

BIOLOGY

BASIC SCIENCE

Syllabus

Preliminary exam

- General Studies Paper I - General Science

Mains exam

- General studies Paper III- Biotechnology

Weightage in prelims

YEAR	NUMBER OF QUESTIONS
2022	5
2021	5
2020	4
2019	5
2018	2
2017	1
2016	1
2015	1

FOOD AND NUTRITION

PROTEIN, CARBOHYDRATES & FAT



MACRONUTRIENTS

VITAMINS & MINERALS



MICRONUTRIENTS

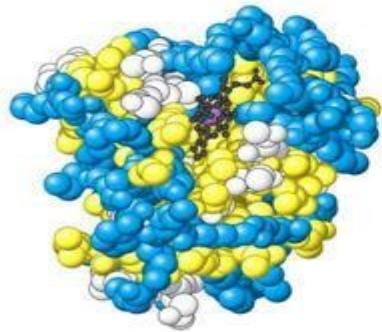
CARBOHYDRATES



Proteins



Fibrous vs. Globular proteins



Globular: functional protein
with active domain(s)

Fibrous: general structural
role (e.g. collagen)



LIPIDS



Different Types of Fat

Unsaturated ("Good") Fats



Nuts, avocados and other vegetables

Saturated Fats



FOUND IN:

Animal products (dairy, meats) and oils (palm, coconut)

Trans Fats



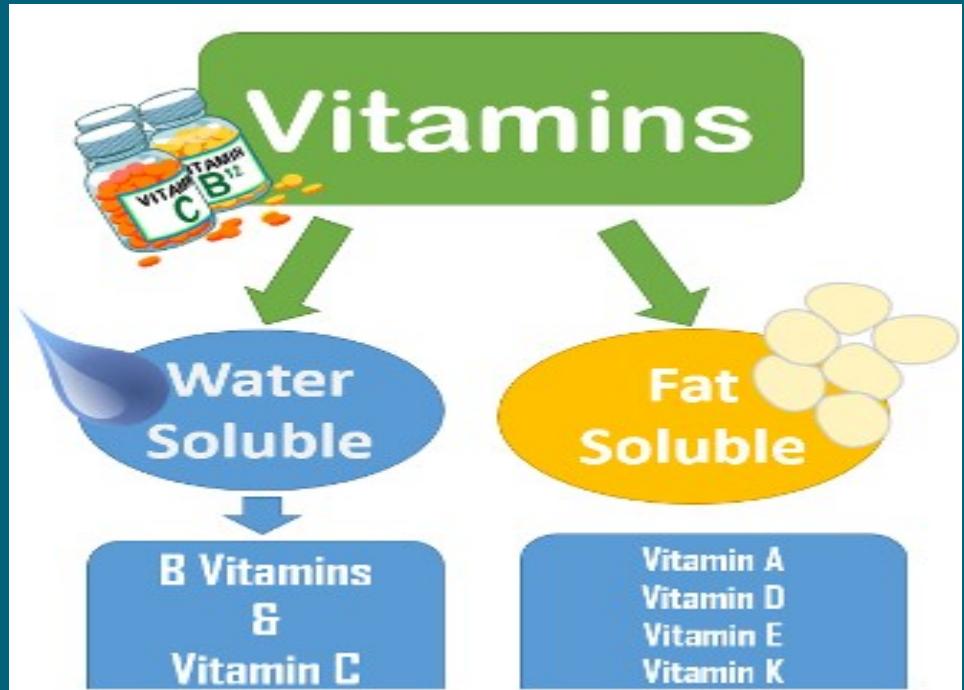
Processed snacks and baked goods

A company marketing food products advertises that its items do not contain trans-fats. What does this campaign signify to the customers?

1. The food products are not made out of hydrogenated oils.
2. The food products are not made out of animal fats/oils.
3. The oils used are not likely to damage the cardiovascular health of the consumers.

Which of the statements given above is/are correct?

- a) 1 only
- b) 2 and 3 only
- c) 1 and 3 only
- d) 1, 2 and 3



Which one of the following statements is NOT correct ?

- a) Milk contains none of the B-vitamins
- b) Vitamin-A retinol deficiency leads to dry and scaly skin
- c) One of the symptoms of scurvy is pain in the joints
- d) Vitamin B, thiamine deficiency can lead to heart failure

MINERALS



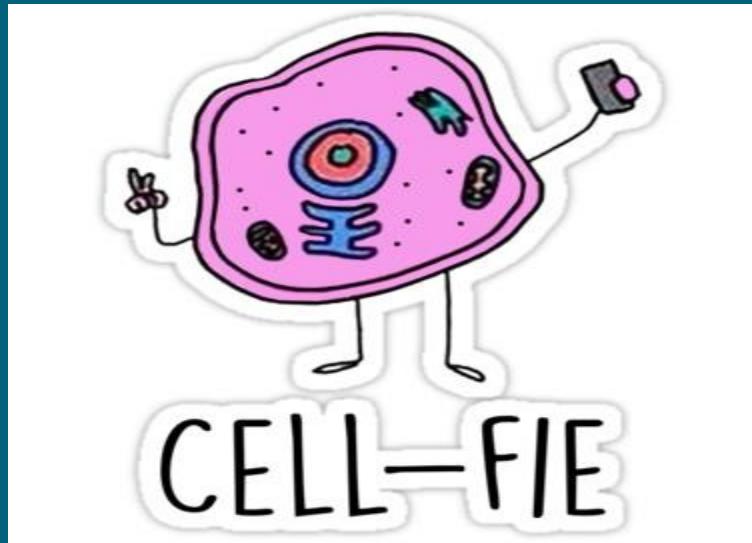
Consider the following minerals:

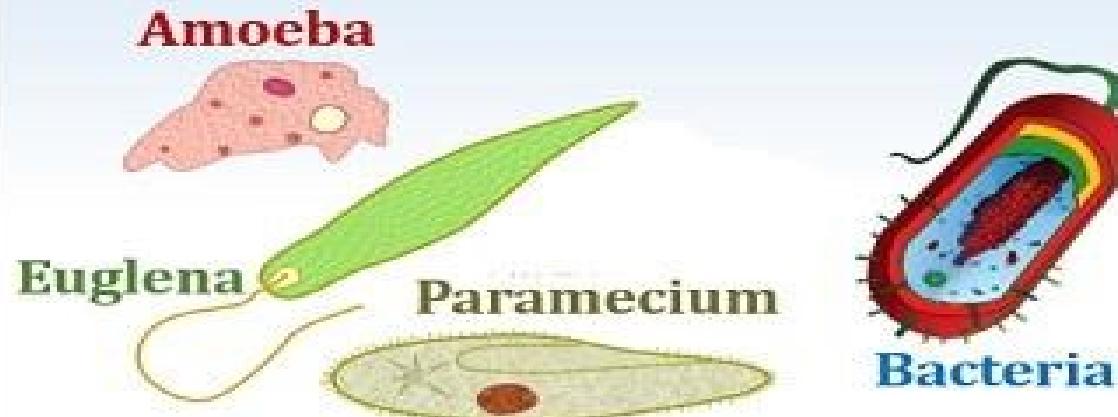
1. Calcium
2. Iron
3. Sodium

Which of the minerals given above is/are required by human body for the contraction of muscles?

- a) 1 only
- b) 2 and 3 only
- c) 1 and 3 only
- d) 1, 2 and 3

Cell Biology





EXAMPLES OF UNICELLULAR ORGANISMS



Insect



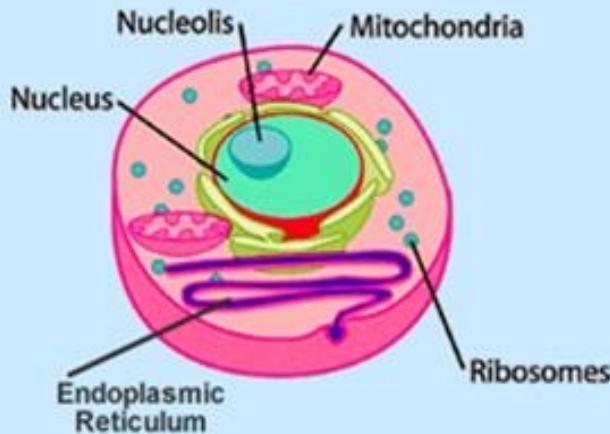
Human body



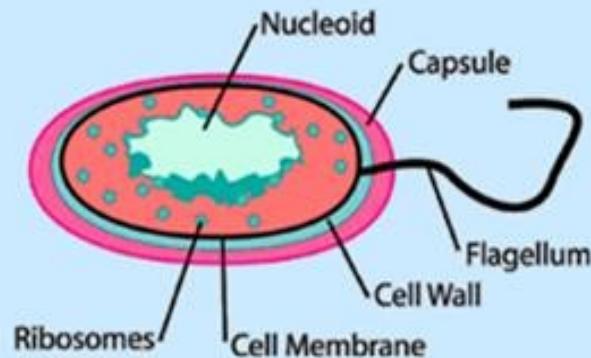
Plant body

EXAMPLES OF MULTICELLULAR ORGANISMS

EUKARYOTE



PROKARYOTE





Biology- 2

BASIC SCIENCE

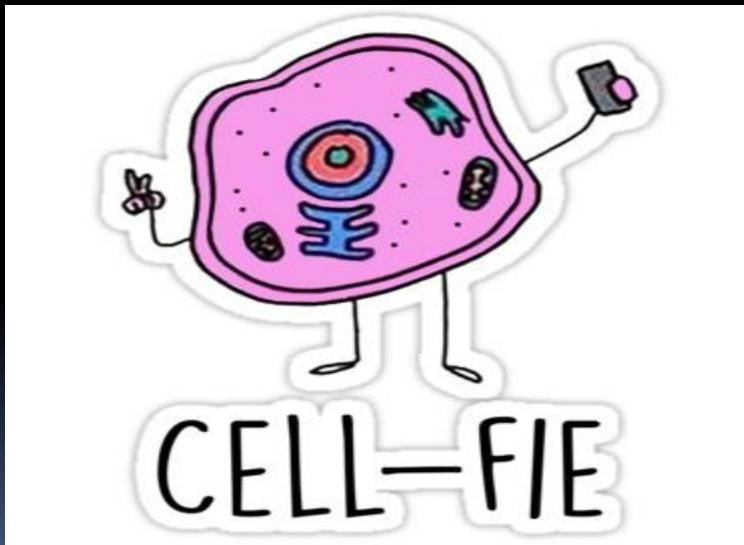
Consider the following statements :

1. Non- function of lachrymal gland is an important symptom of deficiency of Vitamin A.
2. Deficiency of Vitamin B₁ can lead to indigestion and heart enlargement.
3. Vitamin C deficiency can lead to pain in the muscles.
4. Deficiency of Vitamin D causes increased loss of Ca ++ in urine.

Which of these statements given above are correct?

