



GUIDED SELF STUDY PROGRAMME



BIOTECHNOLOGY AND HEALTH Capsule

Part-1 (June-November 2019)

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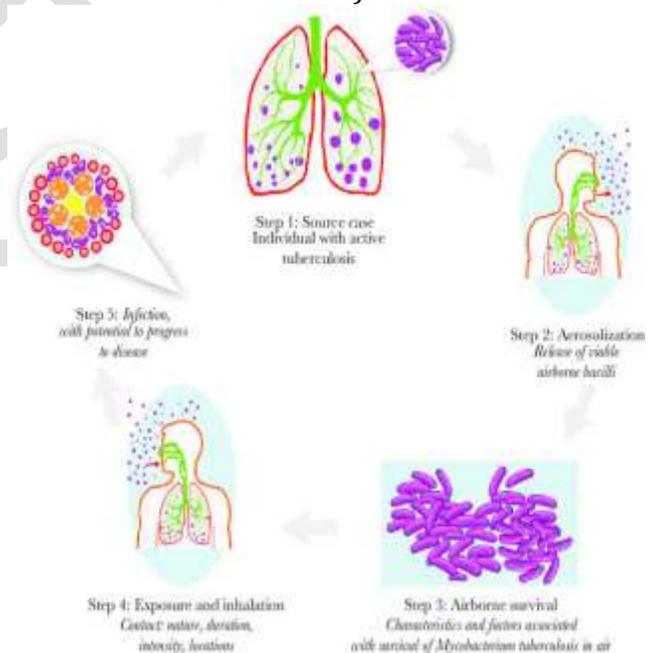
Tuberculosis

Why in news?

- A report released by WHO proves that TB burden in India has reduced and improvement was seen.

Tuberculosis:

- It is a disease caused by bacteria that spreads from individual to individual by air (Mycobacterium tuberculosis).



Though TB usually affects the lungs, it can affect other parts of the body like the liver, renal or spinal cord as well.

- In most cases, tuberculosis is treatable and curable, but those with tuberculosis can die if not treated properly.
- Diabetes is easily introduced to this infectious disease by people with a weak immune system due to HIV.

Drug-resistant TB:

Multidrug resistant (MDR TB) is a particular type of drug resistant TB. It means that the TB bacteria that a person is infected with are resistant to two of the most important TB drugs, isoniazid (INH) and rifampicin (RMP).

Other drugs then need to be taken by the person if they are to be cured of TB.

Rifampicin Resistant TB (RR TB) - People with RR TB are resistant to rifampicin. They may or may not have resistance to other drugs. The **Genexpert test** detects resistance to rifampicin as well as resistance to isoniazid.

- MDR-TB that occurs in the host body has no therapeutic drug available and because of the delayed cycle of antibiotic pharmaceutical drugs, the bacteria are not completely eradicated from their body.
- The host is treated with second-line anti-TB drugs because the bacteria are resistant to first-line anti-TB drugs.
- There is an **Extremely-Resistant Drug TB (XDR-TB)** in the host body, which develops because of the high TB levels in an area that make it very hard to control. In the second-line antibiotics therapy, the strain of the XDR-TB bacteria refuses one or two drugs.
- Poor management in the state may lead to further mutations in bacteria leading to total drug resistance known as **Total Drug Resistance TB (TDR)**.
- **India and TB:** According to the latest report released by the World Health Organisation (WHO) **India accounted for 27 per cent of the total global TB cases** (followed by China with 9 per cent). As per the report 10 million people had TB in 2018. India also had maximum number of drug resistant TB which is 27 percent of a total 130,000 drug-resistant TB cases while China had 14 per cent such cases

Food fortification

Why in news?

- NITI Aayog seeks creation of a roadmap by Department of Food and Public Distribution for taking the Rice Fortification Pilot Scheme Pan India.

What is food fortification?

- Fortification is the **addition of key vitamins and minerals** such as Iron, Iodine, Zinc, Vitamins A & D **to staple foods** such as rice, wheat, oil, milk and salt to improve their nutritional content.
- These **nutrients may or may not have been originally present** in the food

before processing or may have been lost during processing.

- **Micronutrient malnutrition, also known as hidden hunger**, is a serious health risk.
- Sometimes due to **lack of consumption of a balanced diet, lack of variety in the diet or unavailability of food** one does not get adequate micronutrients.
- Hence fortification of food is a safe method of improving nutrition among people as the **addition of micronutrients to food does not pose a health risk** to people.
- It **does not alter the characteristics of the food** like the taste, aroma or the texture of the food.

According to the **National Family Health Survey (NFHS-4)**

- 58.4 percent of children (6-59 months) are anaemic.
- 53.1 percent of women in the reproductive age group are anaemic.
- 35.7 percent of children under 5 are underweight.

In August, 2018, FSSAI introduced the **Food Safety and Standards (Fortification of Foods) Regulations, 2018**, to regulate the provisions regarding fortified food.

Features:

- It **prescribes the standards of addition of micronutrients** for the purpose of food fortification. The manufacturers of the fortified food have to provide a quality assurance undertaking.
- **Packaging and labelling has to state the food fortificant added, +F logo and the tagline "Sampoorna Poshan Swasth Jeevan"**.
- It should be in **compliance with the Food Safety and Standards (Packaging and Labeling) Regulations, 2011**.

Fortified salt: In 1950, Indians were among the first countries in Asia to implement mandatory salt iodisation. It is fortified with Iodine.

Fortified wheat: The flour is fortified with iron, vitamin A and folic acid.

Fortified rice: Iron, Folic Acid, Vitamin B12.

Fortified milk: Studies suggest the intake of fortified milk by children not only increased

mean serum vitamin D levels but also decreased morbidity rates. It is fortified with Vitamin A, Vitamin D.

Fortified oil: Is fortified with vitamin A and D. In February, 2019, the government approved a center-sponsored "**Rice Fortification and Public Distribution System**" pilot scheme. The **three-year** pilot scheme from the start of 2019-20 has been accepted. The budget allocated is a total amount of Rs 42.65 crore.

During the initial implementation phase, the scheme focuses on 15 districts preferably one District per State.

In their respective Integrated Child Development Services (ICDS), Mid-day Meal (MDM) and PDS programmes, the Union Ministry for Women and Child Development, has already ordered the distribution of fortified food.

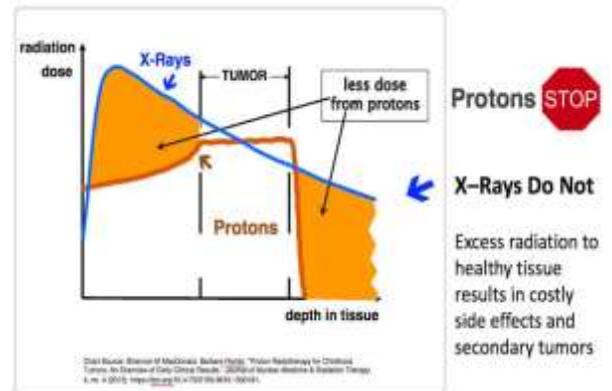
Proton Therapy

Why in news?

- Progress on photon therapy in India was reported in Rajya Sabha.

What is this?

- A proton is a **positively charged particle**.
- At high energy, **protons can destroy cancer cells**.
- Doctors may use proton therapy alone or may also combine it with x-ray radiation therapy, surgery, chemotherapy, and/or immunotherapy.
- Like x-ray radiation, proton therapy is a type of **external-beam radiation therapy**.
- It painlessly delivers radiation through the skin from a machine outside the body.
- A machine called a **synchrotron or cyclotron** speeds up protons.
- The high speed of the protons creates high energy.
- This energy makes the protons travel to the desired depth in the body.
- The protons then give the targeted radiation dose in the tumor.



- **With proton therapy, there is less radiation dose outside of the tumor.**
- In regular radiation therapy, x-rays continue to give radiation doses as they leave the person's body thus damages nearby healthy tissues, possibly causing side effects.

Serotonin

• Why in news?

Serotonin has been found to be helpful in stimulating brain activity.

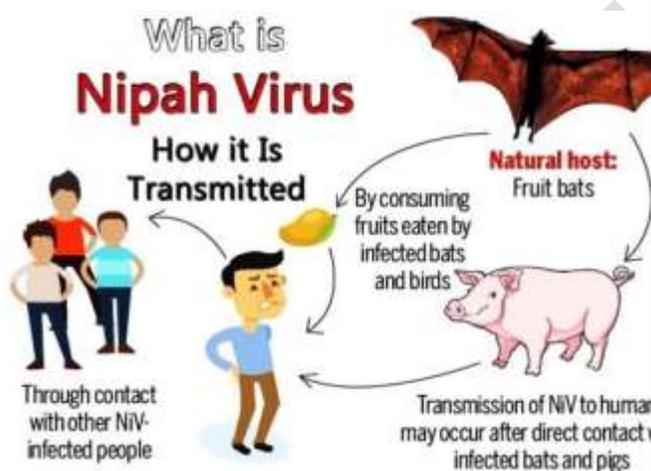
What is Serotonin?

- Serotonin is a chemical that transmits information from one part of the brain to the other and is known to play an important role in various functions from sleep to social behaviour.
- The study conducted by scientists at the Tata Institute in Mumbai showed that the neurotransmitter increases the number of mitochondria in brain cells.
- This Mitochondria produce cellular energy and play a part in the survival of stressed brain cells.
- Furthermore, serotonin increases mitochondrial energy production.
- Up until now, this role of serotonin was not known to regulate neuronal energy.
- Serotonin is important in reducing toxic oxygen reactivity in neurons, boosting antioxidant enzymes and buffering neurons from harmful cell stress effects.
- The study revealed an unparalleled role of serotonin in neuronal energy production, directly affecting the treatment of stress by neurons.
- It also has identified new treatment objectives for neurodegenerative and psychiatric disorders.

- The mechanism by which serotonin performs its energy boosting function has also been identified by researchers.

