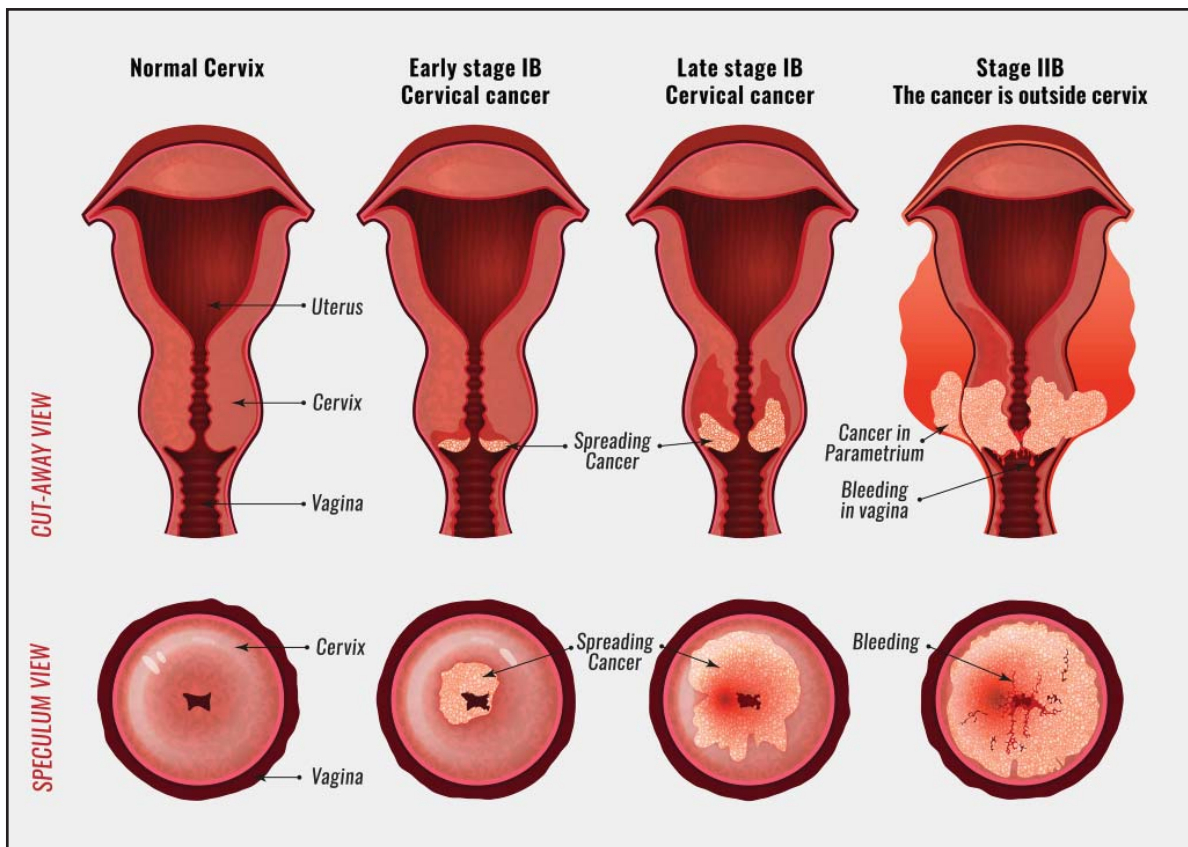
- Antibodies against the virus have been reported in swine reared locally in China.
- It indicates that the virus has formed a "natural cycle" in the local area and has the ability to spread in pigs and other animal populations through mosquitoes.

## 17 WHO commits to eliminate cervical cancer globally

**Context:** In a first, the World Health Organisation's (WHO) launched the **Global Strategy to Accelerate the Elimination of Cervical Cancer**.

### About:

- Cervical cancer develops in a woman's **cervix** (the entrance to the uterus from the vagina).
- Almost all cervical cancer cases (99%) are linked to infection with **high-risk human papillomaviruses (HPV)**, an extremely common virus transmitted through sexual contact.
- Although most infections with HPV resolve spontaneously and cause no symptoms, persistent infection can cause cervical cancer in women.
- Effective primary (**HPV vaccination**) and secondary prevention approaches (screening for, and treating precancerous lesions) will prevent most cervical cancer cases.
- When diagnosed, cervical cancer is one of the most successfully treatable forms of cancer, as long as it is detected early and managed effectively.
- Cancers diagnosed in late stages can also be controlled with appropriate treatment and palliative care.