- a) 1 and 2
- b) 2, 3 and 4
- c) 1, 3 and 4
- d) 1, 2, 3 and 4

Cell Biology



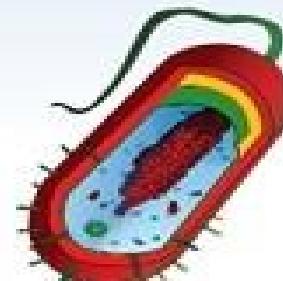
Amoeba



Euglena



Paramecium



Bacteria

EXAMPLES OF UNICELLULAR ORGANISMS



Insect



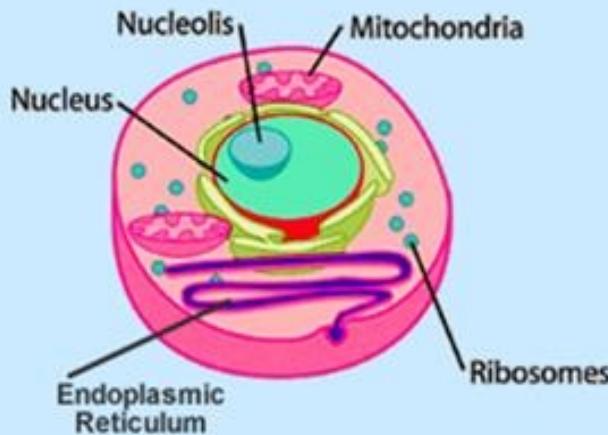
Human body



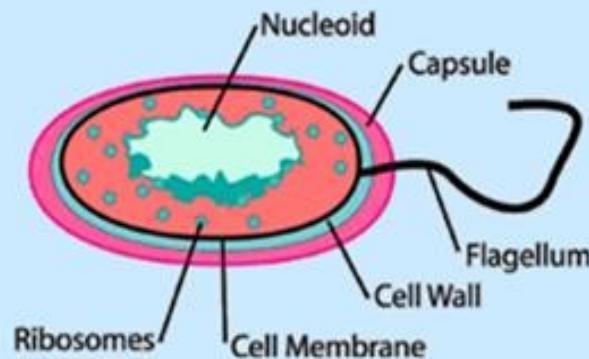
Plant body

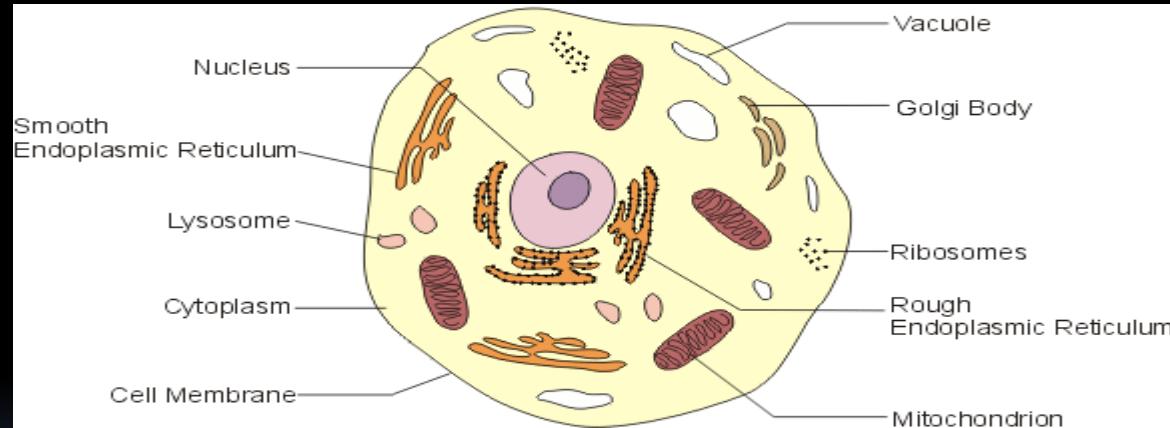
EXAMPLES OF MULTICELLULAR ORGANISMS

EUKARYOTE

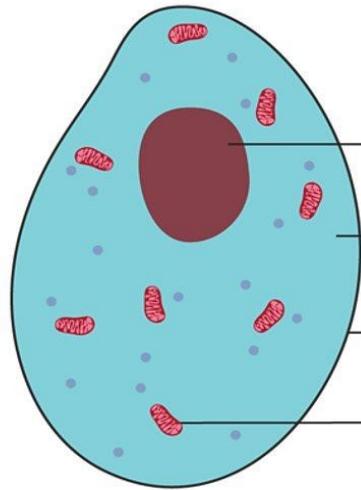


PROKARYOTE

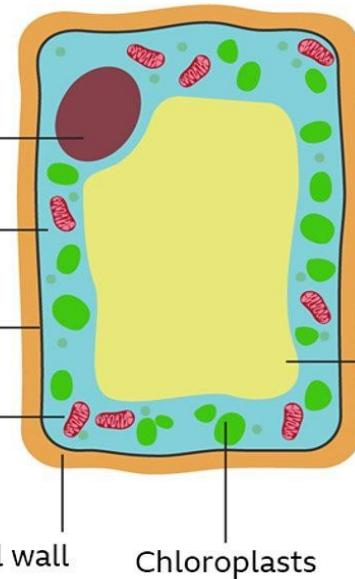




Animal cell



Plant cell



Nucleus

Cytoplasm

Cell membrane

Mitochondria

Vacuole

Cell wall

Chloroplasts

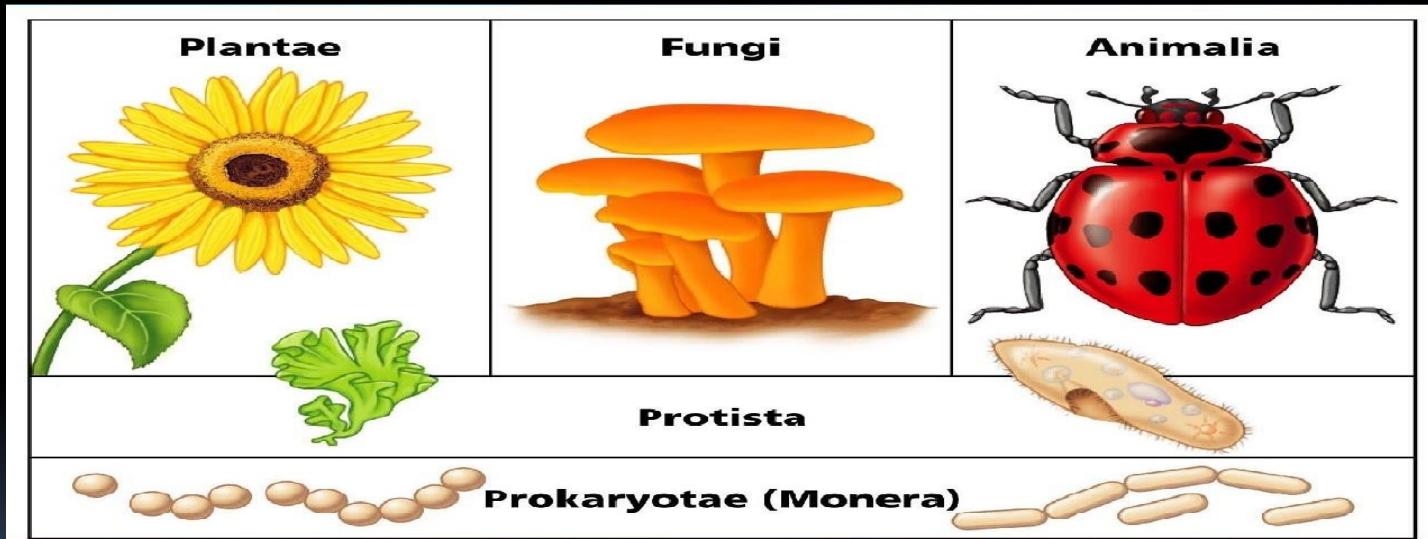
Which of the following statements are correct regarding the general difference between plant and animal cells?

1. Plant cells have cellulose cell walls whilst animal cells do not.
2. Plant cells do not have plasma membrane unlike animal cells which do.
3. Mature plant cell has one large vacuole whilst animal cell has many small vacuoles.

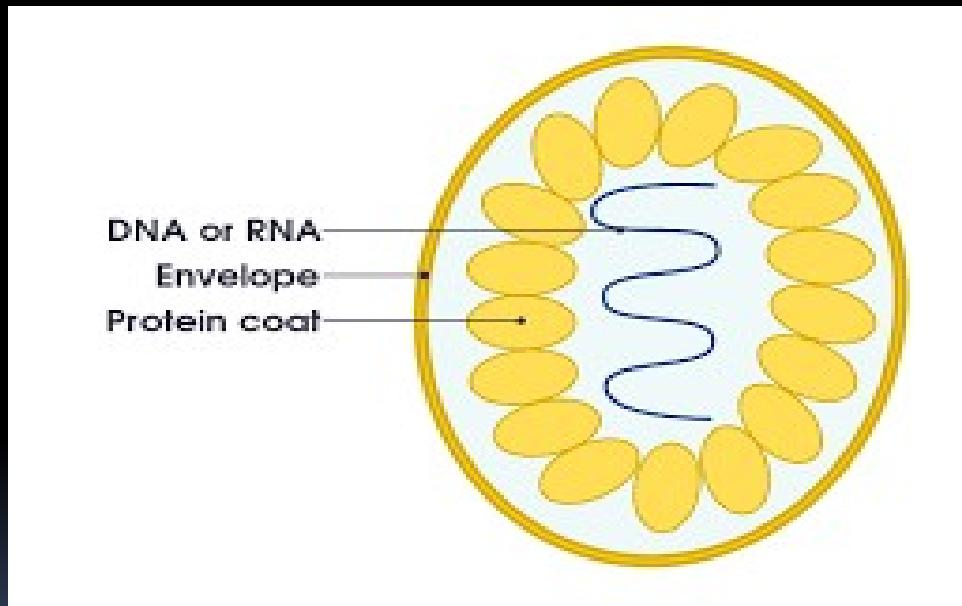
Select the correct answer using the code given below:

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

5 kingdom Classification



VIRUS



Animal Kingdom

Porifera



Coelenterata/Cnidaria



Platyhelminthes



Aschelminthes



Annelida



Arthropoda

Insects



Arachnids - Arthropoda



Arthropoda- Crustaceans



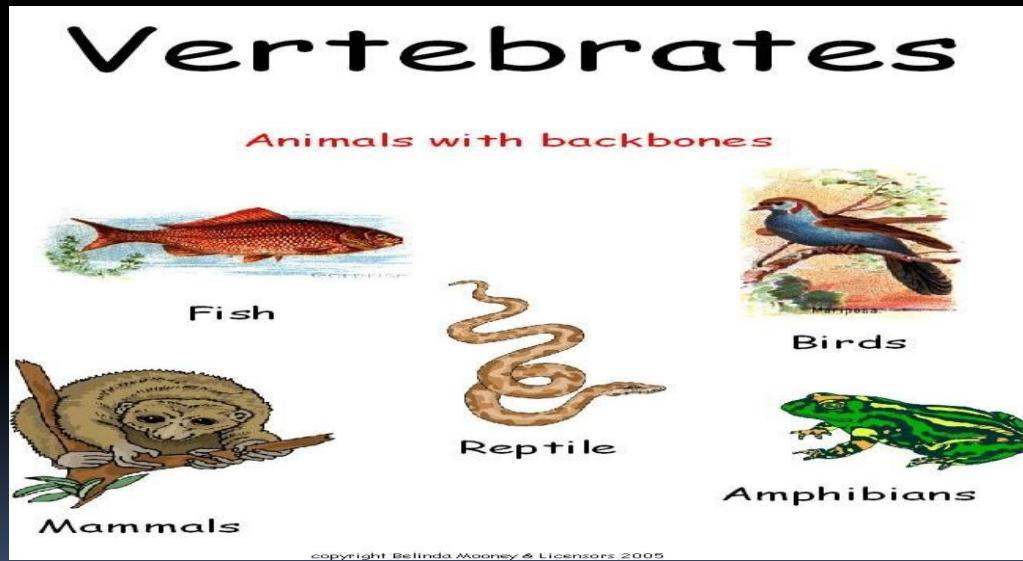
Mollusca



Echinodermata



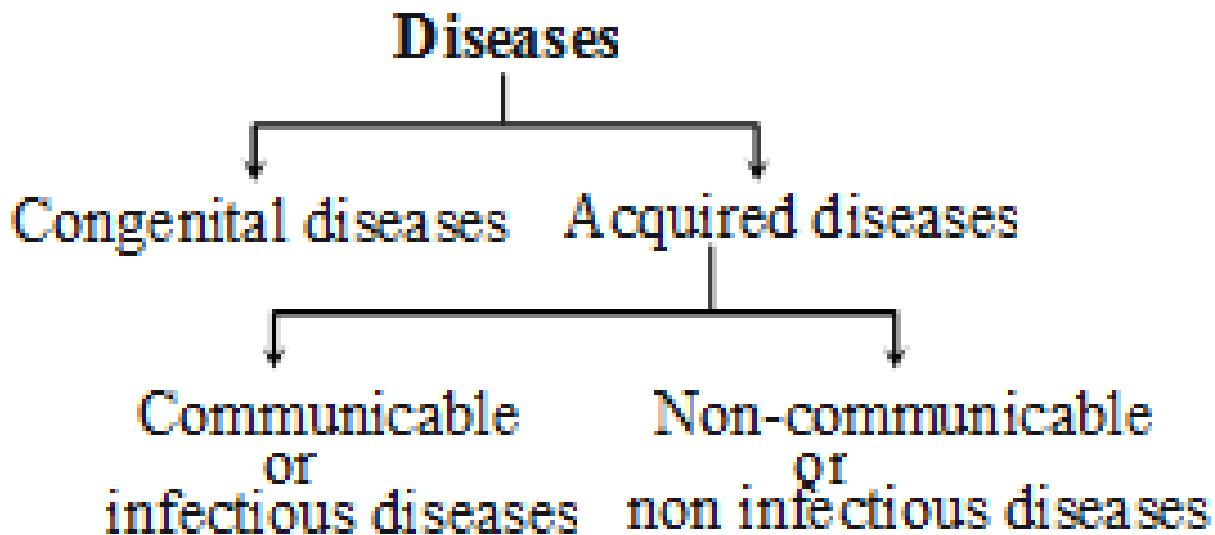
Chordata



With reference to the evolution of living organisms, which one of the following sequences is correct?

- a) Octopus-Dolphin-Shark
- b) Pangolin- Tortoise-Hawk
- c) Salamander-Python-Kangaroo
- d) Frog-Crab-Prawn





Modes of transmission

- Air
- Water
- Food
- Soil
- Blood and body fluids
- Direct contact
- Zoonotic
- Vector
- Fomite

Vector

Mechanical Vector Biological Vector



VS



Non- Communicable Diseases

- Cardiovascular diseases
- Chronic respiratory diseases
- Deficiency diseases
- Mental disorders
- Environmental diseases
- Cancer

Class- 3

BIOLOGY

Consider the following:

- 1) Bacteria
- 2) Fungi
- 3) Virus

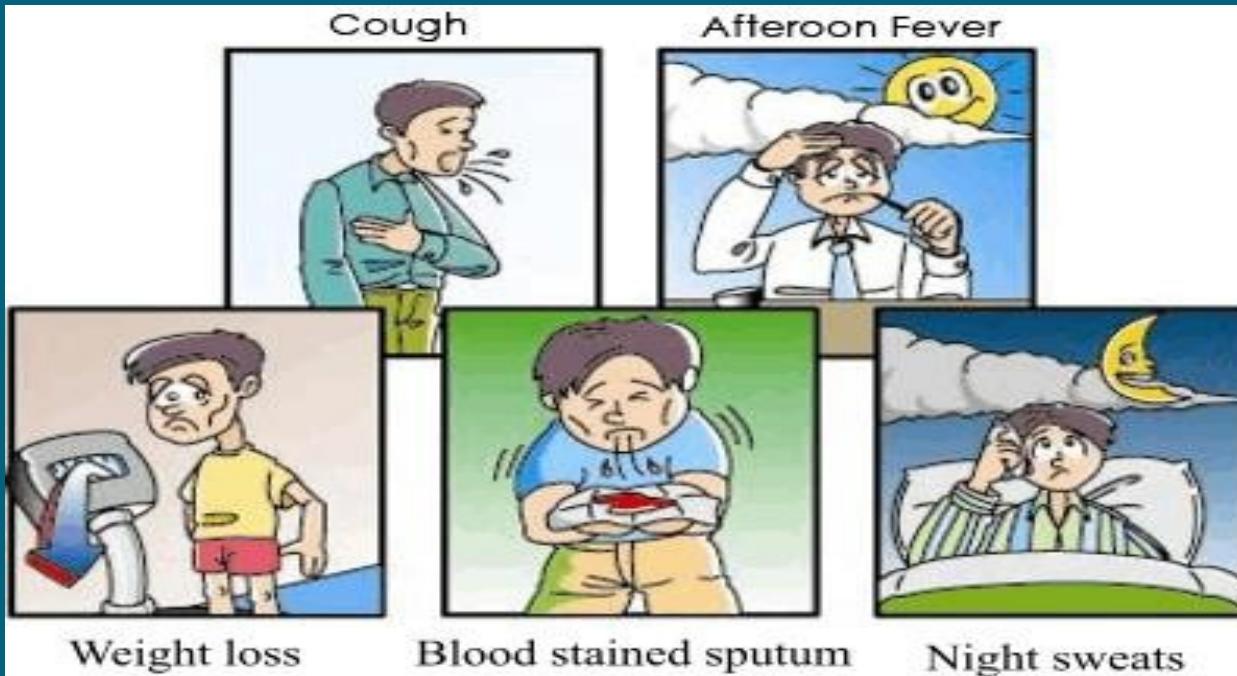
Which of the above can be cultured in artificial/synthetic medium?

- a) 1 and 2 Only
- b) 2 and 3 Only
- c) 1 and 3 Only
- d) 1, 2 and 3

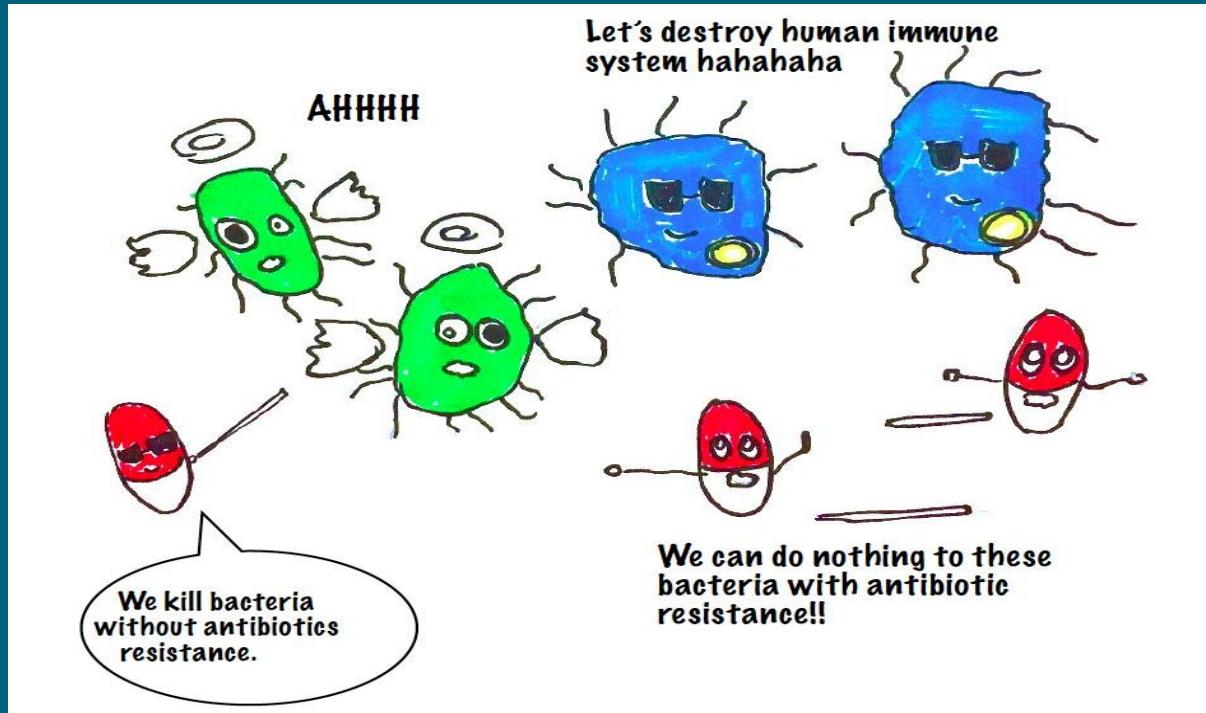
Bacterial diseases

- Tuberculosis
- Leprosy
- Typhoid
- Tetanus
- Cholera
- Anthrax

Pulmonary Tuberculosis



Antibiotic resistance



Which of the followings are the reasons for the occurrence of multi-drug resistance in microbial pathogens in India?