Nipah Virus

- **Why in news?**
- The virus attacked again in Kerala after its devastating previous episodes.
- **What is Nipah Virus?**
- The newly emerging zoonosis, i.e. diseases transmitted from animals to humans, has been the infection of the Nipah virus according to the WHO.
- The Nipah virus is a **type of RNA virus** in the genus Henipavirus.
- The infection is generally believed to be emerging from fruit bats from the Pteropodidae family.
- After eating the date palm contaminated with fruit bats, humans were affected in 2004.
- Pigs can also act as middlemen.



- It was first found in 1998 in the Malaysian village of Kampung Sungai Nipah (hence named after this village).
- Nipah's symptoms are similar to influenza, including fever, muscle pain and breathing problems.
- Complications can include inflammation of the brain and seizures following recovery.
- As of now, there are no vaccines available.
- People infected with the Nipah virus are provided intensive medical care.

Parthenogenesis

Why in news?

- The New England Aquarium in the United States recently announced that during the

winter a "virgin" anaconda was born. There is no male anaconda in the aquarium. Anna, an anaconda green lady, bore some twins, two of whom survived. This is known as parthenogenesis in scientific terminology.

What is this?

- Parthenogenesis is derived from the Greek words for "virgin birth".
- It is an **asexual reproductive technique** involving the creation of a female (rarely male) gamete (a mature germ cell which can be mixed in sexual reproduction without fertilization with another of the opposite sex).
- Parthenogenesis frequently occur in Lower plants and invertebrates (especially revolving animals, pheasants, ants, wasps and bees) and rarely seen among high vertebrates.
- The mother's clones are babies born by parthenogenesis.
- The New England Aquarium has demonstrated this by means of DNA testing.
- Parthenogenetic offspring tend to be parent clones because genetic information has not been exchanged and re-arranged with another person, as in the case of sexual reproduction.
- In parthenogenesis, **stillbirth is common**.

Gestational diabetes mellitus

- **Why in news?**
- According to a recent report, all pregnant women need to check themselves with the problem of Gestational diabetes Mellitus.
- **What is this issue?**
- Gestational diabetes mellitus (GDM) is characterized as a degree glucose sensitivity during pregnancy.
- GDM not only affects acute maternal and neonatal complications (preeclampsia, stillbirths, macrosomia, need for caesarean section) but also increase the risk of further Type 2 diabetes in mothers and babies.
- Low fetal blood glucose flow activates the fetal pancreatic cells to get insulin secreted earlier and in higher quantities when mother has high blood sugar. It is auto-perpetuated once initiated.
- The amniotic fluid is filled with glucose when the maternal glucose reading becomes high.

- When the fetus starts swallowing up amniotic fluid 20 weeks later, the insulin production gets increased,
- The prevalence of GDM in India according to world standards is very high. There is also a very high rate of conversion to type 2 diabetes.



- The number of Indians with type 2 diabetes mellitus is expected to reach 79.4 million by 2025.

Barcoding of Medicines

Why in news?

In an attempt to offset India's growing reputation as a source of counterfeits, the Government plans to make bar coding obligatory on all drugs sold on the local market.

Reason behind it:

- **Annual Special 301 Report on the Protection of Intellectual Property** and the Review of 'notorious markets' for piracy and counterfeiting released by the Office of the **United States Trade Representative (USTR)** in April 2019 revealed that India is facing the growing problem of counterfeit medicines.
- Counterfeit is a term used in the context of trademark violations, and refers to an exact copy.
- **Nearly 20% of all pharmaceuticals on the Indian market have been counterfeited.**
- Reasons for counterfeit medicines market in India - limited access to medical care, especially in rural areas, fragmented supply chain, lack of consumer awareness, prevalent practice of self-medication, high cost of genuine medicines, weak enforcement of legislation and corruption, prevalence of

online pharmacies, technology advancements in counterfeiting.

- The Special 301 report eventually ends up classifying countries into 3 groups:
 - **Priority Foreign Countries (PFC)** – (Red Flag) - These are most egregious offenders - Ukraine is the only country placed here.
 - **Priority Watch List (PWL)** – Serious offenders
 - **Watch List (WL)** – Less serious offenders
- **India has been placed on the 'Priority Watch List'** (in total 11 countries) because of the issues around patent laws and processes in the country.
- Other countries include China, Indonesia, Russia, Saudi Arabia and Venezuela.
- 25 countries, including Pakistan, Turkey, UAE are on the watchlist.

Jumping genes

• Why in news?

- Scientists have recently discovered a technique using “jumping genes” for genetic editing. It could offer a seamless, safer alternative to CRISPR-Cas9 process.

The technique:

- The technique could allow edited genes to be more precisely inserted into genomes, possibly addressing concerns with current CRISPR systems that can lead to off-target editing and random deletions or even cancer.
- Gene editing is the modification of the DNA code in some sections. It can rectify, remove or insert new parts in this code for disease prevention.
- CRISPR tools are now used to cut out and delete a part of the genetic code with **enzymes such as Cas9 and Cas13**, using their cell-back function to glue together the cutting strands.
- The process is not always effective as repairs are sometimes incomplete or incorrect and the damage caused by cutting can be adverse.
- Whereas the hopping/jumping genes also known as **transposons** jump spontaneously, by using proteins, or transposases (enzymes), from one site to another.
- Despite cuts, it can easily slip into the genome.
- The jumping gene has all of the chemical properties required for direct insertion or

integration without a double-strand break in DNA.

- A guide could effectively program the jumping gene and could insert it into user-defined sites in the genome with incredible precision.

Epilepsy

Why in news?

- The World Health Organization, International League Against Epilepsy and the International Bureau for Epilepsy released a report called "Epilepsy, a public health priority."

Epilepsy, what is it?

- Epilepsy is a central (neurological) disorder of the nervous system in which brain activity is abnormal, causing seizures or times of unusual behaviour.
- This affects men and women of every sex, gender and age.
- Early deaths are slightly more common in low- and middle-income countries than in high-income countries.
- There is a risk for premature death among more than 75% of people with epilepsy in low-income countries due to an inability to access anti-seizure medicines.
- The report says that the care discrepancy for epilepsy is unfair because 70 percent of people with the disease can be symptom free if they have access to drugs that can cost as little as \$5 per year.

GM Crops

Why in news?

- Concerns have been expressed with regards to cultivation and growth of BT brinjal which is a genetically modified crop.

What are genetically modified crops?

- A GM plant is a plant that has a new genetically modified combination obtained through the use of modern biotechnology or genetic editing.
- A gene in GM crop is artificially inserted instead of the plant that acquires the gene by pollination.
- The resulting plant is said to be "genetically modified" although in fact, by domestication, selection and controlled reproduction, all plants were genetically modified from their original wild condition over long periods.

STATE OF BT CROPS IN INDIA

BT COTTON

- Bt cotton grown in India for over a decade —output up fourfold since commercial cultivation allowed in 2002
- 99% of 11-12m ha under the crop is GM cotton
- Punjab & Haryana produce 4m bales (1 bale = 170kg) of India's total output of 38m bales

CULTIVATION & FIELD TRIALS

Punjab (Mustard, maize)
Rajasthan (cotton)
Gujarat (maize, cotton)
Karnataka (cotton)

Haryana (maize, cotton)
Delhi (Mustard)
Maharashtra (Brinjal, rice, maize, cotton)
Andhra (chickpea, cotton)

CONTRIVERSY

- Bt cotton, supposed to be immune to pests, crumbled under whitefly attack in Punjab in 2015
- Over 95% damaged crop was Bt cotton | **Rs 4.5k cr estimate**
- Blamed for over a dozen farmer suicides

FORECAST

- US says India will surpass China as world's largest cotton producer in 2015/16
- India's cotton forecast for 2015-16 | **29.5m bales** (Share in world production | 26.5%)

BT BRINJAL

- Had it not been banned, BT brinjal would have been India's first GM food crop
- Approved for cultivation by India's Genetic Engineering Approval Committee in Oct 2009
- But stiff opposition led to indefinite moratorium on its cultivation in Feb 2010

CONTRIVERSY

- Activists raised food safety
- Farmers dependent on MNCs for seeds from the single firm that makes them

BT MUSTARD

- India's edible oils import bill exceeds \$10bn
- On Feb 5, the biotechnology regulator deferred a decision to allow commercial cultivation of Mustard DMH-11 — a transgenic crop
- DMH11 (Dhara Mustard Hybrid 11) is said to deliver 25-30% higher mustard-seed yields compared to the best "check" varieties

CONTRIVERSY Those opposing DMH-11 mustard are against genetic modification tech over food safety issues

Source: Nature India, GEAC, TNN & Agencies

Pros

- They help the nation with its ability to achieve food security.
- They are resistant to pests and in many ways protect the environment.
- These have a better taste and a longer lifespan.
- They contribute less towards pollution.
- They offer better health and nutritional benefits.
- They contribute to reduce export dependency.
- They will give farmers higher revenue.

Cons

- Although the environmental gain is considered positive, their exact benefits have not been proven and there are risks for the climate.
- They have a range of health issues as researchers point out.
- The suppliers of seeds will monopolize the industry.
- Once the plague gets used to the transition, it will resist and it is a long-term possibility.
- **India is reportedly farming BT Cotton only** and is the the fourth biggest grower of it in the world.
- **Genetic Engineering Appraisal Committee (GEAC)** is apex body under Environment Ministry for regulating manufacturing, use, import, export and storage of hazardous micro-organisms or genetically engineered organisms (GMOs) and cells in the country.
- It is also responsible for giving technical approval of proposals relating to release of GMOs and products including experimental field trials.

Arogyapacha

Why in news?

- A new plant has been **unearthed in the Agastya hills**, also called a miracle plant.

What is this plant?

- The genetic makeup of Arogyapacha (*Trichopus zeylanicus*), a popular medicinal plant native to the hills of Agasthya has been decoded by scientists in the University of Kerala.
- Called "Wonderful Plant," the **Kani Tribal Community** traditionally use the plant to tackle fatigue.
- The wide spectrum of pharmacological effects, such as antioxidant, aphrodisiac, anti-microbial, anti-inflammatory, anti-tumor, anti-ulcer, anti-hepatic, hepatoprotective, has been shown.