### Key-highlights of the Programme

- The programme aims to complete the following targets by 2030 globally:
  - ▶ 90 per cent of girls fully vaccinated with the **Human papillomavirus (HPV) vaccine** by 15 years of age
  - ▶ 70 per cent of women screened using a high-performance test by 35 years and again by 45 years
  - ▶ 90 per cent of women identified with the cervical disease receive treatment (90 per cent of women with pre-cancer treated and 90 per cent of women with invasive cancer managed).
- Another highlight of the strategy is to stress investing in interventions to meet these targets that can generate substantial economic and societal returns.

## 18 Kyasanur Forest Disease (KFD)

**Context:** Karnataka government has allocated Rs 15 crore for establishing a research center on **Kyasanur Forest Disease (KFD)** in Sagar, Karnataka.

**About:**

- Kyasanur Forest Disease (KFD) is caused by Kyasanur Forest disease Virus (KFDV), a member of the virus family Flaviviridae.
- It was first identified in 1957 in a sick monkey from the Kyasanur Forest in Karnataka.
- Since then, about 400-500 human cases per year have been reported.
- It is also called **monkey fever** by locals as KFD is **endemic** to the Indian state of Karnataka.
- **Rodents, shrews, and monkeys** are common hosts for KFDV after being **bitten** by infected Hard ticks (Haemaphysalis Spinigera). KFDV can cause **epizootics** (outbreak of the disease in animals) with **high fatality in primates**.

- **Transmission:** To humans, it may occur after a tick bite or contact with an infected animal (a sick or recently dead monkey).
- **Signs and Symptoms:** chills, fever, headache, severe muscle pain, vomiting, gastrointestinal symptoms, and bleeding. Patients may experience abnormally low blood pressure, and low platelet, red blood cell, and white blood cell count.
- **Diagnosis:** It can be diagnosed in the early stage of illness by molecular detection by Polymerase Chain Reaction (PCR) or virus isolation from the blood. Later, serologic testing using enzyme-linked immunosorbent serologic assay (ELISA) can be performed.
- **Treatment and Prevention:** There is **no specific treatment** for KFD although a **vaccine is available**.

## 19 Rare Diseases Day

**Context:** World Rare Disease Day is observed every year on the last day of February.

### What is Rare Disease?

- A rare disease also referred to as an orphan disease, is any disease that affects a small percentage of the population.
- Each rare disease may only affect a handful of people, scattered around the world, but taken together with the number of people directly affected is equivalent to the population of the world's third-largest country.

### What causes rare diseases?

- There are many different causes of rare diseases. The majority are thought to be genetic, directly caused by changes in genes or chromosomes.
- In some cases, genetic changes that cause disease are passed from one generation to the next.
- In other cases, they occur randomly in a person who is the first in a family to be diagnosed.
- Many rare diseases, including infections, some rare cancers, and some autoimmune diseases, are not inherited.
- The most common rare diseases identified in India are **Haemophilia, Thalassemia, Sickle-cell Anaemia, Primary Immuno Deficiency, Lysosomal Storage Disorders such as Gaucher Disease, Fabry Disease, Hunter Syndrome and Pompe's Disease.**

## 20 New tick-borne virus in China

**Context:** A new infection disease called Severe Fever with Thrombocytopenia Syndrome (SFTS), caused by a tick-borne virus has killed seven and infected at least 60 in China.

### What is SFTS Virus?

- Severe fever with thrombocytopenia syndrome virus (SFTSV) belongs to the **Bunyavirus family** and is transmitted to humans through **tick bites**.
- The virus was first identified in China over a decade ago. The first few cases were reported in rural areas of Hubei and Henan provinces in 2009.
- **Prime vector:** Asian tick called **Haemaphysalis longicornis** is the primary vector, or carrier, of the virus.
- **Who are vulnerable?** Farmers, hunters and pet owners regularly come in contact with animals that may carry the *Haemaphysalis longicornis* tick.

