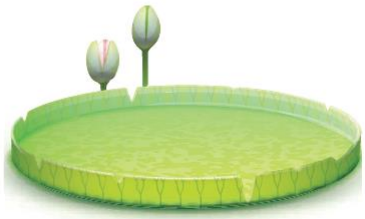
CAVE OF LEARNING'S

BIOLOGY

DO YOU KNOW COMPILATION

FOR TNPSC | TRB | SI EXAMS

Victoria amazonica, the leaves of this plant grow up to 3 metres across. A mature Victoria leaf can support an evenly distributed Load of 45 Kilograms or apparently young person.



Air spaces in stems and petioles of lotus are useful for floating in water

- Nile is the longest river in the world. It is 6650 Km long. The Longest river in India is Ganges River. It is 2525 Km long.

The first land plants appeared around 470 million years ago. They were mosses and liverworts.

The Amazon Rain Forest in South America produces half of the world's oxygen supply.

Fact file

Thar Desert, also called Great Indian Desert, is an arid region of rolling sand hills on the Indian subcontinent. It is located partly in Rajasthan state, north-western India, and partly in Punjab and **Sindh** (**Sind**) provinces, eastern **Pakistan**.

World habitat day is observed on 1st Monday of October.

India is the second largest producer of fruits and vegetables in the world.

Bamboo is one of the fast growing plants, during active growth phase.

When an animal moves its location as the season changes it is said to be **Migration**. In Tamil Nadu Bird Sanctuaries are

located at Vedanthangal, Kodiyakkarai and Koondhankulam. There are many birds from foreign countries like Siberia and Russia migrate to our Vedanthaangal. Likewise during summer and drought conditions birds from our country migrate to foreign countries. These birds are called **Migratory Birds**.

Unicellular Organisms	Multicellular Organisms
• They are made up of single cell. • The single cell of the organism can perform all the functions of life. • These organisms are generally very small (microscopic) in size. • They lack tissues, organs and organ systems. • Growth occurs by an increase in the size of the cell. eg. Amoeba, Paramecium and Euglena.	• They [No Title]ganisms are made up of many cells. • Division of labour exists among cells. Different cells are specialized to perform different functions. • They are mostly large in size. • They are composed of tissues, organs and organ systems. • Growth occurs by an increase in the number of cells by cell division. eg. Earthworms, Fish, Frogs, Lizard and human beings.

Kangaroo rat does not drink water at all. Whatever food it eats and oxygen it gets from air combine together to form water inside the body.

Pala spinach

Osteoarthritis is a joint disease affecting joints and knee in old age and any age people. Currently Indian scientists at CDRI (Central Drug Research Institute – Lucknow) have made a nano formulation from the Palak (Pala spinach) to cure this disease..

Info Bits

- Spending winters in a dormant condition is called **Hibernation**. eg. Turtle
- On the other hand, spending the hot and dry period in an inactive state is known as **Aestivation**. eg. Snail

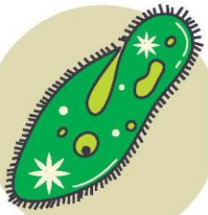
In Jurong Birds Park, Singapore, Penguins are kept in a big glass case with ice bergs and temperature is maintained at 0° C and below.

Penguin

Animals Bio Diversity

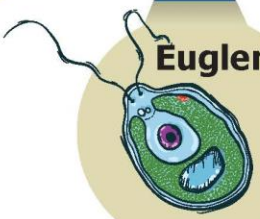
Uni Cellular

Paramecium



Amoeba

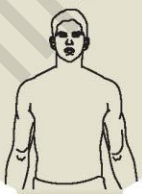
Euglena



Multi Cellular

Tiger

Man



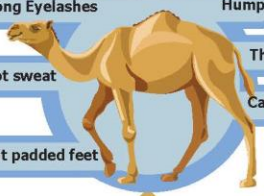
Monkey

Eartworm and Snail

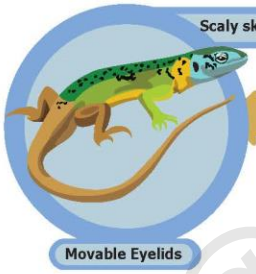
Frog

Fish and pigeon

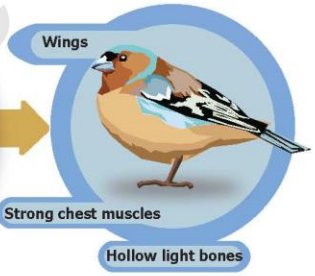
CAMEL



LIZARD

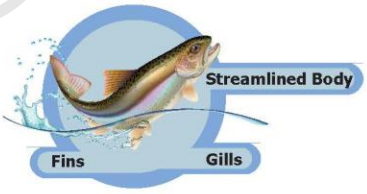


BIRDS



Adaptations

FISH



The mountain goat namely Nilgri Tahr can find small spaces on rock to climb with ease and keep its balance as it feeds.

World Food Day, October-16.

The aim of celebration of this day is to promote worldwide awareness and action for those who suffer from hunger and for the need to ensure food security and nutritious diets for all.

Each year, World Food Day is celebrated by the Food and Agriculture Organization of the United Nations (FAO). World Food Day adopts a different theme each year. Ask your teacher about the theme of this year.

MORE TO KNOW

It is believed that silk was first dicovered in China by the Empress Si Ling Chi

India is the world's second largest producer of Silk.

Kancheepuram, Siruvanthadu, Thirubhuvanam and Arani are famous for silk in Tamil Nadu.

Antonie Van Leeuwenhoek, the first microbiologist designed his own microscope. In 1674, he took plaque from his own teeth and observed it under the microscope. He was astonished to see many tiny organisms moving around, which was otherwise invisible to naked eyes.

Type of Vaccine	Name of the vaccine	Disease
Live attenuated	MMR	Measles, Mumps and Rubella
	BCG (Bacillus Calmette Guerin)	Tuberculosis
Inactivated (Killed antigen)	Inactivated polio virus (IPV)	Polio
Subunit vaccines (Purified antigens)	Hepatitis B vaccine	Hepatitis B
Toxoid (Inactivated antigen)	Tetanus toxoid (TT)	Tetanus
	Ditpheria toxoid	Diptheria

World Health Day – 7th April
World Malaria Day – 25th April
World AIDS Day – 1st December
World Anti -Tuberculosis Day – 24th March

In India, Jute crop is grown in seven states – West Bengal, Assam, Odisha, Bihar, Uttar Pradesh, Tripura and Meghalaya. West Bengal alone accounts for over 50% of raw jute production.

The finely cut wooden boards from the wood are layered one above the other to make plywood. This is a kind of composite wood.

MORE TO KNOW

Pure silk is one of the finest natural fibres and is said to be the **"queen of fibres"**

More to Know

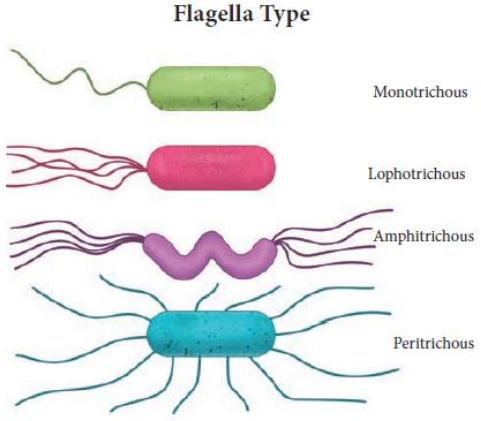
The protein free pathogenic RNA of virus is Viroids. They are found in plant cells and cause disease in plants.

Robert Koch (Father of Bacteriology) is the first German physician to study how pathogens cause diseases. In 1876, he showed that the disease called anthrax of sheep was due to *Bacillus anthracis* which exist in pastures in the form of protective spores. He found the rod shaped bacteria in the blood vessels of infected sheep and came to a conclusion that sheep and cattle came in contact with bacteria while grazing in the pastures.

Plant name	Parts used	Medicinal use
Amla	Fruit	Cure Vitamin 'C" deficiency diseases like Scurvy. Improve immunity.
Tulsi	Leaves, seed	Cough, cold, bronchitis, expectorant.
Aloe	Leaves	Laxative, wound healing, skin burns and ulcer.
Neem	Bark, leaf and seed	Skin diseases
Turmeric	Rhizome	helps body to fight foreign invaders,

MORE TO KNOW

Australian scientists have invented a way of removing wool from Sheep without shearing. The new wool harvest technology is called Bioclip.



Creutzfeldt-Jakob disease (CJD) is a **neurodegenerative disease**. As a result of this disease cerebral cortex is affected and it is characterised by progressive dementia, memory loss, behavioral changes, poor coordination and visual disturbances.

Class of Microorganisms	Type of Microorganism	Antibiotic produced
Bacteria	*Streptomyces griseus*	Streptomycin
	Streptomyces erythreus	Erythromycin
	Bacillus subtilis	Bacitracin
Fungi	*Penicillium notatum*	Penicillin
	Cephalosporium acremonium	Cephalosporin

Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms
Common Cold	*Rhino virus*	Droplet infection	Upper respiratory tract (Inflammation of nasal chamber)	Fever, cough, running nose, sneezing and headache
Influenza	*Myxovirus*	Droplet Infection	Respiratory tract, (Inflammation of nasal mucosa, pharynx)	Fever, body pain, cough, sore throat, nasal discharge, respiratory congestion
Measles	*Rubeola Virus*	Droplet infection, droplet nuclei and direct contact with infected person	Respiratory tract	Eruption of small red spots or rashes in skin, cough, sneezing, redness of eye (conjunctiva), pneumonia, bronchitis
Mumps	*Myxovirus parotidis*	Droplet infection, droplet nuclei and direct contact with infected person	Upper respiratory tract	Enlargement of parotid gland, movement of jaw becomes difficult
Chicken Pox	*Varicella Zoster virus*	Droplet infection, droplet nuclei and direct contact with infected person	Respiratory tract	Eruptions of the skin, fever and uneasiness

Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms	Preventive and Control Measures
Cholera (Acute diarrhoeal disease)	*Vibrio cholerae*	Contaminated food, water, oral route and through houseflies	Intestinal tract	Acute diarrhoea with rice watery stools, vomiting, muscular cramps, nausea and dehydration	Hygienic sanitary condition, intake of Oral Rehydration Solution (ORS)
Typhoid (Enteric fever)	*Salmonella typhi*	Food and water contaminated with faeces of infected person and through houseflies	Small intestine	High fever, weakness, abdominal pain, headache, loss of appetite, rashes on chest and upper abdomen	Preventing contamination of food by flies and dust, improvement of basic sanitation, treatment with antibiotic drugs

Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms
Tuberculosis	*Mycobacterium tuberculosis*	Droplet infection from sputum of infected persons	Lungs	Persistent cough, chest pain, loss of weight and appetite
Diptheria	*Cornyebacterium diphtheriae*	Droplet infection, droplet nuclei	Upper Respiratory tract (nose, throat)	Fever, sore throat, choking of air passage
Whooping Cough	*Bordetalla pertussis*	Droplet infection, direct contact with infected person	Respiratory tract	Mild fever, severe cough ending in whoop (loud crowing inspiration)

More to Know

- Tuberculosis causing bacteria *Mycobacterium tuberculosis* was discovered by Robert Koch.
- Mantoux test: A highly specific tuberculin skin test for detection of tuberculosis.
- National Tuberculosis (TB) control programme was started in 1962.

DO YOU KNOW?

Robert Gallo at National Institute of Health, USA and Luc Montagnier at Pasteur Institute, Paris in 1983 isolated the Human Immunodeficiency Virus (HIV), which causes AIDS.

DO YOU KNOW?

The process of vaccination was introduced by Edward Jenner and according to the World Health Organisation (WHO), Jennerian vaccination has eliminated small pox totally from the human population.

DO YOU KNOW?

No cases of polio reported in India since 13th January 2011. Without reporting any case of polio for three years, WHO declared India as 'Polio-free country' on 13th January 2014.

DO YOU KNOW?

The avian influenza virus A (H5N1) emerged in 1996. It was first identified in Southern China and Hong Kong. The A(H5N1) virus kills a high proportion of the poultry that it infects and is therefore known as a highly pathogenic avian influenza virus. H5N1 was first discovered in humans in 1997 by World Health Organisation. First outbreak was in December 2003.

More to Know

Sphagnum moss was once used in disposable diapers, because it soaks liquid well.

More to Know

Swine flu first surfaced in April 2009. It affected millions of people and then in June 2009 it was declared a pandemic by the World Health Organization (WHO). In 2015, India reportedly had over 31,000 people infected and 1,900 resulting deaths. There was a small outbreak in the Maldives in early 2017. Swine flu has spread to more than twenty countries across the world. World Health Organisation had then assigned pandemic alert level 5 to swine flu. This level indicates that human to human outbreak of swine flu is high.

Know your Scientist

Sir Ronald Ross was an Indian born British doctor who is famous for his work concerning malaria. He worked in the Indian Medical Service for 25 years. He identified the developing stages of malarial parasite in the gastrointestinal tract of mosquito and proved that malaria was transmitted by mosquito. In 1902, he received the Nobel Prize for Physiology or Medicine for his work on the transmission of malaria.

Herbal Facts on Dengue Treatment (Source: AYUSH)

An extraction of tender leaves of papaya and herbal drink Nilavembu Kudineer is given to dengue patients. It is known to increase the blood platelet count.

Know your Scientist

Louis Pasteur was an 18th century French chemist and microbiologist best known for vaccination and pasteurisation. He coined the term vaccine. Pasteur developed vaccine against chicken pox, cholera, anthrax, etc. In 1885 Pasteur administered his first vaccine to a young boy named Joseph Meister who had been repeatedly bitten by rabid dog. The boy was inoculated with less virulent or weakened rabies virus preparations and was saved. He discovered the basis for attenuation, the process of weakening the virulence of pathogenic organisms without losing the capacity to induce immunity.

More to Know

- Cholera caused by *Vibrio cholerae* was first published by Robert Koch.
- Chloragen is a toxin produced by *Vibrio cholerae* causing harmful effects.

More to Know

Acquired Immunodeficiency Syndrome caused by HIV (Human Immunodeficiency Virus), a retrovirus was first recognised in Hatai (USA) in 1981. In India the first confirmed evidence of AIDS infection was reported in April 1986 from Tamil Nadu. The AIDS vaccine RV 144 trial was conducted in Thailand in 2003 and reports were presented in 2011.

More to Know

Polio virus is also called enterovirus. It is primarily an infection of the alimentary tract. The most vulnerable age is between 3-6 years of age. Pulse-polio programme was started in December 1995 in India. India has taken up a massive programme for the eradication of Polio under Pulse Polio Immunisation Programme in which young children are given polio vaccine drops orally.

DO YOU KNOW?

- According to WHO, immunisation currently prevents 2-3 million deaths every year.
- A new vaccine against dengue has been licensed in several countries. In 2018, first vaccine to protect children against malaria will be piloted in three African countries.
- Globally, mortality rate due to measles is reduced by 7 %.

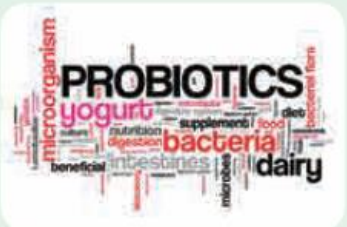
King Cobra

- It is 5.5m long. It is the biggest poisonous snake. A drop of its venom can kill 30 people.
- Except for a few, most of the snakes are non-poisonous.
- Killing of snakes leads to their extinction.

Disease	Causative Organism	Mode of Transmission	Tissue/Organ Affected	Symptoms	Preventive and Control Measures
Poliomyelitis	*Polio virus*	Droplet infection, sputum discharge, secretion from nose, throat, contaminated water, food and milk	Central nervous system	Paralysis of limbs	Salk's vaccine or Oral Polio Vaccine (OPV) is administered
Hepatitis A or Infectious Hepatitis	*Hepatitis A virus (HAV)*	Contaminated water, food and oral route	Inflammation of liver	Nausea, anorexia, acute fever and jaundice	Prevention of food contamination, drinking chlorinated boiled water, personal hygiene
Acute Diarrhoea	*Rotavirus*	Contaminated water, food and oral route	Intestine	Vomiting, fever, watery stools with mucus	Proper sanitation and hygiene

Infectious agent	Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms
Bacteria	Gonorrhoea	*Neisseria gonorrhoea*	Sexual contact	Urethra is affected	Discharge from genital openings, pain during urination
	Syphilis	*Treponema pallidum*	Sexual contact	Minute abrasion on the skin or mucosa, of genital area	Ulceration on genitals, skin eruption
Virus	Genital Herpes	*Herpes Simplex Virus*	Sexual contact, entry through mucous membrane of genital region	Genital organs of male and female individuals	Painful blisters in mouth, lips, face and genital region
	Genital Warts	*Human Papilloma virus*	Sexual contact (skin to skin)	Genital areas of male and female individuals	Vaginal discharge, itching, bleeding and burning

Have you heard about the word "Probiotics"



Probiotic milk products, tooth paste are available in the Market. *Lactobacillus, Bifidobacterium* are used to prepare probiotic yoghurt and tooth paste

- Crocodile is the only living organism that cannot protrude its tongue.
- Anaconda, the world's biggest snake is viviparous. (gives birth to young ones)

Table 1.3: Viral diseases		
Plant diseases	**Animal diseases**	**Human diseases**
1. Tobacco mosaic 2. Cauliflower mosaic 3. Sugarcane mosaic 4. Potato leaf roll 5. Bunchy top of banana 6. Leaf curl of papaya 7. Vein clearing of Lady's finger 8. Rice tungro disease 9. Cucumber mosaic 10. Tomato mosaic disease	1. Foot and mouth disease of cattle 2. Rabies of dog 3. Encephalomyelitis of horse	1. Common cold 2. Hepatitis B 3. Cancer 4. SARS(Severe Acute Respiratory Syndrome) 5. AIDS(Acquired Immuno Deficiency Syndrome) 6. Rabies 7. Mumps 8. Polio 9. Chikungunya 10. Small Pox 11. Chicken pox 12. Measles

Table 1.11: Diseases caused by fungi		
S. No	**Name of the disease**	***Causal organism***
	Plant diseases	
1.	Blast of Paddy	*Magnaporthe grisea*
2.	Red rot of sugarcane	*Colletotrichum falcatum*
3.	Anthracnose of Beans	*Colletotrichum lindemuthianum*
4.	White rust of crucifers	*Albugo candida*
5.	Peach leaf curl	*Taphrina deformans*
6.	Rust of wheat	*Puccinia graminis tritici*
	Human diseases	
1.	Athlete's foot	*Epidermophyton floccosum*
2.	Candidiasis	*Candida albicans*
3.	Coccidioidomycosis	*Coccidioides immitis*
4.	Aspergillosis	*Aspergillus fumigatus*

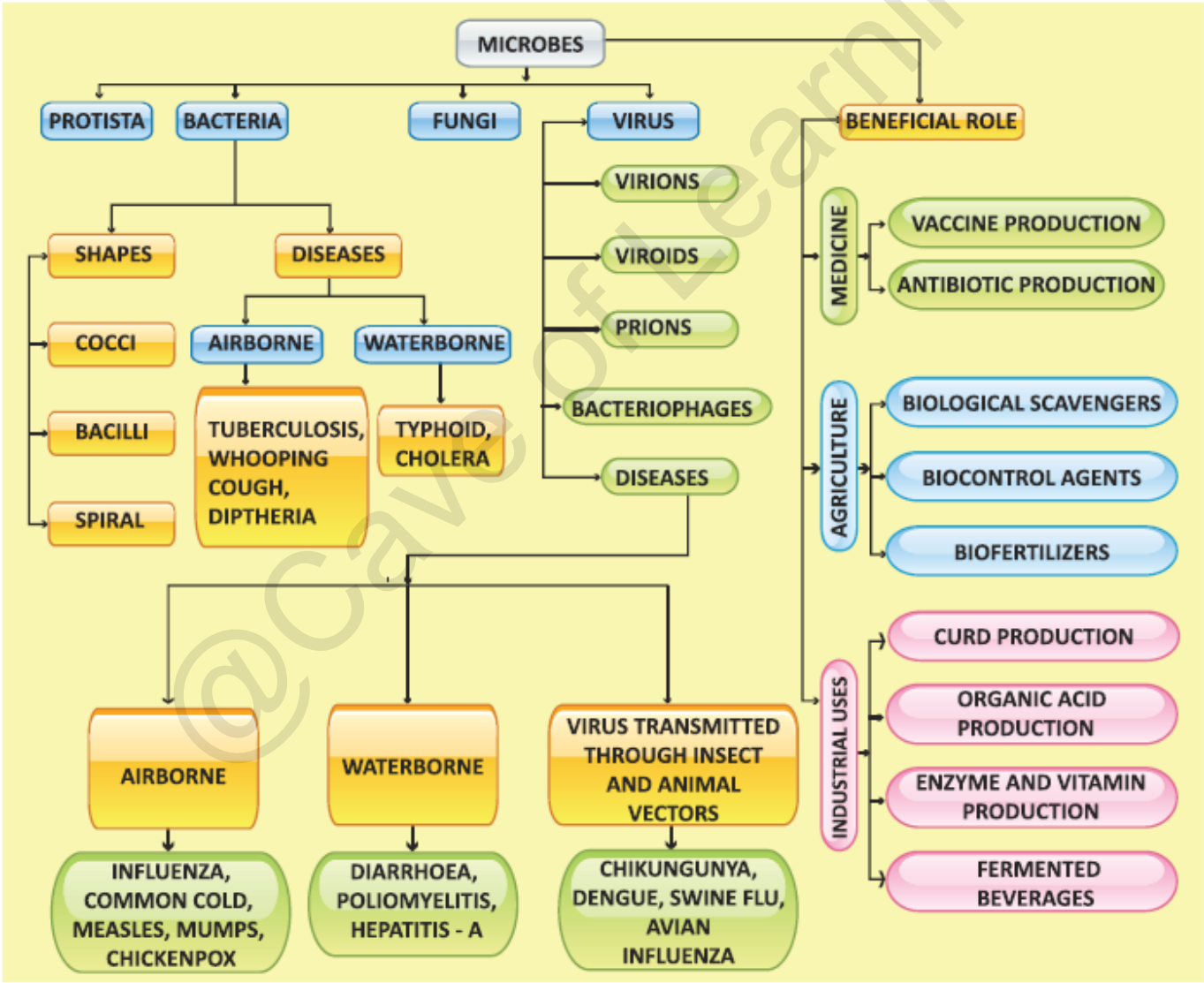
Bacteria forms Biofilms and leads to dental caries and Urinary tract infection (UTI)

Ralstonia synthesize PHB (Poly-β-hydroxybutyrate) a microbial plastic which is biodegradable.

Robert Gallo

In 1984, Robert Gallo discovered HIV which causes AIDS.

Age	Vaccine	Dosage
New born	BCG	1st dose
15 days	Oral Polio	1st dose
6th week	DPT and Polio	1st dose
10th week	DPT and Polio	1st dose
14th week	DPT and Polio	1st dose
9 – 12 months	Measles	1st dose
18 – 24 months	DPT and Polio	1st dose
15 months – 2 years	MMR	1st dose
2 – 3 years	TAB	2 doses at 1 month gap
4 – 6 years	DT and Polio	2nd booster
10th year	TT and TAB	1st dose
16th year	TT and TAB	2nd booster



Visit any museum nearer to your school with your teacher and identify the bones of different animals including mammals. The famous Egmore Museum is in Chennai.

DO YOU KNOW?

Approximate number of cells in the human body is 3.7×10^{13} or 37,000,000,000,000.

Table 1.5: Comparison of Five Kingdoms

Criteria	Kingdom				
	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Level of organization	Unicellular	Unicellular	Multicellular and unicellular	Tissue/organ	Tissue/organ/organ system
Cell wall	Present (made up of Peptidoglycan and Mucopeptides)	Present in some (made up of cellulose), absent in others	Present (made up of chitin or cellulose)	Present (made up of cellulose)	absent
Nutrition	Autotrophic (Phototrophic, Chemoautotrophic) Heterotrophic (parasitic and saprophytic)	Autotrophic-Photosynthetic. Heterotrophic	Heterotrophic-parasitic or Saprophytic	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic)
Motility	Motile or non-motile	Motile or non-motile	Non-motile	Mostly Non-motile	Mostly motile
Organisms	Archaebacteria, Eubacteria, Cyanobacteria, Actinomycetes and Mycoplasma	Chrysophytes, Dinoflagellates, Euglenoids, Slime molds, *Amoeba, Plasmodium, Trypanosoma, Paramecium*	Yeast, Mushrooms and Molds	Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms	Sponges, Invertebrates and Vertebrates

Among the birds, ostrich lays the largest egg. It is almost the size of a coconut.