Kani Tribes

- These are the Nomads and indigenous peoples from the tropical forest of the hills of the Agasthyamalai, the Western Ghats, mountains of the Kerala region.
- The **tribal doctors called Plathi** are the exclusive holders of the tribe's traditional medicine.

Superbugs

Why in news?

- Researchers have found out that superbugs can be transmitted from plants to humans.

What are Superbugs?

- These are strains of some bacteria which withstand most antibiotics and can cause multiple health problems such as pneumonia and several other infections.



What is antimicrobial resistance?

- Antimicrobial resistant bacteria are present in the natural environment (water, soil and air) and in wildlife, in humans and in food.
- They will spread from food of animal origin and get transmitted from person to person and between person and animals.
- The use of antibiotics for viral infections, such as flu, inadequately treated wastewater with resistant bacteria mixed in the environment often increases the antimicrobial resistance load.



- The threat posed to global public health, food safety and an economic burden by antibiotic resistant infections is huge.
- With the ingestion of infected vegetables, superbugs can hide in the gut (colonizing) for a long-time during escape and infect asymptotically.

New Biomarker of Malaria

Why in news?

- A researcher's team from the Indian Council of Medical Research's Jabalpur-based National Institute of Research in Tribal Health has identified **Glutamate dehydrogenase** as a new biomarker in the body of the malaria parasite for malaria detection.
- This discovery will help in better understanding and research on the disease.

What are biomarkers?

A biomarker is a measurable indicator of the severity or presence of some disease state. Biomarkers can be specific cells, molecules, genes, gene products, enzymes or hormones. They help

to understand the relationship between specific substances in the environment and human conditions or diseases.

Malaria:

- Blood disease caused by **Plasmodium** infectious parasites transmitted by mosquito bites.
- Female anopheles mosquitoes inject sporozoites on the human host's surface.
- Malaria is the leading cause of human disease and death.
- As per WHO reports, there are still 212 million new cases of malaria and 430,000 malaria-related deaths each year.
- Sub-Saharan African countries have the bulk of cases (80%) and deaths (90%).

Lukoskin

● **Why in news?**

- It is a new drug **developed by DRDO** for leucoderma.

Key information

- Leucoderma also called vitiligo, is a skin and autoimmune disorder.
- Autoimmune disorders occur when the body's tissue and organs are attacked by the immune system.
- Because of the lack of melanin in the skin (a pigment in the blood), Vitiligo is a skin disease in which pale white spots appear on the face.
- It is either infectious or life-threatening (i.e. it will not spread through direct contact with the affected person).
- Patients with leucoderma are also vulnerable to iris inflammation, hearing loss and sunburn.
- This affects roughly 4-5% in India.
- The occurrence is as high as 5-8 percent in some areas of Rajasthan and Gujarat.
- Leucoderma (skin disorder) is regarded in India as a social stigma where it is confused with leprosy (a bacteria-inflammatory disease).

Cancer detection tool

Why in news?

- For patients with kidney and brain cancer, a team at Yale University has developed a method that can theoretically identify the causes.

- This development could aid the early detection of cancer.
- Researchers have found the initiating role of cancer cells in spreading to other parts of the body (a process called metastasis for spreading cancer cells).
- Early cancer diagnosis and care can save lives. If cancer becomes metastasized or progresses, the diagnosis becomes more complicated.

Benefits: The research may be used in order to develop novel prognostic tools and pave the way for more customized surgical procedures. New drugs can be created to target cancer cells and avoid environmental changes that serve as a cancer cause.

DNA Technology Bill

Why in news?

- The cabinet cleared up the draft regulation on DNA technology (Use and Application) paving the way to its Parliamentary reintroduction.
- The Bill was passed in January 2019 by the Lok Sabha, but the Rajya Sabha couldn't authorise it.
- It therefore expired with the term of the former Lok Sabha.

The Bill and its features:

- It is aimed at the establishment of domestic and regional DNA data banks to identify victims, suspects, etc.
- **Those who exploit or illegally divert DNA data are imprisoned for up to three years and fined up to one lakh of property.**
- The DNA can only be used to identify the particular person, not any other person.
- During natural disasters, their data will be useful to match the IDs of individuals.
- In order to determine individual identity, it **establishes a DNA Regulatory Board** to accredit DNA laboratories that analyze DNA samples.
- The advantages are protected DNA records. There can be good results.

DNA technology:

DNA tests are an extremely useful and exact technology for the identification and establishment of biological relationships among people from a person's DNA sample.

For instance, a hair sample or even clothes blood tissue from a crime scene may be compared to

that of a suspect, and whether a victim's DNA belongs to the sample can, in most instances, be determined conclusively.

DNA technology is increasingly relied on for crime investigations, identifying unidentified bodies or parenting. The increased use of DNA testing is expected to lead not only to quicker prosecution but also to a higher conviction rate of 30 percent (NCRB 2016 Statistics).

Colistin antibiotic

Why in news?

- The Ministry of Health and Family welfare has ordered that **Colistin and its formulations be prohibited** for the production, sale and distribution of animals for food, poultry, aquaculture and supplements for animal feed.

Colistin

- It is a critical antibiotic that is frequently known as **last resort to save lives in Critical units**.
- It is also known as **polymyxin E** against gram negative bacteria.
- It is used for poultry and several other veterinary uses in order to stimulate development.
- This ban represents a major step forward for taking antimicrobial resistance action because it could easily spread to living organisms.
- **Drugs and cosmetics Act, 1940** has imposed the prohibition.

Anthrax

Why in news?

- DRDO, JNU researchers are developing a more potent vaccine for anthrax, claiming that the new vaccine is superior to existing one since both anthrax and spores can generate an immune reaction.
- Anthrax is a **soil-induced disease** caused by the soil germ **Bacillus anthracis**.
- Animals such as horses, buffaloes, pigs, sheep get affected.
- Anthrax is **not transmitted directly to another contaminated animal or person but is distributed by spores**.
- Such fungi **can be borne by wearing clothes or shoes**.

Symptoms

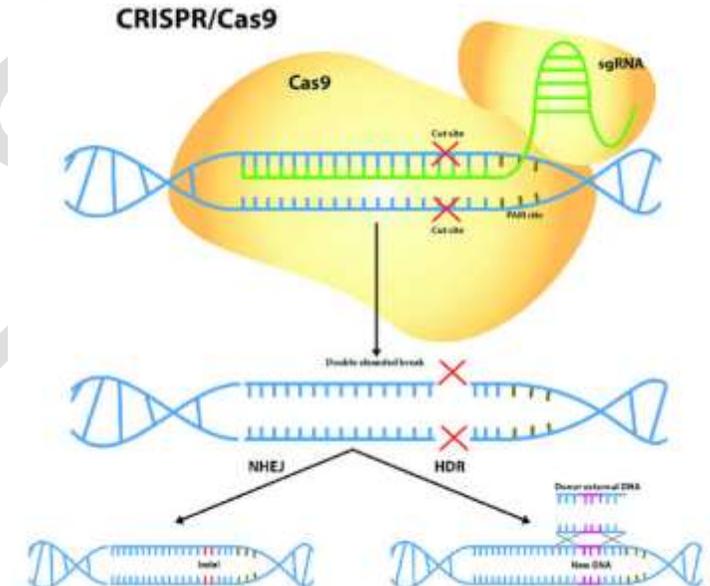
- Within a week, the symptoms such as respiratory infections, acidity, blood diarrhea, bowel swelling develop.
- A **60-day antibiotic regimen is the standard treatment** for anthrax.
- If begun as soon as possible, therapy is most successful.
- By later stages the bacteria often create more toxins than pharmaceuticals can kill.

CRISPR Cas9

Why in news?

- A Chinese researcher recently claimed that he had altered the genes of a human embryo that eventually resulted in the birth of twin girls. The genes were claimed to be "edited" to ensure that they do not get infected with HIV.

How does it work?



- The system CRISPR-Cas9 acts on genetically modified molecules like a process of cut-and-paste.
- A special position is found on the DNA strand with genetic codes, which must be modified or "fixed".
- Using the **Cas9 protein acting like a pair of scissors**, gene is removed from the strand.
- A DNA molecule has a natural propensity to fix itself, if it is damaged.
- In this automated repair process, scientists intervene to supply a necessary genetic code sequence that attaches to the damaged DNA strand.

What is CRISPR Cas9?

- The **Clustered Regularly Interspersed Short Palindromic Repeats (CRISPR 9)** (CRISPR-Cas9) method has streamlined gene editing, making it simpler and easier for most laboratories to access.
- CRISPR technology is basically a **gene-editing technique which can be used to modify or change the organism's genome**.
- The technique can be used to **target specific parts of the genetic code** or to edit the DNA at certain locations.
- **Researchers can change DNA sequences and gene activity** quickly.
- **Other potential applications** include genetic defect repair, treatment and prevention of disease transmission and the improvement of crops.

Concerns: Manipulation of the genetic code is more controversial in human beings. For many years, leading scientists in the field have called for the "world pause" on clinical applications to humans before international level standards are established.

University of Stanford research, U.S. showed that the device CRISPR-Cas9 implants unanticipated off-target results in the mice, outside the expected editing sites.

The fear of a premature rush of the CRISPR system for therapeutic use still remains. Studies have shown that cells edited from CRISPR-Cas9 can lead to cancer.

The risk of mutations in those cells elsewhere in the genome may increase. Although the technique of CRISPR-Cas9 has been used widely to treat many disorders, what diseases or characteristics should be decided through genetic modification is still unknown.

Regarding ethical concerns, there is doubt over human embryo development for one's own sake.

Rice blast disease

Why in news?

- Researchers from ICAR-National Rice Research Institute (NRRI), Odisha have mapped out the diverse genes in rice that help in disease resistance.

