



NCERT Solutions for 12th Class Biology: Chapter 6-Molecular Basis of Inheritance



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Chapter 6 Notes.

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Exercises

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1. Group the following as nitrogenous bases and nucleosides:

Adenine, Cytidine, Thymine, Guanosine, Uracil and Cytosine.

Answer

Nitrogenous bases are Adenine, Thymine and Uracil.

Nucleosides are Cytidine, Guanosine and Cytosine.

2. If a double-stranded DNA has 20 percent of cytosine, calculate the percentage of adenine in DNA.

Answer

The percent of cytosine = 20 (given)

% of C = % of G

Therefore, the percent of guanine = 20

The percent of thymine + adenine will be $100 - (20 + 20) = 60$

Therefore, the percent of adenine will be $60/2 = 30$

3. If the sequence of one strand of DNA is written as follows:

5'-ATGCATGCATGCATGCATGC-3'

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Write down the sequence of the complementary strand in the 3' → 5' direction.

Answer

The sequence of the complementary strand in the 3' → 5' direction will be 3'-TACGTACGTACGTACGTACGTACG-5'.

4. If the sequence of a coding strand in a transcription unit is written as follows:

5'-ATGCATGCATGCATGCATGCATGC-3'

Write down the sequence of m-RNA.

Answer

The sequence of a template strand will be

3'-TACGTACGTACGTACGTACGTACG-5'

Thus, the sequence of mRNA will be

5'-AUGCAUGCAUGCAUGCAUGCAUGC-3'

5. Which property of DNA double helix led Watson and Crick to hypothesise the semi-conservative mode of DNA replication? Explain.

Answer

The property of DNA double helix led Watson and Crick are:

- Two strands running opposite to each other, wherein bases will always pair with their counterpart-A with T and G with C (specific pairing).

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- If H bonds break and bases of one strand lie exposed, unpaired, they will easily pair up with free nucleotides as well.

This type of arrangement in DNA molecule led to the hypothesis that DNA replication is semi-conservative. where the two strands separate and act as a template for the synthesis of a new complementary strand.

6. Depending upon the chemical nature of the template (DNA or RNA) and the nature of nucleic acids synthesised from it (DNA or RNA), list the types of nucleic acid polymerases.