Humming Bird is the only bird that can fly forwards, backwards and sideways.

Electron microscope was invented by Ernst Ruska and Max Knoll in 1931.

More to know

- *Blue whale is the largest living organism. Its weight is equal to the weight of 22 elephants. Its heart is of a size of a small car.*
- *Dog was the first animal sent to space. Its name was Laika. It was sent by Soviet Russia.*
- *In cows, sweat glands are found on the surface of nose.*
- *Man is the only living animal who can sleep with his back touching the floor.*
- *The trunk of an elephant is the modified form of nose and upper lip. Tusks are the incisors of the elephant.*

Table 1.7: Economic importance of Bacteria		
Beneficial aspects	**Bacteria**	**Role**
1. Soil fertility		
Ammonification	1. *Bacillus ramosus* 2. *Bacillus mycoides*	Convert complex proteins in the dead bodies of plants and animals into ammonia which is later converted into ammonium salt
Nitrification	1. *Nitrobacter* 2. *Nitrosomonas*	Convert ammonium salts into nitrites and nitrates
Nitrogen fixation	1. *Azotobacter* 2. *Clostridium* 3. *Rhizobium*	(i) Converting atmospheric nitrogen into organic nitrogen (ii) The nitrogenous compounds are also oxidized to nitrogen (iii) All these activities of bacteria increase soil fertility
2. Antibiotics		
1. Streptomycin	*Streptomyces griseus*	It's cures urinary infections, tuberculosis, meningitis and pneumonia
2. Aureomycin	*Streptomyces aureofaciens*	It's used as a medicine to treat whooping cough and eye infections
3. Chloromycetin	*Streptomyces venezuelae*	It cure typhoid fever
4. Bacitracin	*Bacillus licheniformis*	It is used to treat syphilis
5. Polymyxin	*Bacillus polymyxa*	It cure some bacterial diseases
3. Industrial Uses		
1. Lactic acid	*Streptococcus lactis* and *Lactobacillus bulgaricus*	Convert milk sugar lactose into lactic acid
2. Butter	*Streptococcus lactis*, *Leuconostoc citrovorum*	Convert milk into butter, cheese, curd and yoghurt
3. cheese	*Lactobacillus acidophobus*, *Lactobacillus lactis*	
4. Curd	*Lactobacillus lactis*	
5. Yoghurt	*Lactobacillus bulgaricus*	
6. Vinegar (Acetic acid)	*Acetobacter aceti*	This bacteria oxidizes ethyl alcohol obtained from molasses by fermentation to vinegar(acetic acid)

7. Alcohol and Acetone (i) Butyl alcohol (ii) Methyl alcohol	*Clostridium acetobutylicum*	Alcohols and acetones are prepared from molasses by fermentation activity of the anaerobic bacterium
8. Retting of fibres	*Clostridium tertium*	The fibres from the fibre yielding plants are separated by the action of *Clostridium* is called **retting of fibres**
9. Vitamins	*Escherichia coli*	Living in the intestine of human beings produce large quantities of vitamin K and vitamin B complex
	Clostridium acetobutylicum	Vitamin B_2 is prepared by the fermentation of sugar
10. Curing of Tea and Tobacco	*Mycococcus candisans, Bacillus megatherium*	The special flavor and aroma of the tea and tobacco are due to fermentation

S.No.	Name of the Host	Name of the disease	Name of the pathogen
1.	Rice	Bacterial blight	*Xanthomonas oryzae*
2.	Apple	Fire blight	*Erwinia amylovora*
3.	Carrot	Soft rot	*Erwinia caratovora*
4.	Citrus	Citrus canker	*Xanthomonas citri*
5.	Cotton	Angular leaf spot	*Xanthomonas malvacearum*
6.	Potato	Ring rot	*Clavibacter michiganensis* subsp. *sepedonicus*
7.	Potato	Scab	*Streptomyces scabies*

S. No	Name of the Animal	Name of the disease	Name of the pathogen
1.	Sheep	Anthrax	*Bacillus anthracis*
2.	Cattle	Brucellosis	*Brucella abortus*
3.	Cattle	Bovine tuberculosis	*Mycobacterium bovis*
4.	Cattle	Black leg	*Clostridium chanvei*

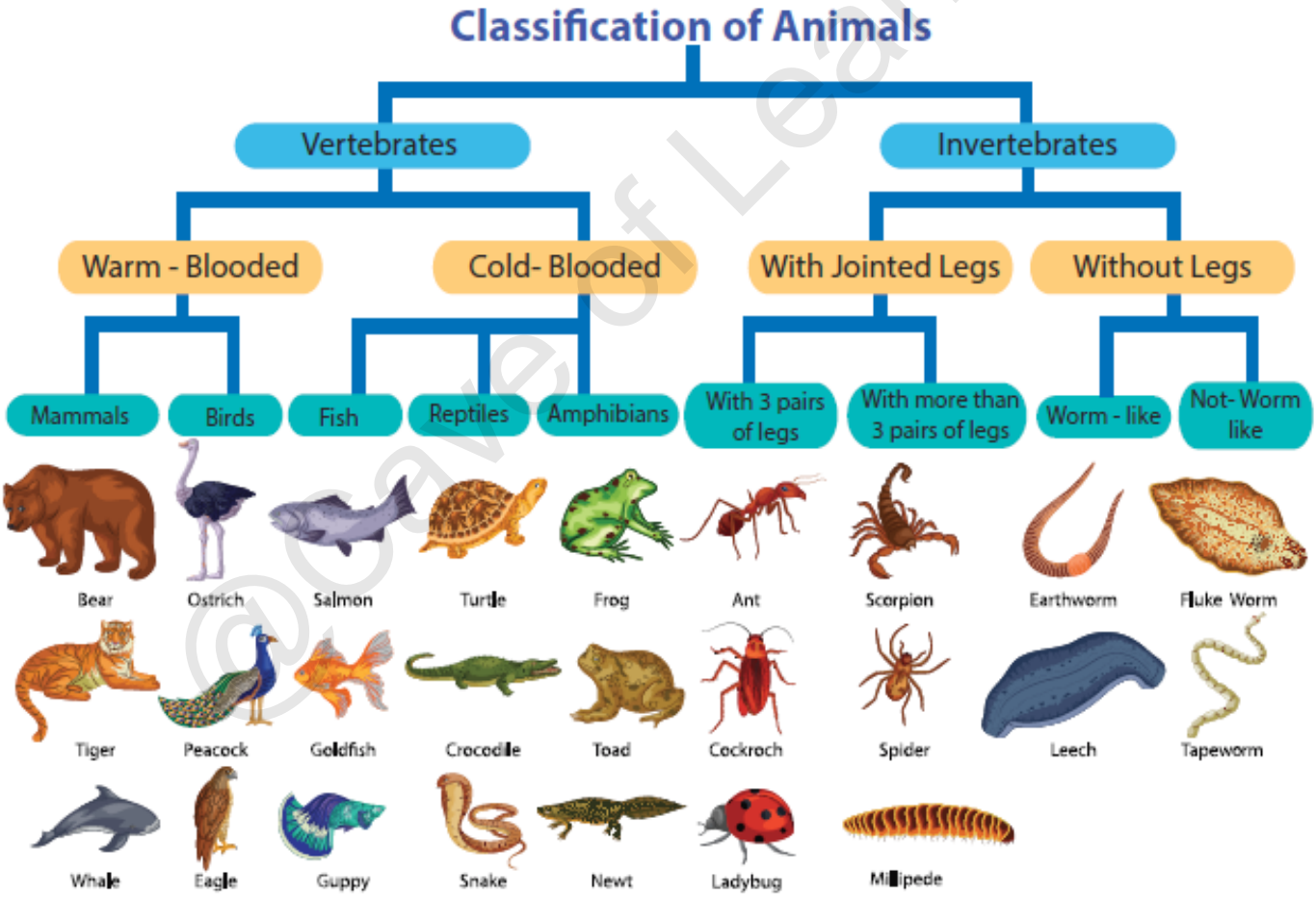
More to Know

Lactobacillus acidophilus are acid-loving bacteria. These are found in buttermilk, yogurt, sour cream, and frozen desserts. They convert sugar and carbohydrates into lactic acid, and hence are called "lactic acid bacteria."

More to Know

1. *Lycopodium*, is known as club moss.
2. *Equisetum* is known as horse tail.

S.No	Name of the disease	Name of the pathogen
1.	Cholera	*Vibrio cholerae*
2.	Typhoid	*Salmonella typhi*
3.	Tuberculosis	*Mycobacterium tuberculosis*
4.	Leprosy	*Mycobacterium leprae*
5.	Pneumonia	*Diplococcus pneumonie*
6.	Plague	*Yersinia pestis*
7.	Diphtheria	*Corynebacterium diptheriae*
8.	Tetanus	*Clostridium tetani*
9.	Food poisoning	*Clostridium botulinum*
10.	Syphilis	*Treponema pallidum*



DO YOU KNOW?

Aristotle was a Greek philosopher and thinker who lived about 2400 years ago. Aristotle came up with the following grouping system that was used for almost 2000 years after his death!

- He classified all organisms into either animals or plants.
- Then he classified into those 'with blood' and those 'without blood'.
- Then the animals are classified into three groups based on their method of movement: walkers, flyers or swimmers.

MORE TO KNOW

African sleeping sickness, which is spread by the bite of the tsetse fly, is caused by the flagellate protozoan *Trypanosoma*.

Info bits

The rules and recommendations regarding binomial nomenclature were found in ICBN (International Code of Botanical Nomenclature) now it is known as ICN (International Code of Nomenclature).

Info bits

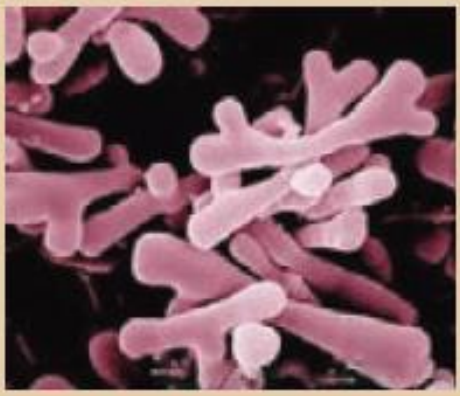
Fungi placed as third kingdom in RH Wittekar's five kingdom of classification because absence of chlorophyll and starch.

More to know

Scientists discovered a new antibiotic pseudouridimycin. The new antibiotic is produced by a microbe found in a soil sample collected in Italy. The new antibiotic kills drug-sensitive and drug-resistant bacteria in a test tube and cures bacterial infections in mice.

More to Know

Scientists discovered a particular strain of probiotic *Bifidobacterium bifidum* can help to repair stomach ulcers caused by *Helicobacter pylori*. Another probiotic in this genus, *Bifidobacterium breve*, is useful in the treatment of childhood constipation.

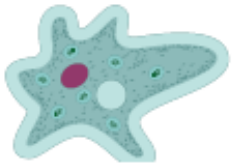
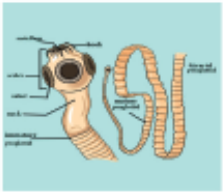
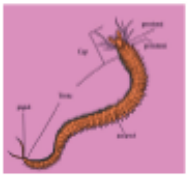
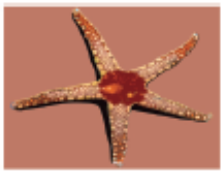


DO YOU KNOW?

The largest herbaria of the world is Museum National d'Historie Naturelle in paris, France

$C_6H_{12}O_6 \longrightarrow (C_6H_{12}O_6)_n$

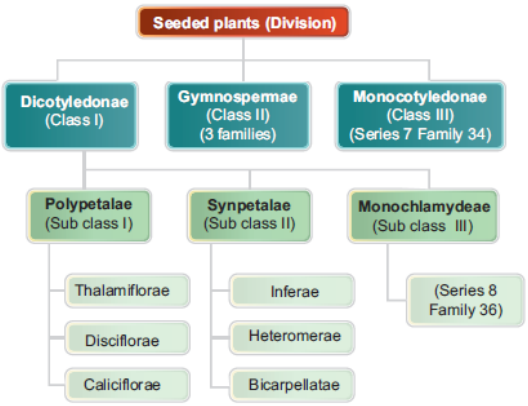
Glucose — Starch

S. NO	General Characters	Division
1	Microscopic unicellular, pseudopodia, flagella and cilia for locomotion, reproduce by fission or conjugation.	Phylum **Protozoa** Eg. *Amoeba, Euglena* and *Paramoecium* 
2	Multicellular organisms with holes in the body. Skeleton formed of spicules, asexual and sexual reproduction.	**Phylum Porifera** Eg. *Leucosolenia, Spongilla, Sycon.* 
3	Multicellular organisms Diploblastic, sessile or free swimming, solitary or colonial, asexual and sexual reproduction	Phylum **Coelenterata** Eg. Hydra, Sea anemone, Jelly fish, Corals. 
4	Acoelomates, parasites inside the body of animals and human beings, mostly hermaphrodite (bisexual).	Phylum **Platyhelminthes** Eg. *Planaria*, Liver fluke , Blood fluke, Tapeworm 
5	Unsegmented body, mostly parasites in human beings and animals, causing diseases, asexual reproduction.	Phylum **Aschelminthes** or Nematoda Eg. *Ascaris lumbricoides* 
6	Triploblastic, segmented body, mostly hermaphrodite (bisexual and unisexual).	**Phylum Annelida** Eg. Earthworm, Nereis, Leech. 
7	Segmented body, thick chitinous cuticle forming an exoskeleton, paired and jointed legs, unisexual exhibits sexual dimorphism.	Phylum **Arthropoda** Eg. Crab, Prawn, Millipede, Insects, Scorpion, Spider 
8	Soft bodied, unsegmented, muscular head, foot and visceral mass, mantle, a calcareous shell, sexual reproduction.	Phylum **Mollusca** Eg. Cuttle fish, Snail, Octopus 
9	Exclusively marine, spines and spicules over the body, water vascular system, tube feet, for feeding, respiration and locomotion, sexual reproduction.	Phylum **Echinodermata** Eg. Starfish, Sea – Urchin, Brittle star, Sea cucumber and Sea- lily 

Phylum - CHORDATES		
10	Aquatic, cold blooded vertebrates with boat shape body and jaws, locomotion by paired and median fins, sexual reproduction.	Class **Pisces** Shark, Catla, Mullet, Tilapia 
11	Amphibious, cold- blooded, two pairs of limbs, sexual reproduction.	Class **Amphibia** Eg. Frog, Toad, Salamander, Caecilian 
12	Cold- blooded , lung breathing, scales over the body, pentadactyl limb, adapted for climbing, running and padding, oviparous.	Class **Reptilia** Garden lizard, House lizard, Turtles, Tortoise , Snakes, Crocodile 
13	Warm blooded, exoskeleton of feathers, flight adaptation, spongy bones with air cavities, powerful eyes, sexual reproduction, oviparous.	Class **Aves** Wader bird, Roller bird, Hoopoe bird, Parrot, Sparrow, Hen, Ostrich, Kiwi 
14	Terrestrial warm blooded, external ear or pinna, muscular diaphragm, non – nucleated RBC, heterodont and diphyodont dentition, viviparous give birth to young ones.	Class **Mammalia** Duck bill Platypus, Kangaroo, Cat, Dog, Tiger, Zeebra, Man 

Characteristics	Monera	Protista	Fungi	Plantae	Animalia
1. Cell Type	Unicellular, Prokaryotic.	Unicellular, Eukaryotic.	Multicellular, Non – green and Eukaryotic.	Multicellular, Eukaryotic.	Multicellular, Eukaryotic.
2. Nucleus	Absent.	Present.	Present.	Present.	Present.
3. Body Organisation	Cellular level of organization	Cellular level of organization is	Multi cellular with loose tissue.	Tissue level and organ level.	Tissue, organ and organ system.
4. Mode of Nutrition	Auto (or) Heterotrophic.	Auto (or) Heterotrophic.	Saprophytic, parasitic sometime symbiotic	Autotrophic.	Heterotrophic.
5. Example	Bacteria and Blue green algae.	Spirogyra and Chlamydomonas.	Rhizopus and Agaricus.	Herb, Shrub and Trees.	Fish, frog, crocodile, Birds and human being

Outline of Bentham and Hooker's system of Classification



S. No.	Class	Types of Pigments	Reserve food material	Example
1	Bluegreen algae (Cyanophyceae)	Phycocyanin	Cyanophycean Starch	*Oscillatoria* 
2	Green algae (Chlorophyceae)	Chlorophyll	Starch	*Chylamydomonas* 
3	Brown algae (Phaeophyceae)	Fucoxanthin	Laminarian starch and Manitol	*Laminaria* 
4	Red algae (Rhodophyceae)	Phycoerythirin	Floridian Starch	*Polysiphonia* 

S. No.	ALGAE	FUNGI
1	Algae are autotrophs.	Fungi are heterotrophs.
2	It has pigments.	It has no pigments
3	Reserve food material is starch.	Reserve food materials are glycogen and oil.
4	Some algae are prokaryotic in nature eg: *Cyanobacteria (Nostac, Anabenae)*	All are eukaryotic nature. eg: *Agaricus*

Queen of medicine is Penicillin, discovered by Sir Alexander Fleming in 1928.

More to Know

Sphagnum moss was once used in disposable diapers, because it soaks liquid well.

Largest Herbarium of India is in Kolkata, which has more than 10,00,000 (one million) species of herbarium specimens.

S. No.	Pathogen	Name of the Disease
1	*Fusarium oxisporam*	Wilt disease of cotton
2	*Cercospora personata*	Tikka disease of ground nut
3	*Colletotrichum falcatum*	Red rot of sugar cane
4	*Pyricularia oryzae*	Blast disease of paddy
5	*Albugo candida*	White rust of radish

More to Know

Claviceps purpuriya is the hallucinogenic fungi causes greatest damages to the frustrated youth by giving unreal, extraordinary lightness and hovering sensations

Aspergillus species cause allergy to children while ***Cladosporium*** protects against allergy.

S. No.	Name of the Fungi	Name of the Disease
1	*Trichophyton sp.*	Ring worm (Circular rash on the skin) 
2	*Microsporum furfur*	Dandruff 
3	*Tinea pedis*	Athletes foot 

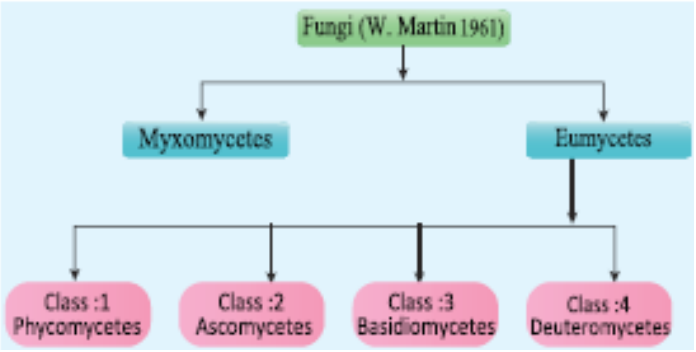
Scientific Names of Some Organisms

S.No	Common Name	Scientific Name
1.	Human being	*Homo sapiens*
2.	Onion	*Allium sativum*
3.	Rat	*Rattus rattus*
4.	Pigeon	*Columba livia*
5.	Tamarind	*Tamirindus indica*
6.	Lime	*Citrus aurantifolia*
7.	Neem Tree	*Azadirachta indica*
8.	Frog	*Rana hexadactyla*
9.	Coconut	*Cocos nucifera*
10.	Paddy	*Oryza sativa*
11.	Fish	*Catla catla*
12.	Orange	*Citrus sinensis*
13.	Ginger	*Zingiber officinale*
14.	Papaya	*Carica papaya*
15.	Date	*Phoenix dactylifera*

More to Know

In *Desmodium gyrans* (Indian telegraph plant), the compound leaf shows three leaflets, one terminal large leaflet and two very small lateral opposite leaflets. The two lateral leaflets move up, move back and then move down and finally back to the original position showing rhythmic movement. *Desmodium gyrans* is also called the dancing plant. This plant was used by Indian scientist Jagadish Chandra Bose for his experiment.

Mimosa pudica is called as *Thotta surungi* and *Desmodium gyrans* is called as *Thozhu kanni* in Tamil.



S. No.	Bryophytes	Pteridophytes
1	Plant body cannot be differentiated into root, stem and leaf.	Plant body can be differentiated into root, stem and leaf.
2	Bryophytes are amphibians.	Pteridophytes are land plants.
3	Vascular tissues are absent.	Vascular tissues are present.
4	The dominant phase of the plant body is gametophyte.	The dominant phase of the plant body is sporophyte.
5	Sporophytic generation depends on the gametophytic generation. e.g. *Riccia*	Gametophytic generation does not depend on sporophytic generation. eg. *Selaginella*

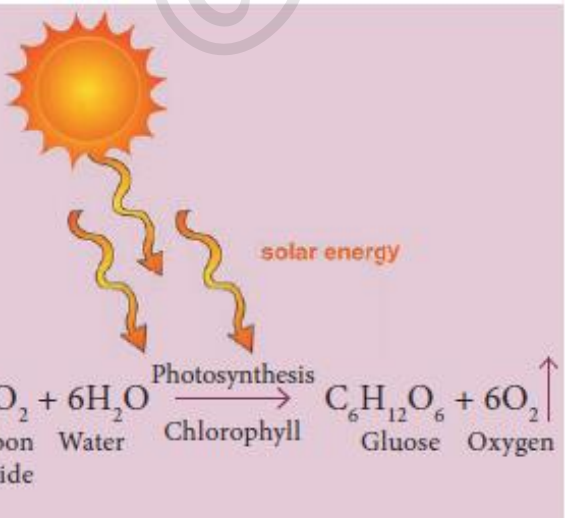
Info bits

- Tropism allows plant to get the best conditions for its survival.
- Tropic movements are slow, directional movements towards or away from the stimulus and it depends on growth.
- Nastic movement is an immediate action.

Cycadales *eg: Cycas sps*	Ginkgoales eg: *Ginko biloba*	Coniferales eg: *Pinus sps*	Gnetales eg: *Gnetum sps*
Palm like small plants (erect and unbranched)	*Ginko biloba* is the only living species in the group.	Evergreen trees with cone like appearance.	Small group of plants.
Leaves are pinnately compound forming a crown.	It is a large tree with fan shaped leaves.	Needle like leaves or scale leaves.	It possesses advanced characters like Angiosperm
Tap root system and Coralloid root. 	They produce unpleasant smell. 	Seeds are winged and produced in female cone. 	Ovules are naked but, developed on flower like shoot. 

Info bits

Some halophytes produce negatively geotropic roots (E.g. *Rhizophora*). These roots turn 180° upright for respiration.



DO YOU KNOW?

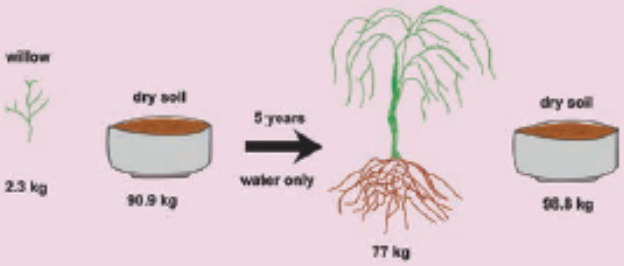
Some plants feed on insects and small animals, even a frog. (Example: *Nepenthes, Drosera* and Venus flytrap). The Venus Flytrap (*Dionaea muscipula*) presents a spectacular example of thigmonasty. It exhibits one of the fastest known nastic movements.

More to Know

Look at a gigantic banyan tree. Many years ago it would have been just a sapling. It has grown into a huge tree. How did it gain the mass? Whether it is from soil/water/air? A Belgian scientist, Jan Baptist van Helmont was intrigued by this question and performed an experiment in 1648 to test how much the plant gains from extracting materials out of soil. He devised an interesting experiment to find out.

He took soil and heated it to make it dry. He then measured the weight of the soil. It was 90.9 kg. Can you guess why he first dried the soil? He placed this soil in a container which can transport water through its pores but without soil. He took a small sapling of willow tree, cleaned it and measured its weight. The tree weighed 2.3 kg. He closed the container with a lid having number of holes permitting free movement of air and light, but not dust. The experiment went on for five years, and he added only water to the pot. After five years the sapling grew into a small tree. He uprooted the tree carefully, cleaned it and measured its weight. Now the tree weighed 77.0 kg. Once again he dried the soil in the container and measured its weight. Soil weighed 90.8 kg.

