

Topics Covered –

Biotechnology

Activity 1

Identify the output or function in each of the following process or section of the central dogma. Identify one common disorder or application associated in the absence of the intended output/function



Process/Section	Output/Function	Disorder/Application
Transcription		
Translation		
RNA-splicing		
si-RNA		
Methylation (Promoter region in DNA)		
DNA polymerase		

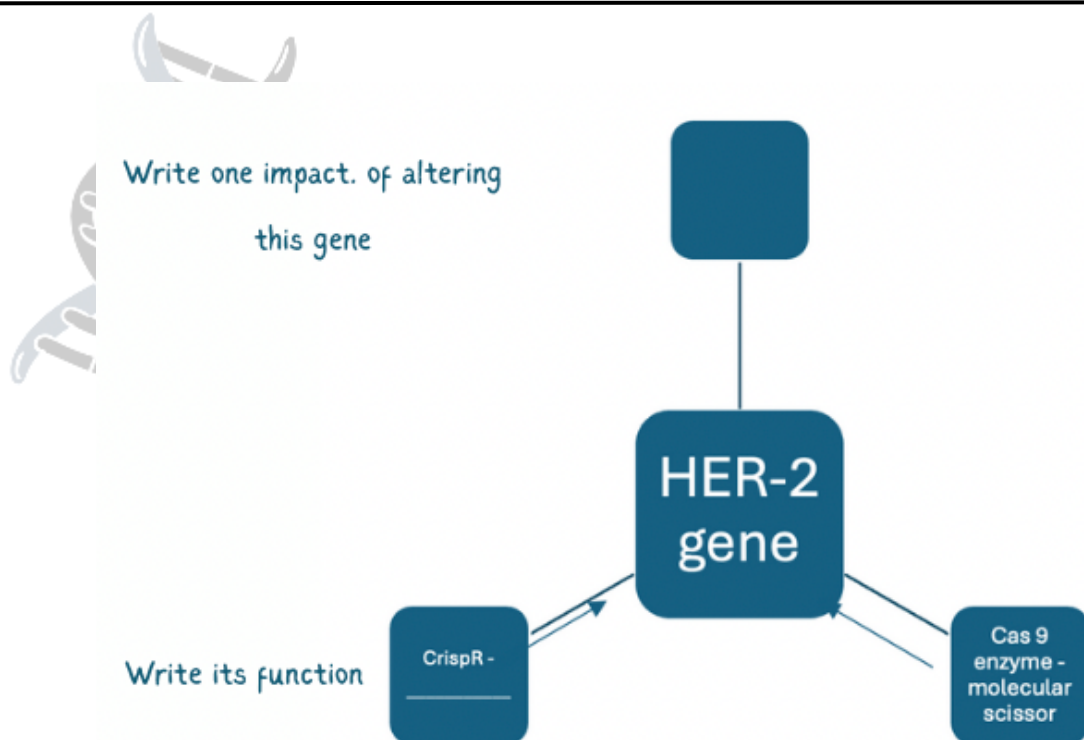
Activity 2

In the way you understand fill up the details in the following

- To make a transgenic variety of cotton to develop insect resistance



- Use your notes/google to find the following



Activity 3

Write one real use case from contemporary times for each of the following using notes and google. If there is no use case write not applicable

Technique	Real Use case
1. R-DNA technology in human health	
2. RNA-interference in agriculture	
3. CRISPR technique in gene therapy	
4. SDN 1/2 in agriculture in India	
5. CRISPR system in developing molecular diagnostic	
6. iPS cells in blood related disorders	
7. DNA fingerprinting	
8. Mitochondrial replacement therapy in health	

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Technique	Real Use case
9. Inserting plant gene into humans/animals	
10. Lab-made si-RNA	
11. CRISPR system to editing germline cells (gametes or sex cells)	
12. R-DNA technology in agriculture to infuse herbicide resistance	

Activity 4 Read the following and respond if the following can or cannot be done in India(with yes/no)

1. I can cultivate a transgenic variety of mustard
2. I can tweak the embryonic cell to knock off a gene responsible for breast cancer
3. I can tweak my T-cells to fight my cancer cells using CRISPR system
4. A farmer can reuse Bt cotton seeds
5. A company can patent seeds coming out of genetically modified plants
6. I can insert a gene from microbe to humans to generate functional/healthy result
7. I can insert a gene from animal to plant to generate functional result
8. I can tweak stem cells to produce healthy RBCs
9. I can create m-RNA in the laboratory to elicit immune response in the body
10. I can use R-DNA technology to make insulin



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Practice Questions

1. Which of the following may be said to be true with respect to genetic material in living things?

1. The genetic material of all living things are made out of same nucleotides as the base molecules
2. The genetic material of plants and animals differ not only in their nucleotide sequence but also the base molecules
3. Viruses are the only organisms whose primary genetic material may be made of DNA or RNA.