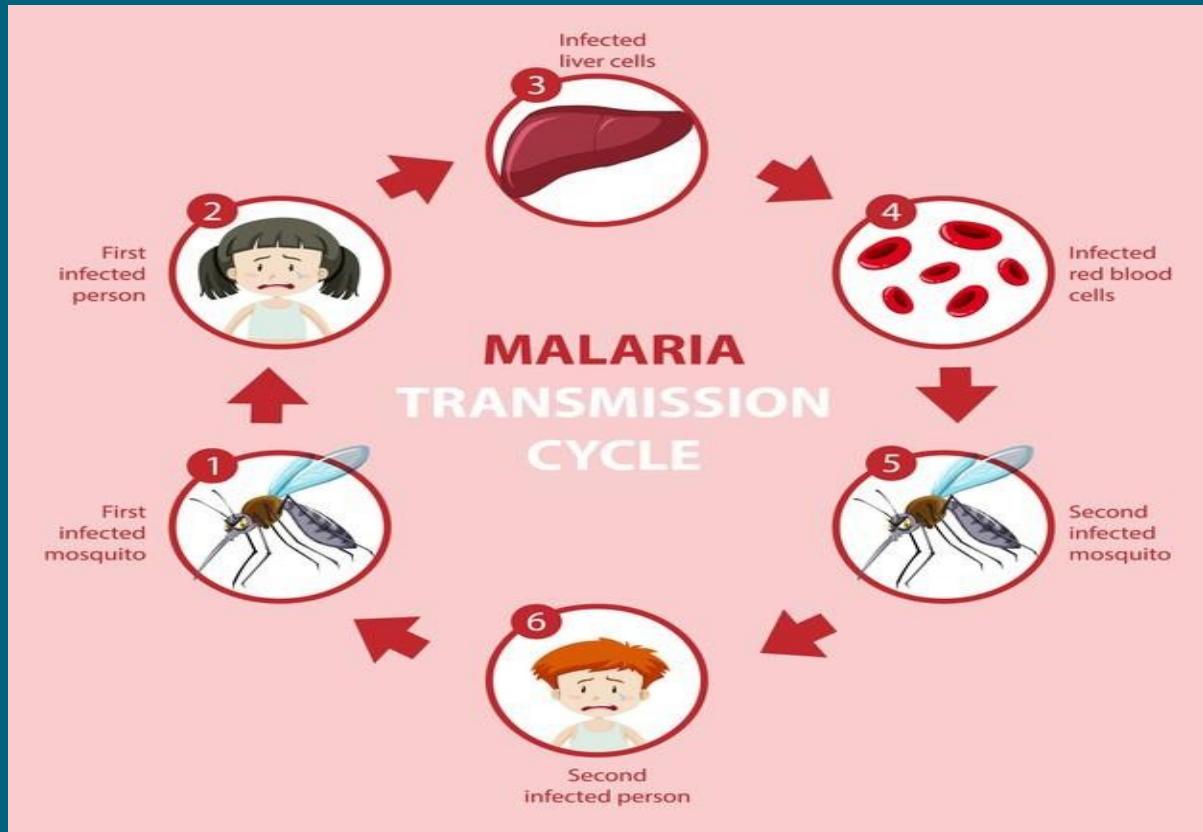
1. Genetic predisposition of some people.
2. Taking incorrect doses of antibiotics to cure diseases.
3. Using antibiotics in livestock farming.
4. Multiple chronic diseases in some people.

Select the correct answer using the code given:

- (a) 1 and 2
- (b) 2 and 3 only
- (c) 1,3 and 4
- (d) 2,3 and 4

Protozoan Disease

- Amoebiasis
- Giardiasis
- Malaria



Fungal diseases

- Candidiasis
- Ringworm
- Athlete's foot

Helminthic diseases

- Ascariasis
- Taeniasis
- Lymphatic filariasis
- Hookworm infection

Viral diseases

- Hepatitis
- Chicken pox
- Polio
- Dengue
- Zika
- Chikungunya
- AIDS

Which of the following statements is / are correct?

1. Viruses lack enzymes necessary for the generation of energy.
2. Viruses can be cultured in any synthetic medium.
3. Viruses are transmitted from one organism to another by biological vectors only.

Select the correct answer using the codes given below.

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

Non- Communicable Diseases

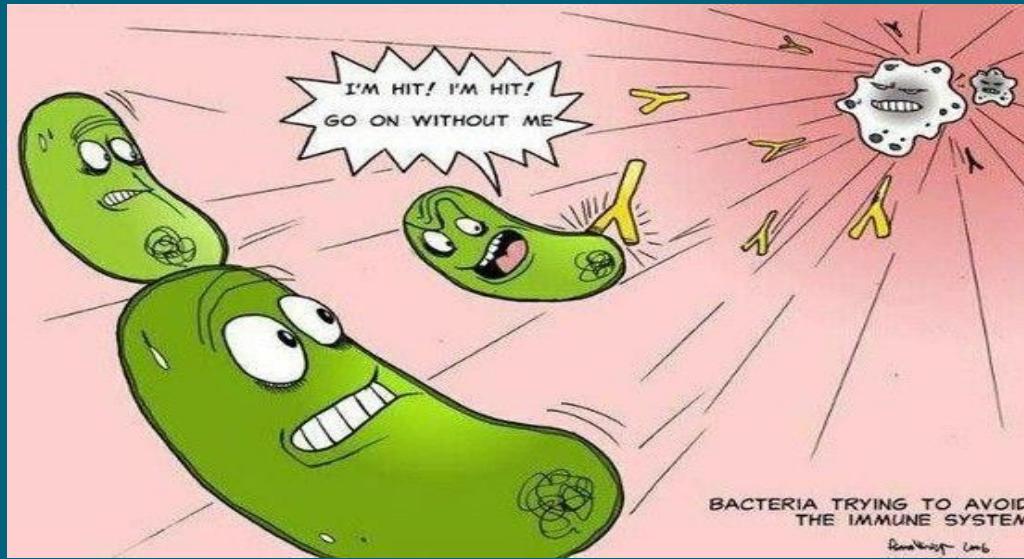
- Cardiovascular diseases
- Chronic respiratory diseases
- Deficiency diseases
- Mental disorders
- Environmental diseases
- Cancer

Immunity

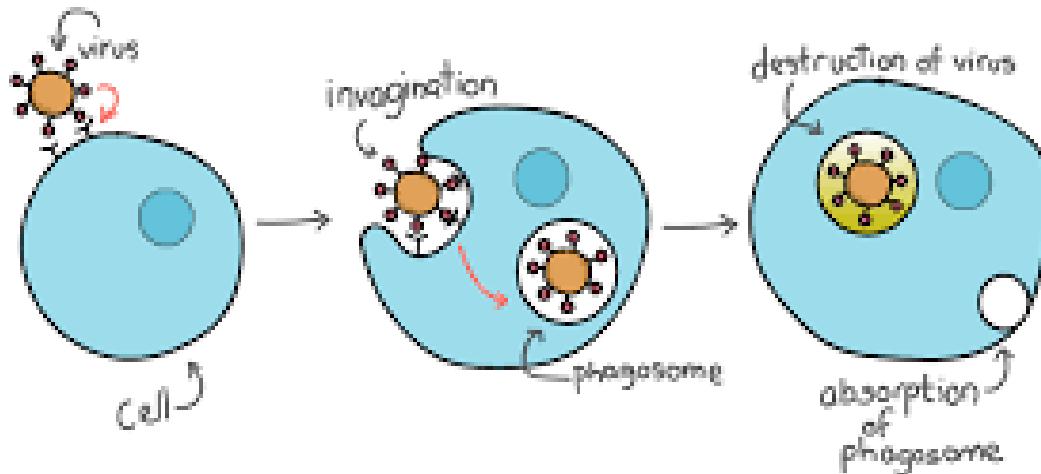


Getty/indianexpress.com

Antigen- Antibody



Phagocytosis





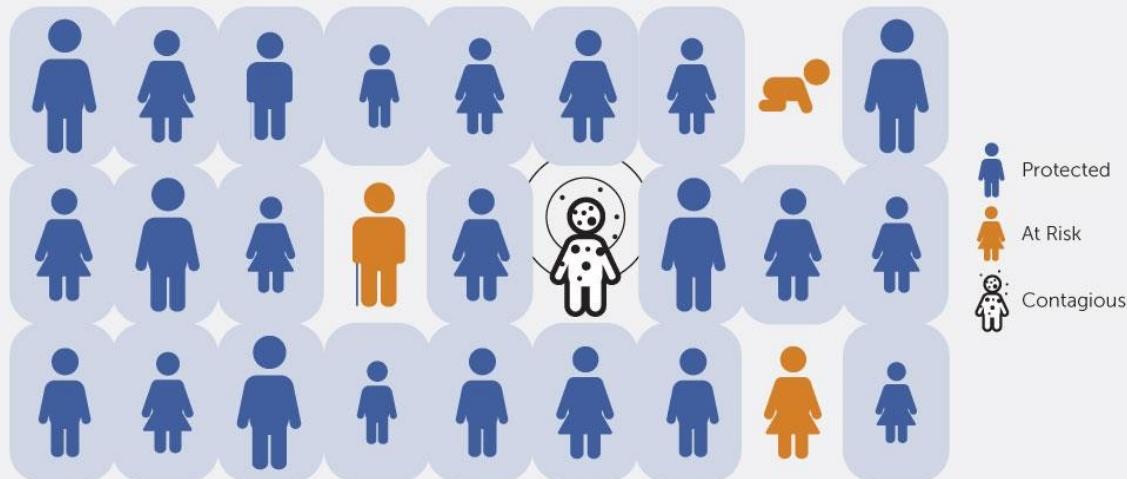
Vaccination

Widespread resistance of malarial parasite to drugs like chloroquine has prompted attempts to develop a malarial vaccine to combat malaria. Why is it difficult to develop an effective malaria vaccine ?

- (a) Malaria is caused by several species of Plasmodium
- (b) Man does not develop immunity to malaria during natural infection
- (c) Vaccines can be developed only against bacteria
- (d) Man is only an intermediate host and not the definitive host

HERD IMMUNITY

When enough people in a population have immunity that disease can't spread



Biology- 5

Oxygen transportation in a human body takes place through:

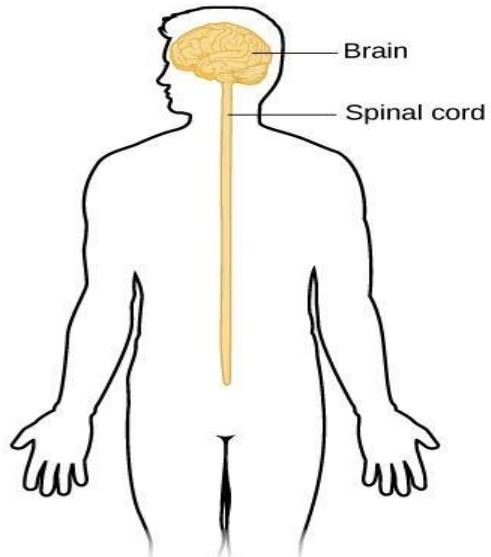
1. Blood
2. Lungs
3. Tissues

The correct sequence of transportation is:

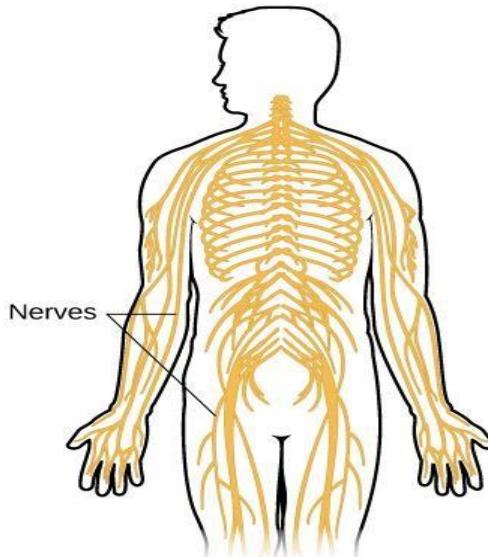
- a) 1,2, 3
- b) 3, 1, 2
- c) 2, 1, 3
- d) 1, 3, 2

Nervous System

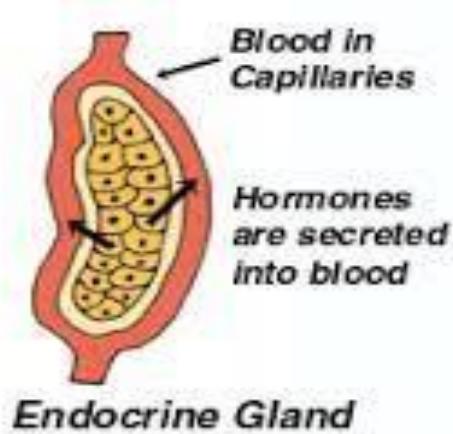
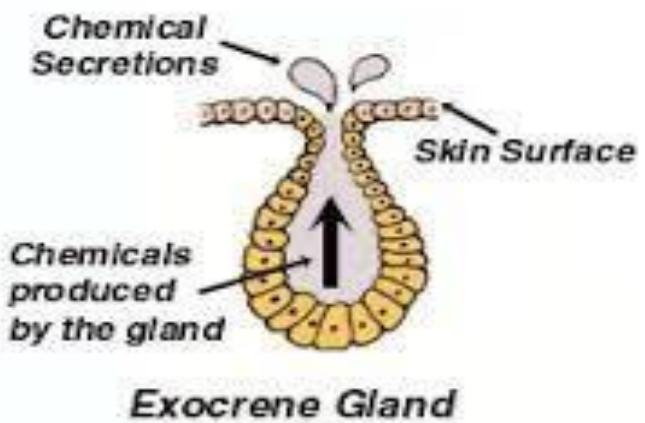
Central Nervous System