Jan Baptist van Helmont



He was able to see that the plant gained 74.7 kg (77.0 – 2.3 = 74.7) in five years, but the soil had lost only 0.1 kg (90.9 – 90.8 = 0.1 kg) in five years. So, we can see that soil is not the major contributor to the gaining of the mass of the plant. Perhaps like vitamins in Humans, soil may supply vital elements and crucial, but that is not how plants make their food is clear. Van Helmont thought water alone was the cause of the increase in weight. Do you agree? Can you think of any other factor that could have added mass to the growing tree? The next step in our understanding is the process by which plants produce food came from the experiments of Joseph Priestley.

Priestley devised an extraordinary experiment in 1771. First he burned a candle inside a jar and converted all the oxygen into carbon dioxide. (How can you be sure that all the oxygen inside the jar has been converted into carbon dioxide?) Now he placed a sprig of mint inside the jar, without outside air mixing with the gases inside the jar. He waited for ten days. Using a lens he re-lit the candle from outside. (Why he did not use a matchstick?) The candle burned. This means that oxygen was once again inside the jar. Priestley concluded that sprig of mint had absorbed the carbon dioxide and released oxygen. That is why, he said, the candle was lit again. Priestley concluded that the plant was converting the carbon dioxide back into oxygen.

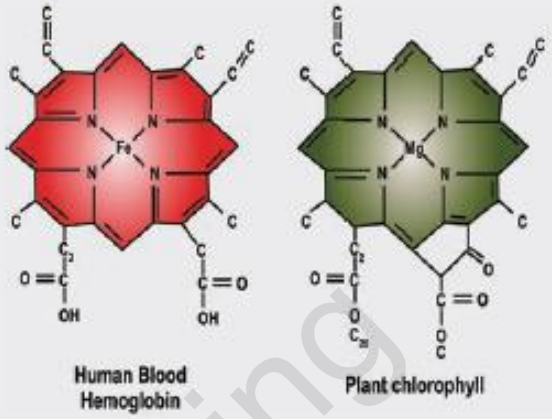
Joseph Priestley

Info bits

Only plants can photosynthesize and release oxygen (O_2). This is converted into ozone (O_3), which protects our mother Earth.

Info bits

Structurally chlorophyll resemble haemoglobin but differ with the central molecule.



DO YOU KNOW?

Scientists have discovered a brilliant emerald green sea slug, *Elysia chlorotica* that was photosynthetic to produce energy. The sea slug consumes alga *Vaucheria litorea*, which is not fully digested. Instead, the algae remain in the creature's system and continue to provide food for the slug through continued photosynthesis.

DO YOU KNOW?

Sunlight can penetrate 100 m to 200m into the oceans, gradually dims as the depth increases. Is it possible for the organisms that live deep into the ocean to do photosynthesis?

A team of researchers including a photosynthesis expert from ASU (Arizona State University, USA) have found that photosynthesis taking place deep within the Pacific Ocean. They discovered a green sulphur bacteria living near hydrothermal vents nearly 2400m deep into the ocean of Mexico. This bacteria lives in the razor-thin interface between extremely hot water (350° C or 662° F) and very cold water (2°C or 36° F) surrounding it. "This is just one example of life in extreme environments."

More to Know

Parasitic Protozoans

- Amoebic dysentery is caused by protozoa called *Entamoeba histolytica* which spreads through contaminated food and water.
- Malaria is caused by *Plasmodium sp.* which spreads through female *Anopheles* mosquitoes.

Info bits

If a moon jelly fish loses its limb, it rearranges the remaining limbs until they are symmetrically placed around its body so it can swim more efficiently.

Info bits

Plant use only 1% of water absorbed and remaining 99% is lost through transpiration. A maize plant transpire 54 gallons of water during its life span.

Transpiration is a necessary evil

- creates a pull in leaf
- creates a pull in stem
- creates an absorption force in roots, so takes more water

But

- this is necessary for continuous supply of minerals
- This regulates the temperature of the plant.

More to Know

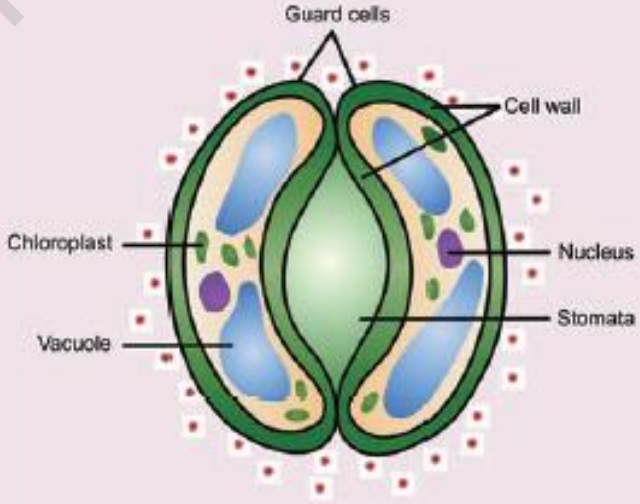
Plant absorbs water from soil and uses it for photosynthesis. A chemical analysis shows that 100 grams of water reacts with 260 grams of carbon dioxide to form 180 grams of carbohydrate. 180 grams of oxygen is created in this process. But the plant does not use all the water it absorbs through its roots to produce carbohydrates. Actually, most of this water evaporates in the air.

DO YOU KNOW?

Guard cells of stomata are green but can't photosynthesize.

Why?

It is Because, Enzymes RUBISCO and NADP-dehydrogenase are absent.



More to Know

- Deuterostome & Protostome : In the development of embryo, deuterostomes, the first opening (the blastopore) becomes the anus, while in protostomes, it becomes the mouth.

The conifers have a pyramid shape - Isn't it wonderful? Coniferous trees like spruces, pines and firs have a unique geometrical three-sided pyramid shape. They rely on the sunlight all around the year for photosynthesis. Their pyramidal shape allows all the branches to receive more sunlight since the top branches don't shade the bottom branches. The major branches of the conifers are layered with an open area between the layers. This helps in passing through light and the tree to get enough light especially when sunlight comes in at a low angle during the winter months.

You are in a village, which is part of a taluk. Your taluk is part of district, which falls under a state- Tamilnadu. Tamilnadu is a state in India which is a country in South East Asia. Similarly, the Tiger is classified as **Kingdom**: Animalia; **Phylum**: Chordata; **Sub phylum**; Vertebrata; **Class**: Mammalia; **Subclass**: Eutheria; **Order**: Carnivora; **Family**: Felidae; **Subfamily**: Panthernae; **Genus**: *Panthera*; **Species**: *tigris*. Find out the classification of cat and humans?

Number of fat cells in obese adults is about 60-100 billion while in non-obese adults is 30-50 billion.

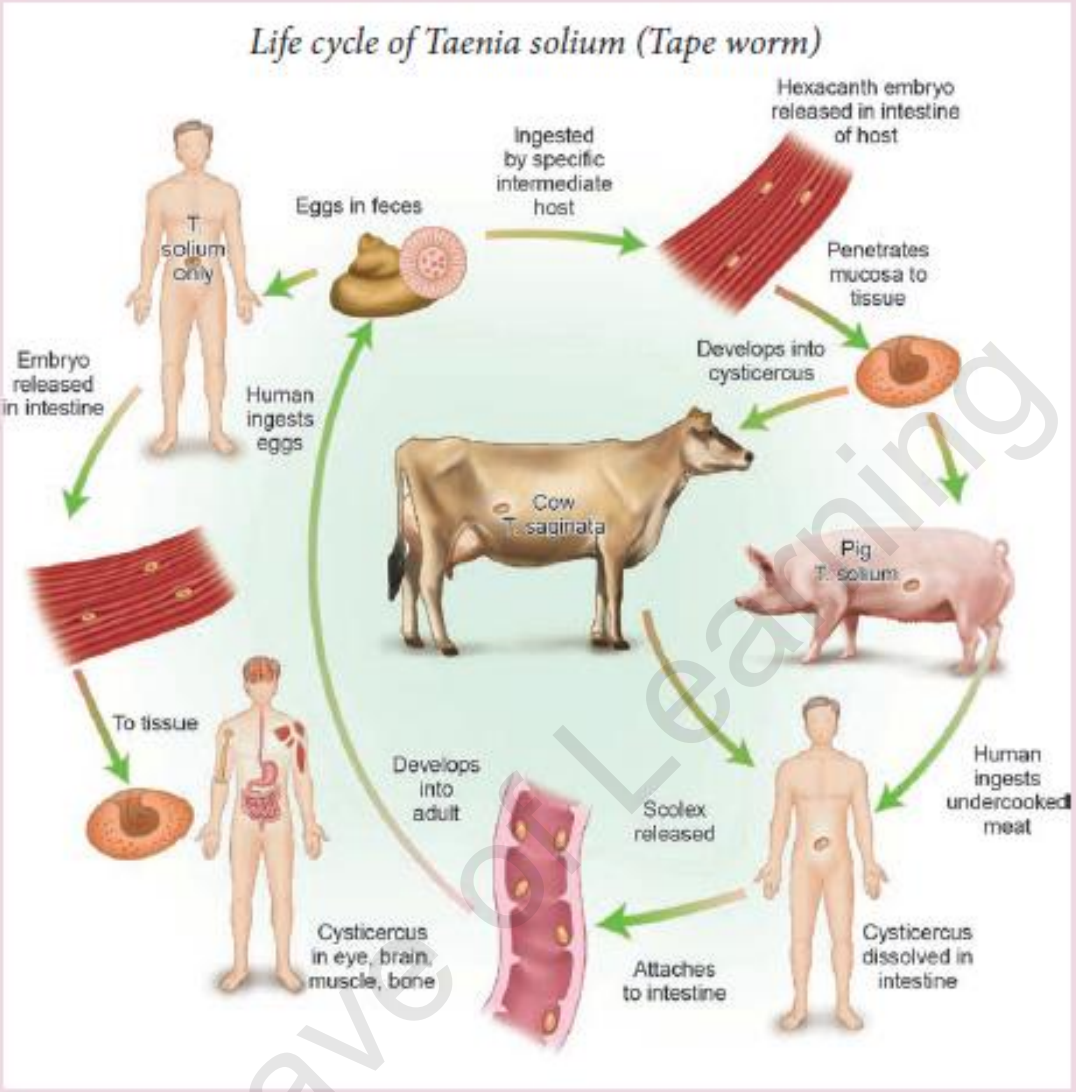
Why do we get more rainfall in the Amazon? The Amazon is the most biodiverse terrestrial place on the planet. In the Amazon, deep-rooted trees increase local transpiration and high tree cover increase local interception evaporation. These increased evapotranspiration fluxes have positive effects on forests as they stimulate rainfall. ¾ of the rainfall received by the Amazon tropical rainforest comes from plant transpired water vapour, which is visible as a mist.

The plants trap solar energy for photosynthesis. Do the insects also trap solar energy? Tel Aviv University Scientists have found out that *Vespa orientalis* (Oriental Hornets) have similar capabilities to trap solar energy. It has a yellow patch on its abdomen and an unusual cuticle structure which is a stack of 30 layers thick. The cuticle does not contain chlorophyll but it contains the yellow light sensitive pigment called xanthopterin. This works as a light harvesting molecule transforming light energy into electrical energy.

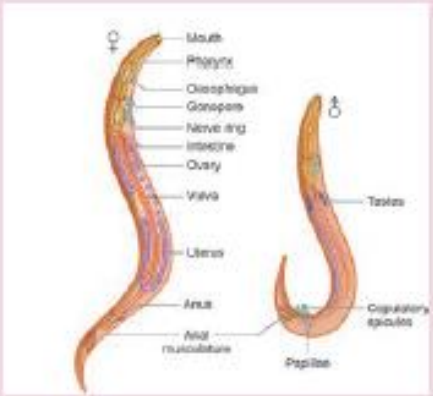
Jute is used in making of rope and fabrics.

More to Know

Taeniasis is an intestinal infection in mammals caused by an adult tape worm. Due to intake of partially cooked pork meat.



Your class mate suffers from stomach pain. The teacher takes him to the doctor. The doctor advises that he is infected with round worms. Have you ever experienced such stomach pain?



Ascaris lumbricoides – Female and Male Worm

DO YOU KNOW?

Protein fibres of matrix are made up of Yellow fibres of elastin and White fibres of collagen

Nano fibres - Sharpey's fibres are minute fibres of tendon which enter into peristomium of bone. Aponeurosis is similar to tendon but fibres are interwoven and thinner.

Sprain is caused by excessive pulling (stretching) of ligaments.

More to Know

Deworming is treatment for *Ascaris* infection. National Deworming day is observed on February 10th every year in India

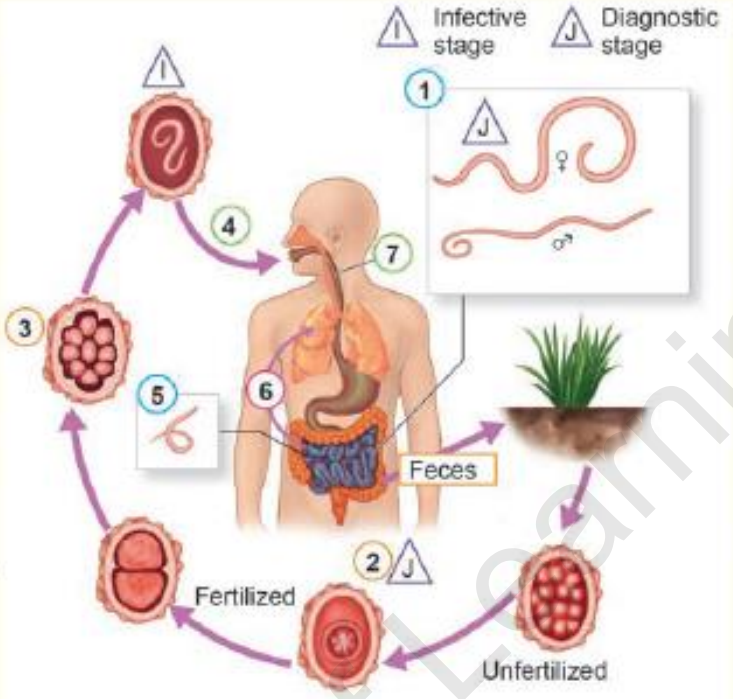
Life Cycle of *Ascaris lumbricoides* (Round worms)

Adult males and females are in the small intestine.

Females produce eggs that are passed in the host's feces (A single female can produce 200,000 eggs per day).

Juveniles in eggs mature to the infective (second) stage.

Eggs ingested by host and hatch in the small intestine. The juveniles penetrate the tissues of the intestine and enter the blood stream.



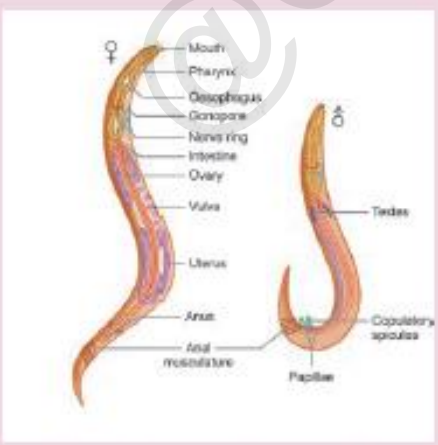
The juveniles are "coughed up" and swallowed. The juveniles complete their development in the small intestine.

The third stage juveniles migrate from the pulmonary capillaries into the alveoli (air sacs).

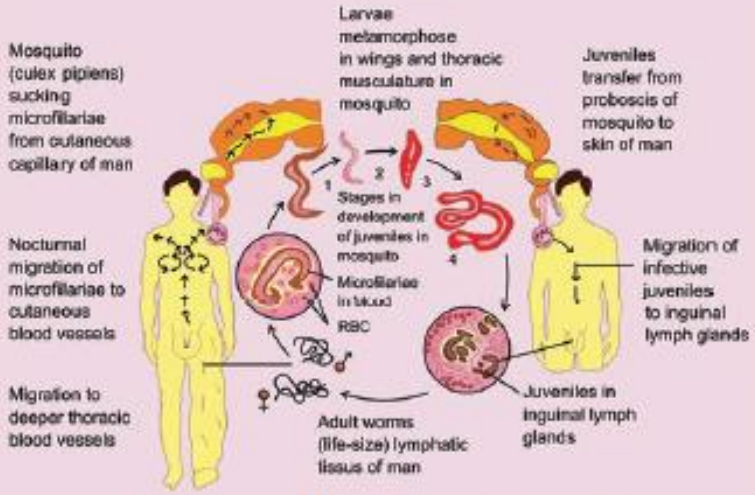
The juveniles migrate to the lungs and molt into third stage juveniles.

More to Know

Filariasis or Elephantiasis is caused by *Wuchereria bancrofti*. It leads to the swelling of legs and groin due to the accumulation of excess of lymph.



Wuchereria bancrofti-
Female and Male worm



Life cycle of *Wuchereria bancrofti*

Info bits

Copepods are tiny crustaceans (like shrimp) that live in the sea. They are the only creatures known to have only one eye.

Centipedes

They are fast hunters. They come out at night and feed on animals such as slugs, woodlice and earwigs. They grasp them with their fangs and kill them with poison. Female centipedes lay their eggs in the soil and guard them fiercely against predators. There are 2,800 species of centipedes and they are found all over the world. Giant centipedes over 30 cm (12 inches) long live in rain forests. Centipede means 'hundred legs' but most species have only 30 pairs.

Centipede

Millipedes

There are about 8,000 different species of millipedes. They live in the soil and feed mainly on rotting plants. The segments of their skin overlap to protect them and some can curl up into balls. Millipedes have two pairs of legs on each segment. This name means "thousand legs" but, most millipedes have only about a hundred. The longest have 750 pairs. Millipedes curl into tight balls when they are disturbed. Pilli millipedes look like woodlice but have more legs.

Millipede

Activity 3

Do you see honey bee visiting flowering plants of your garden. When do they visit? Why do they visit? What is the great service they render to us?

More to Know

Pearl Culture

Pearl is synthesised by Pearl oyster. It is precious and used in jewellery making.

The Octopus is incredibly intelligent

It is the only invertebrate that is capable of emotion, empathy, cognitive function, self awareness, personality and even relationships with humans. Some speculate that without humans, octopus would eventually take our place as the dominate life form on earth.

The Giant squid

It has a donut-shaped brain that encircles the oesophagus.

More to Know

The smallest vertebrate, **Philippine goby/dwarf pygmy goby is a tropical** species fish found in brackish water and mangrove areas in south East Asia, measuring only 10 mm in length.

The gigantic **Blue whale** which is 35 meters long and 120 tons in weight is the biggest vertebrate animal.

More to Know

Ornamental Echinoderms

Dried star fish and sea urchin are used as decorative items.

Sea Cucumber is a costly dish served in foreign countries.

More to Know

Blue Revolution

The term blue revolution refers to remarkable emergence of aquaculture through fish and prawn production. Culturing of aquatic organisms is referred to as **Aquaculture.**

Flying fish: *Exocoetus*

A boy was playing in the ground enjoying the shower of rain. Suddenly he was surprised to see an organism which was jumping like frog. He tried to catch with his hand, at once he was instructed by his mother not to touch as it is poisonous. Is it a toad? Is it not a frog?

Info bits

The cosmopolitan sailfish can swim faster than a cheetah can run! It can swim at least 109 kilometres (68 miles) per hour, while a cheetah can only manage 100 kilometres (62 miles) per hour.

Info bits

Dimetrodon was a mammal like reptile with a snail like structure on its back. This acted as a radiator to cool the body of the animal.

Info bits

Archaeopteryx was the first bird. It was covered with feathers, but it had teeth, not a beak.

DO YOU KNOW?

The Chinese giant salamander *Andrias davidians* is the largest amphibian in the world. Its length is about five feet and eleven inches. It weighs about 65 kg, found in Central and South China.

The arrow poison frog, *Triturus helveticus* found in Cuba, is the smallest amphibian in the world. Its length varies from 8.5 – 12.5 mm.

Can you imagine the size of Dinosaur and Home lizard which belong to the same class? Do you find both of them around us now? Give reasons. Which age is known as Golden age of reptiles?

DO YOU KNOW?

In potato, Parenchyma vacuoles are filled with starch. In Apple, parenchyma stores sugar

State bird of Tamil Nadu

Common Emerald dove.
(*Chalcophaps indica*)

Info bits

A mole can dig a tunnel 300 feet long in just one night.

Info bits

Flying fox - The largest bat is the flying fox. Some are found on the island of Java and have a wing span of 1.7 m with a length of upto 42 cm. The smallest bat lives in Thailand. It weighs just 2 grams and is no longer than 3.3 cm

The bird with largest wing span

Length of wing span of Albatross is 3.5 m. Which bird flies at the highest altitude?

American golden plover, *Pluvialis dominica*, covers long distance during migration, breeding in Alaska and Arctic. It flies to South America in autumn and then reaches New Zealand. It takes more than six months to cover 24,000 – 27,000 km.

Donate Blood

Hospitals have blood banks where blood can be temporarily stored before it is given to the patients in need. Every healthy person over 18 years of age can donate blood. So that, it can be given to persons in need during emergencies of accidents or operations. Blood donation saves their life.

Common name	Binomial name
Amoeba	*Amoeba proteus*
Hydra	*Hydra vulgaris*
Tape worm	*Taenia solium*
Round worm	*Ascaris lumbricoides*
Earthworm	*Lampito mauritii/Perionyx excavatus*
Leech	*Hirudinaria granulosa*
Cockroach	*Periplaneta americana*
Snail	*Pila globosa*
Star fish	*Asterias rubens*
Pearl oyster	*Pinctada fucata*

Common name	Binomial name
Frog	*Rana hexadactyla*
Toad	*Bufo melanosticus*
Wall lizard	*Podarcis muralis*
Crow	*Corvus splendens*
Peacock	*Pavo cristatus*
Dog	*Canis familiaris*
Cat	*Felis felis*
Tiger	*Panthera tigris*
Man	*Homo sapiens*

Sclereids	Fibres
Usually broad	Elongated narrow thread like
End walls blunt	End walls tapering
Occur singly	Occur in bundles
Deep pits	Narrow pits

Tracheids	Vessels
Formed from single cells	Made up of number of cells.
Ends are oblique and taper	ends are round and transverse.
Fraction of a cm in length	Several cms in length
Walls are thick, lumen-narrow	Walls are less thick, lumen- wide.

Collenchyma	Sclerenchyma
It consist of living cells	It consist of dead cells
Cells contain protoplasm	Cells are empty
Cell walls are made of cellulose	Cell walls are lignified
Thickening of cell wall is not uniform	Cell wall thickening is uniform
Lumen of the cell is wide	Lumen of the cell is narrow
Pits are simple straight	Pits are simple oblique sometimes branched
It provides mechanical support and elasticity to the plant body	It provides only mechanical support

Parenchyma	Collenchyma
Cell wall is thin and uniform in thickness	It possesses well developed extra thickening at places adjacent to intercellular spaces
It serves as storage tissue.	It serves as mechanical tissue
It is found in outer and inner parts of plant organs	It is restricted to sub epidermal parts of plant organs.

Epithelial tissue in the skin functions as a water-proof membrane

Meristematic tissue	Permanent tissue
Component cells are small, spherical or polygonal and undifferentiated	Component cells are large, differentiated with different shapes
Cytoplasm is dense, and vacuoles are nearly absent	Usaually large central vacuole present in living permanent cells
Intercellular spaces absent	Intercellular spaces present
Cell wall thin and elastic	Cell wall thick
Nucleus is large and prominent	Nucleus is less conspicuous
Cells grow and divide regularly	Cells do not normally divide
Provides mechanical support and elasticity to the plant body	Provides only mechanical support

Xylem	Phloem
Conducts water and minerals	Conducts organic solutes or food materials
Conduction is mostly unidirectional i.e., from roots to apical parts of the plant.	Conduction may be bidirectional from leaves to storage organs and growing parts or from storage organs to growing parts of plants.
Conducting channels are treacheids and vessels	Conducting channels are sieve tubes.
Component of xylem include Tracheid vessels, xylem parenchyma and xylem fibres.	Components are sieve elements, companion cells, phloem parenchyma and phloem fibres.

Nerve cells do not undergo cell division due to the absence of centrioles, but they are developed from glial cells by neurogenesis

Microglia are modified neuroglial cells which are phagocytic in nature and found throughout the brain and spinal cord. These are also known as astroglea or oligodendroglea.

Discovery: Maher- 1819 coined the term Histology

Marie Francies Xavier Bichat – Anatomist and Pathologist – Father of Histology – distinguished 21 types of tissues from which the organs of human body are formed.

