Chhatrapati Shahu Ji Maharaj University, Kanpur

Answer Script Details
Barcode 11557343

Roll No. 24080022030
Total Mark 61/75.00

Exam M.SC-III_ODD_EXAM_NOV_2025
Subject B050902T - Molecular Biology Immunology and Bioinform

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5						
1B	4/5						
1C	4/5						
1D	4/5						
1E	4/5						
1F	4/5						
1G	4/5						
1H	3/5						
1I	3/5						
2	13/15						
3	0/15						
4	0/15						
5	0/15						
6	0/15						
7	0/15						
8	0/15						
9	14/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-I

Date of Exam: 04/12/2025 Shift: 3rd Room No.: 25
Paper Code: B050902T Subject: Zoology Paper II Year/Sem.: 3rd
Name of Candidate: ALSHIFA ALAM
Roll No.: 2408002220 30
Signature of Candidate
Signature of Invigilator
COE Facsimile

PART-II

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
(a)										
(b)										
(c)										
(d)										
(e)										
(f)										
(g)										
(h)										
(i)										
(j)										
Total										
Total Marks in Figures									Max. Marks	
Total Marks in Words										

B050902T
Paper Code

Signature of Evaluator

PART-III

Course: M.Sc. final Zoology 3rd
Session: 2025-26 Year/Semester:
Subject: Zoology Paper II

Paper Code: B050902T
Exam Date: 04 12 2025
Name of Candidate: ALSHIFA ALAM
Father's Name: MOHD ALAM

महाविद्यालय का कोड College Code: KN04
परीक्षा केन्द्र का कोड Exam Centre Code: KN04

परीक्षा का प्रकार Type of Exam
Regular ● Ex. Student ○
Private ○ Re-Test/Back paper Exam ○

ANSWER BOOKLET NO.
11557343
B050902T
Paper Code

Enrollment Number: CSJMA240000013789

परीक्षार्थी अनुक्रमांक संख्या Candidate's Roll Number: 2408002220 30

पेपर कोड Paper Code: B050902T

Alshifa Alam
Signature of Candidate

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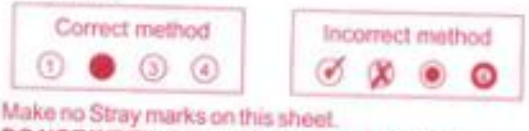
नोट : 1. परीक्षार्थी को निर्देशित किया जाता है कि आंसर पत्र के मुख भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. बॉक्स में भरी जाने वाली प्रविष्टियां काली स्याही से शुरू की जायें। 3. बॉक्सों को काले या नीले बॉलपेन से भरा जायें।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in ☐ Boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.



4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

परीक्षार्थी के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. B कॉपी या अतिरिक्त ग्राफ नहीं दिया जायेगा।

INSTRUCTIONS TO THE CANDIDATE

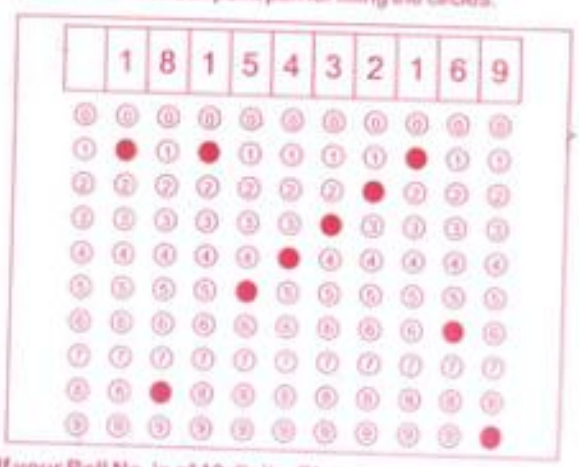
1. Read the instructions carefully given on the Question Pape Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of damag in your answer script, if found than change the answer scri immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e. Subject Code, Subject Name and Question of the Questi Paper during first THIRTY MINUTES of the commencement the exam, so that it can be corrected in TIME. After that n corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over pape should fill in status as Carry Over. Those appearing as E Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्देशित स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखें तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की श्रेणी में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लायें, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक एवं सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल संबंधित प्रश्नपत्र में ही मेमोरी लैस साइंटफिक केल्कुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रबड़ न रखें न ही उत्तर पुस्तिका में चिपकायें। ऐसा करना अनुचित साधन प्रयोग की श्रेणी में आता है।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-IV

1. Use blue or black ball point pen for writing alphabets & numberal in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three colum

Paper Code: B050902T 01

(SEC-A)

Short Answers

Ans. 1(A)

(A) Define primary and secondary respon

Primary response :- Primary immune response occurs when the immune system encounters an antigen for the first time. During this period, immune system do not have prior antibodies against that antigen.