Diseases and findings:

- **Magnaporthe grisea** also known as **rice blast fungus, rice rotten neck, rice seedling blight, blast of rice**, oval leaf spot of

graminea, pitting disease, ryegrass blast, and Johnson spot, is a **plant-pathogenic fungus** that causes a serious disease affecting rice

- By characterising over 150 rice varieties from nine States across the country researchers have identified new markers associated with blast resistance.
- The present study showed that the **rice landraces collected from north-eastern states of India had the highest resistance**.
- The rice varieties also have different resistant/susceptible behaviors under specific ecological conditions.
- Fungicides are very expensive, environmentally harmful and may cause health problems due to unsuitable application.
- The rapid changes in pathogenic virulence represents a constant challenge to the production of current rice immune to blast.
- The fungus causes injuries to the leaves, stems, peduncles, panicles, seeds and even the roots.
- Thus, new generic blast-resistant genes / alleles in rice germplasm such as landraces, wild rice, etc. are always needed.
- The potential threat of crop failure from this disease is very high.
- Other herbs, including **crabgrass** are infected by closely related fungi, that cause their respective hosts almost identical symptoms.

REMDESIVIR

• Why in news?

In response to the 2019–20 Wuhan coronavirus outbreak, Gilead Sciences provided **Remdesivir for a "small number of patients" affected by nCoV-2019** in collaboration with Chinese medical authorities for studying its effects.

The new antiviral agent of Remdesivir (GS-5734), was **developed by Gilead Sciences as a Ebola Virus medicine**, is a new analog nucleotide medication.

It has subsequently been found to show reasonable antiviral activity against more distantly related viruses such as respiratory syncytial virus, Junin virus, Lassa fever virus, and MERS-coronavirus. It may also help protect against Nipah, SARS and Hendra virus infections.

Acute encephalitis syndrome

Why in news?

- Several children died in the Muzaffarpur district of north Bihar, due to Acute Encephalitis Syndrome (AES), which is locally known as **Chamki bukhar (brain fever)**.

Acute encephalitis syndrome

- This is a serious case of **mosquito-borne encephalitis** and is characterized by high fever and brain inflammation.
- In 2006, the WHO coined the term AES to describe a collection of pathogens that seem like one another but are hard to distinguish between them in a messy epidemic.
- Children and young adults are most affected by this disorder and can **result in significant morbidity and mortality**.
- Viruses are the primary causal agents of AES, though bacteria, fungi, parasites, chemicals and toxins may also be present in other samples.
- The major cause of AES in India (ranging from 5% to 35%) is the **Japanese encephalitis virus (JEV)**.
- High fever, omitting, diarrhoea and unconsciousness cause confusion, disorientation, paralysis and/or voice incapability.
- A specific vaccine was not identified, but a country-wide surveillance of the AES was developed in India under the **National Vector Borne Diseases Control Programme** through sites focusing on detecting Japanese encephalitis (JEV).
- The cases of AES in the districts of Muzaffarpur, Bihar and adjacent litchi growing areas were mainly noted in April and June of 2019 especially in children who were under-nourished and had the history of visiting litchi gardens.
- A **link between AES and litchi consumption** has been postulated in Muzaffarpur case by the National Center for Disease Control of Delhi (along with the Center for Disease Control, US).
- Unripe litchi contains the **toxins hypoglycin A (natural amino acid) and MCG** that, when ingested in large quantities, cause vomiting.
- **High summer temperatures and the humidity** are considered to be the best situation for the outbreak of AES.

Genome sequencing

Why in news?

- In the form of an indigenous genetic mapping project, the Council for Scientific and Industrial Research (CSIR) will sequence almost 1,000 rural young people from all over the world.

What is the sequence of genomes?

- **Genome:** It is a complete set of DNA of an organism including all its genes.
- All information necessary to construct and maintain that organism is contained in each genome.
- Genome sequencing is figuring out the order of DNA nucleotides, or bases, in a genome—the order of As, Cs, Gs, and Ts that make up an organism's DNA.
- The **human genome is made up of over 3 billion of these genetic letters**.

What is the approach?

- Blood samples are used for sequencing.
- A report shall be given to each individual whose genomes are sequenced.
- It would be revealed to participants if they bear gene variants that made them less susceptible to certain therapeutic types. For example, having a certain gene reduces susceptibility to clopidogrel, a major medicine that prevents strokes and heart attack.
- It will help to map the demographic composition and help to measure the distribution of different traits or diseases across the country.
- Assists in mapping genetic traits in population and genetics.

Eugenics

Why in news?

With regards to its use and misuse.

What is it?

- Eugenics is the study to deliberately align individuals with different genetic features to improve the population.
- It aims at **reducing human suffering through the "selective out production"** of diseases, disabilities and so-called unwanted human population characteristics.
- Eugenics promoted the breeding and prevention of mentally challenged people.
- **Contemporary eugenics also called human genetic modification**, has been clinically and

ethically further forwarded which offers hope of cure of many of the crippling diseases but still controversial.

- A major criticism of eugenics policies is that they are **susceptible to abuse, irrespective of whether negative or positive** policies are being used, as criteria of genetic selections are identified.
- In particular, negative eugenics, which **include the right to reproduce**, are **criticized by many as a breach of basic human rights**.
- Another concern is that eugenics programs inevitably result in a loss of genetic diversity and thus a loss of genetic diversity inbreeding depression.
- Another criticism is that it is designed to disrupt millions of years of evolution permanently and artificially and that attempting to create 'clean' genetic lines of disorders could have a far-reaching downstream impact on genetic ecology, including negative immunity and resilience of the species.

Pollinator protection

Why in news?

Recent reports have shown that pollinators are under threat and need adequate protection.

More information

- Pollination is an essential process for the reproduction of the flowering plants, involving the transfer of pollen grain from the anther (or male part) or from a similar stigma (or female part).
- The fertilized egg cells are converted into seeds which are then distributed around various fruit and vegetables.
- It's essential not only for mankind but also for crops.

Importance of pollinators:

- Pollinators are vital for creating and maintaining the habitats and ecosystems that many animals rely on for food and shelter.
- Worldwide, over half the diet of fats and oils comes from crops pollinated by animals.
- They facilitate the reproduction in 90% of the world's flowering plants.

Reasons for disappearance of pollinators:

- The disappearance of moths, bees, butterflies and other pollinators is unmistakably related to human activities: vast natural habitats have been cleared up for monocultures while the use of pesticides and fertilizers sucks out the little helpers in existence.
- Researchers at the University of Calcutta have shown that native Indian bees suffer from memory and olfactory (smellless), lower levels of reaction, and the oxidative stress that kills cells, when subjected to several pesticides.
- Researchers in Kashmir have pinned the declining frequency of bee visitors which in turn reduces apple trees yield.
- Lowering mustard crop yields in northern India is attributed to the loss of pollinators.

Vaccine hesitancy

Why in news?

- WHO has reported that vaccine hesitancy is one the foremost threats to global health.

What is it?

- WHO describes vaccine resistance as a pause in approval or denial of vaccinations.
- In more than 90% of countries worldwide, vaccine resistance has been registered.
- In 2019, nearly 4,24,000 children worldwide reported measles compared to 1,73,000 in 2018.

How to combat it?

- Certain countries have implemented special penalties for vaccine hesitant families.
- For unvaccinated children, France has made vaccination compulsory with 11 vaccines and unvaccinated children can not enroll in schools or nurseries.
- The manufacturer of vaccines may provide honest information on the side effects of the robust safety system and provide reassurance.
- FAQs relating to vaccination and the benefits, health and immune aspects of vaccines can be provided and doctors and patients with a variety of on-line services can be connected.
- Google, Facebook and others such as these can be asked to ensure that users can view only trustworthy science-based vaccine information.
- Collaborative efforts between pediatricians, family physicians, caregivers, public health

agencies, legislatures, technological companies and civil society can dispel vaccine misconceptions and misinformation.

Oxytocin

Why in news?

- A ban has been called for the usage of oxytocin.

What is oxytocin?

- It is also known for its love-creating effect in the human body and the women's reproductive and biological function, hence **called love hormone** or hug hormone.
- It is produced in the hypothalamus of the brain and secreted by the Pituitary gland.
- It is also a neurotransmitter and a hormone.
- During conception and breastfeeding it plays a vital role.
- Ban has been called because of its effect on uterus contractions and lactation.
- Use of it seemed inappropriate for the dairy industry.
- It is also overused in the steroid industry.
- The High Court of Delhi quashed the Notification of the Centre of 14 December 2018, which forbade sales by private manufacturers and retail chemists, stating that sales were permitted.
- The drug **could only be produced by Karnataka Antibiotics and Pharmaceuticals limited (KAPL)** since no other public sector company exists.
- The revised order was also abrogated by the Delhi High Court. Against the high court order of Delhi, the Central Government moved the Supreme Court.

Artificial intelligence in TB

Why in news?

- In order to explore the use of artificial information technology for treating tuberculosis (TB), the Ministry of Health has signed a MoU with the Wadhvani Institute of Artificial Intelligence.

About

- The **Revised National TB Control Program (RNTCP)** is being revamped and aims to incorporate AI technology for fast tuberculosis fighting.
- RNTCP is the Government of India's state-run tuberculosis (TB) treatment programme.

- Wadhvani AI would support the national tuberculosis program as part of the collaboration, helping it to become AI-ready and to develop, pilot and deploy AI-based solutions.
- It is developing new screening methods and diagnostic approaches as India plans to **end tuberculosis by 2025**.
- Tuberculosis (TB) is an infectious disease caused usually due to Mycobacterium tuberculosis (MTB) bacteria.
- Tuberculosis though typically affects the lungs, it also affects other parts of the body.
- According to the World Health Office (WHO), India has almost 27 lakh cases of tuberculosis annually and 4.23 lakh people are killed (2016).

Vector borne disease

Why in news?

Growth of these diseases is a cause of concern.

What are these?