Sieve cells	Sieve tubes
Sieve cells have no companion cells	Sieve tubes always have companion cells
Sieve areas do not form sieve plates	Sieve areas are confined to Sieve plates
Cells are elongated and are unique long with tapering end walls	Cells consist of vertical cells placed one above the other forming long tubes connected at the walls by sieve pores
Sieve pores are smaller and numerous	Sieve pores are larger and fewer in number
Sieve cells are found in pteridophytes and gymnosperms	Sieve tubes are found in angiosperms

INFO BIT

Age of our body cells

- Cells of the eye lens, nerve cells of cerebral cortex and most muscle cells last a life time but once dead are not replaced.
- Epithelial cells lining the gut last only about 5 days.
- Average life of other gut cells is about 15 years.

Duration of cell replacement

- Skin cells- about every 2 weeks.
- Bone cells- about every 10 years.
- Liver cells- about every 300 – 500 days.
- Red blood cells last for about 120 days and are replaced.

More to Know

- Leeches do not have ear, hence can sense vibrations through their skin.
- Leeches have 2 to 10 tiny eyes, which helps them to locate their food.
- Leeches can suck blood five times more than their body weight.
- It may take more than a year for the complete digestion and absorption of a full meal.

More to Know

Medicinal value of Leech

Leeches are effective in increasing blood circulation and breaking up blood clots. It is surprising that they can be used to treat cardiovascular diseases. Biochemical substances derived from leech saliva are used for preparation of pharmaceutical drugs that can treat hypertension.

Blood letting is a technique of bleeding in a patient to remove toxic impurities from the body.

The pygmy rabbit was listed as a threatened species in Washington in 1990, because of decline in its population size and distribution due to habitat loss. In March 2003, the Columbia Basin Pygmy Rabbit was federally listed as an endangered species.

Mitosis	Meiosis
Occurs in somatic cells.	Occurs in reproductive cells
Involved in growth and occurs continuously throughout life.	Involved in gamete formation only during the reproductively active age.
Consists of single division	Consists of two divisions
Two diploid daughter cells are formed.	Four haploid daughter cells are formed.
The chromosome number in the daughter cell is similar to the parent cell (2n).	The chromosome number in the daughter cell is just half (n) of the parent cell.
Identical daughter cells are formed	Daughter cells are not similar to the parent cell and are randomly assorted.

Name of the Algae	Economic importance
Beneficial activities	
Chlorella, Laminaria, Sargassum, Ulva, Enteromorpha	Food
Gracilaria, Gelidiella, Gigartina	Agar Agar – Cell wall material used for media preparation in the microbiology lab. Packing canned food, cosmetic, textile paper industry
Chondrus crispus	Carrageenan – Preparation of tooth paste, paint, blood coagulant
Laminaria, Ascophyllum	Alginate – ice cream, paints, flame proof fabrics
Laminaria, Sargassum, Ascophyllum, Fucus	Fodder
Diatom (Siliceous frustules)	Diatomaceous earth– water filters, insulation material, reinforcing agent in concrete and rubber.
Lithophyllum, Chara, Fucus	Fertilizer
Chlorella	Chlorellin -Antibiotic
Chlorella, Scenedesmus, Chlamydomonas	Sewage treatment, Pollution indicators
Harmful activity	
Cephaleuros virescens	Red rust of coffee

Info bits

Punnett square is a checker board form devised by a British geneticist R.C.Punnett for study of genetics. It is a graphical representation to calculate the probability of all possible genotypes of offsprings in a genetic cross.

More to Know

T.H. Morgan was awarded Nobel Prize in 1993 for determining the role of chromosomes in heredity.

Info bit

STEM CELLS

They are undifferentiated cells which undergo unlimited divisions and give rise to one or more different types of cells. Embryonic stem cells differentiate into different tissues and organs.

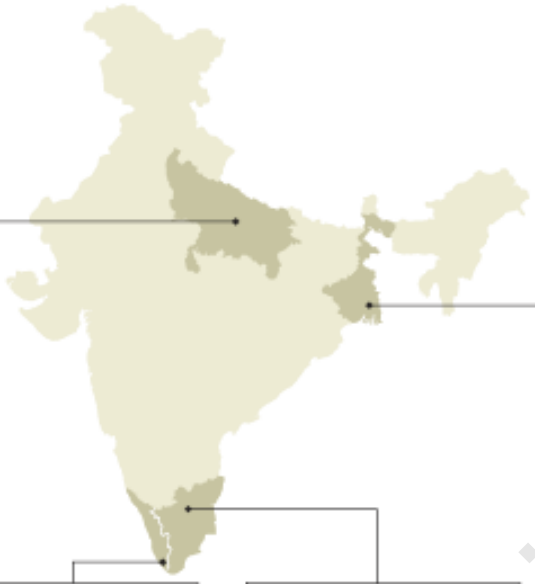
Stem cells are used in the treatment of certain degenerative diseases

In present days umblical cord blood is collected at the time of child birth and is being stored in stem cell banks to treat any diseases in the future

Scientific Names

Peacock (மயில்)	*Pavo cristatus*
Crow (காகம்)	*Corvus splendens*
Sparrow (குருவி)	*Passer domesticus*
Rat (எலி)	*Rattus rattus*
Dog (நாய்)	*Canis familiaris*
Cat (பூனை)	*Felis domesticus*
Tiger (புலி)	*Panthera tigris*
Lion (சிங்கம்)	*Panthera leo*
Elephant (ஆசிய யானை)	*Elephas maximus*
Man (மனிதன்)	*Homo sapiens*
Monkey (குரங்கு)	*Macaca radiata*
Mongoose (கீரிப்பிள்ளை)	*Herpestes edwardsi*
Bear (கரடி)	*Ursus arctos*
Fruit bat (பழந்தின்னி வெளவால்)	*Cynopterus sphinx*
Donkey (கழுதை)	*Equus hemionus*
Rhinoceros (காண்டாமிருகம்)	*Rhinoceros unicornis*
Spotted deer (புள்ளி மான்)	*Axis axis*
Angel fish (ஏஞ்சல் மீன்)	*Pterophyllum scalare*
Guppy (கப்பி மீன்)	*Poecilia reticulata*
Apple snail (ஆப்பிள் நத்தை)	*Pila globosa*
House fly (ஈக்கள்)	*Musca nebula*
Bed bug (மூட்டைப் பூச்சி)	*Cimex hemipterus*
Cobra (நல்ல பாம்பு)	*Naja naja*
Parrot (கிளி)	*Psittacula krameri*
Garden lizard (ஓணான்)	*Calotes versicolor*

National Botanical Gardens



National Botanical garden Lucknow

Established in **1948**

Arboretum- **500** species of trees

500 species of **Rose hybrids**

Major attraction- **germ plasm collection** & *ex-situ* conservation

JNTBGRI Trivandrum Kerala

Established in 1979

Conserving tropical plant: Genetic resources

4,000 species of flowering plants &

300 species of non-flowering plants

Major attraction- Bambusetum (69 species)

The National Orchidarium Yercaud

Established in **1963**

Maintained by Southern circle of BSI

3,000 trees and **1,800** shrubs

Major Attraction- Insectivorous plants

AJCB Indian Botanical garden Kolkata

Established in 1786 by **Lt. Col. Robert Kyd**

Largest and oldest

15,000 species of plants

Major Attraction- The Great Banyan Tree

Telomeres act as aging clock in every cell.

Telomeres are protective sequences of nucleotides found in chromosomes. As a cell divides every time, they become shorter. Telomeres get too short to do their job, causing our cells to age.

Sickle cell anaemia is caused by the mutation of a single gene. Alteration in the gene brings a change in the structure of the protein part of haemoglobin molecule. Due to the change in the protein molecule, the red blood cell (RBC) that carries the haemoglobin is sickle shaped.

Living Fossils: These are living organisms that are similar in appearance to their fossilized distant ancestors and usually have no extinct close features. e.g. *Ginko biloba*.

NASA is developing the Mars 2020 astrobiology to investigate an astrobiologically relevant ancient environment on Mars, its surface geological processes and the possibility of past life on Mars and preservation of biosignatures within accessible geological materials.

Cell size has no relation to the size of an organism. It is not necessary that the cells of, say an elephant be much larger than those of a mouse.

More to Know

Chargaff rule of DNA base pairing

Erwin Chargaff states that in DNA, the proportion of adenine is always equal to that of thymine. and the proportion of guanine always equal to that of cytosine.

Relationship between Mutation and Variation

Mutation and Variation are two events involved in the process of evolution. Mutation arises due to errors occurring in DNA during replication or exposure to UV rays or chemicals. Mutation leads to variation. It brings about changes in a single individual.

More to Know

What is the Geologic Time Scale?

The geological time scale is a system of chronological dating that relates geological rock strata to time, and is used by geologists, paleontologists, and other Earth scientists to describe the timing and relationships of events that have occurred during Earth's history.

Thiruvakkarai fossil wood park (Villupuram district, Tamil Nadu): 2 million years ago tree trunks that got buried along the river, incourse of time the organic matter was replaced by silica and was fossilized. They retained their color, shape and texture and was converted into solid rocks. The annular rings, the texture, colors of the layers, nodes and every properties of plants are still visible.

More to Know

Can you see a cell with your naked eye?

Cells are very minute and said to be microscopic cannot be seen with our naked eyes.

They can be observed only through a specialized scientific instrument called "microscope".

Now a days an electron microscope is used to magnify the cells and observe the cells

Activity 5:

Aim: To prove that exhaled air is rich in carbon- di- oxide

Materials required: Two glass jars with lime water and a straw

Procedure: Leave the first jar with lime water undisturbed, blow air in to the second jar with the help of a straw

Observation: Lime water turns milky in few seconds in the second jar. The CO_2 gas alone can change the lime water into milky white.

Conclusion: Carbon-di-oxide is present in the air that we exhale.

1.The smallest bone in our body is present inside the ear. It is called **Stapes.** It is only 2.8 millimeters long (average length). The longest bone in the body is the **thigh bone.** (Femur)

2. A new born baby has more than 300 bones. As the baby grow, some bones are joined together, hence the skeleton of an adult has 206 bones.

Parts of Alimentary canal	
1.	Mouth
2.	Buccal cavity
3.	Pharynx
4.	Oesophagus or Food pipe
5.	Stomach
6.	Small Intestine
7.	Large Intestine
8.	Anus

Associated glands for digestion	
1.	Salivary glands
2.	Gastric glands
3.	Liver
4.	Pancreas
5.	Intestinal glands

Each lung has about 300 million air sacs or alveoli.

Yawning helps us to take in more amount of O_2 and to give out CO_2.

Prokaryotic cell	Eukaryotic cell
It's diameter ranges from 1 to 2 micron	It's diameter ranges from 10 t0 100 micron
Absence of membrane bound organelles	Presence of membrane bound organelles
Nucleus consisting of no nuclear membrane	True nucleus consisting of nuclear membrane
Absence of nucleoli	Presence of nucleoli

S.No	Cell Components	Main Functions	Special Name
1	Cell wall	• Surrounds and protects the cell • Make the cell stiff and strong	Supporter and protector
2	Cell membrane	• Holds and protects the cell • Controls the movement of materials in and out of the cell	Gate of the cell
3	Cytoplasm	• A watery, gel-like material in which cell parts move	Area of movement
4	Mitochondria	• Produce and supply most of the energy for the cell	Power house of the cell
5	Chloroplasts	• Contain green pigment chlorophyll • Capture the energy of sunlight and use it to produce food for the cell by photosynthesis.	Food producers for the cell (Plant cell)
6	Vacuoles	• Store food, water, and chemicals	Storage tanks
7	Nucleus	• Acts as 'brain' of the cell • Regulates and controls all the cell activities	Control centre
8	Nucleus membrane	• Surrounds and protects the nucleus control the movement of materials in and out of the nucleus	Gate of the nucleus

Brain is said to store as many as 100 million bits of information in a life time.

More to know

1. The mixing of foodstuffs and digestive juices in the gut occurs by diffusion.
2. Exchange of respiratory gases, (oxygen and carbon dioxide) between blood and tissue fluids and between tissue fluid and cells occurs by diffusion.

Activity 6: Place the middle and index fingers of your right hand on the inner side of your left wrist. Can you feel a throbbing movement. Why do you feel the throbbing? This throbbing is called the **pulse** and it is due to the blood flowing in the arteries. Count the number of pulse in one minute.

How many pulse beats could you count in one minute? The number of beats per minute is called the **Pulse rate**. A resting person usually has a pulse rate between 72 to 80 beats per minute.

Find other places in your body where you can feel the pulse. Record your own pulse beats and your classmates as beats per minute; Compare the values.

Glands	Location
Pituitary gland	At the base of brain
Pineal Gland	At the base of brain
Thyroid Gland	Neck
Thymus Gland	Chest
Pancreas (Islets of Langerhans	Abdomen
Adrenal Gland	Above the kidney
Gonads	Pelvic cavity

DO YOU KNOW?

The sunflower is not a single flower. It is a group of flowers clustered together. A group of flowers arranged together is called inflorescence. *Tridax procumbens*, looks like a single flower, but is an inflorescence. Leaf juice of this plant is used to cure wounds and cuts.

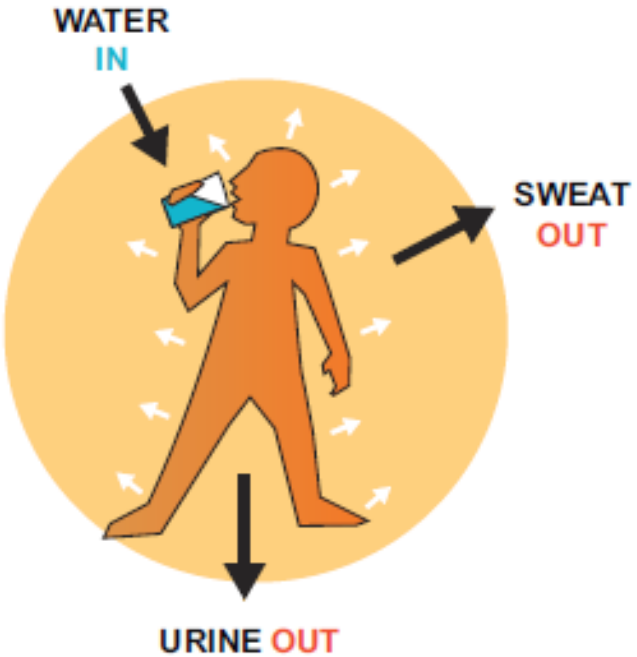
DO YOU KNOW?

A root growing from a location other than the underground, such as from a stem or leaf is called as adventitious root

DO YOU KNOW?

Why do we drink water? Our body contains about 70% water. Some parts have more water like the grey matter of the brain (about 85%) and some less, like fat cell (about 15%).

We normally consume 1.5 to 3.5 litres of water every day in the form of food and water.



Self Pollination	Cross Pollination
Pollen grains are transferred from the anther to the stigma of the same flower or to another flower of the same plant.	Pollen grains are transferred from the anther of one flower to the stigma of another flower of the same kind or different plant.
Plants do not need to produce pollen grains in a large quantity for self pollination	Plants need to produce pollen grains in larger quantities to increase the chance of pollination.
It does not produce changes in the characteristics of new plants.	Cross pollination does introduce variations in characteristics of new plants.

DO YOU KNOW?

1. The world's largest and heaviest seed is the double coconut. The seed looks like two coconut fused together. It only grows in two islands of the Seychelles. A single seed may be 12 inches long, nearly 3 feet in circumference and weighs about 18 kg.

2. Orchids have the smallest seeds in the plant kingdom. 35 million seeds may weight only about 25 gram.

DO YOU KNOW?

Various range of these plastids impart different colours to various parts of plant. Chromoplast impart colour to flower and fruits. As fruits ripen, chloroplasts change to chromoplasts. Starch is converted to sugar.

DO YOU KNOW?

On an average, an adult human being at rest breathes in and out 15 – 18 times in a minute. During heavy exercise, the breathing rate can increase upto 25 times per minute

Smoking damages lungs. Smoking is also linked to cancer. It must be avoided.

When you sneeze, you should cover your nose so that the foreign particles you expel are not inhaled by others.

DO YOU KNOW?

Vanda is an epiphytic plant, which grows on trees. The velamen tissue present in the epiphytic root, absorbs moisture, to perform photosynthesis

Vanda

DO YOU KNOW?

Red blood cells

Red blood cells do not contain a nucleus. Without a nucleus, these cells die quickly; about two million red blood cells die every second! Luckily, the body produces new red blood cells every day.

DO YOU KNOW?

Since snakes do not have legs, they use their muscles and their scales to move.

PLANT CELL

Cell Wall

The outer most covering of the plant cell. It maintain the shape and protect the cell.

Chloroplast

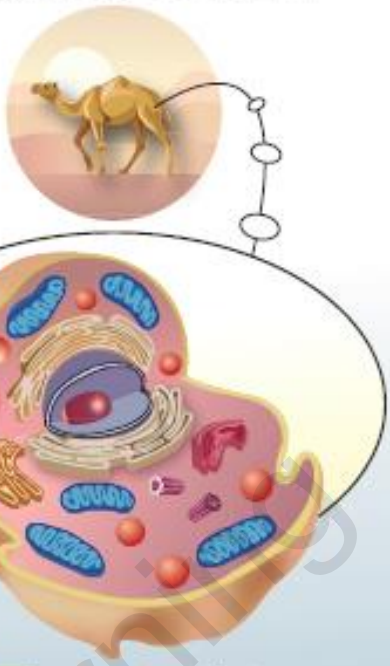
[No Title]

Chloroplast is a organelle, characterized by its two membranes and a high concentration of chlorophyll and carry out the photosynthesis.

Large vacuole

filled with both inorganic and organic molecules, along with water to support the organelle

ANIMAL CELL



Centriole

Centriole is a pair of minute cylindrical, involved in the development of spindle fibres in cell division.

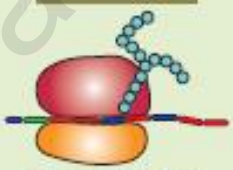
Small vacuole

filled with both inorganic and organic molecules, along with water to support the organelle

Nucleus

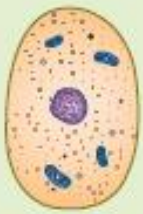
The nucleus is the control centre of the cell. It is the largest Organelle.

Ribosome



Ribosome is a minute particle consisting of RNA. They synthesize polypeptides and proteins.

Cytoplasm



The cytoplasm includes all living parts of cell with in the cell membrane but excluding the nucleus.

Endoplasmic reticulum

Endoplasmic reticulum a network of membranous tubules and is involved in protein and lipid synthesis.

Golgi body

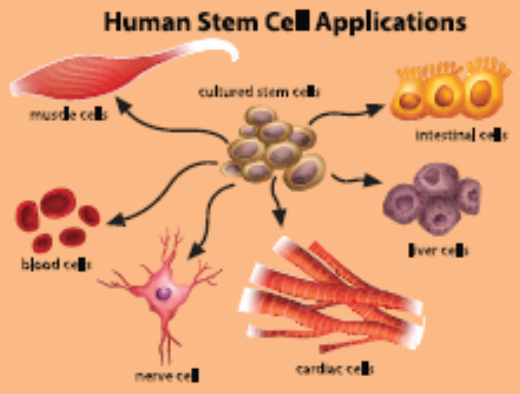
Golgi body is a complex of vesicles and folded membranes, involved in secretion and intracellular transport.

Mitochondria

Mitochondria are organelles, They make most of the cell's supply of adenosine triphosphate (ATP), a molecule that cells use as a source of energy. Their main job is to convert energy.

Stem Cells

Stem cells are quite amazing as they can divide and multiply while at the same time with their ability to develop into any other type of cell. Embryonic stem cells are very special as they can become absolutely any type of cell in the body, for example, blood cell, nerve cell, muscle cell or gland cell. So they are utilized by the Scientist and Medicos, to cure and prevent some diseases like Spinal cord injury.

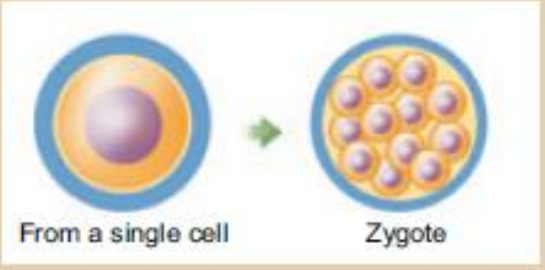


Inhalation	Exhalation
The muscles of the diaphragm contract.	The muscles of the diaphragm relax.
The diaphragm goes downward.	The diaphragm goes upward.
The ribs move upwards and outwards.	The ribs move downwards.
The volume of thoracic (chest) cavity increases.	The volume of thoracic (chest) cavity decreases.
Air enters the lungs through the nose.	Air goes out of the lungs through the nose.

Stem cell

A stem cell is essentially a 'blank' cell, capable of becoming another more differentiated cell type in the body, such as a skin cell, a muscle cell, or a nerve cell. They are microscopic in size. Stem cells can be used to replace or even heal the damaged tissues in the body. They can serve as a built-in repair system for the human body, replenishing other cells as long as a person is still alive.

Our body is developed from a single cell called zygote. The zygote undergoes continuous mitotic division and forms the foetus consisting multitude of cells of different shape, size and content. Foetal cells gradually attain change in structure and function. This process is known as cell differentiation.



More to know

1. Aerobic respiration releases 19 times more energy than anaerobic respiration from the same amount of glucose
2. In aerobic respiration each glucose molecules produce 36 ATPs.

Yeast makes bread soft, puffy when added to wheat flour in the bakery due to the release of CO_2.

AEROBIC	ANAEROBIC
1) Aerobic respiration takes place in the presence of oxygen	1) Anaerobic respiration takes place in the absence of oxygen
2) The end products of aerobic respiration are carbon dioxide and water	2) The end products of anaerobic respiration are CO_2 and ethanol or lactic acid
3) Common in all higher plants and animals	3) Common in certain micro organisms and human muscle cell

Fish have streamlined body structure which helps them to move smoothly with the flow of water. Muscles and fins on the body and the tail help to keep the balance.

- A Cheetah can run 76 kilometrer per hour.
- A Hippopotamus can run faster than a man.
- Cockroach is the fastest animal on 6 legs covering a metre per second.
- The fastest mammal, the Dolphin can swim up to 35 miles per hours.

Humans and giraffes have the same number of bones in the necks, but the vertebrae in a giraffe's neck are much, much larger.

Info bit

Menstruation is a periodical phenomenon that continues from puberty to menopause. This will happen if the released ovum is not fertilized by the sperm. Lack of menstruation generally indicates pregnancy.

The milk produced from the breast during the first 2 to 3 days after child birth is called colostrum. It contains immune substances and provides immunity to the new born which is essential for the body.

More to know

Basal metabolism refers to the minimum energy required to maintain the normal activities of the body during complete rest in a warm atmosphere 12 – 18 hours after the intake of food

Locomotion	Movement
Locomotion is the movement of an organism from one place to another.	Movement is the act of changing the place or position by one or more parts of the body.
It is always voluntary.	It can either be voluntary or involuntary.
Locomotion takes place at the organism level.	A movement takes place at the biological level.
Locomotion doesn't necessarily require energy.	Movement requires energy.

Joints are the place where two bones meet or connect. Ligaments are short bands of tough fibrous connective tissues that function to connect one bone to another, forming the joint. Tendons are made of elastic tissues and they also play a key role in the functioning of joints.