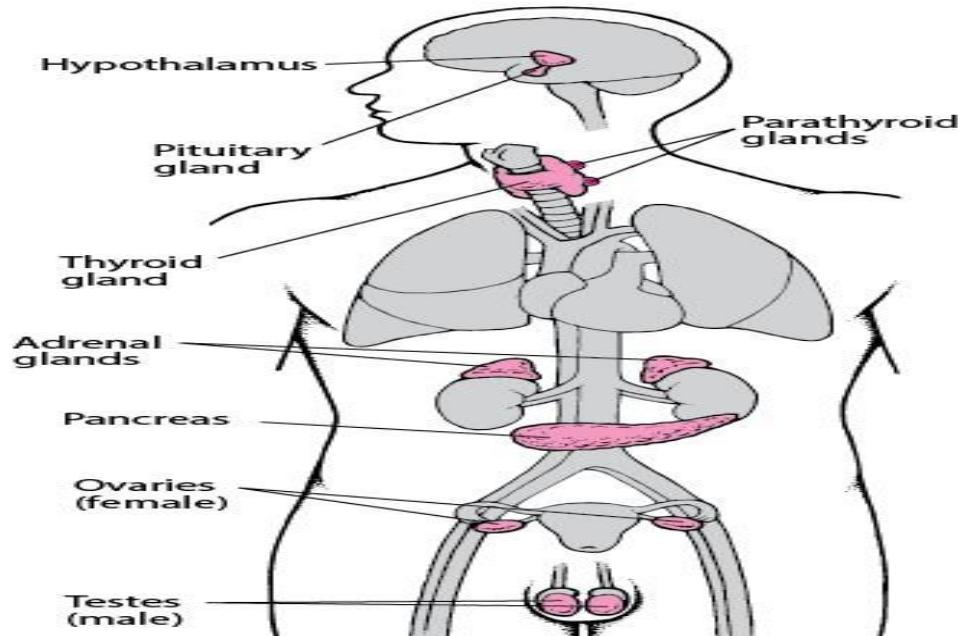
Peripheral Nervous System



Glands



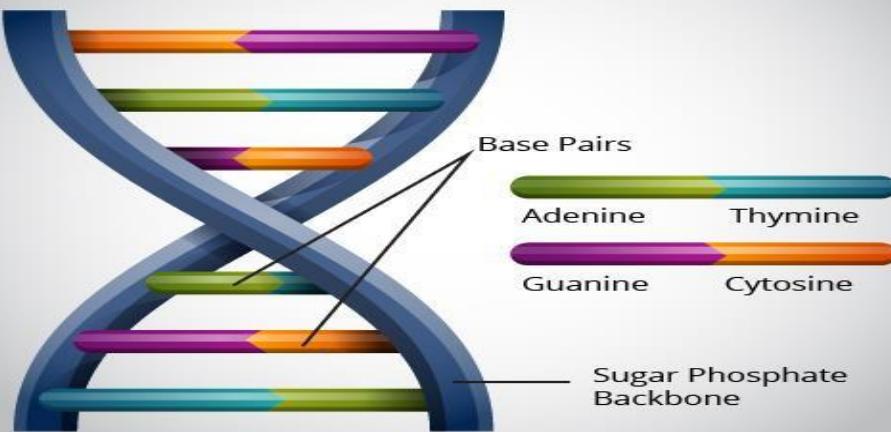
Endocrine Glands



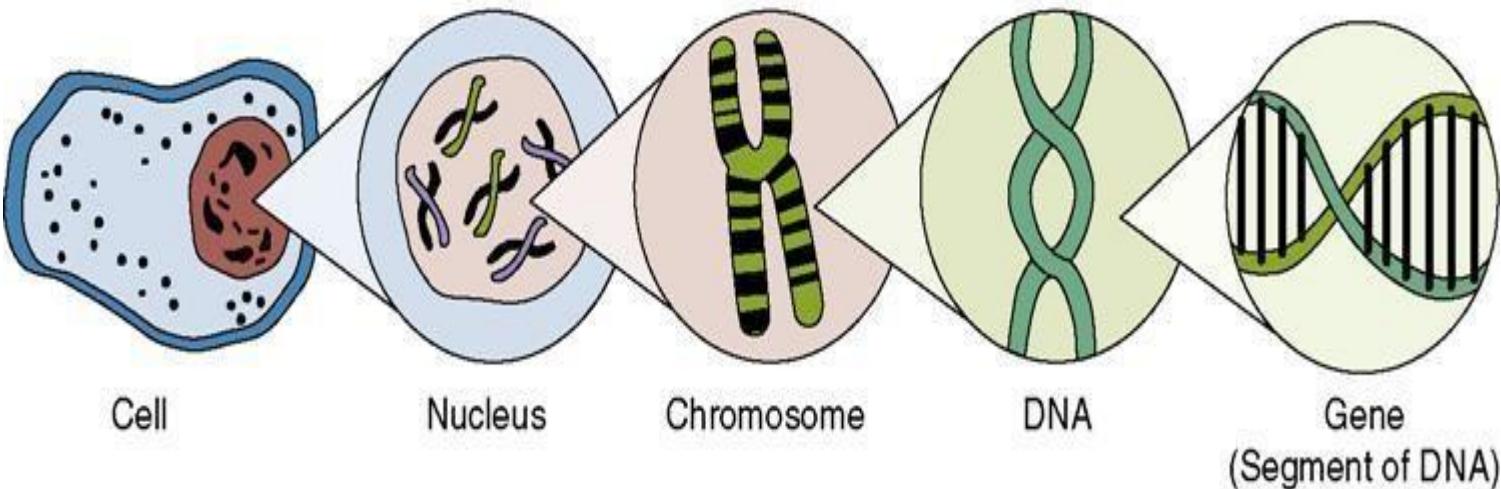
The pituitary gland by virtue of its tropic hormones controls the secretory activity of other endocrine glands. Which one of the following endocrine glands can function independent of the pituitary gland ?

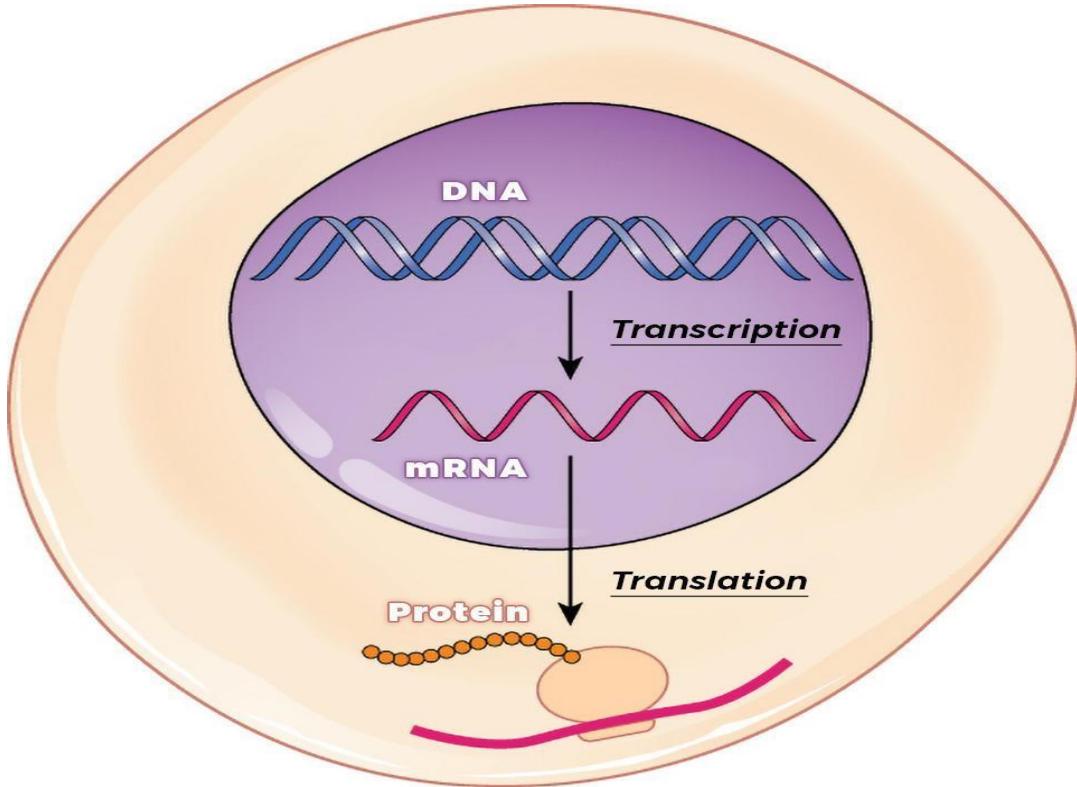
- (a) Thyroid
- (b) Gonads
- (c) Adrenals
- (d) Parathyroid

DNA Structure

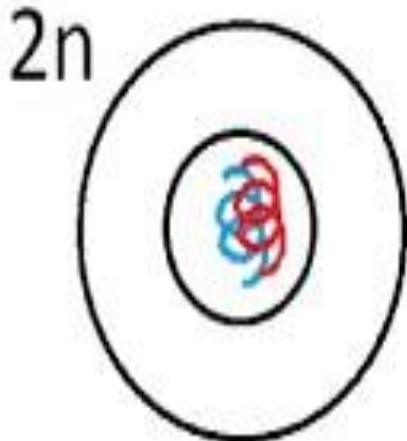


INSIDE THE CELL

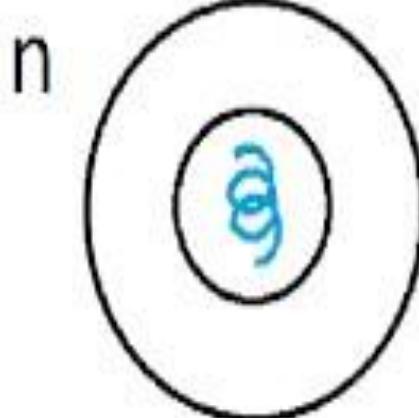




DIPLOID CELL

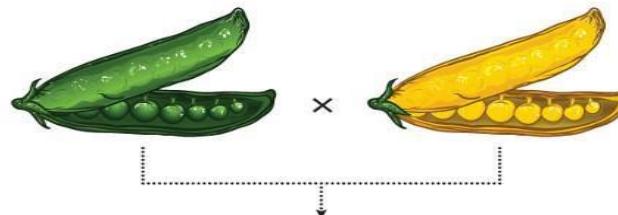


HAPLOID CELL

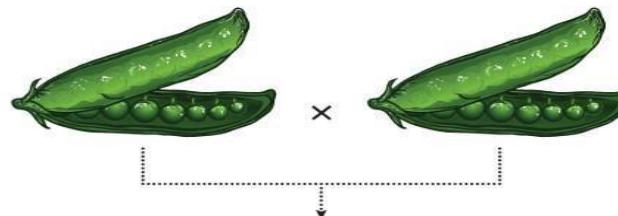


Mendel's Experiments

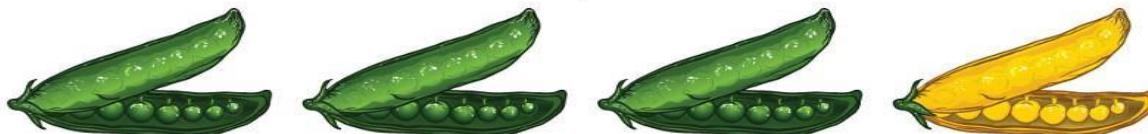
P Generation



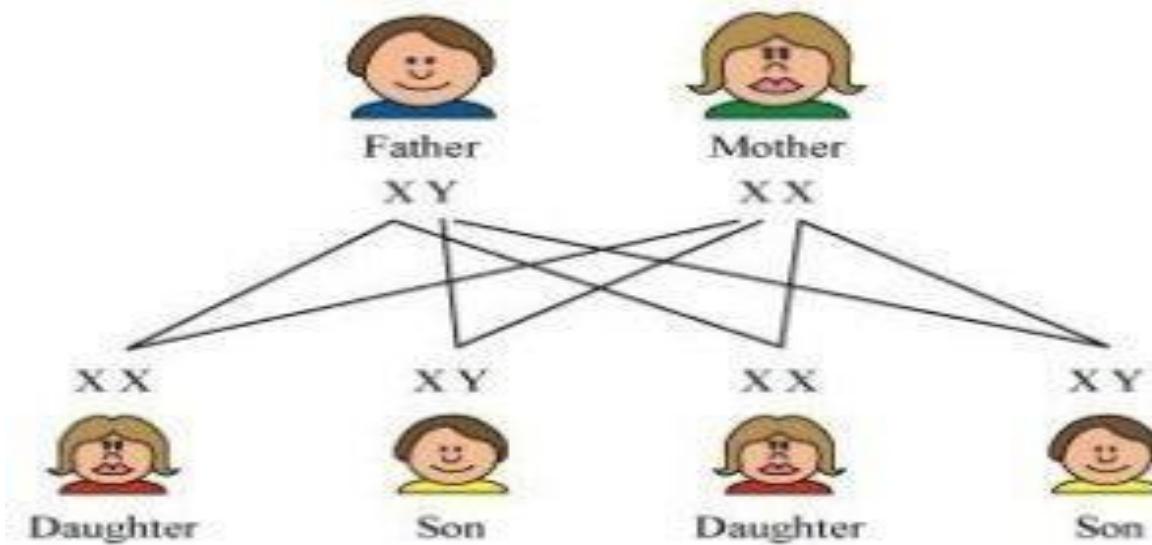
F₁ Generation



F₂ Generation



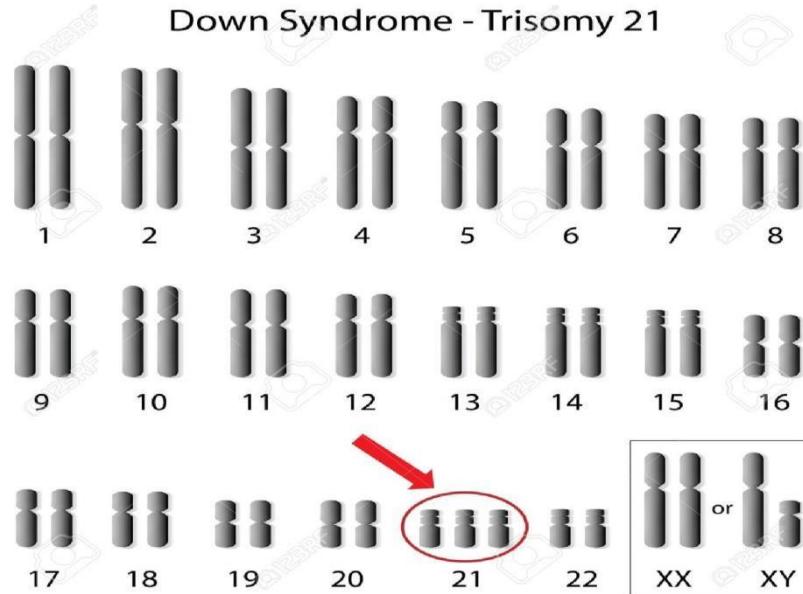
Sex determination



A married couple adopted a male child. A few years later, twin boys were born to them. The blood group of the couple is AB positive and O negative. The blood group of the three sons is A positive, B positive, and O positive. The blood group of the adopted son is

- A) O positive B) A positive
- C) B positive D) Cannot be determined on the basis of the given data