Steps :- ① Recognisition phase
② Activation of B-cells
③ Cloral expansion and differentiation
④ Antibody production.

Timeline :- Generally takes 7 to 14 days to develop desired number of antibodies.

Secondary response :- Secondary immune response occurs when the immune system encounters the same antigen again, after the initial exposure

Steps:- ① Recognition by Memory B-cells
② Rapid cloral expansion and differentiation.

③ Affinity maturation and switch recombination.

Timeline :- Generally takes 2-3 days to develop desired number of antibodies.

- Secondary response takes less time than primary response and it is more stronger and effective.

Ans. 1 (B)

RNA polymerase II cannot recognize promoter on its own therefore it relies on specific Transcriptional factors.

Formation of pre- Initiation complex

① Nucleation

TF II D binds to the TATA site.

② Addition of factors that link RNA polymerase to Promotor.

Nucleation permits the addition of TFIIA and TFIIB to form the

DAB Complex which is more stable. and activates the system.

(5) RNA polymerase entry.

RNA polymerase binds to the promotor with the help of TFIIF. Then TFIIE, TFIIH, TFIIJ are orderly added to form to pre-initiation complex.

TATA INF

↓ ← TFIID (Binds to the TATA)

↓ ← TFIIA

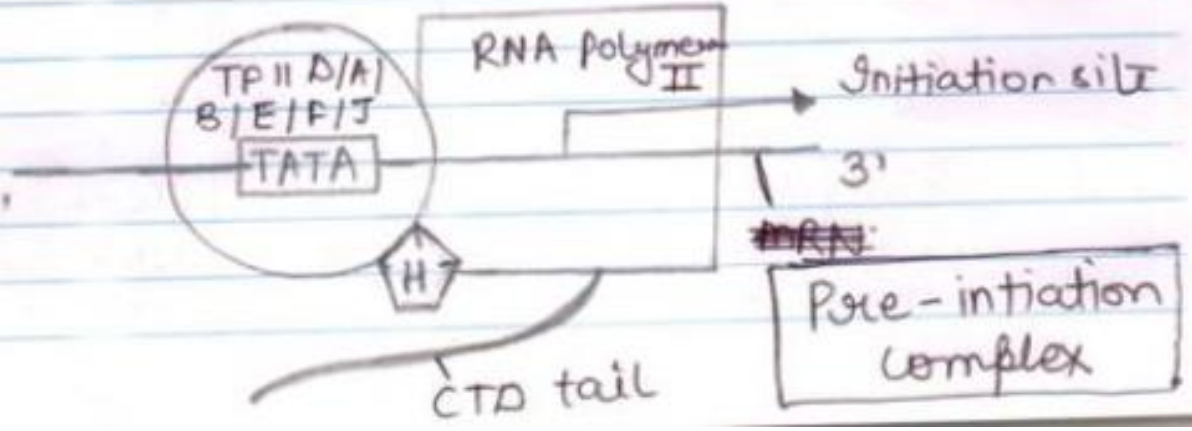
↓ ← TFIIB

↓ ← TFIIF / RNA polymerase II

↓ ← TFIIE

↓ ← TFIIH

↓ ← TFIIJ



Ans. 1 (C)

FASTA

- FASTA is a simple and standard text Format.
- It is used to represent protein or nucleotide sequence.
- Widely used text method in bioinformatics tools and databases.
- Structure of a FASTA file :-

FASTA file has two main components :-

① Header line :- Begins with a '>' greater than symbol, followed by a unique identifier and description.

② Sequence line :- The actual biological sequence written in a single letter code. (A, T, G, C for DNA and amino acids for proteins).