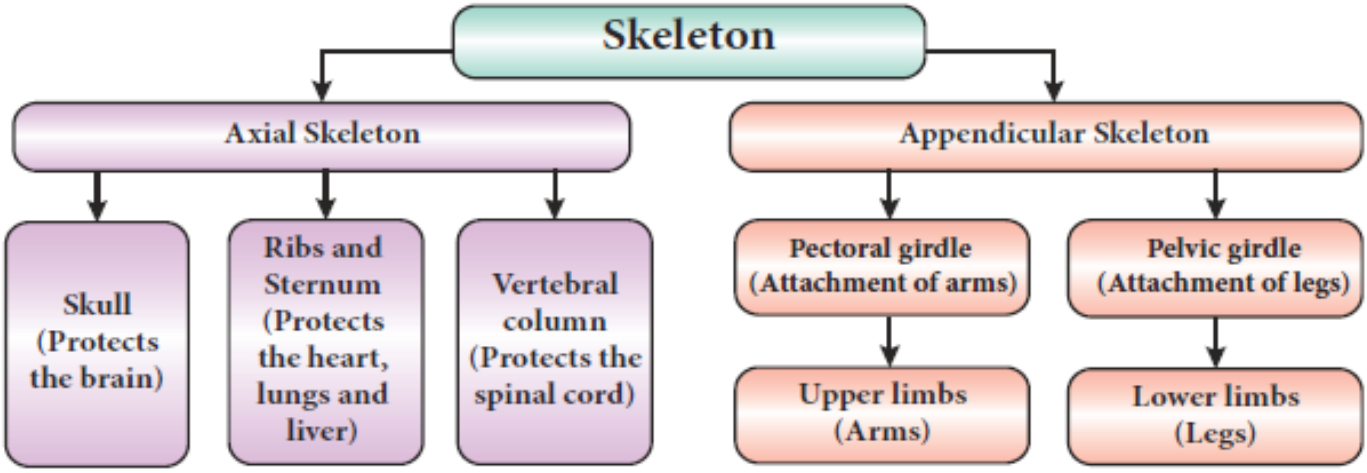
Inflammation of joints is a condition that usually results either due to friction of articulating cartilage or due to lack of synovial fluid in the joint. During this condition, the person feels acute pain in joints particularly while moving joints. This disease is referred to as arthritis. Arthritis is however also caused due to the deposition of uric acid crystals in the joints.

Joint	Examples	Description	Mobility
Ball and Socket	Shoulder Hip	A ball shaped head of one bone articulates with a cup like socket of an adjacent bone.	Movement can occur in three planes. This joint allows the greatest range of movement.
Hinge	Elbow Knee Ankle	A cylindrical protrusion of one bone articulates with a trough-shaped depression of an adjacent bone.	Movement is restricted to one plane. This joint allows bending and straightening only.
Pivot	Spine (Atlas / Axis joint at the top)	A rounded or pointed structure of one bone articulates with a ring-shaped structure of Radius Ulna- an adjacent bone.	Movement is restricted to one plane. This joint allows rotation about its longitudinal axis only.
Condyloid	Wrist	Similar to a ball and socket joint but with much flatter articulating surfaces forming a much shallower joint.	Movement can occur in two planes. This joint allows the second greatest range of movement.
Gliding	Spine (between the bony processes of the vertebrae)	Articulating surfaces are almost flat and of a similar size.	Gliding allows movement in three planes, but it is severely limited.
Saddle	Thumb, shoulder and inner ear.	One part is concave (turned inward) at one end and looks like a **saddle.** The other end is convex (turned outward), and looks like a rider in a **saddle.**	Flexion-extension and abduction-adduction movements are seen

Feature	Structure	Function
Ligament	A band of strong fibrous tissue.	To connect bone to bone.
Synovial fluid	A slippery fluid with the consistency of egg-whites that is contained within the joint cavity.	To reduce friction between the articular cartilage in the joint.
Articular cartilage	Glassy-smooth cartilage that is spongy and covers the ends of the bones in the joint.	To absorb shock and to prevent friction between the ends of the bones in the joint.
Joint Capsule	A tough fibrous tissue that has two layers, with the fibrous capsule lying outside the synovial membrane.	The fibrous capsule helps to strengthen the joint, while the synovial membrane lines the joint and secretes synovial fluid.

- The femur or thighbone is the longest and strongest bone of the human skeleton.
- The stapes in the middle ear is the smallest and lightest bone of the human skeleton.

- There are muscles in the root of your hair that give you goose bumps.
- It takes 17 muscles to smile and 42 muscles to frown.
- The hardest working muscle is in eye.



Muscle	Location	Characteristics
Striated / Skeletal / Voluntary muscle	Attached to bones. Found in arms, legs, neck.	Multinucleate, Unbranched, Voluntary.
Non striated / Smooth / Involuntary muscle	Attached to soft parts of the body like blood vessels, iris, bronchi and the skin.	Single, central nucleus Involuntary
Cardiac muscle	Heart	Branched, 1 -3 central nuclei Involuntary

Types of teeth	Number of teeth	Functions
Incisors	8	Cutting and biting
Canines	4	Tearing and piercing
Premolars	8	Crushing and grinding
Molars	12	Crushing, grinding and mastication

Lysosomes are involved in the destruction of aged and worn out cellular organelles. Therefore, they are also called demolition squads or scavengers or cellular housekeepers.

More to Know

The tongue is connected underneath by a membrane called the **frenulum**. This runs between the tongue and the floor of the mouth. It prevents from swallowing our own tongue.

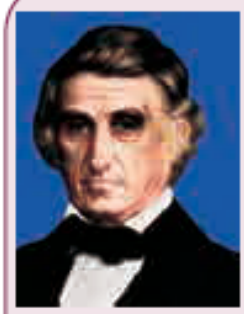
Connecting Concepts

Rennin: Causes curdling of milk protein caesin and increases digestion of proteins

Renin: Converts angiotensinogen to angiotensin and regulate the absorption of water and Na^+ from glomerular filtrate

DO YOU KNOW?

The small intestine is about 5m long and is the longest part of the digestive system. The large intestine is a thicker tube, but is about 1.5 m long



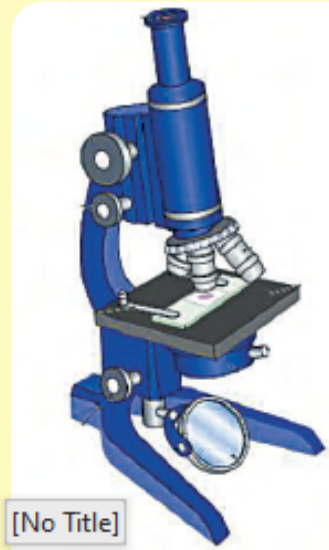
William Beaumont (1785-1853)

William Beaumont was a surgeon who was known as the "Father of Gastric Physiology". Based on his observations he concluded that the stomach's strong hydrochloric acid played a key role in digestion.

Organ Systems	Organs	Function
Integumentary system	Skin and skin glands	Protection, Excretion, etc.
Skeletal system	Skull, Vertebral column, Sternum, Girdles and Limbs	Give support, shape and form to the body.
Muscular system	Muscle fibres	Contraction and relaxation resulting movement.
Nervous system	Brain, spinal cord and nerves.	Conduction of nerve impulse.
Circulatory system	Heart, blood and blood vessels	Transportation of respiratory gases, nutritive substances and waste products.
Respiratory system	Respiratory tract and Lungs	Breathing
Digestive system	Digestive tract and digestive glands	Digestion, Absorption, Egestion
Excretory system	Kidneys, ureters, urinary bladder and urethra.	Elimination of nitrogenous waste products.
Reproductive system	Testes and ovary	Gametes formation and development of secondary sexual characters.
Sensory system	Eyes, nose, ears, tongue and skin	Sight, smell, hearing, taste and touch.
Endocrine system	Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Pineal body, Thymus, Reproductive glands, etc.	Co-ordinates the functions of all organ systems.

MORE TO KNOW

- *The study of cell is not possible without a microscope. Robert Hooke in 1665 coined the term cell and discovered the cellular structure of cork.*
- *Anton Van Leeuwenhoek (1674), studied the structure of bacteria, protozoa, etc. under the simple microscope which he himself designed.*
- *Robert Brown, a Scottish Botanist, discovered that all cells contain nucleus.*
- *Purkinje coined the term 'protoplasm' for the living substance present inside the cell.*



Compound Microscope

Digestive glands	Enzymes	Substrate (nutrient)	Product of digestion
Salivary glands	Ptyalin (Salivary amylase)	Starch	Maltose
Gastric glands	Pepsin	Proteins	Peptones
	Rennin (in infants)	Milk protein or caseinogen	Curdles milk to produce casein protein
Pancreas	Pancreatic amylase	Starch	Maltose
	Trypsin	Proteins and peptones	Peptides and amino acids
	Chymotrypsin	Protein	Proteoses, Peptones, Polypeptide, tri and dipepetides
	Pancreatic lipase	Emulsified fats	Fatty acids and Glycerol
Intestinal glands	Maltase	Maltose	Glucose and Glucose
	Lactase	Lactose	Glucose and Galactose
	Sucrase	Sucrose	Glucose and Fructose
	Lipase	Fats	Fatty acids and Glycerol

DO YOU KNOW?

Two healthy kidneys contain a total of about 2 million nephrons, which filter about 1700-1800 litres of blood. The kidneys reabsorb and redistribute 99% of the blood volume and only 1% of the blood filtered becomes urine.

DO YOU KNOW?

The sperm is the smallest cell in the male body. A normal male produces more than 500 billion sperm cells in his life time. The process of formation of sperms is known as spermatogenesis.

DO YOU KNOW?

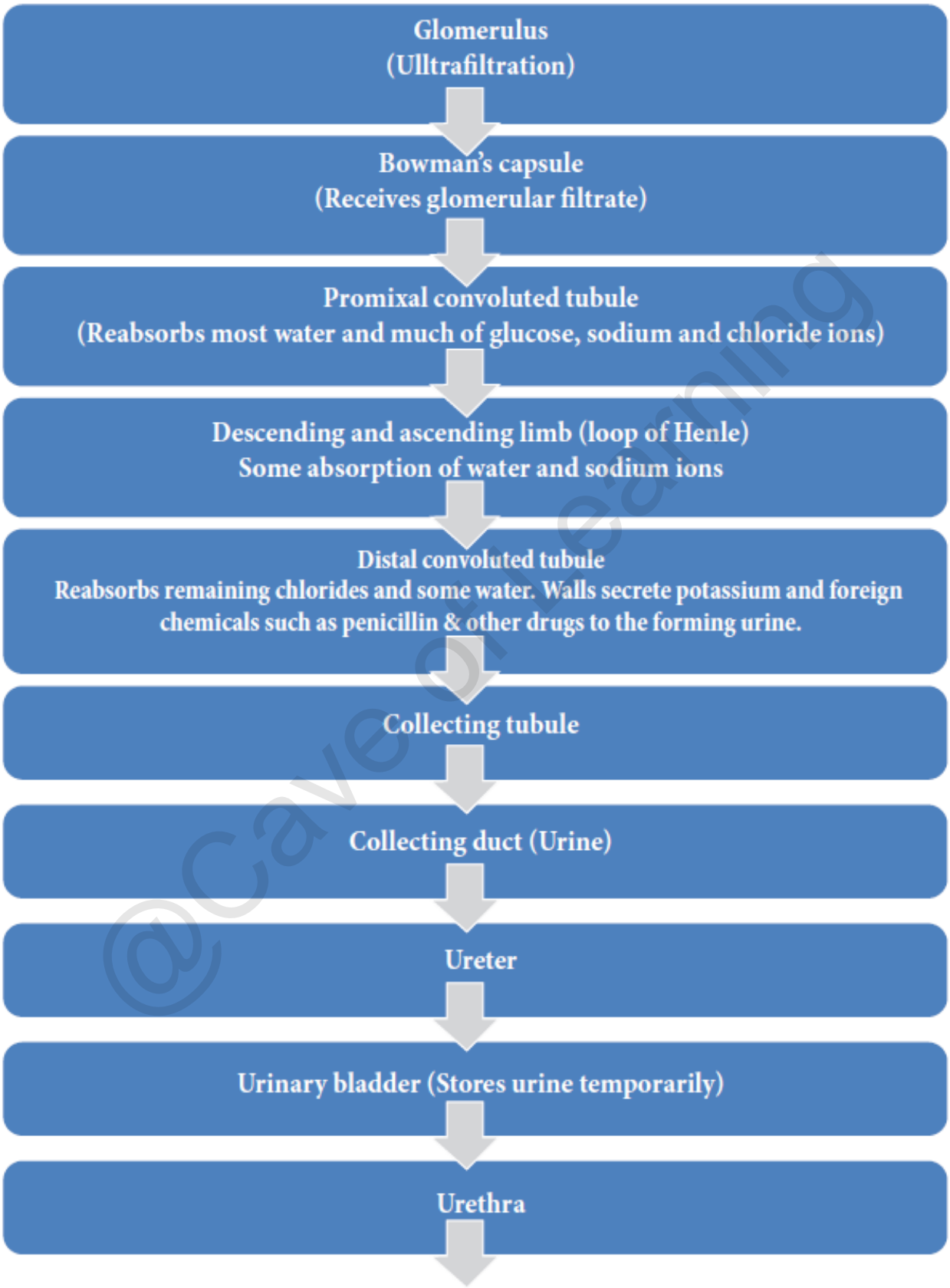
First kidney transplant

In 1954, Joseph E.Murray and his colleagues at Peter Bent Brigham Hospital in Boston performed first succesful kidney transplant between Ronald and Richard Herrick who were identical twins. The recepient Richard Herrick died after 8 years of transplantation

More to Know

An ovum is the largest human cell. The process of formation of ova is known as **oogenesis**.

Route of urine flow



Tissue System	Components	Funtions
Dermal Tissue System	Epidermis and Periderm (in older stems and roots)	• Protection • Prevention of water loss
Ground Tissue System	Parenchyma tissue Collenchyma tissue Sclerenchyma tissue	• Photosynthesis • Food storage • Regeneration • Support • Protection
Vascular Tissue System	Vascular tissues - Xylem tissue - Phloem tissue	• Transport of water and minerals • Transport of food

S. No.	Tissues	Dicot Root	Monocot Root
1	Number of Xylem	Tetrarch	Polyarch
2	Cambium	Present(During secondary growth only)	Absent
3	Secondary Growth	Present	Absent
4	Pith	Absent	Present

S. No.	Tissues	Dicot Stem	Monocot Stem
1	Hypodermis	Collenchymatous	Sclerenchymatous
2	Ground tissue	Differentiated into cortex, endodermis, pericycle and pith	Undifferentiated
3	Vascular bundles	(i) Less in number (ii) Uniform in size (iii) Arranged in a ring (iv) Open (v) Bundle sheath absent	(i) Numerous (ii) Smaller near periphery, bigger in the centre (iii) Scattered (iv) Closed (v) Bundle sheath present
4	Secondary growth	Present	Mostly absent
5	Pith	Present	Absent
6	Medullary rays	Present	Absent

S. No.	Dicot Leaf	Monocot Leaf
1	Dorsiventral leaf	Isobilateral leaf
2	Mesophyll is differentiated into palisade and spongy parenchyma	Mesophyll is not differentiated into palisade and spongy parenchyma

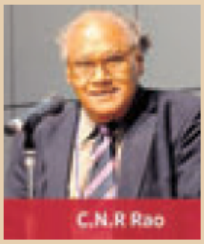
More to Know

ATP	Adenosine Triphosphate
ADP	Adenosine Diphosphate
NAD	Nicotinamide Adenine Dinucleotide
NADP	Nicotinamide Adenine Dinucleotide Phosphate

DO YOU KNOW?

A cell cannot get its energy directly from glucose. So in respiration the energy released from glucose is used to make ATP (Adenosine Triphosphate)

Info bit



Artificial photosynthesis is a method for producing renewable energy by the use of sunlight. Indian scientist C.N.R. Rao who was conferred the Bharat Ratna (2013) is also working on similar technology of artificial photosynthesis to produce - Hydrogen fuel (renewable energy).

DO YOU KNOW?

Why does mammalian RBC lack cell organelles and nucleus?

Mammalian RBC lack nucleus and makes the cells biconcave and increase surface area for oxygen binding, loss of mitochondria allows the RBC to transport all the oxygen to tissues, and loss of endoplasmic reticulum allows more flexibility for RBC to move through the narrow capillaries.

More to Know

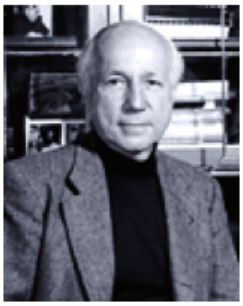
Closed circulatory system was discovered by William Harvey (1628) who is regarded the Father of Modern Physiology.

More to Know

Neurogenic and Myogenic Heart Beat

Neurogenic heart beat is initiated by a nerve impulse caused from a nerve ganglion situated near the heart. e.g. Annelids, most arthropods

Myogenic heart beat is initiated by a specialized group of modified heart muscle fibres. e.g. Mollusca and Vertebrates



Melvin Calvin, an American biochemist, discovered chemical pathway for photosynthesis. The cycle is named as Calvin cycle. He was awarded with Nobel Prize in the year 1961 for his discovery.

More to Know

Dews are water droplets on the leaves of grass seen in the early mornings, when the climate is humid and excess of water is present in the plants, the excess water is exudated in the form of liquid. This is due to root pressure .This phenomenon is called **Guttation** which takes place through specialized cells called **Hydathodes**.

More to Know

Anemia: Decrease in number of erythrocytes.
Leucocytosis: Increase in the number of leukocytes.
Leukopenia: Decrease in number of leukocytes.
Thrombocytopenia: Decrease in the number of thrombocytes.

More to Know

Heart chambers in vertebrate animals
Two chambered: Fishes
Three chambered: Amphibians
Incomplete four chambered: Reptiles
Four chambered: Aves, Mammals and Crocodiles (Reptile)

DO YOU KNOW?

Atrioventricular bundle was discovered by His (1893). So is called Bundle of His.

S.No	Artery	Vein
1	Distributing vessel	Collecting vessel
2	Pink in colour	Red in colour
3	Deep location	Superficial in location
4	Blood flow with high pressure	Blood flow with low pressure
5	Wall of artery is strong, thick and elastic	Wall of vein is weak, thin and non-elastic
6	All arteries carry oxygenated blood except pulmonary arteries	All veins carry deoxygenated blood except pulmonary veins
7	Internal valves are absent	Internal valves are present

Unipolar Neurons	Found in early embryos but not in adult
Bipolar Neurons	Found in retina of eye and olfactory epithelium of nasal chambers
Multipolar Neurons	Found in cerebral cortex of brain

DO YOU KNOW?

Each neuron can transmit 1,000 nerve impulses per second and make as many as ten thousands of synaptic contacts with other neurons.

Blood Group	Antigens on RBC	Antibodies in Plasma	Can donate to	Can receive from
A	Antigen A	anti- b	A and AB	A and O
B	Antigen B	anti- a	B and AB	B and O
AB	Antigen A and B	No antibody	AB	A, B, AB and O (Universal Recipient)
O	No Antigen	Both anti a and b	A, B, AB and O (Universal Donor)	O

DO YOU KNOW?

Meningitis is an inflammation of the meninges. It can occur when fluid surrounding the meninges becomes infected. The most common causes of meningitis are viral and bacterial infections.

Info bits

The number of primordial follicles in new born female child ranges over 7 million and during reproductive period (at puberty) the number is around 60,000 to 70,000. During a woman's lifetime, she will only ovulate 300 to 400 of the 1-2 million eggs, she was initially born with. On the other side, men will produce over 500 billion sperms in their lifetime.

DO YOU KNOW?

The human brain constitutes nearly 60 percent of fat. The most crucial molecules that determine our brain's integrity and the ability are Essential Fatty Acids (EFAs). EFAs cannot be synthesised and must be obtained from food. Fish, green leafy vegetables, almond, walnut are rich sources of EFAs.

More to Know

Electroencephalogram (EEG) is an instrument which records the electrical impulses of brain. An EEG can detect abnormalities in the brain waves and help in diagnoses of seizures, epilepsy, brain tumors, head injuries,etc.

Structure	Functions
Cerebral cortex	Sensory preception, control of voulntary functions, language, thinking, memory, decision making, creativity
Thalamus	Acts as relay station
Hypothalamus	Temperature control, thirst, hunger, urination, important link between nervous system and endocrine glands
Cerebellum	Maintenance of posture and balance,coordinate voluntary muscle activity
Pons and medulla	Role in sleep-awake cycle, cardiovascular, respiratory and digestive control centers

Info bits

Normally one egg matures in the ovary each month. Ovulation is the rupture of the follicle releasing the egg or ovum . The uterus prepares itself to receive the fertilized egg every month. The uterine lining becomes thick and spongy for implantation of the fertilized egg.

Events leading to when fertilization occurs and does not occur

If fertilization takes place the corpus luteum persists, continues to secrete progesterone maintains the thickened state of uterine wall and prevents maturation of another follicle till the end of pregnancy

If fertilization does not occur, corpus luteum degenerates, the egg disintegrates and the uterine lining slowly breaks, discharged as blood and mucus leading to menstrual events.

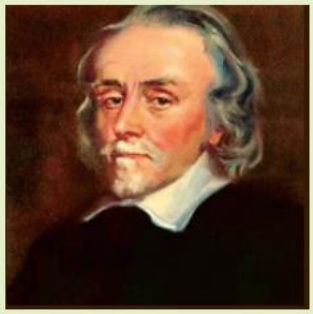
Iodine reacts with Starch to form Starch-Iodine complex which is blue-black in colour. Thus, the appearance of blue-black colour confirms the presence of Starch in the food item

Phase	Days	Changes in Ovary	Changes in Uterus	Hormonal Changes
Menstrual phase	4–5 days	Development of primary follicles	Breakdown of uterine endometrial lining leads to bleeding	Decrease in progesterone and oestrogen
Follicular phase	6th–13th day	Primary follicles grow to become a fully mature Graafian follicle	Endometrium regenerates through proliferation	FSH and oestrogen increase
Ovulatory phase	14th day	The Graafian follicle ruptures, and releases the ovum(egg)	Increase in endometrial thickness	LH peak
Luteal phase	15th–28th day	Emptied Graafian follicle develops into corpus luteum	Endometrium is prepared for implantation if fertilization of egg takes place, if fertilization does not occur corpus luteum degenerates, uterine wall ruptures, bleeding starts and unfertilized egg is expelled	LH and FSH decrease, Corpus luteum produces progesterone and its level increases followed by a decline, if menstrual bleeding occurs

Sometimes ovaries releases two eggs and each is fertilised by a different sperm, resulting in **Non-Identical Twins (Fraternal Twins)**. If single egg is fertilised and then divides into two foetus, **Identical Twins** develop.

More to Know

Every year May 28 is observed as Menstrual Hygiene day to make girls and women aware of maintaining menstrual hygiene and importance of menstrual hygiene for good health. By way of awareness through films, discussions and campaigns menstrual hygiene has taken quite the centre stage in recent days.



William Harvey 1578-1657 *was an English physician. He was the first to give details about blood circulation, properties of blood and pumping of blood by the heart.*

Fact File

Sun screen lotion reduces your skin's ability to produce Vitamin D by up to 95% which may lead to Vitamin D deficiency.

Minerals	Functions
Calcium	Strong bones and teeth, clotting of blood
Phosphorus	Strong bones and teeth
Iodine	Synthesis of thyroid hormone
Iron	Formation of haemoglobin and brain development

The inverted red triangle is a symbol of family planning in India for family welfare. It is displayed prominently at all hospitals, primary health clinics and family welfare centres where any help or advice about family planning is available free of cost. The symbol is displayed along with a slogan *Small Family, Happy Family.*

Info bits

The menstrual hygiene scheme to provide subsidized sanitary napkins was launched by the Health ministry in 2011.

In Tamil Nadu, UNICEF has developed an affordable incinerator that uses firewood to handle sanitary napkin waste at schools and special wells are equipped where sanitary napkins are composted.

Change in colour of the given food sample turns purple or violet confirms the presence of Protein.

Soyabean is the highly rich source of protein.

green gram sprouts are low in calories, have fibre and Vitamin B. It has comparatively high amount of vitamin C and vitamin K

Gooseberries contains nearly 20 times the vitamin C than Orange.

Vitamin	Found abundantly in	Disease we get if deficient in this	Symptoms
Vitamin A	Fish oil, egg, milk, ghee, carrot, corn, yellow fruits, greens	Night blindness	Poor vision, difficulty in seeing in dim light
Vitamin B	Whole grain, unpolished rice, milk, fish, meat, peas, lentils Green vegetables	Beriberi	Nervous weakness, fatigue.
Vitamin C	Oranges, Gooseberry, Greenchilly, Tomato	Scurvy	Bleeding gums
Vitamin D	Fish oil, milk and eggs. It is also made in our skin using sunlight	Rickets	Weak, flexible bones
Vitamin E	Vegetable oils, Green vegetables, whole wheat, Mango, apple, greens	Nervous weakness, dimming of eyesight	Childlessness, lack of resistance power to illnesses
Vitamin K	Green vegetables, Tomato, cabbage, eggs, milk products.	Weakness of the bones, teeth etc.	Even a small cut bleeds profusely.

80% of the world production of Moringa Leaves is in India. The Major countries which import Moringa Leaves are China, US, Germany, Canada, South Korea and European countries.

Protein Diseases	Symptoms
Kwashiorkar	Stunted growth, Swelling of face and limbs, Diarrhoea.
Marasmus	Skinny appearance, Slow body growth.