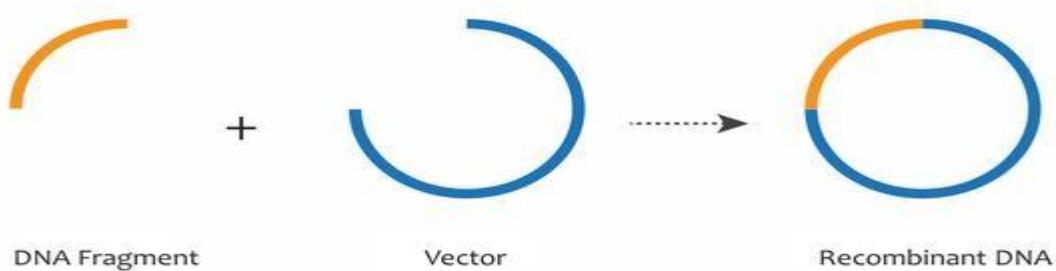
Genetic abnormalities



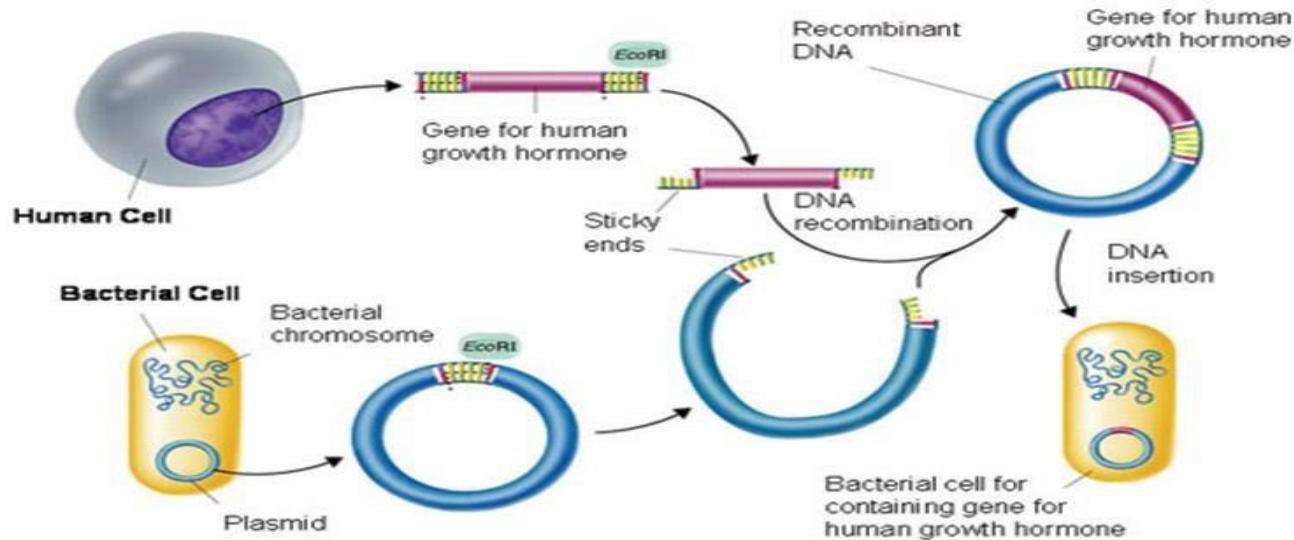
In the context of genetic disorders, consider the following: A woman suffers from colour blindness while her husband does not suffer from it. They have a son and a daughter. In this context, which one of the following statements is most probably correct?

- A. Both children suffer from colour blindness.
- B. Daughter suffers from colour blindness while son does not suffer from it.
- C. Both children do not suffer from colour blindness.
- D. Son suffers from colour blindness while daughter does not suffer from it.

Biotechnology



Recombinant DNA technology



Recombinant DNA technology (Genetic Engineering) allows genes to be transferred

1. across different species of plants
2. from animals to plants
3. from microorganisms to higher organisms

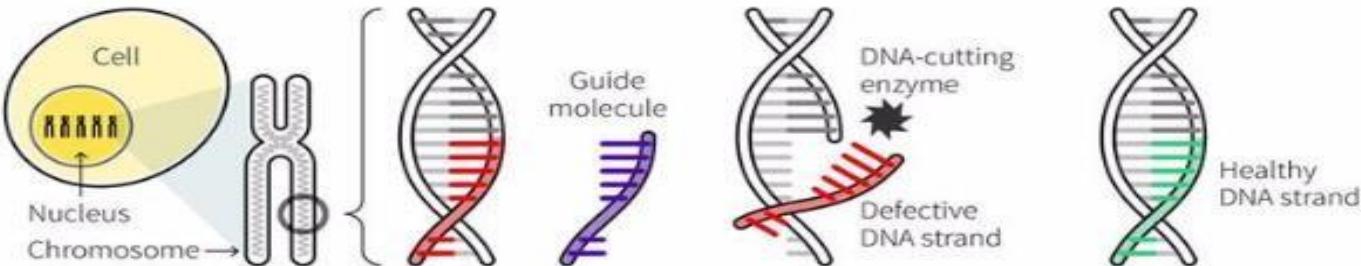
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DNA editing

A DNA editing technique, called CRISPR/Cas9, works like a biological version of a word-processing programme's "find and replace" function.

HOW THE TECHNIQUE WORKS



A cell is transfected with an enzyme complex containing:

- Guide molecule
- Healthy DNA copy
- DNA-cutting enzyme

A specially designed synthetic guide molecule finds the target DNA strand.

An enzyme cuts off the target DNA strand.

The defective DNA strand is replaced with a healthy copy.

Sources: Reuters; Nature; Massachusetts Institute of Technology

Class- 6

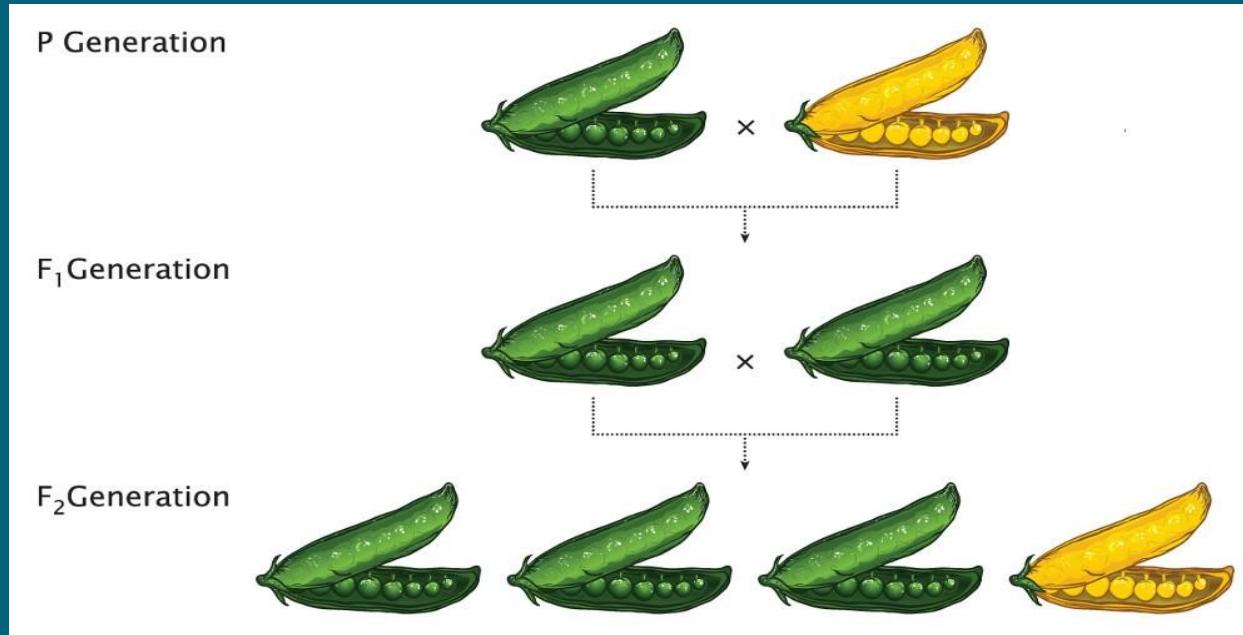
BIOLOGY

Assertion (A): The person with diabetes insipidus feels thirsty.

Reason (R): A person with diabetes insipidus suffers from excess secretion of vasopressin.

- (a) Both (A) and (R) are individually true and R is the correct explanation of A
- (b) Both (A) and (R) are individually true and R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

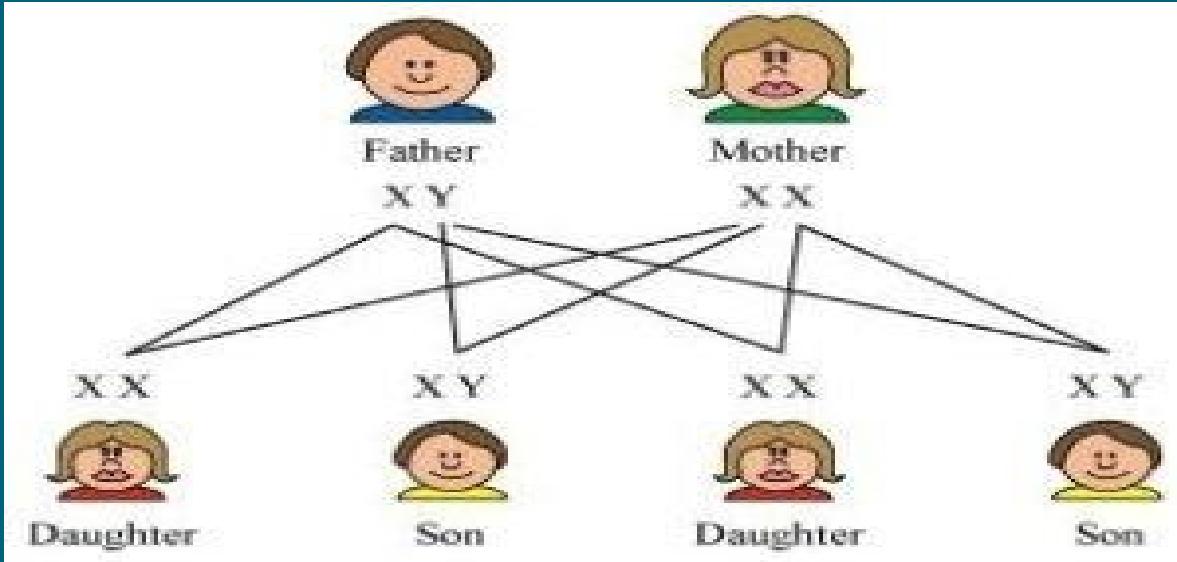
Mendel's Experiments



Blood group inheritance



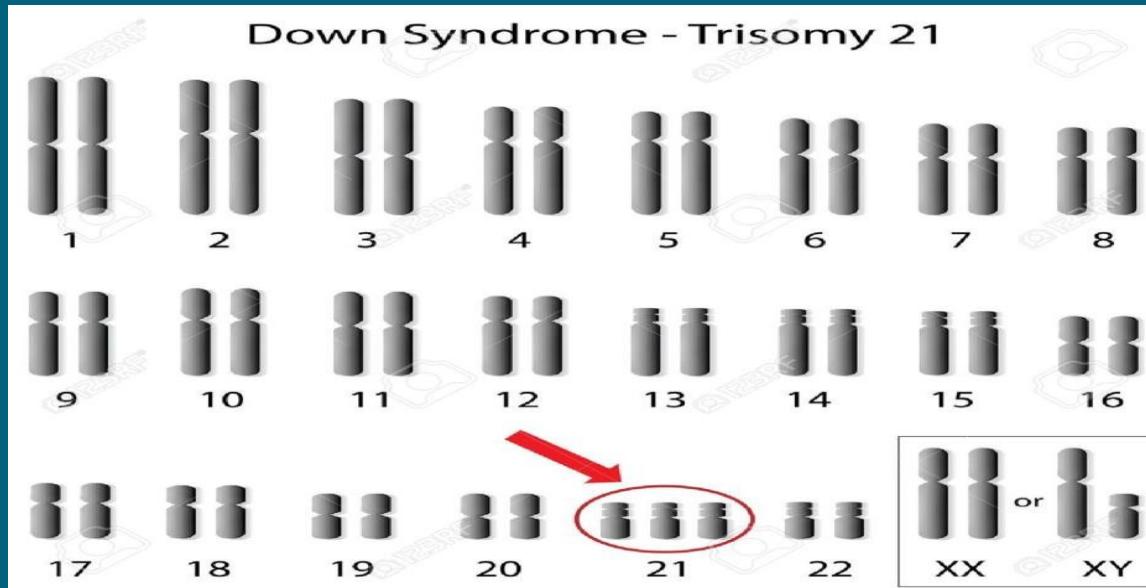
Sex determination



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Genetic abnormalities

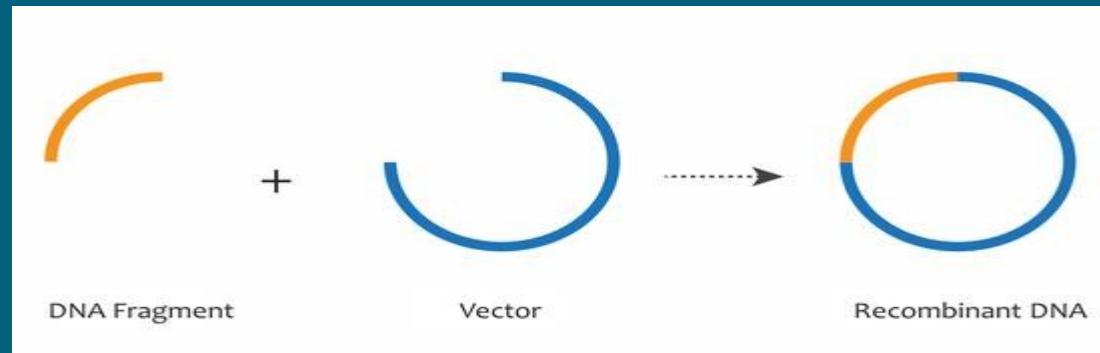


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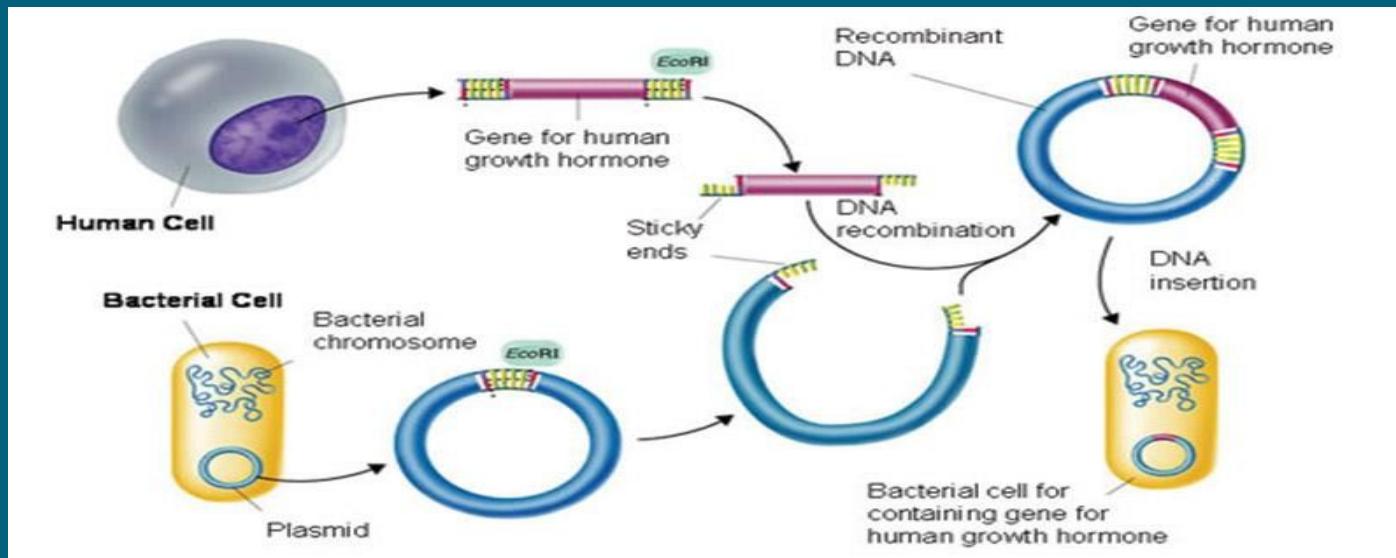
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Biotechnology