How many of the statement(s) above is/are correct?

- (a) Only 1
- (b) Only 2
- (c) All three
- (d) None are correct

2. Which of the following is incorrect with respect to human genome?

- (a) Human genome is made of both DNA and RNA molecules
- (b) Human genome is made primarily of DNA molecule
- (c) While human genome is made only of DNA, a copy is made in the form of RNA molecule.
- (d) All coding part of human genome is made of DNA.

3. The process of transcription involves which of the following?

1. DNA in the nuclei
2. Messenger RNA
3. Short non-coding RNA
4. Long non-coding RNA
5. Transposons

Select the correct answer using the codes given below:

- a) 1 and 2 only
- b) 1, 2 and 3 only
- c) 1, 2 and 4 only
- d) 1, 2, 4 and 5 only

4. Which of the of following is involved in RNA interference pathway after transcription?

1. mRNA
2. Short non-coding RNA
3. Micro-RNA
4. DNA
5. tRNA
6. Introns and exons

Select the correct answer using the codes given below:

- (a) 2, 3 and 4 only
- (b) 1, 2, 3 and 6 only
- (c) 1, 2, 4 and 5 only
- (d) 1, 2, 4, 5 and 6 only

5. In the field of genetic engineering which of the following can be done at the current level of development?

1. Augmenting a missing nucleotide base in a gene
2. Deleting an unwanted nucleotide base in a gene
3. Creation and insertion of a lab-made nucleotide base not found in nature into a living organism
4. Creation of a functional protein with an entirely unnatural nucleotide base.

How many of the above statements are correct

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All options are incorrect

6. The cellular and molecular control of programmed cell death are known as :

- (a) Apoptosis
- (b) Ageing
- (c) Degeneration
- (d) Necrosis

7. DNA in prokaryotic cells is typically found in

- (a) Linear chromosome within a nucleus
- (b) Single, circular loop in the cytoplasm

8. How does the plant cell differ from the animal cell?

- (a) Mitochondria
- (b) Cell wall
- (c) Presence of protoplasm

- (d) Cell nucleus

9. Meiosis is a type of cell division that is important for:

- (a) Growth and repair of body tissues
- (b) Sexual reproduction
- (c) (c) Variability in a species
- (d) (d) Both (b) and (c)

10. _____ is the type of cell division that is essential for preservation of genetic information. It is the process cells use to make exact replicas of themselves for growth and repair.

- (a) Mitosis
- (b) Meiosis

11. Gene is:

- (a) A segment of DNA
- (b) A segment of DNA and histone
- (c) (c) A segment of DNA, RNA and histone
- (d) None of the above

12. Different versions of the same gene are called:

- (a) Traits
- (b) Alleles

13. Which of the following is/are considered to be the component/components of the human genome?

1. Exons
2. Introns
3. Jumping Genes
4. Retrovirus

Select the correct option/options:

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

14. During translation, the codons on mRNA are "read" by molecules called:

- (a) Messenger RNA (mRNA)
- (b) Transfer RNA (tRNA)
- (c) Ribosomal RNA (rRNA)
- (d) None of the above

15. Consider the following statements:

1. In eukaryotic organisms transcription and translation occur in the cytoplasm.
2. The process of translation is carried out by ribosomes.
3. Reverse transcription is the flow of information from DNA to RNA.

How many of the statements given above are

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

16. Mitochondrial DNA is inherited from:

- (a) Both parents equally
- (b) Father only
- (c) Mother only
- (d) It varies depending on the species

17. The process of determining the complete DNA sequence of an organism's genome is called:

- (a) Gene mapping
- (b) Genome sequencing

- (c) DNA profiling
- (d) Karyotyping

18. The study of SNPs is important for:

1. Understanding genetic diversity within a population
2. Developing targeted medical treatments
3. Tracing human evolutionary history
4. Genetic profiling of an individual

How many of the above statements are correct?

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All of the above

19. DNA fingerprinting identifies individuals based on:

- (a) The entire DNA sequence
- (b) Specific repetitive DNA sequences
- (c) The presence of specific genes
- (d) The sugar-phosphate backbone of DNA

20. Given:

1. Blood cells
2. Bone cells
3. Hair strands
4. Saliva

Samples taken for DNA testing in criminal investigation can be:

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

(d) 1, 2, 3 and 4

21. A vector in recombinant DNA technology refers to:

- (a) A carrier molecule used to introduce foreign DNA into a host cell
- (b) The target DNA to be inserted
- (c) An enzyme that cuts DNA
- (d) A short sequence of DNA used for identification

22. What are the vectors used in recombinant DNA technology?

- (a) Plasmids
- (b) Cosmids
- (c) Bacteriophage
- (d) Yeast artificial chromosomes
- (e) All of the above

23. Site-Directed Nuclease (SDN)-1 is a site-directed genetic mutation without using a DNA sequence template.

- (a) True
- (b) False

24. Which of the following is a key advantage of the CRISPR-Cas9 system for genome editing?

- (a) Ease of use and high specificity
- (b) Ability to target multiple genes simultaneously
- (c) Potential for therapeutic applications
- (d) All of the above

25. Which genome editing technique facilitates genetic mutations by inserting

DNA elements or genes of foreign origin to generate specific changes?