Mineral	Deficiency Disease
Calcium	Rickets.
Phosphorus	Osteomalatia
Iodine	Cretinism (in Child) Goitre (in adult)
Iron	Anaemia

Fact File

Moringa leaves are rich in

Vitamin A,

Vitamin C,

Potassium,

Calcium,

Iron and

Protein.

It also contains

Powerful anti oxidants

India has the second highest number of obese children in the world after China, according to a study that has found that 14.4 million children in the country have excess weight.

Disease

Disease is a definite pathological process having a characteristic set of signs and symptoms.

Disorder

Disorder is a derangement or abnormality of function.

Dengue is spread by mosquitoes of Aedes aegypti caused by DEN-1, 2 virus belonging to the type- flavivirus. It decrease counting of the blood platelets of human blood and it has a maximum flight range of 50–100 meters in and around the places.

As a general rule, iron supplements should be given orally, not to be injected, because it leads to dangerous.

Deep sleep seems to be one of the most critical time for body repair.

Discuss with Friends

" Early to bed and early to rise make a man healthy, wealthy and wise"

Benjamin Franklin

Microscopes help to study the structure of the microorganisms

Vaccine

A **vaccine** is a biological preparation that provides active acquired immunity to a particular disease. Vaccines like (BCG, Polio, MMR) are given at early child wood to protect from other diseases.

Leucoderma is a non – communicable diseases caused by partial or total loss of pigmentation in the skin. **(melanin pigment).** This condition affects any age, gender and ethnicity. There is no cure. It does not spread by touching, sharing food and sitting together.

Sl. No.	Name of the Diseases	Causative Agents	Impacts/ Consequences	Remedial measures
1	Bleeding gums	Vitamin C deficiency	Bleeding of the gums	Eating citrus fruits
2	Tooth decay	Bacteria in plaque	Bacteria produce acids	Brushing and flossing the teeth can prevent decay.
3	Periodontitis	Tobacco chewing	Severe form of gum disease ruin the bones, gums, and other tissues	Chewing type of tobacco should be avoided. Eat a well-balanced diet.

S.No.	Name of the Disease	Causative Agents	Impacts/Consequences	Remedial measures
1.	Night Blindness	a lack of vitamin A , a disorder of the cells in your retina	makes it hard to see well at night or in poor light..	Eat foods rich in anti-oxidant, vitamins and minerals.
2.	Conjunctivitis (Pink eye)	Caused by a virus and bacteria	One or both eyes can be affected. Highly contagious; can be spread by contamination and sneezing.	Antibiotic eye drops or ointments, home remedy
3.	Color blindness	genetic condition	• Difficulty distinguishing between colours • Inability to see shades or tones of the same colour	There is no known cure for colour blindness. Contact lenses and glasses with filters.

Testes and ovaries are called primary sex organs of the male and female respectively.

More to Know

Every 7 calories of excess consumption leads to 1 gm fat deposit and increase in body weight. Weight due to fat in adipose tissue exceeds more than 20% to 25 % of body weight. An adult weighing 10% more than the standard weight is OVERWEIGHT and 20% more is OBESE.

World Cancer Day - 4th February

National Cancer Awareness Day -7th November

The secretions of sweat and sebaceous or subcutaneous glands (Oil glands) are very active during adolescence. Many adolescent boys and girls get pimples on face because of increased activity of these glands in the skin. Owing to extra secretions sometimes a distinctive odour is also produced from the bodies.

- International Day against Drug Abuse and Illicit Trafficking - June 26.
- Narcotic Drugs and Psychotropic Substances Act was introduced in 1985.

DO YOU KNOW?

At puberty, the growth of the larynx is larger in boys than that of girls. The growing voice box in boys can be seen as a protruding part of the throat called Adam's apple, so that the voice becomes deep and harsh. This is caused mainly by male hormone (regulatory chemicals) during adolescence. As a result of this, muscles (chords) attached to the cartilage get loosened and thickened. When air passes through these loosened and thickened chords a hoarse sound is produced. In girls larynx is hardly visible from outside because of its small size and the voice becomes high pitched.

DO YOU KNOW?

Estrogen is not a single hormone but a collection of related steroid hormones.

DO YOU KNOW?

Sleep is vital to the well-being of adolescents. It can even help you to come out of the stress you experience during this period. During this period about 8 to 10 hours of sleep each night is necessary. But most teens do not get enough sleep.

DO YOU KNOW?

World Health Organization (WHO) 1984 suggested the use of the term drug dependence in place of drug addiction or drug abuse

Info bits

World Health organization (WHO) 1984 suggested the use of the term drug. WHO issued a directive under which all cigarette advertisements and packs carry a statutory warning **"Smoking is injurious to Health".**

Girls	Boys
Height and weight increase.	Height and weight increase.
Fatty and subcutaneous tissues develop.	Muscles develop.
Hip broadens.	Shoulder broadens.
Hair grows in arm pits and pubic area.	Hair grows in the arm pits and pubic area, and facial hair also appears.
Voice becomes shrill.	Voice break takes place due to lengthening of vocal cord and enlarging of larynx.
Breast develops.	Size of the penis increases.

DO YOU KNOW?

Now-a-days girls attain puberty at very early age. This is due to food habits. As you eat lot of junk food, the body growth increases and it look like adults.

DO YOU KNOW?

Women should take in more iron in their diet regularly to make up for the loss of blood during menstruation.

Let us know

- Vitamins will be lost when vegetables and fruits are washed after cutting.
- Adequate amount of vitamins and minerals are present in the peels of fruits and vegetables.
- We lose vitamins and minerals in cereals and pulses by washing it several times.

More to Know

The Ministry of Women and Child Development championed the introduction of the Protection of Children from Sexual Offences (POCSO) Act, 2012. People who traffic children for sexual purposes are also punishable under the provisions relating to the Act.

Objectives of the POCSO Act, 2012

- To protect children from the offences of
  - Sexual assault
  - Sexual harassment
  - Pornography
- To establish Special Courts for speedy trial of such offences.

More to Know

Anti Tobacco Act was passed on May 1st 2004. By 2030 tobacco is expected to be single biggest cause of death worldwide accounting for 10 million deaths per year.

May 31st is observed as No Tobacco Day (World Anti-Tobacco Day)

More to Know

The National Commission for Protection of Child Rights (NCPCR) was set up in March 2007 under the Commissions for Protection of Child Rights (CPCR) Act, 2005. This act emphasizes the principle of universality and inviolability of child rights and recognizes the tone of urgency in all the child related policies of the country.

Protection of all children of all age group upto 18 years of age is of equal importance. Policies define priority actions for the most vulnerable children.

CHILD HELPLINE 1098

More to Know

One in every 8 individuals in India is a diabetic. The revised WHO estimates for the year 2025 is 57.2 million diabetics in India. The average age for the onset of diabetes is 40 years, while it is 55 years in other countries. World Health Organizaation projects that diabetes will be 7th leading cause of death by the year 2030.

According to WHO recommendation, if the fasting blood glucose is greater than 140 mg/dl or the random blood glucose is greater than 200 mg /ml on more than two occasions, diagnosis for confirming diabetes is essential.

Factors	Type-1 Insulin dependent diabetes mellitus (IDDM)	Type-2 Non-insulin dependent diabetes mellitus (NIDDM)
Prevalence	10-20%	80-90%
Age of onset	Juvenile onset (< 20 years)	Maturity onset (>30 years)
Body weight	Normal or Underweight	Obese
Defect	Insulin deficiency due to destruction of β-cells	Target cells do respond to insulin
Treatment	Insulin administration is necessary	Can be controlled by diet, exercise and medicine

Info bits

Flax seeds containing insoluble fibre, Guavas, Tomatoes and Spinach are foods which help reduce blood sugar levels.

More to Know

Desirable level for blood cholesterol should be less than 200 mg/dl for Indians. The risk of coronary heart disease increases slowly as blood cholesterol levels increases from 200 to 300 mg/dl.

DO YOU KNOW?

Dr. Suniti Solomon, pioneered HIV research and treatment in India. She set up the first voluntary testing and counselling centre and an AIDS Research group in Chennai during 80's. Her team was the first to document evidence of HIV infection in India in 1985 (First Indian AIDS patient in Chennai).

DO YOU KNOW?

How Vitamin D is synthesized by our skin?

Human skin can synthesize Vitamin D when exposed to sunlight (especially early morning). When the sun rays falls on the skin dehydro cholesterol is converted into Vitamin D. Hence, Vitamin D is called as **"Sunshine vitamin"**

DO YOU KNOW?

HDL (High Density Lipoprotein) or **"good"** cholesterol lowers risk of heart disease while **LDL** (Low Density Lipoprotein) or **"bad"** cholesterol increases risk of heart disease.

More to Know

Types of Tumours

Benign tumours or Non malignant tumours: Remain confined in the organ affected and do not spread to other parts of the body.

Malignant tumours: Mass of proliferating cells which grow very rapidly invading and damaging the surrounding normal tissues.

More to Know

Many people are ignorant about AIDS and it has been said that – "don't" die of ignorance". In our country NACO (National AIDS Control Organization) and other NGO'S (Non- Governmental Organizations) are educating people about AIDS. Every year December 1st is observed as the "World AIDS Day".

More to Know

The major dietary carbohydrates

Class of carbohydrates	Components
Monosaccharides	Glucose, fructose, galactose
Disaccharides	Sucrose, lactose, maltose
Polysaccharides	Amylose, amylopectin, starch
	cellulose, hemicellulose, glycogen

More to Know

- Dr. Funk introduced the term vitamin. Vitamin A was given the first letter of the alphabet, as it was the first to be discovered.
- Vitamin D improves bone strength by helping body to absorb calcium.
- Iron from meat (heme iron) and plant sources (non-heme iron) are absorbed by the body differentially. While the iron in meat protein is readily absorbed, non-heme iron requires Vitamin C for absorption.

Deep freezing is a method of food preservation where the food materials are kept inside a cold room in a temperature range of -23°C to -30°C. Seeds are preserved at sub - zero temperature.

DO YOU KNOW?

October 21st is declared as Global Iodine Deficiency Day.

Dried neem leaves, turmeric are used to store food grains in our home to protect the grains from insects and beetles.

DO YOU KNOW?

Why do dry grapes (raisins) not spoil at room temperature when fresh grape does?

DO YOU KNOW?

Bananas are not kept in refrigerator why?

Bananas are best stored at room temperature. When it is kept in a refrigerator, the enzyme responsible for ripening becomes inactive. In addition, the enzyme responsible for browning and cell damage becomes more active thereby causing the skin colour change from yellow to dark brown.

Vitamins, their sources, deficiency disorders and symptoms

Vitamins	Sources	Deficiency disorders	Symptoms
		Fat soluble vitamins	
Vitamin A (Retinol)	Carrot, papaya, leafy vegetables, fish liver oil, egg yolk, liver, dairy products	Xerophthalmia Nyctalopia (Night blindness)	Dryness of Cornea Unable to see in the night (dim light) Scaly skin
Vitamin D (Calciferol)	Egg, liver, dairy products, Fish, synthesized by the skin in sunlight	Rickets (in children)	Bow legs, defective ribs, development of pigeon chest
Vitamin E (Tocopherol)	Whole wheat, meat, vegetable oil, milk	Sterility in rats, Reproductive abnormalities	Sterility
Vitamin K (Derivative of Quinone)	Leafy vegetables, soyabeans, milk	Blood clotting is prevented	Excessive bleeding due to delayed blood clotting
		Water soluble vitamins	
Vitamin B1 (Thiamine)	Whole grains, yeast, eggs, liver, sprouted pulses	Beriberi	Degenerative changes in the nerves, muscles become weak, paralysis
Vitamin B2 (Riboflavin)	Milk, eggs, liver, green vegetables, whole grains	Ariboflavinosis (Cheilosis)	Irritation in eyes, dry skin, inflammation of lips, fissures in the corners of the mouth
Vitamin B3 (Niacin)	Milk, eggs, liver, lean meat, ground nuts, bran	Pellagra	Inflammation of skin, loss of memory, diarrhoea
Vitamin B6 (Pyridoxine)	Meat, fish, eggs, germs of grains and cereals, rice, polishings	Dermatitis	Scaly skin, nerve disorders
Vitamin B12 (Cyanocobalamine)	Milk, meat, liver, pulses, cereals, fish	Pernicious anaemia	Decrease in red blood cell production, degeneration of spinal cord
Vitamin C (Ascorbic acid)	Leafy vegetables, sprouts, citrus fruits like goose berry (Amala), lemon, orange	Scurvy	Swollen and bleeding gums, delay in healing of wounds, Teeth and bones malformed

Minerals, their sources, functions and deficiency diseases

Minerals	Sources	Functions	Diseases
		Macro nutrients	
Calcium	Dairy foods, beans, cabbage, eggs, fish	Constitution of bone, enamel of teeth, clotting of blood and controls muscle contraction	Bone deformities, poor skeletal growth, osteoporosis in adults.
Sodium	Table salt	maintains fluid balance and involved in neurotransmission	Muscular cramps, nerve impulses do not get transmitted.
Potassium	Banana, sweet potato, nuts, whole grains, citrus fruits	Regulates nerve and muscle activity	Muscular fatigue, nerve impulses do not get transmitted.
		Micro nutrients	
Iron	Spinach, dates, greens, broccoli, whole cereals, nuts, fish, liver	Important component of haemoglobin	Anaemia
Iodine	Milk, Seafood, Table salt	Formation of thyroid hormones	Goitre

Know your scientist

Louis Pasteur (1822 – 1895)

French chemist and microbiologist, was the founder of microbiology. He discovered that microorganisms cause fermentation and diseases. He invented the process of pasteurisation and developed vaccination against rabies and anthrax.

Methylene Dye Reduction Test - It is widely used in milk processing units to assess the microbial quality of raw and pasteurised milk. The quality of the milk is considered superior or inferior based on the time taken by the milk to decolourize after the addition of Methylene blue dye solution to it. Sooner the decolourization, more inferior is the bacteriological quality of milk and requires further processing.

In addition to microbiological and chemical contamination, preservatives like excess salt, sugar and oil also make food unsafe for consumption and are linked with non-communicable diseases such as diabetes, obesity and heart diseases.

Phenyl Acetic Acid (PAA) and Indole 3 Acetonitrile (IAN) are natural auxins. Indole 3 Butyric Acid (IBA), Indole-3-Propionic Acid, α-Naphthalene Acetic Acid (NAA), 2, 4, 5-T (2,4,5 Trichlorophenoxy Acetic Acid) are some of the synthetic auxins.

More to Know

- Operation Flood, launched in 1970 by National Dairy Development Board, started the White Revolution in India and transformed our country from a milk deficient nation into the World's largest producer of milk and milk products. Dr. Verges Kurien, the founder of "Anand Milk Union Limited"(AMUL) was the brain behind the success of the programme.

More to Know

- October 16th is World Food Day. It emphasizes on food safety and avoid food wastage.

A slogan "**From farm to plate, make food safe**" was raised on World Health Day (7th April 2015) to promote and improve food safety.

Properties	Naturally ripened fruit	Artificially ripened fruit
Colour	Attractive, but not uniformly coloured	Uniformly coloured but very attractive
Aroma	Good	Mild
Firmness	Good	Fair to some extent
Taste	Sweet and pleasant	Though appears ripe, inner core is sour
Shelf life	Long	Short. Black blotches appear on fruit after two to three days

1. Milk: Place a drop of milk on a slanting polished surface. Pure milk flows slowly leaving a trail behind while the milk adulterated with water will flow fast without leaving a trail.
2. Honey: Dip a cotton wick in honey and light it with a match stick. Pure honey burns while adulterated honey with sugar solution gives a cracking sound.
3. Sugar: Dissolve sugar in water. If chalk powder is added as an adulterant, it will settle down.
4. Coffee powder: Sprinkle a few pinches of coffee powder in a glass of water. Coffee powder floats. If it is adulterated with tamarind powder it settles down.
5. Food grains: They have visible adulterants like marble, sand grit, stones, etc. These are removed by sorting, hand picking, washing etc.

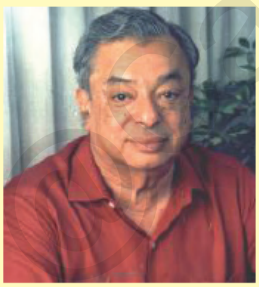
More to Know

The **Codex Alimentarius** (Latin for "Food Code") is a collection of internationally recognised standards, codes of practice, guidelines, and other recommendations relating to foods, food production and food safety. The Codex Alimentarius is recognized by the World Trade Organisation (WTO) as an International reference point for the resolution of disputes concerning food safety and consumer protection.

DO YOU KNOW?

The branch of biology which deals with the study of the endocrine glands and its physiology is known as '**Endocrinology**'. **Thomas Addison** is known as Father of Endocrinology. English physiologists **W. M. Bayliss** and **E. H. Starling** introduced the term ***hormone*** in 1909. They first discovered the hormone secretin.

	ISI (Indian Standards Institution) known as Bureau of Indian Standard (BIS)	Certifies industrial products like electrical appliances like switches, wiring cables, water heater, electric motor, kitchen appliances etc.
	AGMARK (Agricultural Marking)	Certifies agricultural and livestock products like cereals, essential oils, pulses, honey, butter etc.
	FPO (Fruit Process Order)	Certifies the fruit products like juice, jams, sauce, canned fruits and vegetables, pickles etc.,
	Food Safety and Standards Authority of India	Responsible for protecting and promoting the public health through regulation and supervision of food safety.



Dr. V. Kurien is considered as the Father of White Revolution. White Revolution refers to a time when there was tremendous increase in milk production with the use of new improved breeds of cattle. Dr. V.Kurien is the founder chairman of National Dairy Development Board (NDDB). This board designed and implemented the world's largest dairy development programme called OPERATION FLOOD.

White leghorn is the most high egg yielding breed in the world.

India ranks fifth in the world poultry production.

***Vegetarian eggs:** Fertile eggs rot more rapidly than infertile eggs. Hence the production of infertile eggs is desired. Hens are capable of laying eggs without the presence of cock and the eggs obtained are infertile. Such eggs are called vegetarian eggs.*

Facts about Indian Fisheries (both capture and culture)

1. *Total fish production – 2nd position in the world.*
2. *Marine fish production – 7th position in the world.*
3. *Aquaculture production – 2nd position in the world.*
4. *Fish industry contribution - Rs.53,000 crores as foreign exchange annually.*

More to Know

Melatonin is a hormone produced by the pineal gland. It is known as a 'time messenger'. It signals night time information throughout the body.

Exposure to light at night, especially short-wavelength light, can decrease melatonin production interrupting sleep. Suppression of melatonin has been implicated in sleep disturbances and related metabolic disorders.

DO YOU KNOW?

Human insulin was first discovered by Fredrick Banting, Charles Best and MacLeod in 1921. Insulin was first used in treatment of diabetes on 11th January 1922.

DO YOU KNOW?

Globally, about 800 women die every day of preventable causes related to pregnancy and childbirth; 20 per cent of these women are from India. Similarly India's infant mortality rate was 44 per 1,000 live. Although, India has witnessed dramatic growth over the last two decades, maternal mortality still remains high as in comparison to many developing nations.

source: http://unicef.in

Round dance Waggle dance

HONEY BEE COMMUNICATION (Dance forms)

Round dance indicates that the source of nectar is within 100 mts. Waggle dance signifies a long distance. The dance patterns specify the direction of nectar with respect to the sun. In 1973, KARL VON FRISCH received the Nobel Prize for deciphering this dance language.

More to Know

Edward C. Kendal in 1914 first crystallised thyroxine hormone. Charles Harrington and George Barger identified the molecular structure of thyroxine in 1927. Thyroid gland requires "120 µg" of iodine everyday for the production of thyroxine.

More to Know

The **cortisol** hormones of adrenal cortex serves to maintain the body in living condition and recover it from the severe effects of stress reactions. Thus an increased output of cortisol is "life saving" in "shock conditions". It is also known as life-saving hormone.

All women are born with ovaries, but some do not have functional uterus. This condition is called **Mayer-Rokitansky syndrome.**

Health care programmes such as massive child immunization, supply of nutritional food to the pregnant women, Janani Suraksha Yojana, Janani Shishu Suraksha Karyakaram, RMNCH+A approach (an integrated approach for reproductive, maternal, new born, child and adolescent health), Pradhan Mantri Surakshit Matritva Abhiyan, etc., are taken up at the national level by the Government of India.

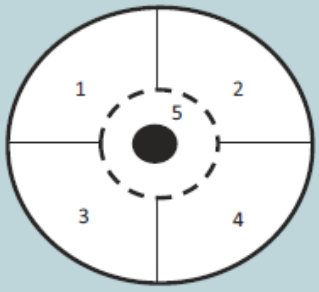
Cryopreservation (or freezing) of embryos is often used when there are more embryos than needed for a single IVF transfer. Embryo cryopreservation can provide an additional opportunity for pregnancy, through a **Frozen embryo transfer** (FET), without undergoing another ovarian stimulation and retrieval.

- Vitamin E is known as anti-sterility vitamin as it helps in the normal functioning of reproductive structures.
- Sex hormones were discovered by Adolf Butenandt.
- 11th July is observed as World Population Day.
- 1st December is observed as World AIDS Day.
- NACO (National AIDS Control Organisation) was established in 1992.
- Syphilis and gonorrhoea are commonly called as international diseases.

According to World Health Organization (WHO), 2017 more than one million people globally acquires a sexually transmitted infection every day. India has the third largest HIV epidemic in the world, with 2.1 million people living with HIV.

TNHSP (Tamilnadu health systems project), a unit of the Health and family welfare department of the Government of Tamilnadu does free screening for cervical and breast cancer.

BREAST SELF EXAMINATION AND EARLY DIAGNOSIS OF CANCER



1. Breast is divided into 4 quadrants and the center (Nipple) which is the 5th quadrant.
2. Each quadrant of the breast is felt for lumps using the palm of the opposite hand.
3. The examination is done in both lying down and standing positions, monthly once after the 1st week of menstrual cycle.

This way if there are lumps or any deviation of the nipple to one side or any blood discharge from the nipple we can identify cancer at an early stage.

Mammograms are done for women above the age of 40 years and for young girls and women below 40 years. Ultrasound of the breast aids in early diagnosis.

Name of the Disease	Causative agent	Symptom	Incubation period
Bacterial STI			
Gonorrhoea	*Neisseria gonorrhoeae*	Affects the urethra, rectum and throat and in females the cervix also get affected. Pain and pus discharge in the genital tract and burning sensation during urination.	2 to 5 days
Syphilis	*Treponema palladium*	**Primary stage** Formation of painless ulcer on the external genitalia. **Secondary stage** Skin lesions, rashes, swollen joints and fever and hair loss. **Tertiary stage** Appearance of chronic ulcers on nose, lower legs and palate. Loss of movement, mental disorder, visual impairment, heart problems, gummas (soft non-cancerous growths) etc	10 to 90 days
Chlamydiasis	*Chlamydia trachomatis*	Trachoma , affects the cells of the columnar epithelium in the urinogenital tract, respiratory tract and conjunctiva.	2 to 3 weeks or upto 6 weeks
Lymphogranuloma venereum	*Chlamydia trachomatis*	Cutaneous or mucosal genital damage, urithritis and endocervicitis. Locally harmful ulcerations and genital elephantiasis.	
Viral STI			
Genital herpes	Herpes simplex virus	Sores in and around the vulva, vagina, urethra in female or sores on or around the penis in male. Pain during urination, bleeding between periods. Swelling in the groin nodes.	2- 21 days (average 6 days)
Genital warts	Human papilloma virus (HPV)	Hard outgrowths (Tumour) on the external genitalia, cervix and perianal region.	1-8 months
Hepatitis-B	Hepatitis B virus (HBV)	Fatigue, jaundice, fever, rash and stomach pain. Liver cirrhosis and liver failure occur in the later stage.	30-80 days
AIDS	Human immunodeficiency virus (HIV)	Enlarged lymph nodes, prolonged fever, prolonged diarrhoea, weight reduction, night sweating.	2 to 6 weeks even more than 10 years.