Recombinant DNA technology



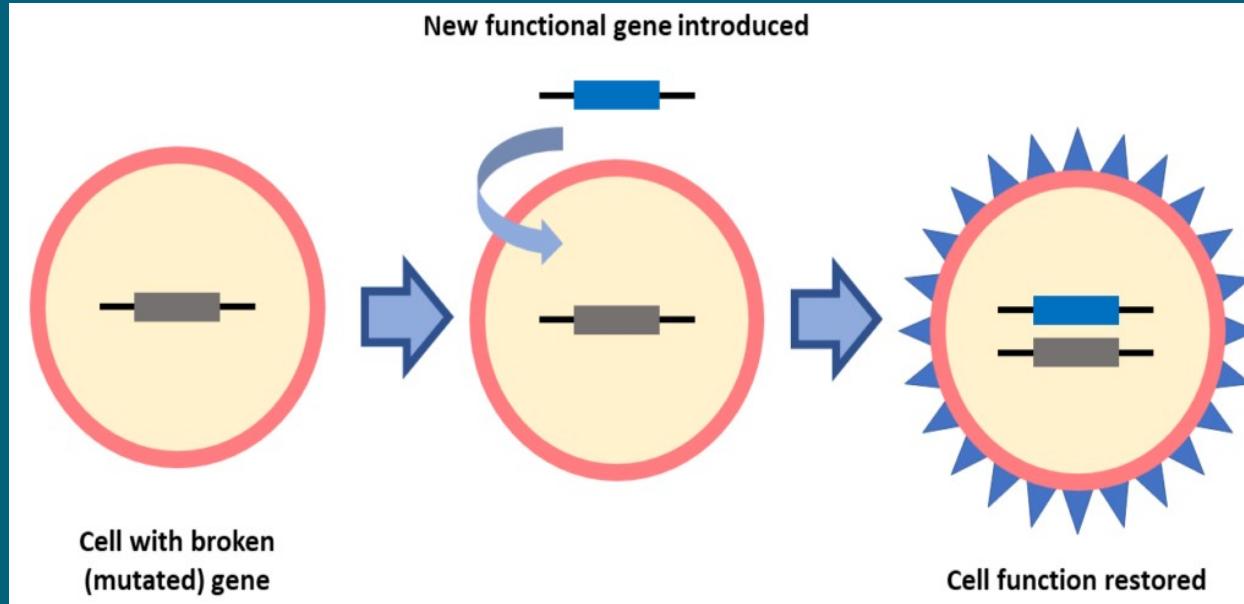
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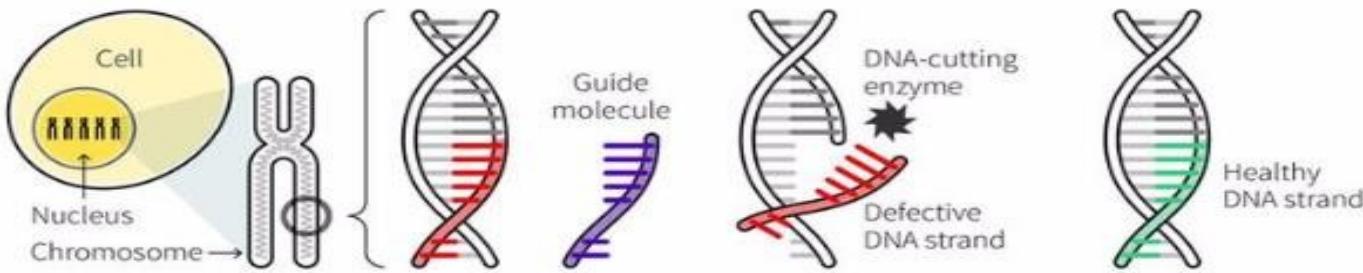
Gene therapy



DNA editing

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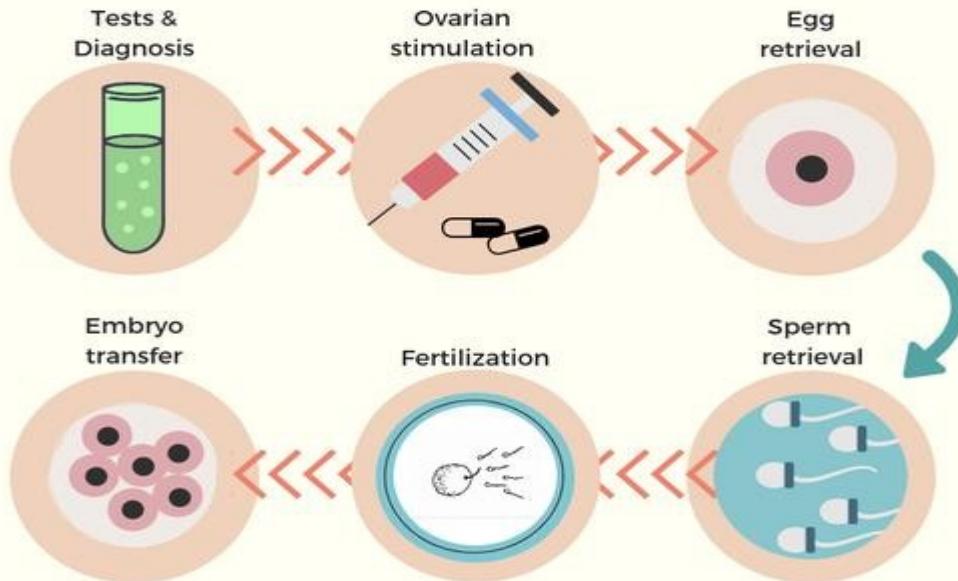
A specially designed synthetic guide molecule finds the target DNA strand.

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Sources: Reuters; Nature; Massachusetts Institute of Technology

IVF PROCESS



Class- 4

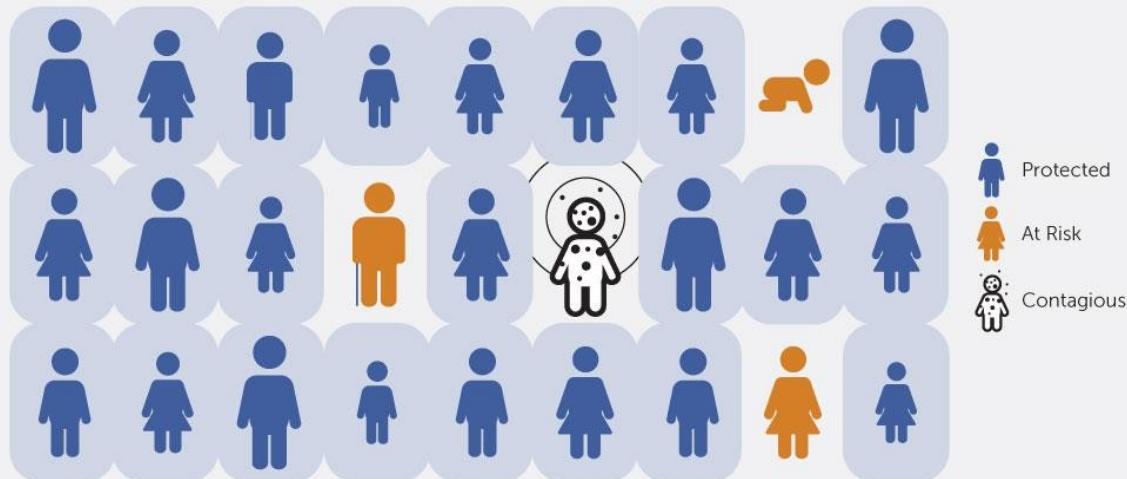
BIOLOGY

Which one of the following statements best describes the role of B cells and T cells in the human body?

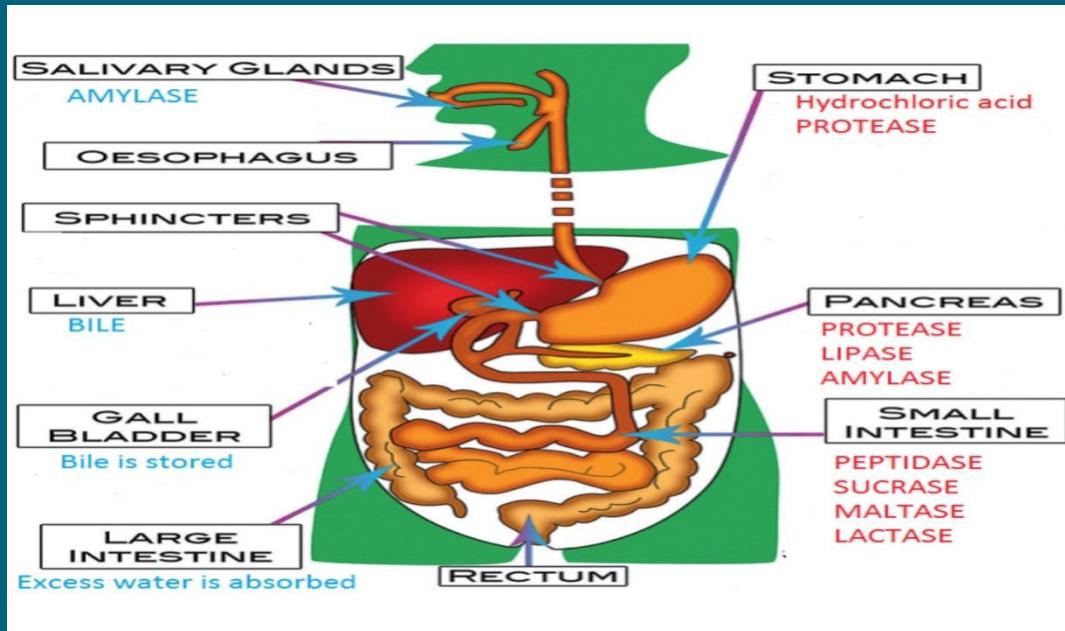
- (a) They protect the body from environmental allergens.
- (b) They alleviate the body's pain and inflammation.
- (c) They act as immunosuppressants in the body.
- (d) They protect the body from the diseases caused by pathogens

HERD IMMUNITY

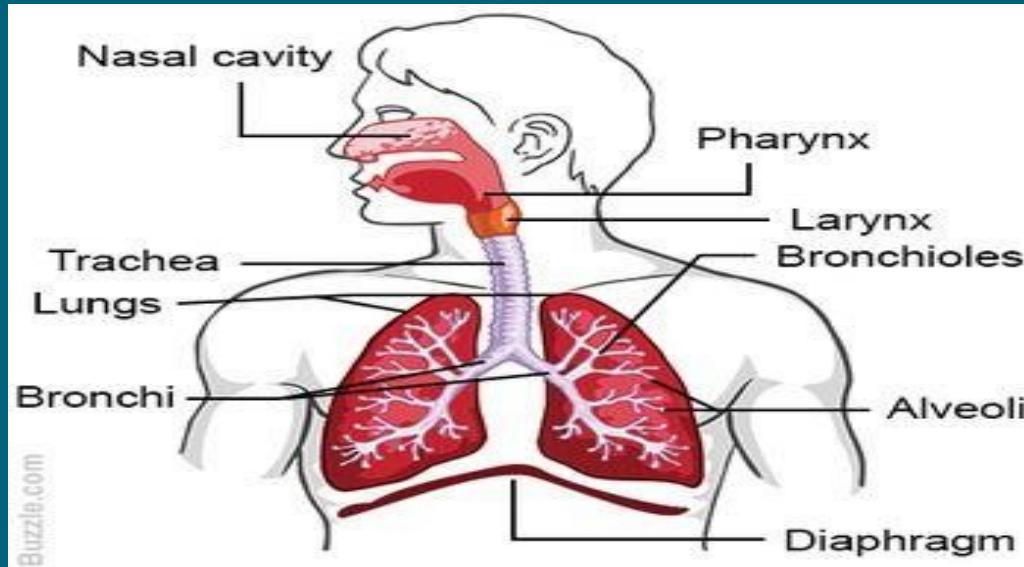
When enough people in a population have immunity that disease can't spread