Eg.

```
>gi|123456|ref|NM-00518|Homo sapiens
Actin Beta (ACTB), mRNA.
AGCTGGTATCCATGCCGTATAT
```

- The line starting with '>' is Header line.
- The next line containe the sequence.

Importance :- ① Easy to read and understand
② Compatible with other tools.

Ans. 1 (D)

Solenoid Model

- It is the second level of compaction of DNA.
- Form by the coiling of nucleosome into a 30 nm fibre.
- Stabilize by the H1 protein and interactions between nucleosomes.
- In this the nucleosomes arranged in helical manner.
- 6 nucleosomes per turn.
- Compact and ordered.
- Nucleosome is the first level of compaction.
- Nucleosome formed of -
- approx 147 base pairs wrapped 1.65 times around a histone octamer.
- Histone octamer is made up of two copies of each of H_2A, H_2B, & H_3 and H_4.
- Linker DNA attach or link two nucleosomes.
- Solenoid model increases the DNA

Compaction to 40 fold.

- Regulate the accessibility of DNA to transcriptional machinery.

Ans. 1 (E)

Monoclonal antibodies are produced by using hybridoma technology.

Steps :-

(1) Immunization:- The mouse is injected with antigen to stimulate antibody production.

(2) Cell collection:- B-cells are collected from spleen cells of mouse.

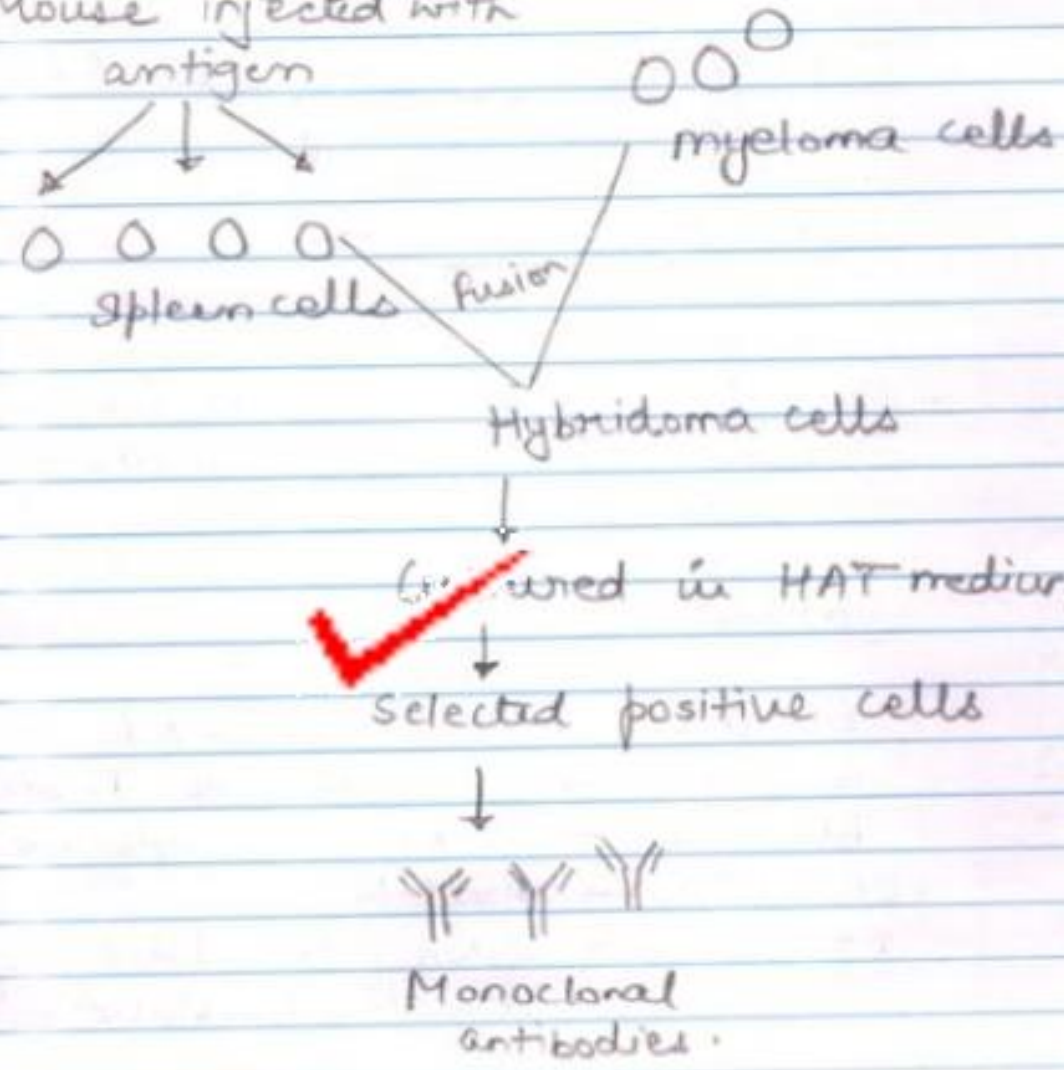
(3) Fusion:- B-cells fuse with mydoma cells to form hybridoma cells.