- Vector-borne diseases are human diseases caused by vector-borne parasites, viruses, and bacteria.
- They are living organisms that can transmit infectious diseases from or to humans and are insects such as mosquitoes, flies, ticks, bugs and so on.
- About **17 percent of all infectious diseases are significant vector-borne diseases**.
- In tropical and subtropical areas, the burden of these diseases is highest and it has a disproportionate impact on the poorest population.
- The world's **fastest growing vector-borne disease is dengue fever**, together with related dengue haemorrhagic fever (DHF).
- Every year, malaria kills over 400,000 people around the world, most of them children, under the age of 5.
- Hundreds of millions of people globally are infected through other illnesses such as Chagas disease, leishmaniasis and schistosomiasis.

Different diseases and their vectors:

- **Mosquitoes - (Aedes)** cause Chikungunya, Dengue fever, Lymphatic filariasis, Rift Valley fever, Yellow fever, Zika.
- **Mosquitoes - (Anopheles)** cause Malaria, Lymphatic filariasis.

- **Mosquitoes- (Culex)** cause Japanese encephalitis, Lymphatic filariasis, West Nile fever.
- **Sandflies** cause Leishmaniasis, Sandfly fever.
- **Triatomine bugs** cause Chagas disease (American trypanosomiasis).
- **Tsetse flies** cause Sleeping sickness (African trypanosomiasis).
- **Fleas** cause Plague (transmitted by fleas from rats to humans) and Rickettsiosis.

Changes in agricultural practices due to variation in temperature and rainfall can affect the transmission of vector-borne diseases. The growth of urban slums, lacking reliable piped water or adequate solid waste management, can render large populations in towns and cities at risk of viral diseases spread by mosquitoes.

GM Aedes Aegypti

- **Why in news?**
 - GM version of Aedes Aegypti plans to be released to control certain diseases.
- GM mosquito**
- The technology uses genetically modified **male Aedes aegypti mosquitoes** that carry a dominant lethal gene.
 - When this male GM mosquitoes' mate with wild female mosquitoes the lethal gene is passed on to offspring.
 - The lethal gene in the offspring kills the larvae before they reach adulthood.
 - **Male mosquitoes do not bite humans, the release of GM males will not increase the risk of dengue, chikungunya and Zika.**
 - Vector control using A. aegypti infected with the **bacterium Wolbachia** is achieved by using the life-shortening bacteria strain in both male and female mosquitoes.
 - As Wolbachia is maternally inherited, the bacteria are anyway passed onto offspring.
 - **Dengue, Zika or chikungunya viruses cannot replicate when mosquitoes have Wolbachia.**
 - A feature of Wolbachia is that it is self-sustaining, making it a low-cost intervention.

Hepatitis B

Why in news?

On September 3, 2019 **Bangladesh, Bhutan, Nepal and Thailand** became the first four countries in the WHO's Southeast Asia region to have successfully controlled hepatitis B.

What is this disease?

- Hepatitis is an **inflammation of the liver**.
- The condition can be self-limiting or can progress to fibrosis (scarring), cirrhosis or liver cancer.
- Though Hepatitis viruses are the most common cause of hepatitis in the world, other infections, toxic substances like alcohol, certain drugs and autoimmune diseases can also cause hepatitis.
- There are **5 main hepatitis viruses**, referred to as types A, B, C, D and E.
- **Hepatitis A virus (HAV)** is present in the faeces of infected persons and is most often transmitted through consumption of contaminated water or food. Certain sex practices can also spread HAV. HAV infections can also be severe and life threatening.
- **Hepatitis B virus (HBV)** is transmitted through exposure to infectious blood, semen, and other body fluids, contaminated injections during medical procedures, and through injection drug use. HBV can be transmitted from infected mothers to infants at the time of birth or from family members to infants in early childhood. **Safe and effective vaccines are available** to prevent HBV.
- **Hepatitis C virus (HCV)** is mostly transmitted through exposure to infectious blood. Sexual transmission is also possible, but is much less common. **There is no vaccine for HCV.**
- **Hepatitis D virus (HDV)** infections **occur only in those who are infected with HBV**. The dual infection of HDV and HBV can result in a more serious disease and worse outcome. **Hepatitis B vaccines provide protection from HDV infection.**
- **Hepatitis E virus (HEV)** is mostly transmitted through consumption of contaminated water or food. **Safe and effective vaccines** have been developed but are not widely available.

Avian Influenza

Why in news?

India has been declared free from Avian Influenza (H5N1).

What is this disease?

- Avian influenza is a highly infectious viral disease which affects a number of food producing bird species (chickens, turkeys, quails, guinea fowl, etc.), pet and wild birds.
- Mammals, including **humans, may occasionally get infected.**
- This is a **poultry fatal virus** and can lead to widespread deaths.
- There are four types of influenza viruses: A, B, C and D.
- Human influenza A and B viruses cause seasonal epidemics of disease (known as the flu season).
- **Influenza A viruses are the only influenza viruses known to cause flu pandemics, i.e., global epidemics of flu disease.**
- Influenza type C infections generally cause mild illness and are not thought to cause human flu epidemics.
- Influenza D viruses primarily affect cattle and are not known to infect or cause illness in people.
- **Influenza A viruses are divided into subtypes based on two proteins on the surface of the virus: hemagglutinin (H) and neuraminidase (N).**
- There are 18 different hemagglutinin subtypes and 11 different neuraminidase subtypes (H1 through H18 and N1 through N11, respectively).
- Current subtypes of influenza A viruses that routinely circulate in people include: A(H1N1) and A(H3N2).
- **A(H5N1) is a virus that occurs primarily in birds.**

Prevention:

- Influenza is the only respiratory virus preventable by vaccination. The inactivated vaccine can prevent influenza illnesses and their complications when given before exposure to the virus. The protection against disease outbreaks requires strict biosecurity measures and good health.

Bombay blood group**Why in news?**

- Recently there has been a spike in demand for a rare blood type called Bombay blood group.

About the Bombay blood Group:

- Blood types are divided into four common blood groups under ABO's blood group scheme, i.e. A, B, O, AB.
- Each red blood cell has a surface antigen that helps to determine which group it belongs to.
- Depending upon a person's ABO blood type, the **H antigen** is converted into either the A antigen, B antigen, or both.
- If a person has group O blood, the H antigen remains unmodified.
- Therefore, the **H antigen is present more in blood type O and less in blood type AB.**
- **In the Bombay blood group, individuals have inherited two recessive alleles of the H gene (i.e. their genotype is hh).**
- This means that **there is no antigen H in the RBC of the hh blood group.**
- Dr Y M Bhende **first discovered the rare Bombay blood group in 1952 in Mumbai** (then in Bombay).
- The occurrence of the hh blood type is one in four million worldwide.
- Nevertheless, because of inbreeding and close marriage between groups, the blood type is more prevalent in South Asia than anywhere else.
- In India, between 7,600 and 10,000 people are born of this kind.
- Because of the rare hh blood type, patients experience blood transfusion problems, which often lead to death.
- **Individuals with the blood group of Bombay can only transfuse blood from people with a very unusual Bombay hh phenotype.**
- This is **not usually stored in blood banks**, particularly because it is rare and **blood shelf-life is 35-42 days.**
- Hh blood group, on the other hand, can donate their blood on ABO blood types.

Hydrogels with tunable bacterial activities**Why in news?**

- Recently, researchers at the Indian Association for the Cultivation of Science (IACS), Kolkata has fabricated Hydrogels which can be tuned with different bacteria-killing properties.

The concept

- These hydrogels were manufactured or mixed in the **presence of silver acetate and**

- phenylboronic acid**, when the natural nucleoside molecule cytidine assembled in an hydrogel.
- This hydrogel is **found against Gram-negative bacterial strains such as E.Coli** to show antibacterial activity.
 - The antibacterial activity of Silver Acetate is known, but due to its toxicity it can not be used.
 - However the toxicity was reduced and thus suitable to treat bacterial infections when silver acetate is incorporated in the hydrogel.
 - As the **hydrogel decreases the cell size of the E.coli by the inclusion of metal, its cell membrane gets disrupted, allowing the cellular material to spill.**
 - The silver-acetate hydrogel was not shown to be harmful to natural kidney and red cells.
 - A large number of hydrogels with various bacterial killing properties can be produced by **changing the boronic acid component in Hydrogel.**
 - The property of certain gels or liquids which are dense or viscous and become fluid (thin, less viscous) at time when they are shaken, agitated, sheared or otherwise stretched is called **thixotropy**. For eg, painting quickly disappears and the surface is set as water (or oil) instantly evaporates.

Biofuels

Why in news?

New targets have been set under the national policy of biofuels

What are they?

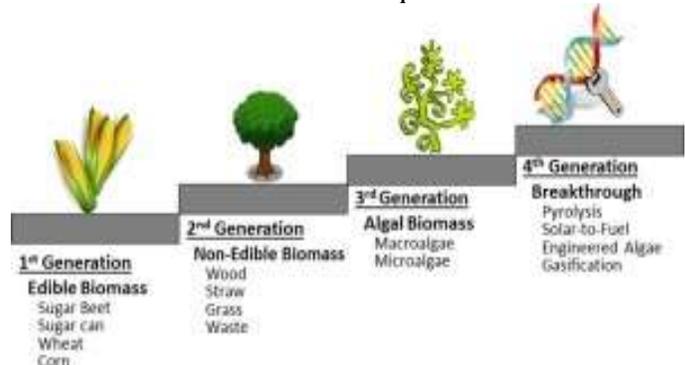
- Biofuels are fuels made directly or indirectly from organic material, such as compost, which includes plant materials and animal waste.
- Overall, around 10 percent of the world's total energy demand is bioenergy.
- Biofuels may be rigid, gaseous or liquid.
- These can also be derived from crop residues, forestry products, farming products etc..

Types

There are **four generations of biofuel:**

- Biofuels of the first generation are also known as **conventional biofuels**. They're made of sugar, starch or vegetable petroleum (all these are food products).

- Non-food crops are used in the production of 2nd generation biofuels.
- Biofuels of second generation are commonly called "**advanced biofuels.**"
- Biofuels of third generation are **algae-based biofuels** which do not require cultivable land.