- **Transmission:** Scientists have found that the virus is often transmitted to humans from animals like goats, cattle, deer and sheep.
  - ▶ Despite being infected by the virus, **animals generally do not show any symptoms** associated with SFTSV.

### What are Ticks?

- Ticks are blood-sucking bugs, living by feeding on the blood of mammals, birds, and sometimes reptiles and amphibians.
- They are mostly found in bushes, grass and shrubs. The eight-legged bugs are arachnids -- related to spiders.
- According to the **WHO**, ticks are vectors of a large number of diseases including
  - ▶ relapsing fever
  - ▶ Rocky Mountain spotted fever
  - ▶ Q fever
  - ▶ Lyme disease

## 21 Amoebiasis

**Context:** A team of researchers from the Jawaharlal Nehru University (JNU) has developed new drug molecules against the protozoa that cause amoebiasis.

### About:

- Amoebiasis or amoebic dysentery is a common parasitic enteral infection. It is caused by the protozoan parasite **Entamoeba histolytica**.
- Amoebiasis is present all over the world. Each year, about 40000 to 110000 people die from amoebiasis infection.
- Amoebiasis may present with no symptoms or mild to severe symptoms including abdominal pain, diarrhea, or bloody diarrhea.
- Severe complications may include inflammation and perforation resulting in peritonitis. People affected may develop anemia.
- Types
  - ▶ **Acute amoebiasis** can present as diarrhoea or dysentery with frequent, small and often bloody stools.
  - ▶ **Chronic amoebiasis** can present with gastrointestinal symptoms plus fatigue, weight loss and occasional fever.
  - ▶ **Extraintestinal amoebiasis** can occur if the parasite spreads to other organs, most commonly the liver where it causes an amoebic liver abscess.
    - Amoebic liver abscess presents with fever and right upper quadrant abdominal pain

### What is Entamoeba histolytica?

- According to the World Health Organization (WHO), Entamoeba histolytica is the third-leading cause of morbidity and mortality due to parasitic disease in humans.

- *E. histolytica* is classified as a category B biodefense organism because of its environmental stability, ease of dissemination, resistance to chlorine, and it is easily spread through contaminated food products.
- Besides the GI tract, *E. histolytica* can affect many organ systems.

## 22 World Tuberculosis (TB) Day

**Context:** Each year, World Tuberculosis (TB) Day is commemorated on March 24 to raise public awareness about the devastating health, social and economic consequences of TB.

### Analysis:

#### • World TB Day:

- ▶ The date marks the day in 1882 when Dr. Robert Koch announced that he had discovered the bacterium that causes TB, which opened the way towards diagnosing and curing this disease.
- ▶ **Theme:** The theme of World TB Day 2020 - 'It's time'

#### • What is Tuberculosis?

- ▶ Tuberculosis (TB) is caused by bacteria (*Mycobacterium tuberculosis*) that most often affect the lungs. Tuberculosis is curable and preventable.
- ▶ **Transmission:** TB is spread from person to person through the air. When people with lung TB cough, sneeze, or spit, they propel the TB germs into the air.
- ▶ **Symptoms:** Common symptoms of active lung TB are cough with sputum and blood at times, chest pains, weakness, weight loss, fever, and night sweats.

#### • Multidrug-resistant tuberculosis (MDR-TB):

- ▶ Multidrug-resistant tuberculosis (MDR-TB) is a form of TB caused by bacteria that do not respond to at least isoniazid and rifampicin, the 2 most powerful first-line anti-TB drugs.
- ▶ MDR-TB is treatable and curable by using second-line drugs. However, second-line treatment options are limited and require extensive chemotherapy (up to 2 years of treatment) with medicines that are expensive and toxic.
- ▶ In some cases, more severe drug resistance can develop. Extensively drug-resistant TB (XDR-TB) is a more serious form of MDR-TB caused by bacteria that do not respond to the most effective second-line anti-TB drugs, often leaving patients without any further treatment options.

### What is extensively drug-resistant tuberculosis (XDR TB)?

- Extensively drug-resistant TB (XDR TB) is a rare type of MDR TB that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin).