Name of the Disease	Causative agent	Symptom	Incubation period
Fungal STI			
Candidiasis	*Candida albicans*	Attacks mouth, throat, intestinal tract and vagina. Vaginal itching or soreness, abnormal vaginal discharge and pain during urination.	–
Protozoan STI			
Trichomoniasis	*Trichomonas vaginalis*	Vaginitis , greenish yellow vaginal discharge, itching and burning sensation, urethritis, epididymitis and prostatitis	4-28 days

Common human diseases

Bacterial diseases
- Dysentery
- Plague
- Diphtheria
- Cholera
- Typhoid
- Pneumonia

Viral diseases
- Common cold
- Mumps
- Measles
- Viral hepatitis
- Dengue fever
- Chikungunya
- Chicken pox
- Poliomyelitis

Fungal diseases
- Candidiasis
- Athlete's foot

Protozoan diseases
- Malaria
- Amoebiasis
- African sleeping sickness
- Kala-azar

Helminthic diseases
- Ascariasis
- Filariasis

Malaria vaccine is used to prevent malaria. The only approved vaccine as of 2015 is RTS,S(Mosquirix). It requires four injections and has relatively low efficacy (26–50%). Due to this low efficacy, WHO does not recommend the use of RTS,S vaccine in babies between 6 and 12 weeks of age.

The **adenoids** are glands located in the roof of the mouth, behind the soft palate where the nose connects to the throat. The adenoids produce antibodies that help to fight infections. Typically, the adenoids shrink during adolescence and may disappear by adulthood.

[No Title]

Bacterial resistance

If an antibiotic is used too often to fight a specific bacterial infection, the bacteria may become resistant to the specific antibiotic. Hence the specific antibiotic can no longer be used to treat the bacterial infection. Some bacteria have developed resistance to many antibiotics. Therefore, infections caused by these bacteria are difficult to be cured.

Risk of bacterial resistance can be reduced by observing the following steps

- Avoid using antibiotics to treat minor infections that can be taken care by our immune system.
- Do not use an antibiotic to treat viral infections such as common cold or flu.
- Always follow the prescription. Skipping doses or failing to complete the prescription may allow antibiotic resistance to develop.

Peyer's patches are oval-shaped areas of thickened tissue that are embedded in the mucus-secreting lining of the small intestine of humans and other vertebrate animals. Peyer's patches contain a variety of immune cells, including macrophages, dendritic cells, T cells, and B cells.

The **tonsils** (palatine tonsils) are a pair of soft tissue masses located at the back of the throat (pharynx). The tonsils are part of the lymphatic system, which help to fight infections. They stop invading germs including bacteria and viruses.

Spleen is a secondary lymphoid organ located in the upper part of the abdominal cavity close to the diaphragm. Spleen contains B and T cells. It brings humoral and cell mediated immunity.

Nipah virus is a zoonotic virus (transmitted from animals to humans) and also transmitted through contaminated food. In infected people, it causes a range of illness from asymptomatic infection to acute respiratory illness and fatal encephalitis.

Swine flu was first recognised in the 1919 pandemic and still circulates as a seasonal flu virus. Swine flu is caused by the H1N1 virus strain. Symptoms include fever, cough, sore throat, chills, weakness and body aches. Children, pregnant women and the elderly are at risk from severe infection.

Dendritic cells are called so because its covered with long, thin membrane extensions that resemble dendrites of nerve cells. These cells present the antigen to T-helper cells. Four types of dendritic cells are known. They are langerhans, interstitial cells, myeloid and lymphoid cells

The histocompatibility antigens are cell surface antigens that induce an immune response leading to rejection of allografts.

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Shigellosis (Bacillary dysentery)	*Shigella sp.*	Intestine	Food and water contaminated by faeces / faecal oral route	Abdominal pain, dehydration, blood and mucus in the stools
2	Bubonic plague (Black death)	*Yersinia pestis*	Lymph nodes	Rat flea vector- *Xenopsylla cheopis*	Fever, headache, and swollen lymph nodes
3	Diphtheria	*Corynebacterium diphtheriae*	Larynx, skin, nasal and genital passage	Droplet infection	Fever, sore throat, hoarseness and difficulty in breathing
4	Cholera	*Vibrio cholerae*	Intestine	Contaminated food and water/ faecal oral route	Severe diarrhoea and dehydration
5	Tetanus (Lock jaw)	*Clostridium tetani*	Spasm of muscles	Through wound infection	Rigidity of jaw muscle, increased heart beat rate and spasm of the muscles of the jaw and face
6	Typhoid (Enteric fever)	*Salmonella typhi*	Intestine	Through contaminated food and water	Headache, abdominal discomfort, fever and diarrhoea
7	Pneumonia	*Streptococcus pneumoniae*	Lungs	Droplet infection	Fever, cough, painful breathing and brown sputum
8	Tuberculosis	*Mycobacterium tuberculosis*	Lungs	Droplet infection	Thick mucopurulant nasal discharge

Sl No	Types of Malaria	Causative agent	Duration of Erythrocytic cycle
1	Tertian, benign tertian or vivax malaria	*P. vivax*	48 hours
2	Quartan malaria	*P. malariae*	72 hours
3	Mild tertian malaria	*P. ovale*	48 hours
4	Malignant tertian or quotidian malaria	*P. falciparum*	36 – 48 hours

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Common cold	*Rhino viruses*	Respiratory tract	Droplet infection	Nasal congestion and discharge, sore throat, cough and headache
2	Mumps	*Mumps virus (RNA virus) Paramyxo virus*	Salivary glands	Saliva and droplet infection	Enlargement of the parotid glands
3	Measles	*Rubella virus (RNA virus), Paramyxo virus*	Skin and respiratory tract	Droplet infection	Sore throat, running nose, cough and fever. reddish rashes on the skin, neck and ears
4	Viral hepatitis	*Hepatitis - B virus*	Liver	Parenteral route, blood transfusion	Liver damage, jaundice, nausea, yellowish eyes, fever and pain in the abdomen
5	Chicken pox	*Varicella -Zoster virus (DNA Virus)*	Respiratory tract, skin and nervous system	Droplet infection and direct contact	Mild fever with itchy skin, rash and blisters
6	Poliomyelitis	*Polio virus (RNA virus)*	Intestine, brain, spinal cord	Droplet infection through faecal oral route	Fever, muscular stiffness and weakness, paralysis and respiratory failure
7	Dengue fever (Break bone fever)	*Dengue virus or Flavi virus (DENV 1-4 virus)*	Skin and blood	Mosquito vector *Aedes aegypti*	Severe flu like illness with a sudden onset of fever and painful headache, muscle and joint pain
8	Chikungunya	*Alpha virus (Toga virus)*	Nervous system	Mosquito vector *Aedes aegypti*	Fever and joint pain, headache and joint swelling

Type of innate immunity	Mechanism
1. Anatomical barriers	
Skin	Prevents the entry of microbes. Its acidic environment (pH 3-5) retards the growth of microbes.
Mucus membrane	Mucus entraps foreign microorganisms and competes with microbes for attachment.
2. Physiological barriers	
Temperature	Normal body temperature inhibits the growth of pathogens. Fever also inhibits the growth of pathogens.
Low pH	Acidity of gastric secretions (HCl) kills most ingested microbes.
Chemical mediators	Lysozyme acts as antibacterial agent and cleaves the bacterial cell wall. Interferons induce antiviral state in the uninfected cells. Complementary substances produced from leucocytes lyse the pathogenic microbes or facilitate phagocytosis.
3. Phagocytic barriers	Specialized cells (Monocytes, neutrophils, tissue macrophages) phagocytose, and digest whole microorganisms.
4. Inflammatory barriers	Tissue damage and infection induce leakage of vascular fluid, containing chemotactic signals like serotonin, histamine and prostaglandins. They influx the phagocytic cells into the affected area. This phenomenon is called diapedesis.

Sl.No	Active Immunity	Passive Immunity
1	Active immunity is produced actively by host's immune system.	Passive immunity is received passively and there is no active host participation.
2	It is produced due to contact with pathogen or by its antigen.	It is produced due to antibodies obtained from outside.
3	It is durable and effective in protection.	It is transient and less effective.
4	Immunological memory is present.	No memory.
5	Booster effect on subsequent dose is possible.	Subsequent dose is less effective.
6	Immunity is effective only after a short period.	Immunity develops immediately.

The process of production of blood cells in the bone marrow is called **haematopoiesis**.

Antigenicity is the property of a substance (antigen) that allows it to react with the products of the specific immune response.

Sl.No	Primary Immune Response	Secondary Immune Response
1	It occurs as a result of primary contact with an antigen.	It occurs as a result of second and subsequent contacts with the same antigen.
2	Antibody level reaches peak in 7 to 10 days.	Antibody level reaches peak in 3 to 5 days.
3	Prolonged period is required to establish immunity.	It establishes immunity in a short time.
4	There is rapid decline in antibody level.	Antibody level remains high for longer period.
5	It appears mainly in the lymph nodes and spleen.	It appears mainly in the bone marrow, followed by the spleen and lymph nodes.

Mucosa-associated lymphoid tissue (MALT) is a diffuse system of small concentrations of lymphoid tissue in the alimentary, respiratory and urino-genital tracts. MALT is populated by lymphocytes such as T and B cells, as well as plasma cells and macrophages, each of which is well situated to encounter antigens passing through the mucosal epithelium.

Gut-associated lymphoid tissue (GALT) is a component of the mucosa-associated lymphoid tissue (MALT) which works in the immune system to protect the body from invasion in the gut.

Bronchus Associated Lymphoid Tissues (BALT) also a component of MALT is made of lymphoid tissue (tonsils, lymph nodes, lymph follicles) is found in the respiratory mucosae from the nasal cavities to the lungs.

Cell type	Number of cells per µl	Approximate percentage
Red blood cells	4200,000 - 6500,000	-
White blood cells		
Agranulocytes		
Lymphocytes	1500-4000	20-30
Monocytes	200-950	2-7
Granulocytes		
Neutrophils	2000-7000	50-70
Basophils	50-100	<1
Eosinophils	40-500	2-5
Platelets	150,000-500,000	-

MORE TO KNOW

Vanamahotsav is an annual Indian tree planting festival celebrated in the month of July. It is to create an enthusiasm in the minds of people to conserve forests.

Alcoholism is the inability to control drinking due to physical and emotional dependence on alcohol. Treatment involves counseling by a healthcare professional. Detoxification programme in a hospital or medical facility is an option for those who need additional assistance. Medications are available to reduce the desire to drink and smoke.

Vaccino therapy is the method of use of vaccine for treatment of disease. Dr. Edward Jenner prepared first vaccine for small pox in 1796. Polio vaccine was developed by Dr. Jonas Salk (vaccine consists of inactivated microorganism) and Dr. Albert Sabin (live attenuated oral polio vaccine). Louis Pasteur (1885) discovered vaccine against rabies, anthrax and cholera. BCG vaccine was developed by Calmette and Guerin against tuberculosis in France in the year 1908.

Scope of Immunology

The younger graduates in this field can find number of employment opportunities in Government as well as private hospitals. The scope of the immunology is immunotherapy, microbial immunology, clinical immunology, cellular immunology, allergy and immunology, translational immunology, transplantation immunology, neuro-inflammatory disorders, tumour immunology, vaccine immunology, inflammatory disorders, ocular immunology and inflammation.

Group	Drugs	Effects
Stimulants	Amphetamines, cocaine, nicotine and tobacco	Accelerates the activity of the brain
Depressants	Alcohol, Barbiturates, Tranquilizers	Slows down the activity of the brain
Narcotic/ Analgesics	Opium, Morphine	Act as depressants on the Central Nervous System
Cannabis	Bhang (Marijuana), Ganja, Charas	Affects the cardiovascular system.
Hallucinogens	Lysergic acid diethylamide (LSD), Phencyclidine	Distorts the way one sees, hears and feels

Alcoholic Anonymous

Alcoholic anonymous was started in 1935 by a businessman and a doctor who had been a "hopeless drunk" for many years. After the men helped each other to stop drinking and to stay sober, they then founded the alcoholic anonymous to help other alcoholics. Since that time alcoholic anonymous has spread throughout the world.

INTERESTING FACTS

1. Freezing does not kill bacteria; it only arrests their growth.
2. Antibiotics not only kill harmful bacteria, but also kill beneficial bacteria of our body.
3. UTI- Urinary Tract Infection is one of the most common bacterial infections affecting 150 million people each year worldwide.
4. World malaria day is on 25th April
5. Iceland and the Faroe islands are the only countries in the world, where there are "No mosquitos" (Mosquito free countries)
6. Sterile insect technique (SIT) - The screw-worm fly was the first pest successfully eliminated from an area through the sterile insect technique, by the use of an integrated area-wide approach.
7. *Zika virus* could become a surgical weapon against brain cancer.

Types of ecosystem

- Natural ecosystem
  - Terrestrial ecosystem e.g. Forest
  - Aquatic ecosystem e.g. Pond
- Artificial ecosystem
  - Terrestrial ecosystem e.g. Garden
  - Aquatic ecosystem e.g. Aquarium

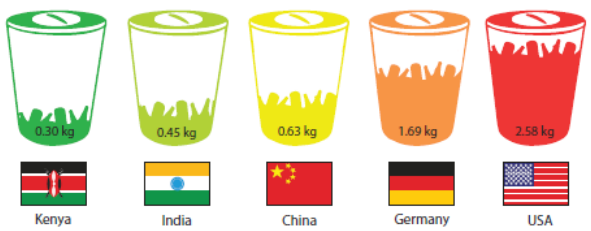
Components of an ecosystem

- Biotic components include all the living components e.g. plants, animals and human beings
- Abiotic components include all the non-living components
  - Physical factors
    1. Light
    2. Temperature
    3. Wind
    4. Humidity
  - Edaphic factors (Soil)
    1. Water in Soil
    2. Air in Soil
    3. Organic matter in Soil

DO YOU KNOW?

How much waste does each person make around the world every day?

The average person in India produces 0.45kg of waste every day. It may be small amount of waste. But, India has a large population and imagine you collected all the waste today and put it into tractors. You would fill so many tractors that you could create a traffic jam approximately 2,800 kilometres long. Imagine, a road all the way from Kanyakumari to New Delhi completely blocked with tractors carrying garbage and no space to walk in between. This is how much waste we create in India each day! If we reduce the waste, we reduce the pollution.



India produces 532 million kilos of solid waste every day.

MORE TO KNOW

IMPORTANT DAYS

World Wetland Day - Feb 2

World Forest Day - March 21

Earth Day - April 22

World Environment Day- June 5

Natural Resources Day - October 5

Nature Conservation Day - Nov 25

MORE TO KNOW

- India receives nearly 4 per cent of the global precipitation and ranks 133 in the world in terms of water availability per person per annum.
- The total renewable water resources of India is estimated at 1,897 sq km per annum.
- By 2025, it is predicted that large parts of India will join countries or regions having absolute water scarcity.

MORE TO KNOW

All oceans and seas have salty water. The saltiest of all is the Dead sea. It is called "dead" because the high salinity prevents any fish or other visible aquatic organisms to live in its water. Imagine 300 grams of salt in one litre of water. Interestingly, even if a person does not know how to swim, he would not drown in this sea. He would only float in it.

MORE TO KNOW

A World Bank report says, "India is the largest user of groundwater in the world and its underground aquifers are being depleted at an alarming rate".

MORE TO KNOW

A design of a toilet in which human excreta are treated by earthworms has been tested in India. It has been found to be a novel technique. Toilets that required little water is safe for processing of human waste. The conversion of toilet waste is very simple and hygienic. The human excreta are completely converted to vermicakes – a resource much needed for soil.

MORE TO KNOW

Three researchers, who made the crystal structure of the ribosomes received the Nobel Prize for Chemistry in the year 2009 - **Venkatraman Ramakrishnan,** an Indian born U.S.A scientist, **Thomas Steitz of** U.S.A and **Ada Yoath** of Israel.

Pelicans feed on fish, which they scoop up in the flexible pouch that lies under their long beaks.

MORE TO KNOW

Cutting down forests increases the amount of carbon dioxide in the atmosphere, which can affect climate and destroy homes of many animals and plants. Deforestation leads to soil erosion, irregular rainfall and global warming.

MORE TO KNOW

When a swarm of desert locust is on the move (a single swarm is about 50,000 million) it eats 3000 tons of vegetation in one day.

- The salmon fish travel up to 1500 miles (2400 km) from the sea to fresh water for breeding. Most of them die after breeding due to exhaustion.
- The Brazilian turtles travel up to 1250 miles (2000 km) in eight weeks time for breeding
- Barren grounds Caribou of North America travel over 3700 miles (5000 km) the longest annual migration of any mammal

DO YOU KNOW?

Rathika Ramasamy, a native of Venkatachalapuram village, Theni District in Tamil Nadu was the first Indian woman to strike an International reputation as wildlife photographer.

Her passion is towards bird photography. A photobook on wildlife titled "The best of wildlife moments" was published in November 2014.

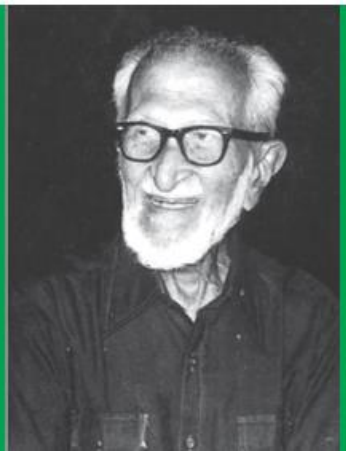
MORE TO KNOW

NGC (National Green Corps) of the Ministry of Environment and Forests, Government of India.

National Animal - Tiger
National Bird - Peacock
National Flower - Lotus
National Fruit - Mango
National Tree - Banyan tree
National Heritage Animal- Elephant

Lion, Tiger, Leopard, Snow leopard and Clouded leopard are found in India.Cheetahs became extinct in the 1950s.

The breeding area of the famous Olive Ridley's turtle is the Coast of Odisha while the Hawksbill Turtle is on the Coast of Tamil Nadu.



Dr. Salim Ali
(1896 – 1987)

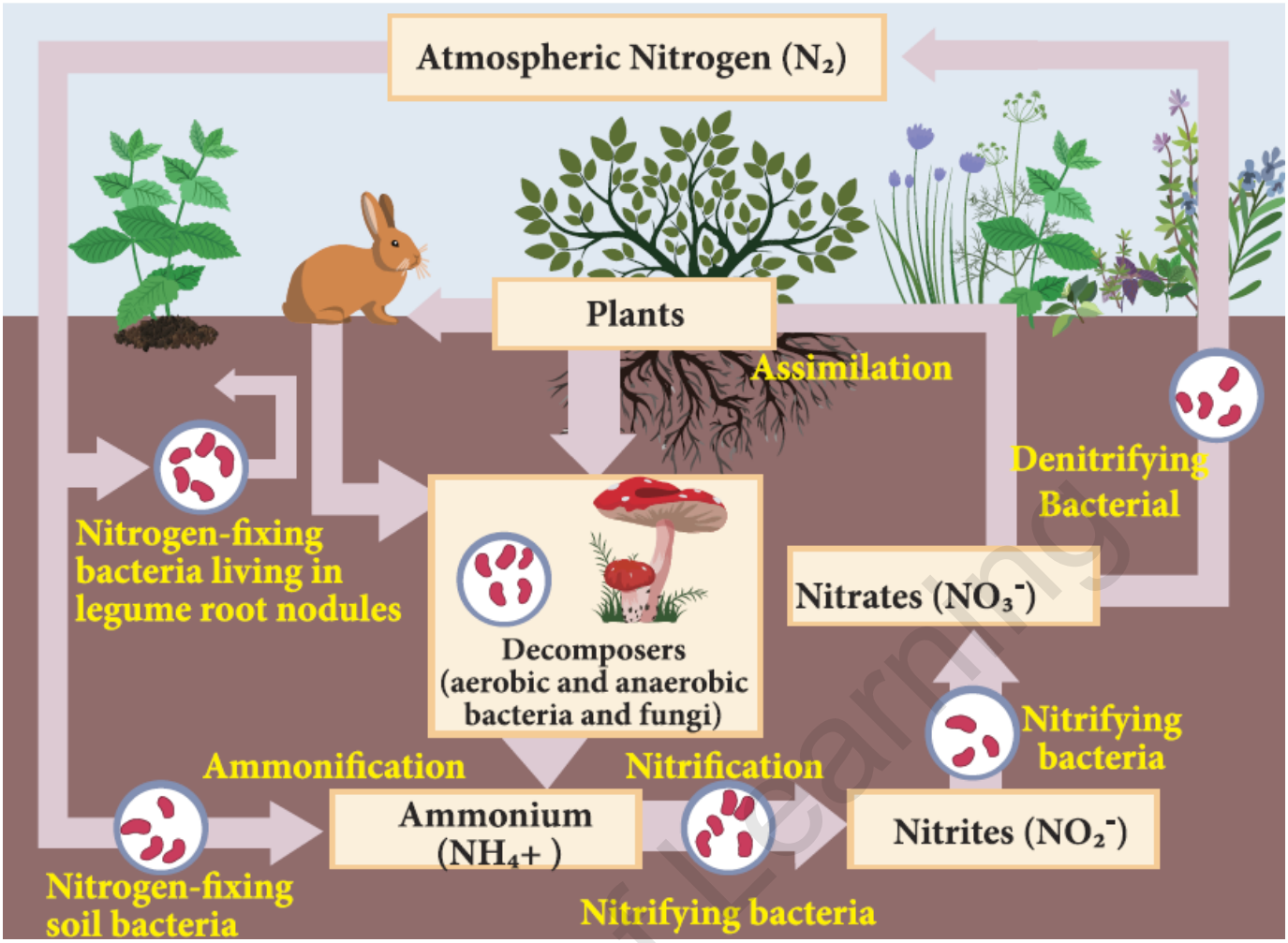
Orinthologist, known as "the bird man of India"

DO YOU KNOW?

India is the third largest consumer of crude oil in the world, after the United States and China.

DO YOU KNOW?

A capacity of 100 litres solar heater can save upto 1500 units of electricity per year.



Role played in nitrogen cycle	Name of the microorganisms
Nitrogen fixation	*Azotobacter* (in soil) *Rhizobium* (in root nodules) Blue green algae- *Nostoc*
Ammonification	Putrefying bacteria Fungi
Nitrification	Nitrifying bacteria *i. Nitrosomonas* *ii. Nitrobacter*
Denitrification	Denitrifying bacteria *Pseudomonas*

DO YOU KNOW?

IUCN was founded on 5th October 1948 at Gland, Switzerland.

DO YOU KNOW?

World Water Day on 22nd March every year, is about focusing attention on the importance of water.

The theme for World Water Day 2018 is 'Nature for Water'- exploring nature-based solutions to the water challenges we face in the 21st century.

Water hyacinth (*Eichhornia crassipes*) is a very charming plant. It is called as '***Cindrella of the plant kingdom***'. It covers entire surface of the water resources like ponds and lakes. It will not allow the light to penetrate into the water and increases the ***Biological Oxygen Demand*** leading to the death of aquatic plants and animals. It also alters the water clarity and decreases phytoplankton production, dissolved oxygen, nitrogen, phosphorus and heavy metals. During monsoon, it blocks the flow of water. During summer, the lake with water hyacinth evaporates nine times faster than the lake with no water hyacinth. Apart from its adverse effects, it is used as a green manure or converted as compost. It is also used as animal fodder. It can be processed to make paper, rope, handbags and even furniture.

Water Hyacinth

Black Lung disease

It is common among coal miners due to the inhalation of carbon particulates which leads to lung cancer.

- Jim Corbett National Park was the first to be established in 1936 in Uttarakhand, India.
- There are 15 biosphere reserves in India.
- The Nilgiris is a biosphere reserve in Tamil Nadu.

Earthworms are referred as '***Farmer's friend***'. After digesting organic matter, earthworms excrete a nutrient- rich waste product called castings.

Vermicompost is a manure prepared by using earthworms to speed up the process of decomposition of plant and animal waste. Vermicomposting is a fundamental practice of organic gardening. Vermicompost helps better plant growth and crop yield, improves physical structure of soil, increases the water holding capacity of soil and is helpful in elimination of biowastes.

Grey water is reusable waste water from residential, commercial and industrial bathroom sinks, bath tub, shower drains and washing of clothes. Use of non-toxic and low sodium soap and personal care products is required to protect vegetation when reusing grey water for irrigation.

- The world's largest and tallest wind turbine is situated in Hawaii.
- One wind turbine can produce electricity for 300 homes.

Inlet - sewage water

↓

Primary treatment(physical)

- Sedimentation (heavy solids)
- Floatation (oil, grease, lighter solids)
- Filtration

↓

Secondary treatment(biological)

- Biological oxidation (biodegradable dissolved organic matter)
- Sedimentation (biological solids)
- Filtration

↓

Tertiary treatment (physio-chemical)

- (nitrogen, phosphorus, suspended solids, heavy metals)
- Disinfection (chlorination 5-15mg/l)

↓

Outlet- recycled water

Biological magnification of DDT (dichloro diphenyl trichloroethane) is seen in aquatic food chain. The concentration of DDT gradually increases at each trophic level. DDT inhibits calcium carbonate deposition in the oviducts of certain birds which result in the laying of thin-shelled eggs. These eggs can easily break during incubation and the developing embryos are destroyed.