- Proposed **fourth generation fuels** are extension of third generation algal biofuels which has an added feature of **carbon capture (CO₂) ability.**

Benefits:

- Remove our reliance on fossil fuels, thus reducing our dependence on imports.
- This cleans up the environment with fewer GHG emissions.
- Elements such as discarded cooking oil, municipal waste and other problems will get solved.
- This sector has the potential to create opportunities and provide employment for hundreds of people through different development segments.

New TB vaccine

Why in news?

- On 15 July, 2019, the Indian Council of Medical Research (ICMR) launched the **third-phase trials for an anti-Tuberculosis vaccine** that could be administered to **anybody aged six years and above.**
- Current BCG vaccines are only for neonates.
- The WHO **End TB Strategy** aims at a 95 per cent reduction in TB mortality and a 90 per cent reduction in TB incidence worldwide by 2035.
- Accordingly, there have been 2.8 million tuberculosis cases in the country with 1,47,000 multi-drug resistant TB cases.
- Around 4.23 lakh people are killed and HIV-TB deaths stand at around 87000.

- The **proportion of TB burden in India is 27 percent higher than worldwide.**
- The government pledged to eliminate tuberculosis in this situation by 2025.
- The two vaccine candidates, 'VPM1002', which is produced by the Serum Institute of India, Pune and **MIP (Mycrobacterium Indicus Pranii)** are being worked upon.
- The study would enroll 12,000 healthy household contacts of a patient whose sputum has tested positive for TB and are therefore at high risk of contracting the disease.
- The **trial would be done on patients' contacts from seven sites:** Delhi, Karnataka, Maharashtra, Odisha, Tamil Nadu and Telangana.

Kala azar

Why in news?

- Study warns Kala azar patients can infect others even after treatment and can be a source of infection for others in their community.

What is this disease?

- **Visceral leishmaniasis** is the most severe form of leishmaniasis, and without proper diagnosis and treatment is associated with high fatality.
- It is known by several names **kala-azar, black fever and Dumdum fever.**
- Caused by **protozoan Leishmania**, it first affects the liver, spleen and bone marrow and then migrate to inner organs.
- Fever, lack of weight, tiredness, anaemia and hepatitis and spleen swelling, skin thickening, fatigue etc.. are the signs and symptoms.
- The parasite is **transmitted to humans by the bite of female sand flies.**
- It has been **endemic to four states in India – Bihar, Jharkhand, West Bengal, and Uttar Pradesh.**
- In 2014, the government launched the **Kala Azar Elimination Programme** with support from international agencies which focuses on the four endemic states and has been on the verge of eliminating the disease.

NADA (National Anti-Doping Agency)

Why in news?

BCCI has now agreed to come under NADA.

What is NADA?

- The NADA is the national organisation responsible for **promoting, coordinating, and monitoring the doping control program in sports** in all its forms in India.
- It implements anti-doping rules and policies which conform with the World Anti-Doping Agency, cooperates with other anti-doping organisations and promotes anti-doping research and education.
- It is meant for free competition.
- It is formed by the Union Government under the societies Registration Act, 1890.

Polio

Why in news?

- World polio day was celebrated and the National Polio Program has been started.

What is Polio?

- Polio-myelitis is a **contagious viral disease** that affects mainly small children and is highly infectious.
- It is **primarily spread through a faecal-oral route or less often, a specific medium (eg. infected water or food)** from person to person and multiplies in the intestines from which it can enter the nervous system and cause paralysis.
- At first the disease does not splash in nearly 90 percent of cases.
- But the problem begins and leads to paralysis when the virus enters into the central nervous system which will remain permanently.
- Early signs include fever, exhaustion, cough, diarrhea, neck stiffness and leg pain.
- No cure has been found and early immunization can prevent it.
- **In 2014, India was officially declared polio-free**, along with the rest of the South-East Asia Region.
- On 13 January 2011, West Bengal and Gujarat were India's latest reported cases of wilderness polio.
- The government has incorporated **Inactivated Polio Vaccine(IPV) into its routine immunization program** in order to provide additional protection for infants.
- The main aim behind this ambitious programme is to strengthen the children's

immune system and to provide double protection against polio.

- Until polio is eradicated globally, Oral Polio vaccine(OPV) is still the main preventive measure against polio. Thus, IPV is recommended in addition to OPV and does not replace OPV.
- IPV may be given alone or in combination with other vaccines as an injectable vaccine.
- **For IPV, all three poliovirus forms (type 1, type 2 and type 3) have serum immunity, resulting in paralyzed poliomyelitis defense.**
- India became the first country to incorporate fractional IPV doses in early 2016 into the infant-immunization system in the world.

Lymphatic filariasis

Why in news?

- 'United to Eliminate Lymphatic Filariasis' was inaugurated by the Union Minister for Health and Family Welfare and he signed the 'Call to Action to eliminate Lymphatic Filariasis by 2021'.

What is lymphatic filariasis?

- Lymphatic filariasis, **also called elephantiasis is known as a neglected tropical illness.**
- Effects are impairment of the lymphatic system and excessive growth of the body, causing pain, serious disability and social stigma.
- It is a **vector-borne illness** caused by parasite infection **classified as Filarioidea nematodes (roundworms).**
- 90% of cases are accounted for by **Wuchereria Bancrofti worms.**
- The rest of the remaining cases are caused by **Brugia Malayi and Brugia Timori.**
- Indian government introduced the **Accelerated Lymph Filariasis Elimination Plan (APELF)** in 2018.
- India has scaled up the use of **Triple Drug Therapy (IDA)** in a phased manner from November 2019.
- India have adopted a **twin pillar strategy** - prevention through Mass Drug Administration (MDA) using combination of **2 anti-filarial drugs (DEC and Albendazole)** and providing Morbidity Management and

Disability Prevention (MMDP) services to those affected by the disease.

Anti-biotic resistance in E-Coli

Why in news?

E Coli has been seeming to have developed antibiotic resistance.

What is E coli?

- Escherichia coli is a bacterium that is an important aspect of **human intestinal tract** health.
- **Most E. coli are harmless bacteria** and assist in everyday health but the ones that cause a problem are generally pathogenic, which cause illnesses such as diarrhoea, or even things outside the intestinal functions.
- Usually, the E. coli that causes diarrhoea is transferred through food, water, or contact with animals/people who already have E. coli.
- It enters the body through human or animal feces.

What is antibiotic resistance?

- Antibiotics are **medicines used to treat infections caused by bacteria.**
- Antibiotic Resistance refers to **resistance developed by bacteria against antibiotics or the ability of bacteria to mutate or change** so as to resist the effects of antibiotics.
- Antibiotic resistance occurs naturally, but misuse of antibiotics in humans and animals is accelerating the process.
- It is also accelerated by poor infection prevention and control.
- A growing number of infections – such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis – are becoming harder to treat as the antibiotics used to treat them become less effective.
- Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality.
- WHO has formulated a **“Global action plan on antimicrobial resistance”** in May 2015.
- It has **5 strategic objectives:**
 - To improve awareness and understanding of antimicrobial resistance.
 - To strengthen surveillance and research.
 - To reduce the incidence of infection.
 - To optimize the use of antimicrobial medicines.

To ensure sustainable investment in countering antimicrobial resistance.

Congo fever

Why in news?

Gujarat recently saw a Congo fever case.

About Congo fever:

- It's also called Crimean–Congo hemorrhagic fever (CCHF).
- The virus was first reported in Crimea in 1944, followed by the Congo in Africa in 1969.
- The CCHF virus is typically **spread by tick bites or contact with livestock carrying the disease**.
- Those affected are often farmers or work in slaughterhouses.
- The virus can also **spread between people via body fluids**.
- The infection-causing tick-borne virus is part of the Bunyaviridae family.
- It is considered **endemic in the Middle East, Africa, the Balkans, and Asia**, and is commonly known as the Congo fever.
- Symptoms include mild viral fevers include fatigue, back pain, articular pain, stomach pain, diarrhea, red eyes and high fever.
- Prevention involves avoiding tick bites. Though vaccines are not commercially available, treatment is typically with supportive care. L
- A wide variety of preventive measures, such as wearing protective long sleeve clothing, repellents for the skin, clothing, and quarantining animals before being brought into killing homes, are proposed by the WHO.

E-cigarette or vaping devices

Why in news?

The Union cabinet has approved a total ban on e-cigarettes and vapes in India.

What are these?

- An electronic cigarette (also known as electronic nicotine delivery systems, vaporizer cigarettes, and vape pens) is a **battery-operated device** that emits **doses of vaporized nicotine, or non-nicotine solutions**, for the user to inhale.
- Aims to provide a similar sensation to inhaling tobacco smoke, without the smoke.

- Are sold as aids to reduce or quit smoking.
- It was invented by Hon Lik, a Chinese pharmacist.

How they work:

Most e-cigarettes have:

- a mouthpiece, or cartridge
- a heating element
- a rechargeable battery
- electronic circuits



As the user sucks on the mouthpiece, a sensor activates a heating element that vaporizes a flavored, liquid solution held in the mouthpiece. The person then "vapes," or inhales, the aerosol solution.

The **solution, also known as e-liquid or e-juice**, is made by extracting **nicotine from tobacco and mixing it with a base, usually propylene glycol**, and flavoring. The nicotine content varies from zero to "extra-high," or 24 to 36 milligrams (mg) per milliliter (ml).

Nicotine, what is it?

- Nicotine is an **alkaloid plant which contains nitrogen** and can be grown synthetically on various plant types, including the tobacco plant.
- Nicotine is both sedative as well as stimulant.

BT Cotton

Why in news?

- Recently, a group of farmers was congregated in Akola village in Maharashtra in defiance of government rules to plant seeds of non-approved, genetically modified cotton.

BT Cotton

- BT cotton is genetically modified cotton, and BT cotton remains the only GM crop to be grown in the country.