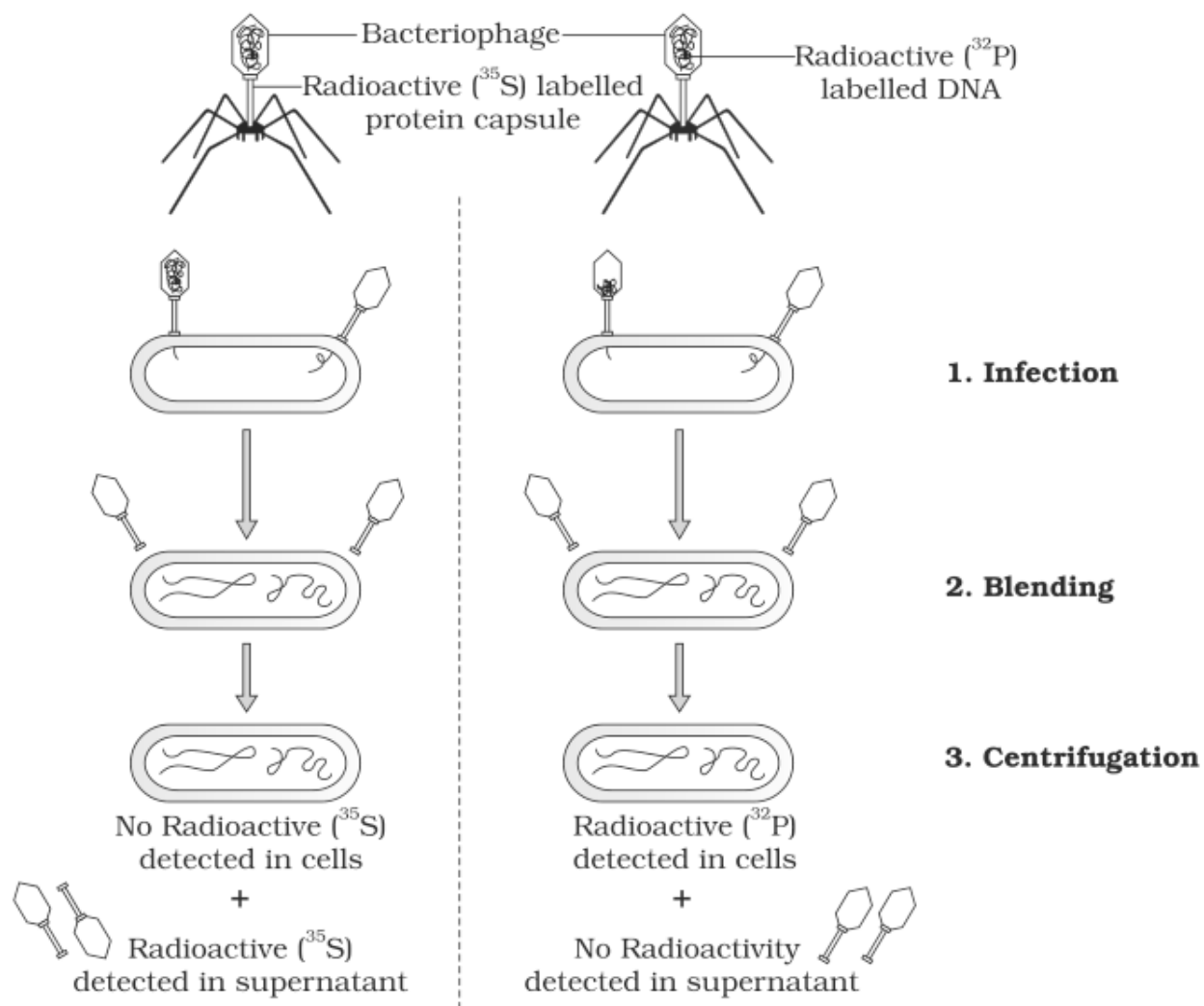
Answer

- DNA-dependent DNA polymerase uses a DNA template to catalyse the polymerisation deoxynucleotides.
- DNA-dependent RNA polymerase catalyses the transcription of all types of RNA (in bacteria).
- DNA-dependent RNA polymerase-I transcribes rRNA.
- DNA-dependent RNA polymerase-II transcribes the precursor of mRNA (hnRNA).
- DNA-dependent RNA polymerase-III transcribes tRNA.

7. How did Hershey and Chase differentiate between DNA and protein in their experiment while proving that DNA is the genetic material?

Answer

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According to Hershey and Chase experiment:

- They grew some bacteriophages on a medium that contained radioactive phosphorus and some in another medium that contained radioactive sulphur.
- Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein as phosphorus is present only in DNA.

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- Viruses grown on radioactive sulphur contained radioactive protein but not radioactive DNA because DNA does not contain sulphur.
- It was found that bacteria which were infected with bacteriophages that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria.
- Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicated that proteins did not enter the bacteria from the viruses.
- This was a clear proof that DNA is the genetic material that is passed from virus to bacteria.

8. Differentiate between the followings:

(a) Repetitive DNA and Satellite DNA

(b) mRNA and tRNA

(c) Template strand and Coding strand

Answer

(a) Repetitive DNA and Satellite DNA

Repetitive DNA

It is the non-coding DNA with multiple copies of identical sequences which may lie in tandem or interspersed.

Satellite DNA

It refers to non-coding tandem repeat sequences.

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These can be few base pairs to hundreds or thousands of base pairs.

It appears as light bands.

These are generally short sequence repeats (up to 60 base pair long).