(4) Selection:- The hybridomas are cultured in HAT medium which allow only fused cells to survive.

(5) Screening :- The selected cells are screened to find those producing desired antibodies.

⑥ Cloning :- The hybridomas are cloned to produce large number of identical cells.

⑦ Production and Purification :- The cloned cells are cultured and the monoclonal antibodies are collected and purified.



Hybridoma Technology

Ans. 1 (f)

BLAST (Basic Local Alignment Sequence Tool)

It is a bioinformatic tool that compares DNA or protein sequence against a Database to find the similar sequences.

Type of Alignment :- Local Alignment - Align only the sub sequences.

Uses of BLAST :-

1. To find Homogenous sequences.
2. To predict gene / protein function
3. To identify the species origin of a sequence.

Variants of BLAST

BLASTn - DNA v/s DNA
BLASTp - L Protein v/s Protein
BLASTx - DNA v/s Protein
tBLASTn - Protein v/s DNA (translated)
tBLASTx - DNA (translated) v/s DNA (translated).

Key terms :-

1. E value :- Shows how likely the

match is by chance. Lower = Better.

- Identity % ⇒ Percentage of exact matches.
- Score ⇒ Higher value = Greater Alignment.

Ans. 1 (G)

Innate immunity :-

- Innate immunity is present from the birth.
- It is natural, non-specific.
- Aquired from mother.
- Protects the individual throughout its life.
- Four types of barriers provide innate immunity.

1. Physiological Barrier
2. Physical Barrier
3. Cellular Barrier
4. Cytokine Barrier.

Aquired immunity :-

- The resistance to a disease than an individual develop / aquired throughout its life is called acquired immunity.
- It is pathogen specific and also called adaptive and specific immunity.

Aquired immunity is —

① Specific :— It is specific for each type of pathogen.

② Diversity :— It can develop against diverse types of pathogens, toxins and various molecules.

③ Discrimination between self and non-self antigens :— It can differentiate between body own cells and foreign molecules.

④ Memory :— It retains the memory of first encounter.

Adaptive immunity includes :—
(i) Antibodies (ii) Lymphocytes.

Ans. 1 (H)

- Pharmacoinformatics include the storage, analyse and use of chemical information with the help of computers
- It includes various tools and databases.
- Pharmacoinformatics ~~at~~ resources

are tools and databases that are used to store, analyze and use chemical information for drug discovery.

- Main databases include :-
(i) ChemBank (ii) PubChem (iii) Zinc database
(iv) Chemspider (v) DrugBank.

- Tools such as Chemdrawer, Avagadro, Marvin sketch helps to draw the structure of chemicals.

- Tools such as OpenBabel convert chemical file formats.
- Pharmainformatics Prediction Tools:- Tools used to predict molecular properties and ADMET Properties.
- ADMET Lab : Used to predict ADMET properties.