- The insertion into cotton seeds of both genes, viz "**Cry1Ab**" and "**Cry2Bc**," is developed by the US giant Bayer-Monsanto.
- This change codes the plant to make it resistant to attacks with a protein toxic to **Heliothis bollworm (rosé bollwurm)**.
- In 2002, the government approved the commercial release of this hybrid.
- The Environment Ministry of India is responsible for evaluating the safety of a plant that is genetically modified and determining its suitability for culture by means of the Genetic Engineering Appraisal Committee (GEAC).

Now what's the issue?

- A herbicide tolerant variety of Bt cotton has been planted by the farmers in Akola. This type of variety (Cp4-Epsps) consists of adding another gene, *Agrobacterium tumefaciens*, from another soil bacterium.
- The GEAC does not approve it. The farmers claim that the HtBt species is able to withstand glyphosate spray, a herbicide used to remove weeds, thus saving de-weeding costs significantly.
- Genetic modifications made to plants can cause an insecurity in consumption, adverse human and animal health effects, or cause soil and neighboring plant problems.
- The tests and field trials have to be followed by an elaborate process.
- GM technology critics argue that only after many generations some traits of the genes begin to express themselves, and so we can never be certain of their safety.
- It is a legally punishable offense under the Environmental Protection Act of 1986 for the sale, storage, transport and use of unauthorized GM seeds.
- The sale of unapproved seeds may also be subject to action pursuant to the 1966 Seed Act and the 1957 Cotton Act.

Canine distemper Virus

Why in news?

In a recent study published in Threatened Taxa (TTT), 86% of the dogs had the Canine distemper virus in their bloodstream. These dogs were from the Ranthambhore National Park in Rajasthan.

What's the condition?

- Canine Distemper Virus is a viral disease which infects, especially carnivores in animals' gastrointestinal, airborne and central nervous systems.
- The CDV can be transmitted by direct (licking, breathing air, etc.) and/or indirect (bedding, toys, food bowls etc.) touch.
- Its continuity is demonstrated by its predominant inhalation.
- No cure is available and by immunization it may be prevented.
- It was also seen in the Gir National Park, which led to the death of several Lions.

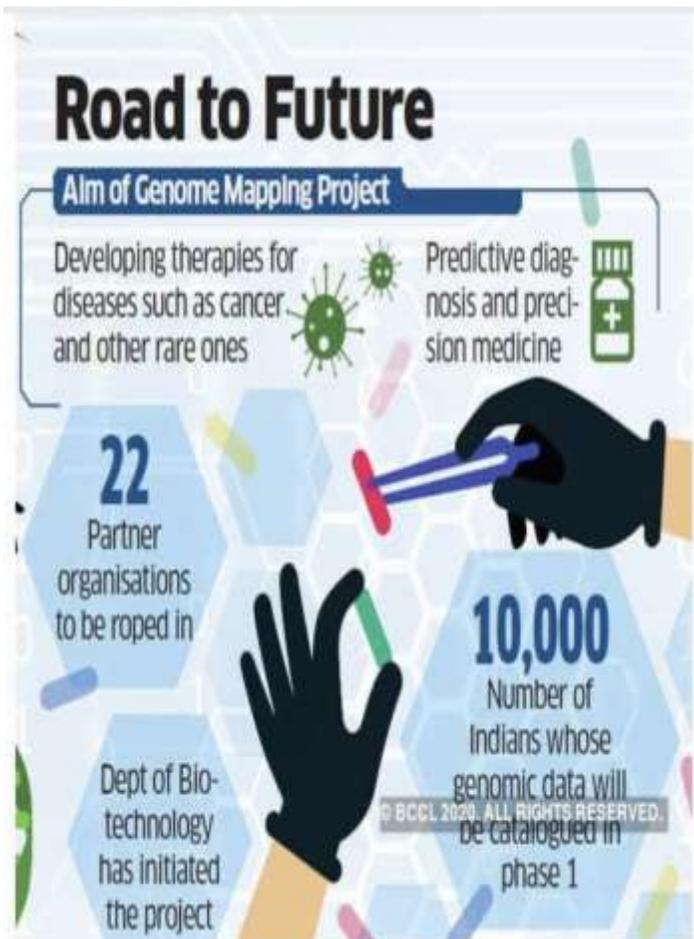
Genome India Initiative

Why in news?

- The Biotechnology Department (DBT) aims to study almost 20,000 Indian genomes in a two-phase experiment over the next five years to develop diagnostic tests that can be extended to cancer.

What is this initiative?

- The first phase involves the sequencing of the entire genomes of almost **10,000 Indians** from across the country and capturing India's biological diversity.
- DBT will capture data from more than 10,000 people over the next three years and link them to its bio banks and biorepository.
- The genomes of **10,000 "diseased persons"** would be sequenced in the next phase. Data on human sequencing would be accessible to researchers through a proposed **National Biological Data Centre** envisaged in **Biological Data Storage, Access and Sharing Policy**.
- Ever since the human genome was first sequenced in 2003, it opened a fresh perspective on the link between disease and the unique genetic make-up of each individual.
- The produced data would be available for study to researchers everywhere.



- As the genetic environment varies throughout the globe, genetic data must be exchanged to gain more insights from research and support the purpose of optimizing patient outcomes.
- The initiative will aim **to make predictive diagnostic markers available for some priority diseases such as cancer** and other rare and genetic disorders
- Nearly 10,000 diseases - including cystic fibrosis, thalassemia are known to be the result of a single gene malfunctioning. The initiative will **pave the way to classify genes and genetic variations for common diseases, to treat Mendelian disorders** and to allow the precise medicine environment to be transformed in India.

Rota virus

Why in news?

- The Ministry of Health drew up an ambitious plan with a 100-day agenda to offer each infant rotavirus vaccine throughout all States and Union Territories by September 2019.
- The **Rotavac vaccine has been developed indigenously** by the Ministries of Science,

Technology and Health and Family Welfare under public-private partnership (PPP).

What is Rota Virus?

- Rotavirus is the leading cause of extreme diarrhoea and death of children under the age of five, up to 10 percent every year of overall infant mortality.
- The virus is **transmitted by the faecal-oral route**.
- It infects and damages the cells that line the small intestine and causes gastroenteritis.
- Nausea, cramps, cough and cold, running nose, dehydration are symptoms.
- In adults there are usually no symptoms and it is highly contagious in nature.
- Rotavirus diarrhoea presents in a similar manner like any other diarrhoea but can mainly be prevented through rotavirus vaccination.
- Other diarrhoea can be prevented through general measures like good hygiene, frequent hand washing, safe water and safe food consumption, exclusive breastfeeding and vitamin A supplementation.
- Three doses of Rotavirus vaccine (RV) has been included in the Universal Immunization Programme (UIP).

Organoids

Why in news?

- Organoids are the so-called 'brains in a bowl' that neuroscientists produce in laboratories.

What are organoids?

- These are **essentially organs developed in a laboratory** or they are a collection of cells that have been produced in laboratories into **three-dimensional, miniature structures** that replicate the cell structure of the entire organ.
- Although small in size, the maturity of an organ is reached quite early.
- These only include cells but not other features such as blood vessels, etc.

How are organoids produced in the laboratory?

- They are grown in the lab with stem cells, which can be one of the specific cells in the human body or cells induced to behave like stem cells, scientifically known as **induced pluripotent stem cells (iPSC)**, from organ and adult cells.

- Nutrients and other unique molecules are given for stem cells to grow and become cells identical to a certain organ.
- The developing cells can assemble themselves into the cell structures of a given organ and can partly reproduce the complex functions of mature organs via **physiological regeneration process**.
- The laboratory has already developed organoids from the brain, small intestines, kidneys, heart, stomach, eyes, liver, pancreas, prostate, salivary glands and interior ears.

How have organoids helped in our understanding of diseases?

- Researchers have used brain organoids for research into how the Zika virus affects embryo brain development.
- Organoids can be used to research the safety and effectiveness of new medications and also to check tissue reaction to current medications.
- Organoids will bring precision medicine closer to reality by developing treatment strategies for individual patients by studying which drugs the patient is most susceptible to.

What are the ethical challenges of growing organoids?

- Scientists argue that organoids have no sensory inputs and that sensory connections are limited from the brain. Isolated brain regions can not interact or produce motor impulses with other brain regions. Therefore, the likelihood of consciousness or other perceptive property of higher order [like the ability to feel trouble] remains extremely remote.

Nano pharmaceuticals

Why in news?

- Evaluation recommendations created by DBT, ICMR and Center Drug Standard Control Organization (CDSCO) for nano-pharmaceuticals in India have been released.

What are Nano-pharmaceuticals?

- An area where the **sizes of drug particles or therapeutic delivery systems function in a nanoscale** is the emergent field of nanopharmaceuticals.
- They come from the use of nanotechnology in medical therapy.

- The **limitation of conventional therapeutics**, which allows the targeting of active agents at the specific site of illness, is being solved by nanopharmaceuticals.
- Such nanopharmaceutical precision targets **minimize toxic systemic side effects** which lead to improved patient adherence.

Benefits: It brings a revolution in treatment strategies as drugs and therapeutic molecules are delivered specifically. In many conditions of disease, they offer greater efficacy and less toxicity. Particularly in cancer treatment they will be very useful.

The guiding principles cover all aspects of testing from identifying and categorizing nanopharmaceuticals to the current clinical collection of pharmacovigilance. It will give new and more affordable innovators and drug manufacturers an important boost to optimize their research and develop medicines.

Typhoid conjugate vaccine

Why in news?

- Bharat Biotech has developed a typhoid (**Typbar TCV**) vaccine that is better able to prevent typhoid fever than commonly used vaccines.

What is typhoid?

- Food and water infected by bacteria **Salmonella Typhi (S. typhi)** are responsible for typhoid fever.
- Fever, fatigue, diarrhea, loss of appetite, constipation are the symptoms of the disease.
- The severity of the illness varies and serious cases can lead to serious complications or even death.
- The WHO notes that in children below two years of age a large proportion of cases of severe typhoid fever exist.