It appears as small dark bands.

(b) mRNA and tRNA

mRNA

It is called messenger RNA and carries the codes for amino acid sequence.

It is a linear molecule.

It is synthesised by RNA polymerase II

tRNA

It is called transfer RNA as it carries amino acids to the site of protein synthesis.

It has clover leaf shape.

It is synthesised by RNA polymerase III.

(c) Template strand and Coding strand

Template strand

It is the strand which is transcribed into RNA.

It is called anti sense strand.

Coding strand

It has the same sequence as mRNA.

It is called sense or non-template strand.

It has $3' \rightarrow 5'$ polarity.

It has $5' \rightarrow 3'$ polarity.

9. List two essential roles of ribosome during translation.

Answer

Two essential roles of ribosomes during translation are:

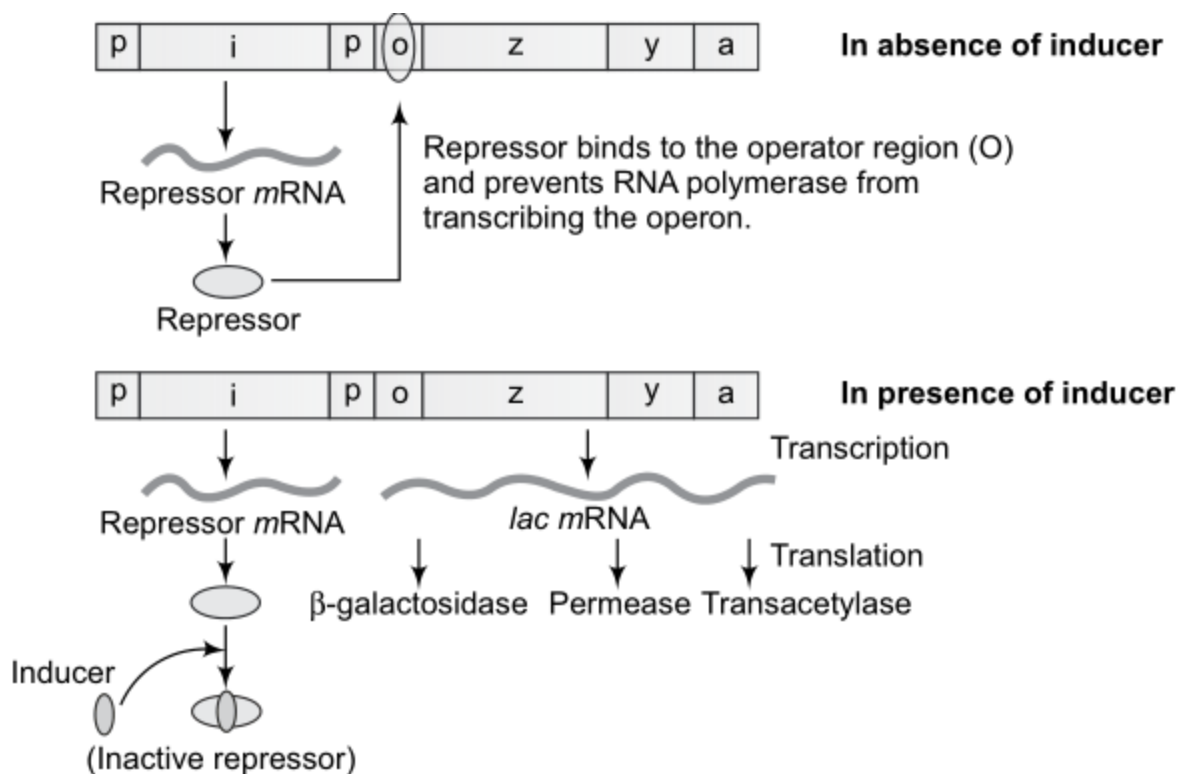
- The ribosome binds to mRNA and provides a platform for joining of amino acids.
- It also acts as a catalyst (23 SrRNA in bacteria is the enzyme ribozyme) for the formation of a peptide bond.