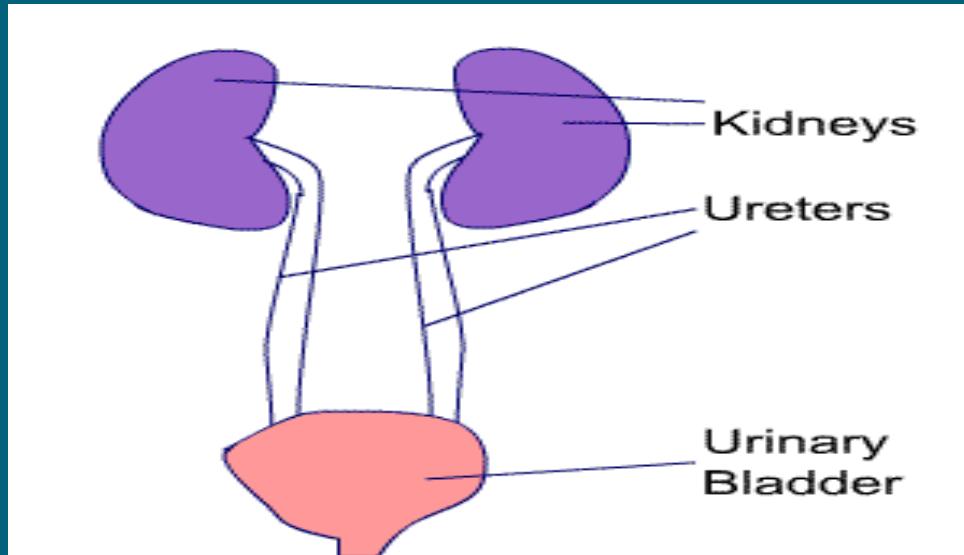
Digestive System



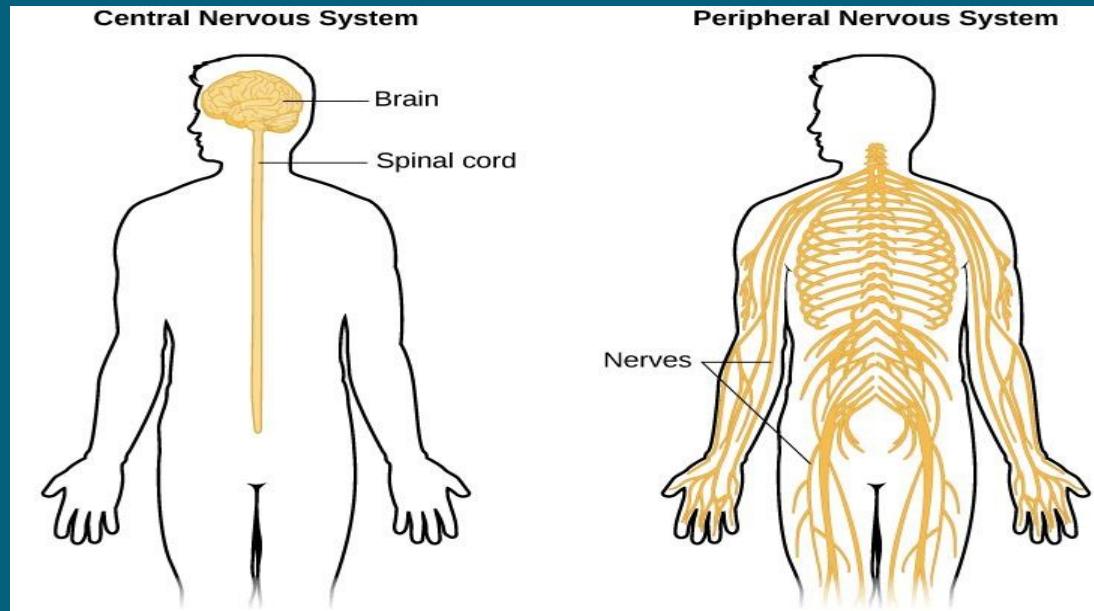
Respiratory System



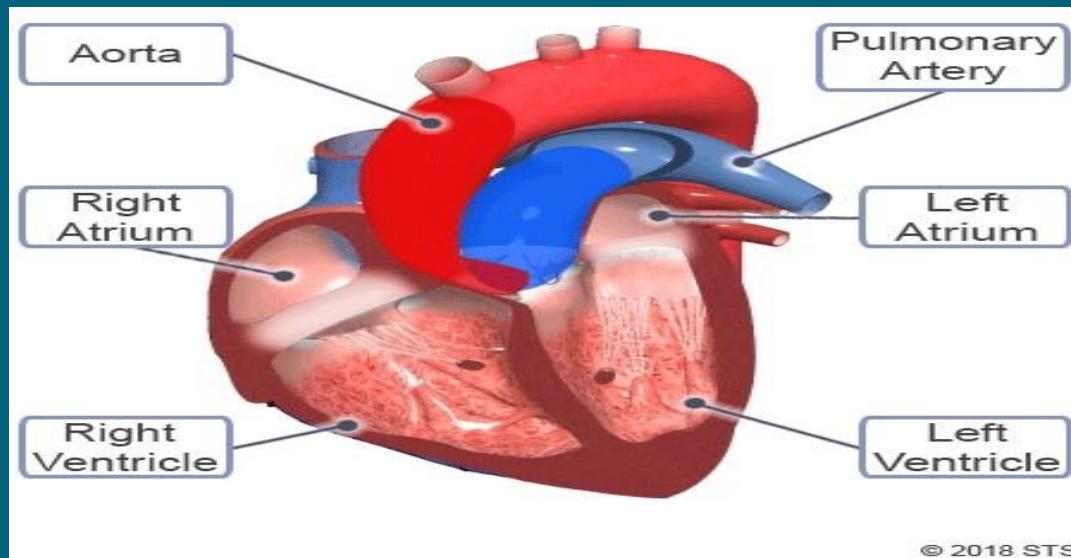
Excretory System



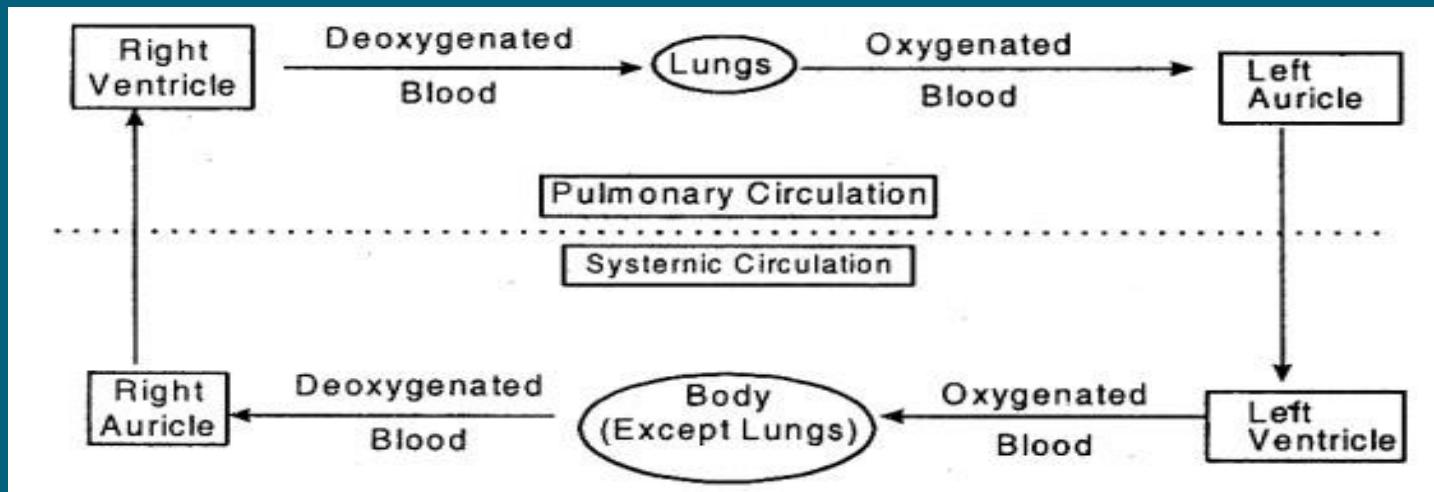
Nervous System



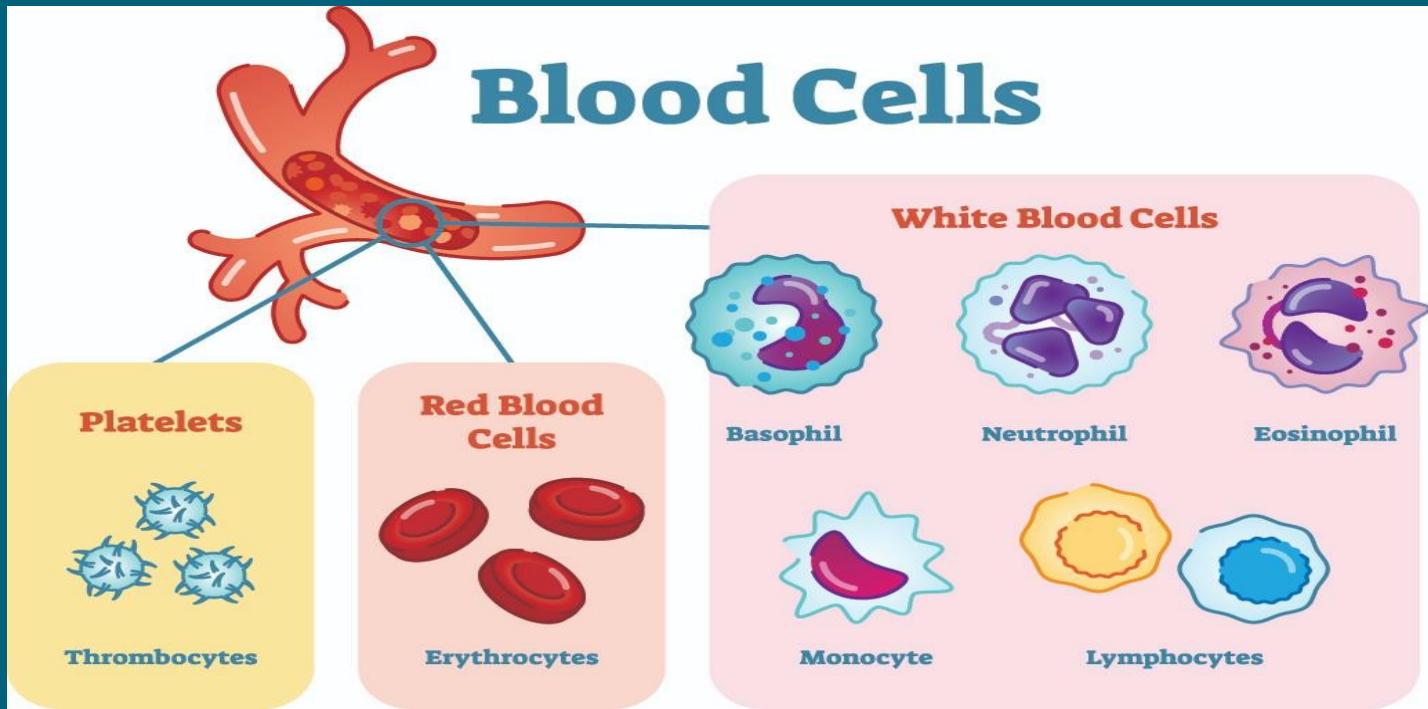
The Heart



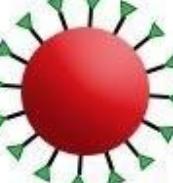
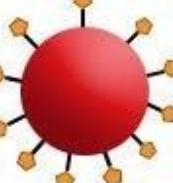
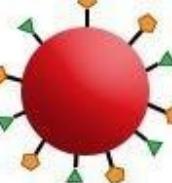
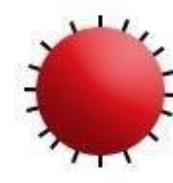
Double circulation in Heart



Blood Cells



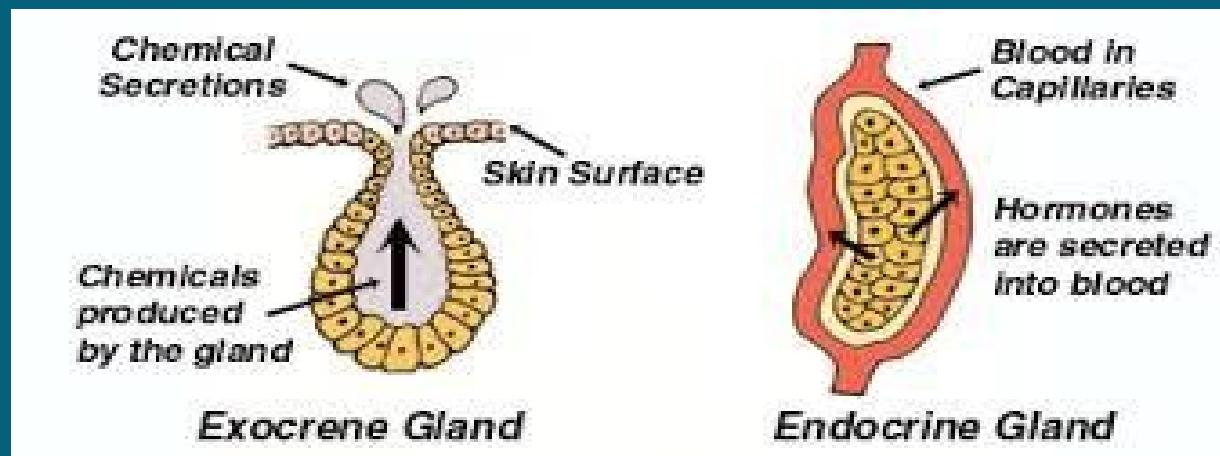
Blood groups

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-B and Anti-A
Antigens in Red Blood Cell	A antigen	B antigen	A and B antigens	None

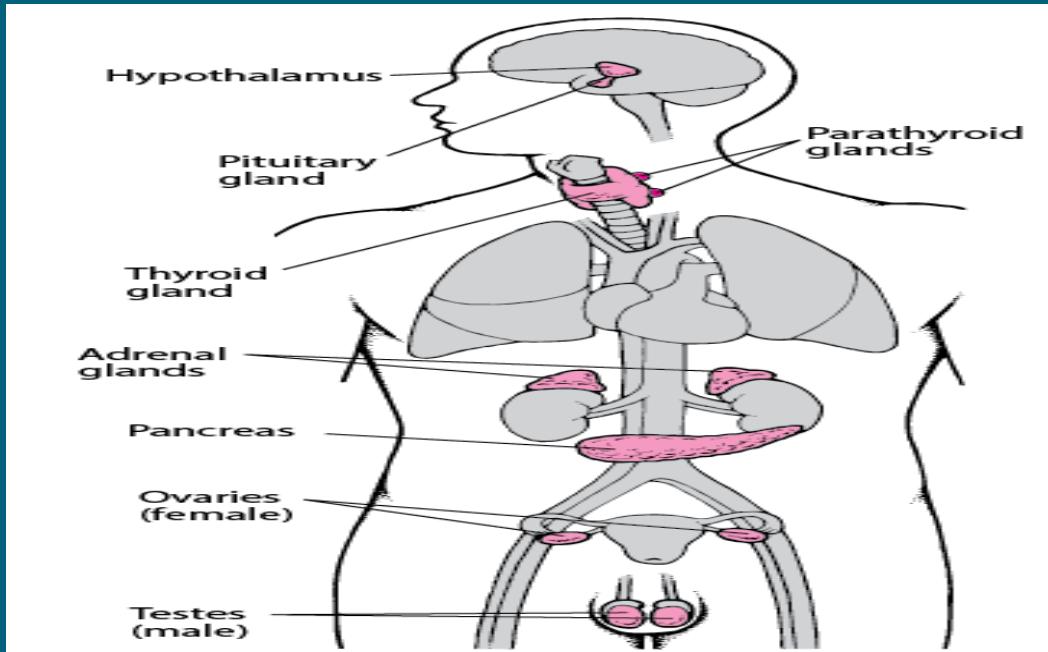
A man whose blood group is not known meets with a serious accident and needs blood transfusion immediately. Which one of the blood groups mentioned below and readily available in the hospital will be safe for transfusion?

- (a) O, Rh-
- (b) O, Rh+
- (c) AB, Rh-
- (d) AB, Rh+

Glands



Endocrine Glands



The pituitary gland by virtue of its tropic hormones controls the secretory activity of other endocrine glands. Which one of the following endocrine glands can function independent of the pituitary gland ?

- (a) Thyroid
- (b) Gonads
- (c) Adrenals
- (d) Parathyroid

Biology

Class-7

In the context of vaccines manufactured to prevent COVID-19 pandemic, consider the following statements:

1. The Serum Institute of India produced COVID-19 vaccine named Covishield using mRNA platform.
2. Sputnik V vaccine is manufactured using vector based platform.
3. COVAXIN is an inactivated pathogen based vaccine.

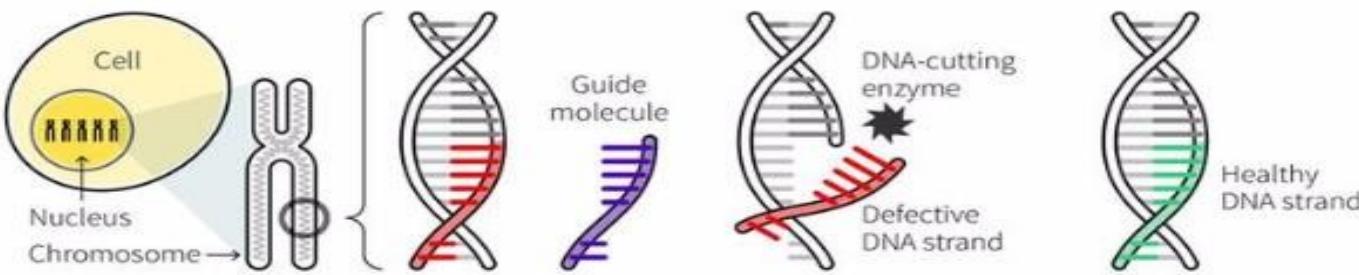
Which of the statements given above are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

DNA editing

A DNA editing technique, called CRISPR/Cas9, works like a biological version of a word-processing programme's "find and replace" function.

HOW THE TECHNIQUE WORKS



A cell is transfected with an enzyme complex containing:

- Guide molecule
- Healthy DNA copy
- DNA-cutting enzyme

A specially designed synthetic guide molecule finds the target DNA strand.