The vaccine

- Typbar TCV vaccine is a type of **conjugate vaccine** that was pre qualified by the **Strategic Advisory Group of Immunization Experts (WHO-SAGE)** of the WHO.

Traditional medicine

Why in news?

- In today's context, AYUSH indicated the relevance of this method.

Concept:

- The system comes from traditional texts and cultural heritage and presents a healthy method to cure diseases.
- Subject to the growing challenges of Non-communicable Diseases (NCDs), lifestyle disorders, long term diseases, and multidrug resistant diseases, importance and demand for yoga, ayurveda, homeopathy, siddha and unani are growing.
- **Steps taken by government to restore it are:**

AYUSH defense wings and train hospitals are being developed.

Strategy to promote effective cross-learning and equitable interaction between new and conventional programs. Provision for the integration of both systems at all levels of education, research and practice.

Including training in modern medicine for AYUSH practitioners through curriculum changes and vice versa.

Soft loans and funding to set up private clinics and AYUSH hospitals.

Building institutes in teaching and research excellence in AYUSH which would enhance traditional medicine's credibility and awareness.

12,500 health centers and wellness centers are expected to be built under the Ayushman Bharat Mission.

The relative strengths, weaknesses, and function of each system should be delineated.

AYUSH practices, training quality and administrative should be standardized. Specific issues related to AYUSH analysis methods should be discussed.

India could learn from the example of Chinese integration with western medicine. A smooth transition through medium-and long-term strategy should be expeditiously implemented to take into account significant push which is already underway in the world towards universal health care.

Through India, the subordinated status of AYUSH can be addressed and its legitimate inclusion in mainstream health services promoted.

AMBIS (automated multi modal biometric identification system)

Why in news?

- **Maharashtra** became the first state in the police investigation to implement the AMBIS.

What is AMBIS?

- An **AMBIS device includes a computer device, camera and iris, fingerprint and palm scanner.**
- It is a **facial recognition technology application.**
- This contains also a **handheld device** for scraping residue and collecting fingerprints from scenes of crime.
- AMBIS (with CCTV facial recognition) enables the police to cross criminals whose fingerprints, apart from the fresh crimes, have been captured on paper over the decades.
- **AMBIS is an up-to-date variant of the AFIS**, which Indian law enforcement agencies have been able to use for quest for fingerprints and palm prints.
- AFIS has minimal utility and offers one-to - one fingerprint matches only in contrast to AMBIS **multimodal matches.**

Penicillin to fight rheumatic fever

Why in news?

- The government plans to resurrect penicillin in order to combat rheumatic fever.

What is rheumatic fever?

- It is an **endemic disease in India.**
- It is a disease that can affect the heart, joints, brain, and skin.
- Rheumatic fever can develop if strep throat and scarlet fever infections are not treated properly.
- Bacteria called **group A Streptococcus or group A strep** cause strep throat and scarlet fever.
- Rheumatic fever is thought to be caused by a response of the body's defense system — the immune system.
- The **immune system responds to the earlier strep throat or scarlet fever infection and causes a generalized inflammatory response.**
- Though **it's not contagious**, people with strep throat or scarlet fever can spread group A strep

to others, primarily through respiratory droplets.

- Common signs and symptoms are Fever, painful and tender joints (arthritis), most commonly in the knees, ankles, elbows, and wrists, fatigue and in some cases a red rash.
- It is more common in school-age children (5 through 15 years old).
- India has a high rheumatic fever burden and rheumatic disease, which often goes undiagnosed and contributes to multiple maternal deaths at birth.
- Penicillin tends to reduce the rheumatic fever attack rate by as much as 80%.

Measles

Why in news?

- After spending three years free from new cases of measles, Sri Lanka has been declared Measles free by the WHO.

What's the problem?

- Measles is a viral disease of contagion which is a major cause of death for young children worldwide despite the availability of a safe and effective vaccine.
- Measles is transmitted via droplets from the nose, mouth or throat of infected persons.
- Initial symptoms, which usually appear 10–12 days after infection, include high fever, a runny nose and tiny white spots on the inside of the mouth.
- Several days later, a rash develops, starting on the face and upper neck and gradually spreading downwards.
- Severe measles is more likely among poorly nourished young children, especially those with insufficient vitamin A or whose immune systems have been weakened by HIV/AIDS or other diseases.
- Blindness, encephalitis, severe diarrhea and corresponding dehydration, and severe respiratory infections like pneumonia are all serious complications.
- In conjunction with mass immunization programs in normal low-coverage areas, compulsory infant measles vaccination is a vital public health policy for reducing worldwide measles mortality.

National institute for Sowa Rigpa

Why in news?

- The Union Cabinet has approved the establishment in Leh, Union Territory of Ladakh, the National Institute of Sowa Rigpa (NISR).

What is Sowa Rigpa?

- Sowa-Rigpa (healing science) is a **traditional medicinal system coming from India's Himalayan belt**, which is still in practice.
- It was **established in Tibet** and has been practiced popularly in countries such as India, Nepal, Bhutan, Mongolia and Russia.
- The father of Sowa Rigpa is said to be Yuthog Yonten Gonpo from Tibet.
- It is practiced in extreme parts of the north east of India, starting from the Ladakh region.
- Sowa-Rigpa's theory and practice is similar to Ayurveda.

Upcoming institute

- In partnership with national and international institutes, it will be under the **ministry of AYUSH**.
- It will act as a Sowa-Rigpa framework apex centre.
- This establishes synergies between the existing institutions of Sowa Rigpa, namely the Central Tibetan Studies University, Varanasi and the central Buddhist studies Institute at Leh.
- Under the Ministry of Culture, current Sowa-Rigpa institutions operate.
- It will also help to revive Sowa-Rigpa and associate the Sowa-Rigpa's traditional knowledge with modern science, technology and instruments.

National Genomic Grid (NGG)

Why in news?

- The government recently announced that the national genome grid would be setup.

What is this?

- It will study genomic data from Indian cancer patients.
- The **project will collect samples from cancer patients with their permission** by bringing all cancer treatment institutions on board through a network of pan-Indian collection centres.

- The grid to be developed will be consistent with the National Cancer Tissue Biobank (NCTB) established at the Indian Technology Institute in Madras.

NCTB

- The **Department of Sciences and Technology (DDST), the Government of India and the Indian Institute of Technology, Madras**, are joint initiatives for National Cancer Tissue Biobank (NCTB).
- The samples collected will aid in cancer research, diagnosis, treatment, etc.
- This research is conducted by the genome sequencing technique.
- The Government **aims to** improve cancer research and make treatment feasible for individuals of various economic groups through the National Genomic Grid.
- **NGG aims to research cancer-related genetic factors** and determines the appropriate approach to care for the Indian population.

Controlled human infection model

Why in news?

- The Department of Biotechnology (DBT) proposed to use the Controlled Human Infection Model (CHIM) to develop new influenza vaccines.

What is CHIM?

- CHIM method is used in volunteers' approach which encourages them to engage in expert supervision trials when their volunteers are contaminated.
- The vaccines that are used here are composed of virus-related diseases and injected into the body to coax the immune system in the preparation of antibodies.
- This concept can help in the development of clinical research.
- Earlier it was also used for Typhoid.

Secretagogin

Why in news?

- The role of **Secretagogin Protein (SCGN) in increasing insulin action in diabetes induced by obesity** has been demonstrated recently by scientists.

What is this?

- SCGN is currently established as a therapeutic diabetes functional insulin-binding protein.
- SCGN binds and protects insulin against different stresses, enhances its stability and increases its action.
- SCGN is **found in lower quantities in the brains of Alzheimer's patients.**

E 2020 initiative

Why in news?

- According to the WHO, **no endogenous malaria cases reported in 2018 by four countries from Asia— China, Iran, Malaysia and Timor-Leste — and one from Central America— El Salvador.**
- Such countries were included in the E-2020 campaign initiated by the WHO in 2016, focusing on **efforts to reduce malaria by 2020 in 21 countries** spread across five continents.

What is the E-2020?

- This is a new strategy used by the new Global Order, which was pioneered by the WHO to eradicate malaria in the span of 15 years by monitoring milestones on their path towards success.
- The countries were chosen based on three criteria: (1) trends in cases (2) incidences of a country (3) informed expert opinion in that industry.
- Together these 21 malaria-exterminating countries are part of an effort to eliminate malaria within ambitious but technically feasible achievable timeframes, known as the E-2020 initiative, supported by the WHO and other partners.
- Malaria is India's leading death cause and recorded 4 lakh deaths in 2017.
- However, in 2017, India reported success on its cases of malaria with 24 percent decrease in cases from 2016.

AWaRe

Why in news?

- WHO is releasing a tool called AWaRe for safer use and resistance to curbing antibiotics.

What's the new instrument?

- The **online tool** is intended to **direct lawmakers and others involved in public**

health to use antibiotics safely and efficiently.

- This **classifies antibiotics into three different groups, known as 'AWaRe,'** i.e., **Access**, antibiotics that treat the most severe and serious infections, **Watch**, antibiotics in the healthcare system available at all times and **Reserve**, antibiotics to use only as a last resort, sparingly or conservingly.
- Antimicrobial resistance has become an "**invisible pandemic**," as infections that can not be treated by all types of antibiotics emerge.
- To ensure that we are still able to treat and prevent serious diseases in the absence of the development of new medicines, we must safeguard these precious last-line antibiotics."

Dolutegravir (DTG)

Why in news?

- WHO has recommended the use of HIV drug DTG as first and second-line therapy for people, including pregnant women.

About the drug:

The antiretroviral drug, used together with other drugs to treat HIV / AIDS is Dolutegravir (DTG), marketed under the **brand name Tivicay**.

Initial study discoveries of a possible link in infants born to women using the medicines were made between DTG and neural tube defects (cerebral and spinal cord birth defects).

However, new studies have shown that DTG is more safe, more easy to take and less of an adverse compound.

The transition to DTG-based care for HIV in 2019 is recorded in 82 low and middle-income countries.