10. In the medium where *E. coli* was growing, lactose was added, which induced the lac operon. Then why does lac operon shut down sometime after the addition of lactose to the medium?

Answer

Lactose regulates switching on and off of the lac operon.

If lactose is provided in the growth medium of the bacteria, it is transported into the cells through the action of permease.



The repressor of the operon is synthesized all the time from the *i* gene. It binds the repressor protein which binds to the operator region of the operon and prevents RNA polymerase from transcribing the

operon. In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. This allows RNA polymerase access to the promoter and transcription proceeds.

11. Explain (in one or two lines) the function of the followings :

(a) Promoter

(b) tRNA

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(c) Exons

Answer

(a) Promoter: It is a region of DNA that helps in initiating the process of transcription. It serves as the binding site for RNA polymerase.

(b) tRNA: tRNA or transfer RNA is a small RNA that reads the genetic code present on mRNA. It carries specific amino acid to mRNA on ribosome during translation of proteins.

(c) Exons: Exons are the coding sequences of DNA that are transcribed and translated.

12. Why is the human genome project called a mega project?

Answer

Human genome project is called a mega project because

- Its aim was to determine the nucleotide sequence of complete human genome which was a task of enormous magnitude.
- A total of 3×10^9 base pairs were to be sequenced and the cost was about 9 billion US dollars.
- It required bioinformatics data base techniques and other contemporary devices for the analysis, storage and retrieval of information.
- Many countries worked jointly to complete this timed project.

13. What is DNA fingerprinting? Mention its application.

Answer

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DNA fingerprinting is a technique used to identify and analyze the variations in various individuals at the level of DNA.

Its Application

- It is used in forensic science to identify potential crime suspects.
- It is used to settle parental disputes.
- It is used to identify and protect the commercial varieties of crops and livestock.
- It is used to find out the evolutionary history of an organism and trace out the linkages between groups of various organisms.

14. Briefly describe the following:

(a) Transcription

(b) Polymorphism

(c) Translation

(d) Bioinformatics

Answer

(a) Transcription: The process of copying genetic information from one strand of the DNA into RNA is known as transcription. RNA is assembled simply based on complementarity of the DNA strand, only uracil is substituted in place of thymine. Only a small segment of DNA that codes for a polypeptide is copied.

(b) Polymorphism: The variation in DNA arising through mutation at non-coding sequences is known as Polymorphism. Such variations are

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unique to specific sites of DNA and can occur due to deletion, insertion or substitution of bases. It can be observed by making fragments of DNA sample and separating them through electrophoresis. The polymorphism in a DNA sequence is the basis of genetic mapping of the human genome as well as DNA fingerprinting.

(c) Translation: It refers to the process of polymerisation of amino acids to form a polypeptide. The order and sequence of amino acids are defined by the sequence of bases in the mRNA. It occurs in cytoplasm in both prokaryotes and eukaryotes.

(d) Bioinformatics: It is the application of computer science and information technology which deals with handling, storing of huge information of genomics, processing information, analyzing data and creating new knowledge.



Chapterwise NCERT Solutions for Class 12 Biology:

- Chapter 1: Reproduction in Organisms
- Chapter 2: Sexual Reproduction in Flowering Plants
- Chapter 3: Human Reproduction
- Chapter 4: Reproductive Health
- Chapter 5: Principles of Inheritance and Variation
- Chapter 6: Molecular Basis of Inheritance
- Chapter 7: Evolution
- Chapter 8: Human Health and Disease
- Chapter 9: Strategies for Enhancement in Food Production
- Chapter 10: Microbes in Human Welfare
- Chapter 11: Biotechnology Principles and Processes
- Chapter 12: Biotechnology: and its Application
- Chapter 13: Organisms and Populations
- Chapter 14: Ecosystem
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