- (a) Site-Directed Nuclease (SDN) 1
- (b) Site-Directed Nuclease (SDN) 2
- (c) Site-Directed Nuclease (SDN) 3
- (d) None of the above

26. What is the main advantage of using adult stem cells for therapy?

- (a) They can differentiate into any cell type.
- (b) They are less likely to be rejected by the body.
- (c) They are readily available in large quantities.
- (d) They are ethically uncontroversial

27. Stem cells are important in regenerative medicine because they can:

- (a) Repair damaged tissues and organs
- (b) Replace lost or dysfunctional cells
- (c) Restore normal function to diseased or injured tissues
- (d) All of the above

28. Induced pluripotent stem cells (iPSCs) offer promise for future stem cell therapies. What is the main advantage of using iPSCs?

- (a) They are readily available from any healthy donor.
- (b) They can be created from a patient's own cells, reducing rejection risks.
- (c) They are currently the most widely used stem cells in clinical trials
- (d) They have a lower risk of tumour formation compared to other stem cell types.

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Instructions: Fill the circles completely using a blue or black ballpoint pen.

- Q01 ☐ A ☐ B ☐ C ☐ D
Q02 ☐ A ☐ B ☐ C ☐ D
Q03 ☐ A ☐ B ☐ C ☐ D
Q04 ☐ A ☐ B ☐ C ☐ D
Q05 ☐ A ☐ B ☐ C ☐ D
Q06 ☐ A ☐ B ☐ C ☐ D
Q07 ☐ A ☐ B ☐ C ☐ D
Q08 ☐ A ☐ B ☐ C ☐ D
Q09 ☐ A ☐ B ☐ C ☐ D

- Q10 ☐ A ☐ B ☐ C ☐ D
Q11 ☐ A ☐ B ☐ C ☐ D
Q12 ☐ A ☐ B ☐ C ☐ D
Q13 ☐ A ☐ B ☐ C ☐ D
Q14 ☐ A ☐ B ☐ C ☐ D
Q15 ☐ A ☐ B ☐ C ☐ D
Q16 ☐ A ☐ B ☐ C ☐ D
Q17 ☐ A ☐ B ☐ C ☐ D

- Q18 ☐ A ☐ B ☐ C ☐ D
Q19 ☐ A ☐ B ☐ C ☐ D
Q20 ☐ A ☐ B ☐ C ☐ D
Q21 ☐ A ☐ B ☐ C ☐ D
Q22 ☐ A ☐ B ☐ C ☐ D
Q23 ☐ A ☐ B ☐ C ☐ D
Q24 ☐ A ☐ B ☐ C ☐ D
Q25 ☐ A ☐ B ☐ C ☐ D



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What Did I Learn This Week?

Name of the student:

Batch name:

 **One fact I found fascinating...** (Write something that surprised or amazed you)

- Why did it stand out to me?

- How can I connect this to a real-world example or current affairs?

 **One concept I still want clarity on...** (Write any topic you're still confused about)

- What exactly confuses me about it?

- What will I do to resolve this confusion?
 - ☐ Revisit class notes
 - ☐ Ask a doubt in class
 - ☐ Watch a video/diagram explanation

 **How well did I understand this week's topics?**

Code	Concept	My Understanding
1	Organisation of life	☐ Excellent ☐ Good ☐ Needs Revision
2	Central Dogma of Biotechnology	☐ Excellent ☐ Good ☐ Needs Revision
3	Miosis: secret to variability	☐ Excellent ☐ Good ☐ Needs Revision
4	Mitosis and Differentiation: Story of you from 1 cell to complex organism	☐ Excellent ☐ Good ☐ Needs Revision
5.	Components of the genome	☐ Excellent ☐ Good ☐ Needs Revision
6.	Recombinant DNA technology	☐ Excellent ☐ Good ☐ Needs Revision
7.	CrispR based Gene editing system	☐ Excellent ☐ Good ☐ Needs Revision
8.	GM Crops	☐ Excellent ☐ Good ☐ Needs Revision
9	Seed sovereignty	☐ Excellent ☐ Good ☐ Needs Revision