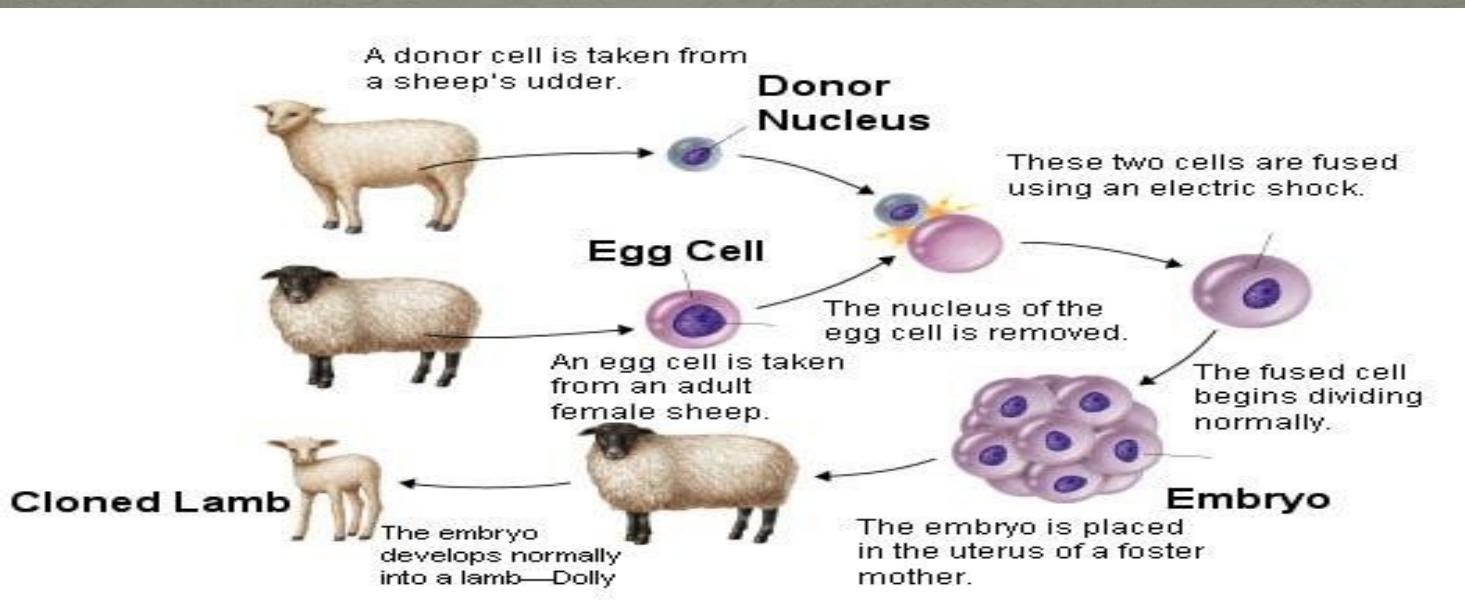
An enzyme cuts off the target DNA strand.

The defective DNA strand is replaced with a healthy copy.

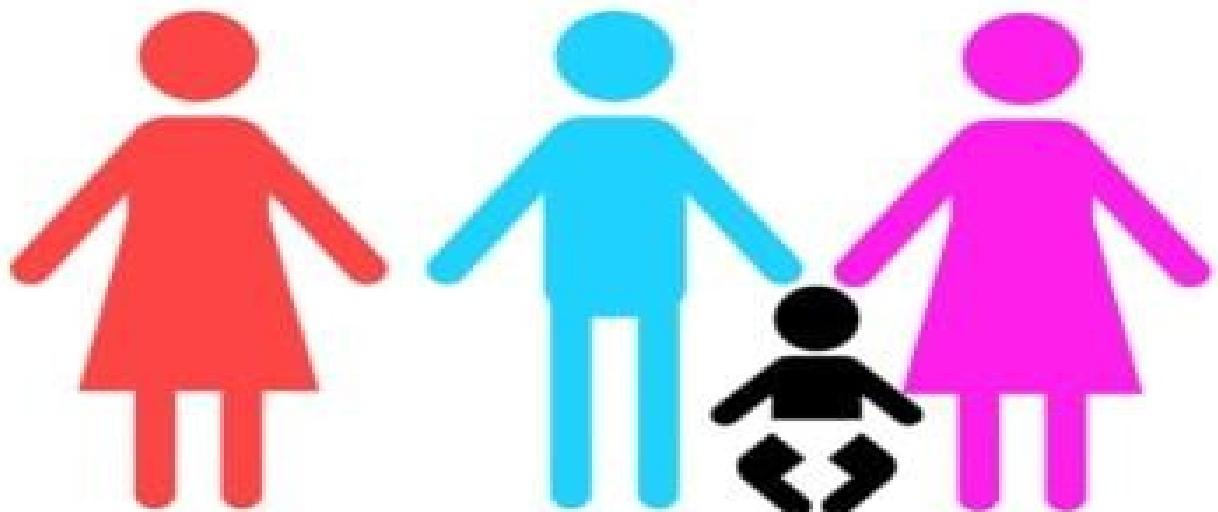
Sources: Reuters; Nature; Massachusetts Institute of Technology



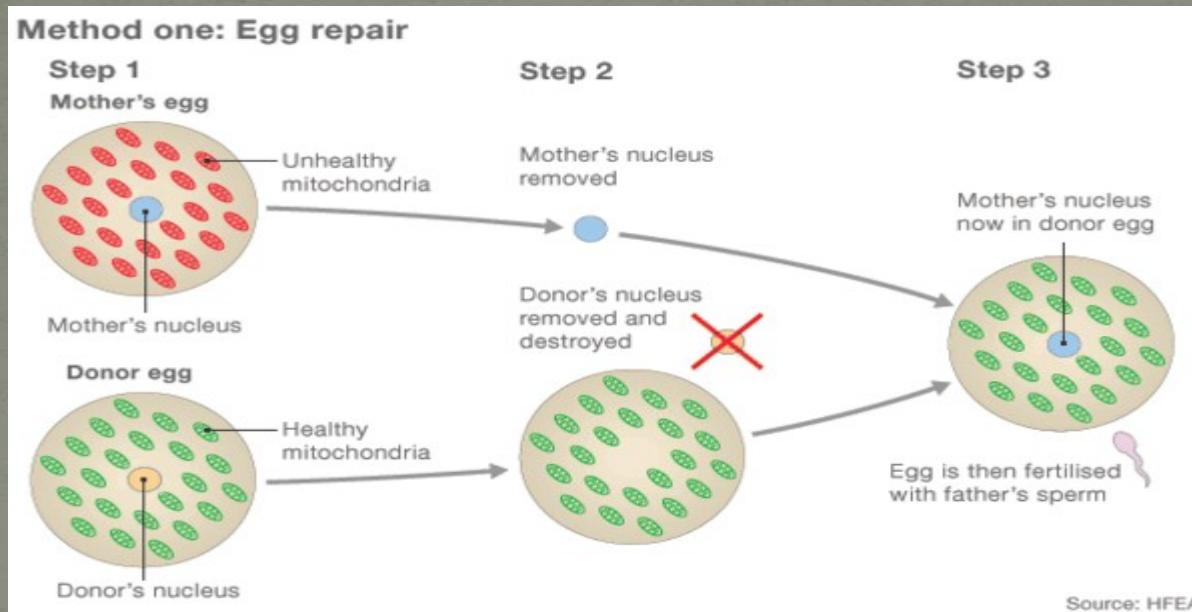
Animal Cloning



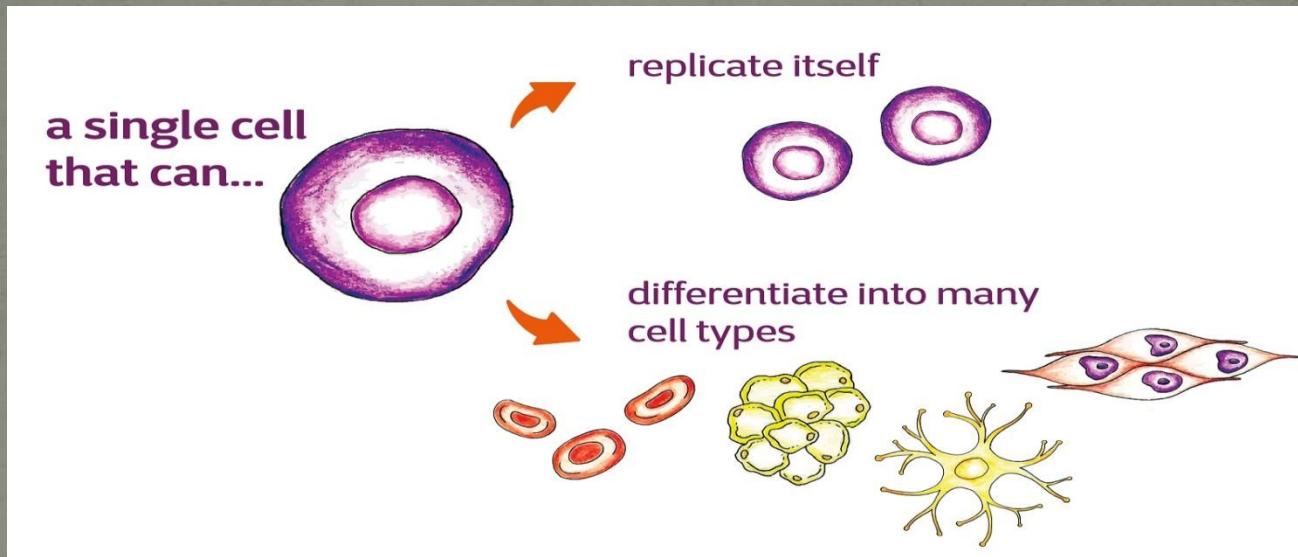
Three Parents baby



Mitochondrial Replacement



Stem Cells



Potential stem cell therapy applications

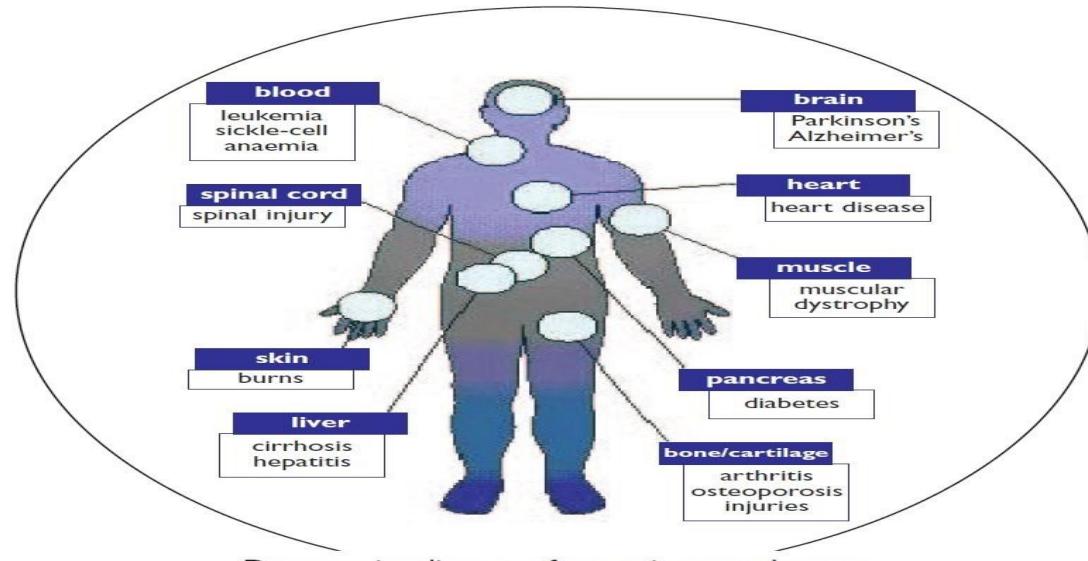


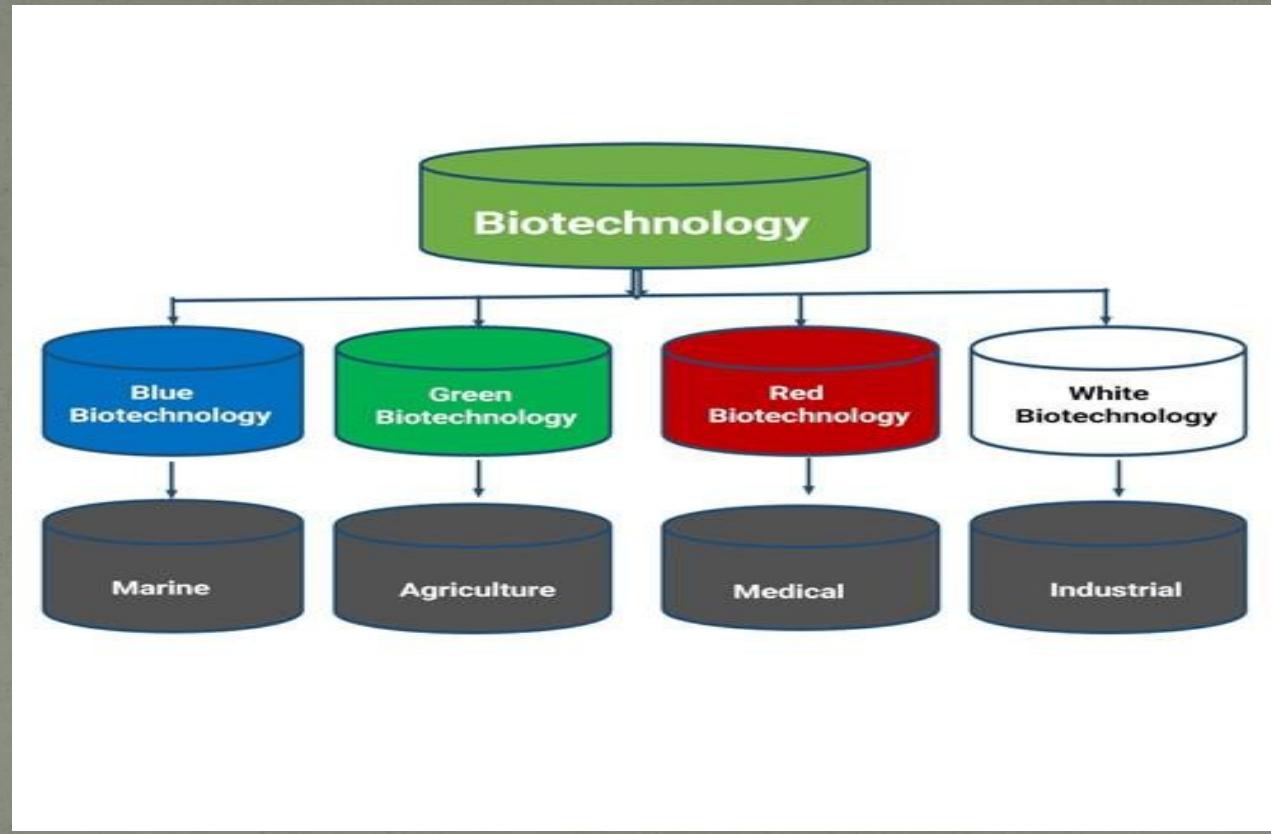
Figure 1 Degenerative diseases of different tissues/organs amenable to cell therapies
Source: MRC, London: stem cell therapy

With reference to 'stem cells', frequently in the news, which of the following statements is/are correct?

1. Stem cells can be derived from mammals only.
2. Stem cells can be used for screening new drugs.
3. Stem cells can be used for medical therapies.

Select the correct answer using the codes given below :

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3



Consider the following statements :

- 1. Genetic changes can be introduced in the cells that produce eggs or sperms of a prospective parent.**
- 2. A person's genome can be edited before birth at the early embryonic stage.**
- 3. Human induced pluripotent stem cells can be injected into the embryo of a pig.**

Which of the statements given above is/are correct ?

- [a) 1 only**
- [b) 2 and 3 only**
- [c) 2 only**
- [d) 1, 2 and 3**