### Government initiatives to end TB

- **Nikshay Poshan Yojana (NPY):** Government of India introduced Nikshay Poshan Yojana (NPY) through Direct Benefit Transfer (DBT) as monthly financial assistance towards nutrition for TB patients in 2018. It aims to-
  - ▶ To determine the number (proportion) of TB patients who received the benefits
  - ▶ To explore the challenges encountered by the health care providers in delivering the NPY through DBT

- ▶ To explore the ways the incentives were utilized by the patients.
- **TB Harega Desh Jeetega:** Launched in 2019, it is a nationwide campaign to spread disease awareness about TB and encourage people with TB symptoms to seek medical attention.
- **Saksham Pravah Project:** The project provides home-based counseling to MDR-TB patients and caregivers. Patients are encouraged to share fears and talk about the discrimination, depression, and familial discord they face.

## 23 World Chagas Disease Day

**Context:** For the first time, the global community is preparing to celebrate 14 April as the first **World Chagas Disease Day**.

### About:

- Chagas disease, also called American trypanosomiasis, has been termed as a “silent and silenced disease”, not only because of its slowly progressing and frequently asymptomatic clinical course but also because it affects mainly poor people who have no political voice or access to health care.
- Once endemic in Latin American countries, Chagas disease is now present in many others, making it a global health problem.

### Transmission of the disease:

- The disease can be transmitted by **vectorial transmission (T. cruzi parasites)** are mainly transmitted by contact with faeces/urine of infected blood-sucking triatomine bugs.
- These bugs, vectors that carry the parasites, typically live in the wall or roof cracks of poorly-constructed homes in rural or suburban areas.

## 24 World Malaria Report 2020

**Context:** India has made considerable progress in reducing its malaria burden, as per the World Malaria Report 2020.

### About:

- **Caused by:** Malaria is caused by *Plasmodium* parasites. The parasites are spread to people through the bites of infected female *Anopheles* mosquitoes, called “malaria vectors.”
  - ▶ 5 parasite species cause malaria in humans, and 2 of these species – *P. falciparum* and *P. vivax* – pose the greatest threat.
- **Symptoms:** The first symptoms – fever, headache, and chills – may be mild and difficult to recognize as malaria.
- **Transmission:** In most cases, malaria is transmitted through the bites of female *Anopheles* mosquitoes.

### Key-highlights of the Report

- The report is published by World Health Organisation
- India is the only high endemic country that has reported a decline of 17.6 per cent in 2019 as compared to 2018 as far as malaria cases are concerned.
- The **Annual Parasitic Incidence (API)** reduced by 27.6 per cent in 2018 as compared to 2017, and by 18.4 per cent in 2019 as compared to 2018. India has sustained API less than one since year 2012.

- India has also contributed to the largest drop in such cases region-wide, from approximately 20 million to about 6 million.
- The percentage drop in the malaria cases was 71.8 per cent and deaths were 73.9 per cent between 2000 to 2019.
- India achieved a reduction of 83.34 per cent in malaria morbidity and 92 per cent in malaria mortality between the year 2000 (20,31,790 cases, 932 deaths) and 2019 (3,38,494 cases, 77 deaths), thereby achieving Goal 6 of the Millennium Development Goals (50-75 percent decrease in case incidence between 2000 and 2019).

### **Government's Malaria elimination efforts**

- Malaria elimination efforts were initiated in the country in 2015 and intensified after the launch of the **National Framework for Malaria Elimination (NFME)** in 2016 by the Ministry of Health and Family Welfare.
- The **National Strategic Plan for Malaria Elimination (2017-22)** was launched by the health ministry in July 2017

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3	6	10	11	16	17	21	22	28			
30	33	38	39	42	44	46	53	54	59	66	69
70	72	77	78	80	82	84	86	87	94	97	98

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CSE 2018

2	3	5	7	27	36	37	40	44	49		
51	52	56	58	62	74	81	89	92	94	98	100

**TOP 100**  
ALL INDIA RANKING  
CSE 2017

3	10	19	31	33	35	40	41	44	45	48		
97	100	54	57	63	64	68	71	75	77	80	83	93

**TOP 100**  
ALL INDIA RANKING  
CSE 2016

5	6	9	15	26	29	43	48	53	59	67
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**TOP 100**  
ALL INDIA RANKING  
CSE 2015

9	13	26	34	39	75	77	78	89	91
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