Chernobyl Disaster (Ukraine) : The explosion at the Chernobyl nuclear power station was undoubtedly the world's worst nuclear disaster. Deadly radioactive material was released into the atmosphere and the inhabitants of Chernobyl were exposed to radioactivity which was a hundred times greater than at Hiroshima. Babies were born with infirmities and people suffered from serious diseases like thyroid cancer.

BHOPAL GAS TRAGEDY (2^{nd} & 3^{rd} Dec 1984) refers to the industrial disaster which killed thousands of people and animals due to inhaling of methyl iso cyanate (MIC) gas which leaked out from a fertilizer factory owned by the Union Carbide Company. Many people who inhaled the gas still suffer from respiratory, immunological and neurological disorders, cardiac failure, birth defects, etc.

MINAMATA DISEASE

Mercury poisoning due to the consumption of fish captured from mercury contaminated Minamata Bay in Japan was detected in 1952. Mercury compound in waste water are converted by bacterial action into extremely toxic methyl mercury which can cause numbness of limbs, lips and tongue. It can also cause deafness, blurring of vision and mental derangement.

REVERSE OSMOSIS (RO)

It is the most efficient way of obtaining purified drinking water. During this process, pressure is applied on the solution which has more concentration. This reverses the natural direction of water flow and osmosis from a high gradient to a low gradient. This process involves energy expenditure. The membranes used as a barrier for RO process have a dense layer which allow only the water to pass through and prevents the passage of solutes. Hence, it is best suited for desalination of sea water (removal of salt).

Various laws and rules have been promulgated from time to time by the Government of India to control pollution. Some of them are:

1974 - Water (prevention, control of pollution) Act.

1980 - Forest Act.

1981 - Air (prevention, control of pollution) Act.

1986 - Environmental pollution Act.

1988 - Motor Vehicles Act

Info bits

Wildlife Conservation Initiatives In India.

- Project Tiger and Project Elephant has been launched in 1973 and 1992 respectively
- Crocodile Conservation Project was launched in 1976.
- Sea Turtle Conservation Project was launched in 1999.
- Indian Rhino Vision 2020 is to conserve at least 3000 greater one-horned rhinos in Assam, India by 2020.

Case study of Taj Mahal

The Taj Mahal is one of the seven wonders of the world and is located in Agra, Uttarpradesh. It is built with white marble. The Mathura oil refinery owned by Indian Oil Corporation present around this area produce sulphur and nitrogen oxides. The white marble became yellow due to air pollution. The Government of India has set up emission standards around the monument to protect it from the damage.

Crop	Variety	Resistance to diseases
Wheat	Himgiri	Leaf and stipe rust, hill bunt
Cauliflower	Pusa Shubhra, Pusa Snowball K-1	Black rot
Cowpea	Pusa Komal	Bacterial blight

EL NINO EFFECT

It causes erratic weather patterns which occur due to the interaction of unusually warm or cold sea surface temperatures in the eastern and central Pacific Ocean. It was once a rare cyclical weather condition which has become more frequent, persistent and intense.

More to Know

Chipko movement

The Chipko movement was a non-violent agitation in 1973 that was aimed at protection and conservation of trees. The name of the movement '**Chipko**' comes from the word 'embrace', as the villagers hugged the trees and encircled them to prevent them from being cut. The movement originated in the Chamoli district of Uttar Pradesh (now Uttarakhand). The protest of Chipko movement achieved a major victory in 1980 with a 15 year ban on cutting trees in the Himalayan forests.

More to Know

India has identified six basins as areas for shale gas exploration: Cambay (Gujarat), Assam-Arakan (North East), Gondwana (Central India), Krishna Godavari onshore (East Coast), Cauvery onshore and Indo-Gangetic basins.

More to Know

kallanai Dam, also known as Grand Anicut, is the fourth oldest dam in the world, constructed by King Karikala Chola of the Chola Dynasty in the 2nd century A.D.(CE). It still serves the people of Tamilnadu, The dam is located on the River Kaveri, approximately 20 km from the city of Tiruchirapalli.

E-wastes include

Computer components	- 66%
Telecommunication components	- 12 %
Electronic components	- 5 %
Biomedical components	- 7 %
Other components	- 6 %

More to Know

Dr. G. Nammalvar

Dr. G. Nammalvar (1938-2013) was a Tamil agricultural scientist, environmental activist and organic farming expert. He founded Nammalvar Ecological Foundation for Farm Research and Global Food Security Trust (NEFFFRGFST-Vanagam) to create public awareness about the benefits of organic farming.

Crop	Variety	Resistant to Insects/Pests
Brassica	Pusa Gaurav	Aphids
Flat Bean	Pusa Sem 2, Pusa Sem 3	Leaf hopper, aphids and fruit borer
Lady's finger	Pusa Sawani, Pusa A4	Shoot and fruit borer

Plasmid is the small circular double stranded DNA molecule found in the cytoplasm of bacterial cell and separated from chromosomal DNA. It can replicate independently.

More to Know

Health Effects of E- Wastes

Lead: Damages central and peripheral nervous system; affect brain development in children

Chromium: Asthmatic bronchitis

Cadmium: Accumulates in kidney and liver; neural damage

Mercury: Chronic damage to brain and respiratory system

Plastics including Polyvinyl Chloride (PVC): Burning produces dioxin which can cause developmental and reproductive problems, damages the immuns system.

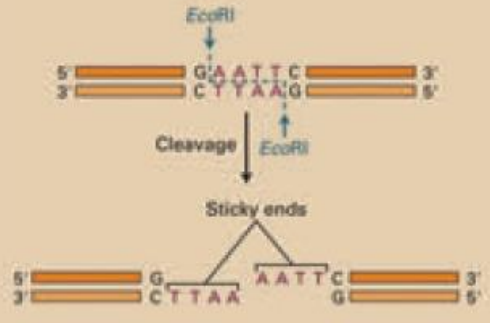
More to Know

Dr. M. S. Swaminathan

Dr. Mankombu Sambasivan Swaminathan is an Indian scientist known for his leading role in India's Green Revolution. His research on potato, wheat, rice and jute are well known plant breeding experiments. Due to his efforts the wheat production increased from twelve million tonnes in 1960's to seventy million tonnes now. He is aptly called as the "Father of Indian Green Revolution".

More to Know

Restriction enzymes recognises a specific base pair sequence (palindromic sequence) in DNA called as restriction site and cleaves the phosphodiester bond within DNA.



More to Know

Gamma Garden

Gamma garden or Atomic garden is a concept popularised after World War II for the peaceful use of atomic energy for crop improvement. This is a type of induced mutation breeding where radioactive sources particularly gamma rays from Cobalt-60 or Caesium-137 are used to induce desirable mutations in crop plants.

DO YOU KNOW?

Eli Lilly and Company, United States, in 1979 first started commercial production of human insulin by using rDNA technology.

MORE TO KNOW

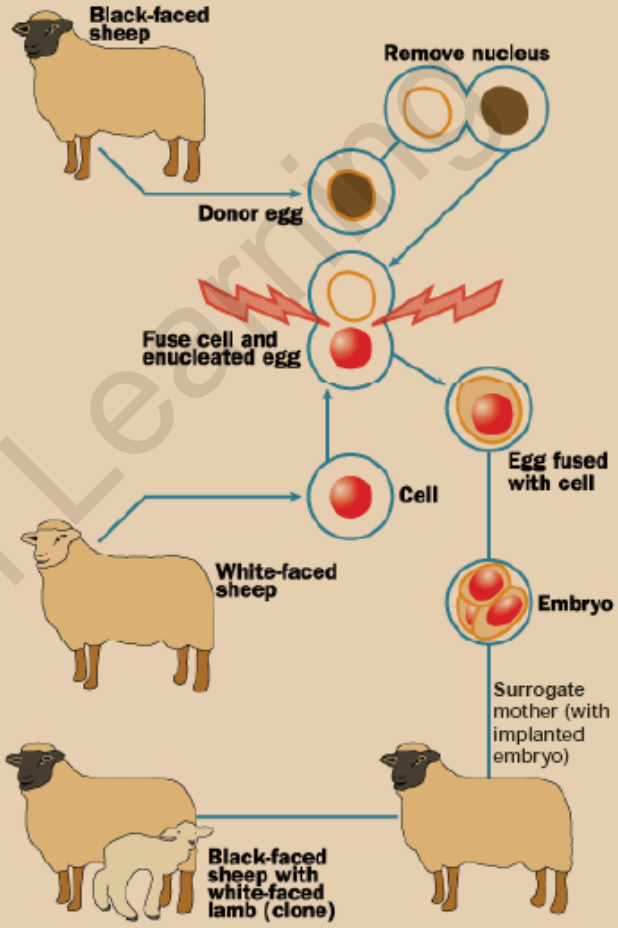
- *Many countries are making commitments to lower green house gas emissions according to the Kyoto Protocol.*
- *Coal is used in thermal power stations and petroleum products like petrol and diesel are used in transportion like motor vehicles, ships and aeroplanes. We cannot really imagine a life without electrical appliances and transportation. Can you think of ways by which consumption of coal and petroleum products can be reduced?*

Ethology *is the scientific study of animal behaviour, under natural conditions.*

Info bits

Development of Dolly

Dolly was the first cloned female sheep, developed by Dr. Ian Wilmut and his colleagues at the Roslin Institute, Scotland in July 1996. She was created by somatic cell **nuclear transfer** technique. She lived for 6.5 years and died in 2003 because of lung disease.



DO YOU KNOW?

Rainfall is lowest in the Atacama Desert of Chile, where it averages less than 15 mm. Some years are even rainless. Inland Sahara also receives less than 15 mm rainfall a year. Rainfall in American deserts is higher — almost 280 mm a year.

Objective	Gene inserted	Achievement
Improved nutritional quality in Rice	Beta carotene gene (In humans, Beta carotene is required for the synthesis of Vitamin A)	**Golden Rice** (Genetically modified rice can produce beta carotene, that can prevent Vitamin A deficiency)
Increased crop production	Bt gene from bacteria *Bacillus thuringiensis.* (Bt gene produces a protein that is toxic to insects)	**Insect resistant plants** (These plants can produce the toxin protein that kills the insects which attack them)

Objective	Gene inserted	Achievement
Improved wool quality and production	Genes for synthesis of amino acid, cysteine	**Transgenic sheep** (gene expressed)
Increased growth in fishes	Salmon or Rainbow trout or Tilapia growth hormone gene	**Transgenic fish** (gene expressed)

MORE TO KNOW

Denmark is called the country of "winds". More than 25% of their electricity needs are generated through a vast network of windmills. In terms of total output, Germany is the leader, while India is ranked 5th in harnessing wind energy for the production of electricity. It is estimated that nearly 45000MW of electrical power can be generated if India's wind potential is fully utilized. The largest wind energy farm has been established near Kanyakumari in Tamilnadu and it generates 380MW of electricity.

van't Hoff's rule

van't Hoff proposed that, with the increase of every 10°C, the rate of metabolic activity doubles or the reaction rate is halved with the decrease of 10°C. This rule is referred as the van't Hoff's rule. The effect of temperature on the rate of reaction is expressed in terms of temperature coefficient or Q_{10} value. The Q_{10} values are estimated taking the ratio between the rate of reaction at X°C and rate of reaction at (X-10°C). In the living system the Q_{10} value is about 2.0. If the Q_{10} value is 2.0, it means 10°C increase and the rate of metabolism doubles.

National Parks in Tamil Nadu	Year of establishment	District(s)
Guindy NP	1976	Chennai
Gulf of Mannar Marine NP	1980	Ramanathpuram and Tuticorin
Indira Gandhi (Annamalai) NP	1989	Coimbatore
Mudumalai NP	1990	Nilgiris
Mukurthi NP	1990	Nilgiris

Prominent WLS in Tamil Nadu	Year of establishment	Districts
Vedanthangal Lake Birds WLS	1936	Chengalpet
Mudumalai WLS	1942	Nilgiris
Point Calimere WLS	1967	Nagapattinam
Indira Gandhi (Annamalai) WLS	1976	Coimbatore
Mundanthurai WLS	1977	Tirunelveli

Phototaxis: The movement of organism in response to light, either towards the source of light as in Moths (positive phototaxis) or away from light (Euglena, Volvox, earthworm (negative phototaxis).

Phototropism: The growth or orientation of an organism in response to light, either towards the source of light (positive phototropism) as seen in Sunflower, or a way from light (negative phototropism) as in case of the root of plants.

Photokinesis: A change in the speed of locomotion (or frequency of turning) in a motile organism or cell which is made in response to a change in light intensity is called Photokinesis. It involves undirected random movement in response to light.

Biotic potential

It is the maximum reproductive capacity of an organism under optimum environmental conditions.

Carrying capacity

The maximum number of organism that a region can support without environmental degradation is called carrying capacity.

Environmental resistance

Is the sum total of the environmental limiting factors, both biotic and abiotic, which together act to prevent the biotic potential of an organism from being realized.

DO YOU KNOW?

The interrelationship and interdependence of all living components in a system can be seen from the example of the fruit bats of Guam (South East Asia). The fruit bats are a delicacy here, and hence their population has dwindled which is not surprising. What is surprising is that local fruit production has got affected as it was identified that the bats served as pollinators. Hence there is a need for conservation of diversity as that could avert such situations.

DO YOU KNOW?

Historically biomes are known to move as climate changes. A classic example is the Sahara Desert, which years ago was supposed to be a lush landscape with river flowing through it. Accordingly, appropriate fauna like Hippos, Giraffes, Crocodiles lived amid abundant trees. Over course of time the climate dried out. It has now become the planets largest desert. The animals have migrated out to adjacent regions with more favourable conditions.

(Source: National Geography)

Mean Sea Level (MSL) is an average level of the surface of one or more of Earth's oceans (or seas) from which heights such as elevations may be measured.

As we travel by train we notice names of stations on big yellow signboards on which is usually written how much elevated that place is compared to MSL. For example, Erode junction is about 171 meters above MSL.

Where are the Sparrows?

Common Sparrows are going extinct because of mindless urbanization. They are losing not just their natural habitats but also the essential human touch they need and thrive upon. The population of sparrows is dwindling due to the use of packed food, insecticides in farming and changing lifestyles, and match box-styled architecture resulting in an inadequate availability of food and shelter for the birds. Unlike pigeons that can make nests on ledges, sparrows need cavities to build their nests.

Project Tiger: The Government of India launched the 'Project Tiger' in 1973 to protect our national animal. From 9 tiger reserves since its inception, the Project Tiger coverage has increased to 50 at present. Project Tiger is an ongoing Centrally Sponsored Scheme of the Ministry of Environment and Forests, providing central assistance to the states for tiger conservation in designated tiger reserves. Project Tiger was launched in the Jim Corbett National Park, Uttarakhand in1973. The project ensures a viable population of Bengal tigers in their natural habitats, protecting them from extinction and preserving areas of biological importance as a natural heritage.

The National Tiger Conservation Authority (NTCA) is a statutory body of the Ministry, created under the Wildlife (Protection) Act, 1972. India holds over half the world's tiger population. According to the latest tiger census report released on 20th January 2015 by NTCA, the current tiger population is estimated at 2,212. There are 50 tiger reserves in the country.

Sameer, an App provides hourly updates on the National Air Quality Index (AQI) published by CPCB.

One more species goes extinct...

George the tree snail (*Achatinella apexfulva*) died on January 1, 2019, at the age of 14. He was the last snail of his species, and is emblematic of the loss of native Hawaiian molluscs.

The Madras Crocodile Bank Trust

The Madras Crocodile Bank Trust and Centre for Herpetology was the brain child of the legendary Romulus Whitaker and a handful of like-minded conservation visionaries, who began work on the facility in 1976. It aimed to save India's dwindling crocodilian population. The mission is to promote the conservation of reptiles and amphibians and their habitats through education, scientific research and capture breeding. The crocodile bank remains a world leader in the field of frontline conservation and the preservation of natural landscapes. The Crocodile Bank currently consists of a large reptile park near Chennai and several field projects located throughout the subcontinent reaching as far as the Nicobar Islands. About half a million people visit the bank every year, making it one of the most popular tourist attractions along the East Coast Road.

Arignar Anna Zoological Park, Vandalur

Arignar Anna Zoological Park is spread over an area of 602 hectares. of Reserve Forest at Vandalur, Chennai. It is one of the largest zoo in South East Asia in terms of area. The Zoological Park exhibits different classes of animals – it has around 2500 wild animals of nearly 180 species which includes Mammals, Birds and Reptiles. 34 years since its establishment, the Zoological Park has emerged as a successful ex-situ conservation centre and a captive breeding centre for many endangered species like Royal Bengal Tiger, Lion Tailed Macaque, Nilgiri Langur, Gray Wolf, etc.,

The Zoo has many attractive features like Butterfly Park, Childrens Park, Walk Through Aviary, Lion & Deer Safari, Forest Museum, Interpretation centre, etc., which attracts more than 21 lakh visitors every year. The Zoo has strengthened its protection by means of installing CCTV Cameras for both visitors and animal management under the name of Zoo e-Eye. 24 x 7 Animal Live Streaming was introduced for the benefit of the visitors for the first time in the world. Vandalur Zoo Mobile Application was introduced to provide services to the visitors like facility to book tickets, Zoo navigation, Animal information in text and audio format. Digital payments at ticket counters are also available.

The Zoo school has been involved in education and outreach programmes. One such successful programme is 'Zoo Ambassador' which is been conducted for school children. In the year 2018, more than 400 students were trained and titled as Zoo Ambassadors. The Zoo also has a Rescue Centre which accommodates rescued wild animals and treats them to come out of stress.

Source: Director, Arignar Anna Zoological Park, Vandalur, Chennai

Insitu Conservation	*Exsitu* Conservation
It is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species.	This is a conservation strategy which involves placing of threatened animals and plants in special care locations for their protection.
It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or restoring the habitat itself, or by defending the species from predators.	It helps in recovering populations or preventing their extinction under simulated conditions that closely resemble their natural habitats.
National Parks, Biosphere Reserve, Wild Life Sanctuaries form *insitu* conservation strategies.	Zoological parks and Botanical gardens are common *exsitu* conservation programs.

The Taj Mahal, a UNESCO world heritage site, is facing deterioration and damage by industrial gases due to several industrial units around Agra. The white marble has decolorized to yellow.

Air Quality Index		
AQI	**Air Pollution Level**	**Colour**
0-50	Good	
51-100	Moderate	
101-150	Unhealthy for Sensitive Groups	
151-200	Unhealthy	
201-300	Very Unhealthy	
301+	Hazardous	

DO YOU KNOW?

Average human consumption of Oxygen per day = 550 L

Cost of 2.75 L Oxygen cylinder = ₹ 6500

Cost of 550 L of oxygen from tree = ₹ 13,00,000

Oxygen production by one healthy tree per year =1,00,375 L

Cost of 2.75 L oxygen cylinder = ₹ 6500

Cost of 1,00,375 L of oxygen from one tree /year = ₹ 23,72,50,000

1. **Mosquito Repellents**

   DEET (n-n-diethylnetatoluamide) and allethrin used in mosquito coils may cause itching, burning, tingling sensation or numbness.

2. **Colony collapse syndrome** in Honey bees due to pesticides/herbicides can lead to destruction of hives and lower agricultural productivity. **!!Remember bees are Nature's best pollinators!!**

Climate change threatens Nilgiri Tahr: The endangered wild goat could lose approximately 60 % of its habitat, starting from the 2030s. (The Hindu, 12.08.2018)

On January 28, 2017, two cargo ships collided off the Ennore coast in Chennai causing oil to spill into the sea. Due to wave action and the southern current, the spill spread over to 34 km down south affecting the coast. Beach sand also got spoiled by the oil sludge. It took more than a thousand volunteers to clean the oil sludge.

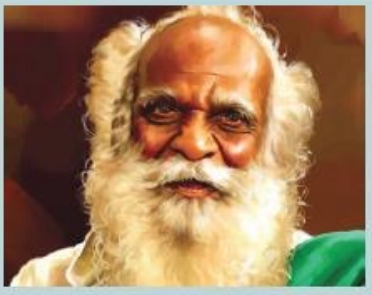
Assessment by CPCB

The number of polluted stretches in India's rivers has increased to 351 from 302 (in 2006), and the number of critically polluted stretches – where water quality indicators are the poorest – has gone up to 45 from 35 (Source: The Hindu, 17 September, 2018).

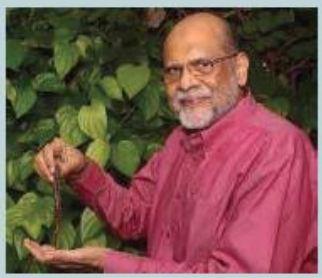
DO YOU KNOW?

The Three Mile Island (Pennsylvania, United States), Chernobyl (Pripyat, Ukraine) and Fukushima Daiichi (Ōkuma, Japan) are nuclear disasters the world has seen in the recent period.

- Remedies: '4R'- Refuse, Reduce, Reuse and Recycle mantra is the best available remedy for plastic waste pollution.
- Tamil Nadu State government successfully implemented the ban on single use plastics from 1st January 2019.



G. Nammalvar was a supporter and expert of **organic farming**. He was an agricultural scientist, environmental activist celebrated for his work on spreading **Ecological farming** & **Organic farming**. He was against the use of chemical fertilisers and pesticides. He trained hundreds of farmers in natural farming. Nammalvar was the author of several **Tamil** and **English** books on natural farming, pesticides & fertilisers and was featured in magazines & television programs. He founded the Nammalvar Ecological Foundation for Farm Research and Global Food Security Trust or simply **Vaanagam** at Karur, Tamilnadu. He developed social forest at Ammankurai and the Kolunji Ecological Farm in Pudukottai. He and his friends made a 10-acre barren land into fertile cultivable land in the dry Pudukottai district. He planted 52 varieties of trees in the same waste land extending in 20 acres. His organization 'Kudumbam' preserves and regenerates hundreds of native flora and fauna, in order to ensure a sustainable livelihood.



Dr. Sultan Ahmed Ismail is an Indian soil biologist and ecologist from Tamil Nadu. His work has centered on techniques for recycling biodegradable waste into fertiliser using varieties of earthworms, and on soil bioremediation.

Dr. Ismail received a D.Sc. in Zoology from the University of Madras for his research on the role of earthworms in soil ecology and waste management. He works on vermicomposting as a sustainable ecological practice. He has been instrumental in introducing as well as spreading awareness on environmental issues, solid waste management, vermicomposting, organic farming, vermitech and waste management to several educational institutions, industries and organic farmers in India and abroad.

World Ozone Day

September 16 has been designated by the United Nations as the International Day for the Preservation of the Ozone Layer.

The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson.

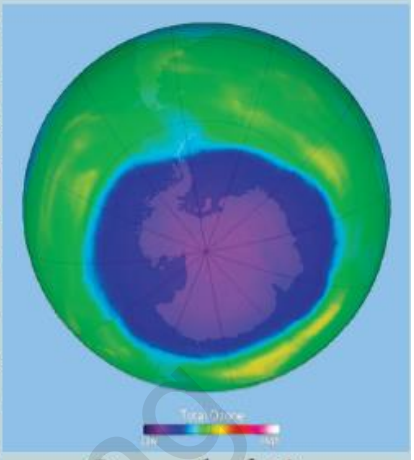
Major International Environmental Conventions

1972: UN conference on Human environment, Stockholm, Sweden
1972: UN environment programme (UNEP), Stockholm, Sweden
1987: Montreal Protocol, Vienna
1989: Intergovernmental panel on climate change, Geneva, Switzerland.
1992: Earth summit, Rio de Janeiro. Agenda 21, otherwise called Rio conference, Brazil
1997: Kyoto Protocol, Japan
2002: World Summit on Sustainable Development, Johannesburg, South Africa
2003: World climate change conference, Moscow, Russia
2012: UN Conference on Sustainable Development, Rio de Janeiro
2015: UN Sustainable Development Summit, New York
2016: Montreal Protocol amendment at Kigali, Rwanda
2017: The COP23 climate change summit in Bonn, Germany
2018: UN climate change conference, Katowice, Poland

Ozone hole (in purple colour), is the area above Antarctica, where the ozone layer is the thinnest.

Ozone thickness is given in Dobson unit (see carefully the scale shown in colour from violet to red). The ozone hole over Antarctica develops each year between late August and early October.

Courtesy: NASA



Ozone depletion around Polar region