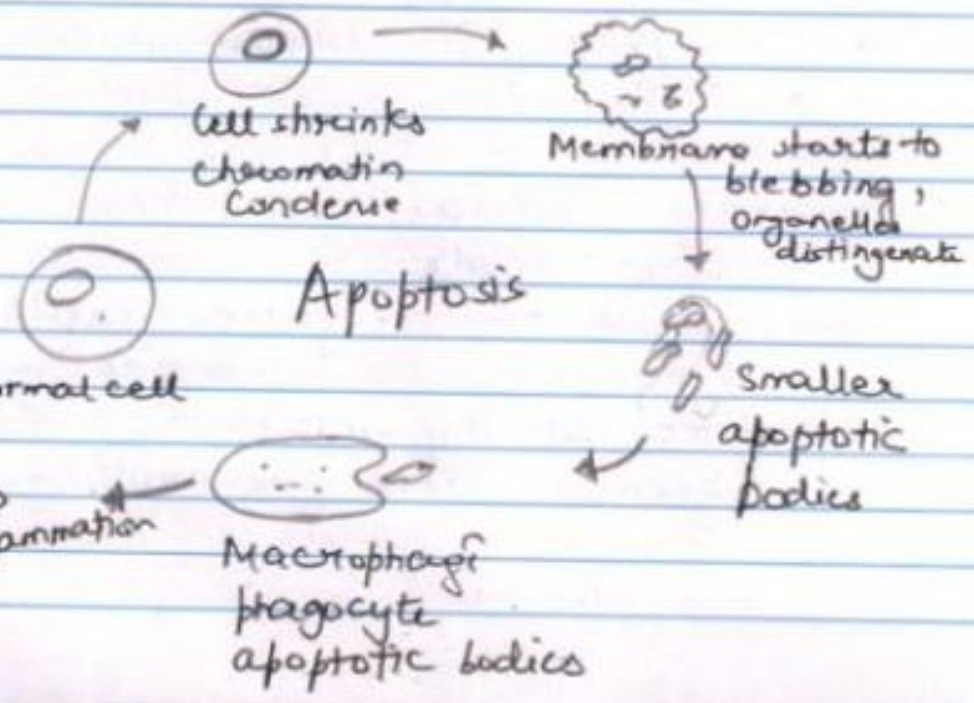
A = Absorption D = Distribution M = Metabolism
E = Excretion T = Toxin.

- Includes Visual screening and docking tools.
- Autodock :- Perform molecular docking.
- Used to study interaction between ligands and receptors.

Ans. 1 (I)

Apoptosis

- Apoptosis is a programmed cell death.
- Seen in physiological conditions.
- Genome distingerate into smaller apoptotic bodies.
- Inducers of appptosis:— UV-radiations, Gamma rays, toxin, dna damage, Oncogenes etc
- Caspace is the proteen responsible for apoptosis.
- It includes two pathways—
  1. Intrinsic pathway
  2. Extrinsic pathway.



(SEC-B)
(Ans. 2)

Translation

Translation is the process in which protein is formed from the mRNA.
It includes following steps:—

① Initiation

- Initiation factors IF1, IF2, IF3 attach to smaller subunit 30S of ribosome with GTP attach to IF2.
- ~~Initiation~~ Initiater tRNA with its amino acid and mRNA binds to smaller subunit of Ribosome (30S).
- In Prokaryotes, initiater tRNA is formylatable tRNA that carries formylmethionine amino acids and represented as $tRNA^{f\text{-}met}$.
- $tRNA^{f\text{-}met}$ binds to P site of 30S ribosomal subunit and base pair with the first codon, initiation codon (AUG) present on the 5' end.
- This completes the formation of 30S pre-initiation complex.

- 30S preinitiation complex then binds to 50S subunit of ribosome to form 70S complex

- In 70S initiation complex. f^{met} tRNA base pairs with AUG present on the P site of 30S subunit.
- Now A site reaches the second codon
- Second ~~codon bit~~ tRNA with anticodon corresponding to second codon binds with it and occupies A-site

(2) Elongation:-

After the formation 70S mRNA fetmet tRNA fetmet complex, ~~an~~ amino acids are added in the following steps.

(i) Binding of AA-tRNA to the A-site of Larger subunit of Ribosome - Larger subunit has two slots ⇒ P site (donor site) and A site (acceptor site). Incoming aminoacyl tRNA binds to the A-site and base pairs with codon present on A site.

(ii) Formation of Peptide Bond:- Enzyme peptidyl syntretase catalysis the formation of peptide Bond between the carboxyl group of one amino acid and amino group of second amino group present on P and A site respectively.

In bacteria this role is played by 23S rRNA.

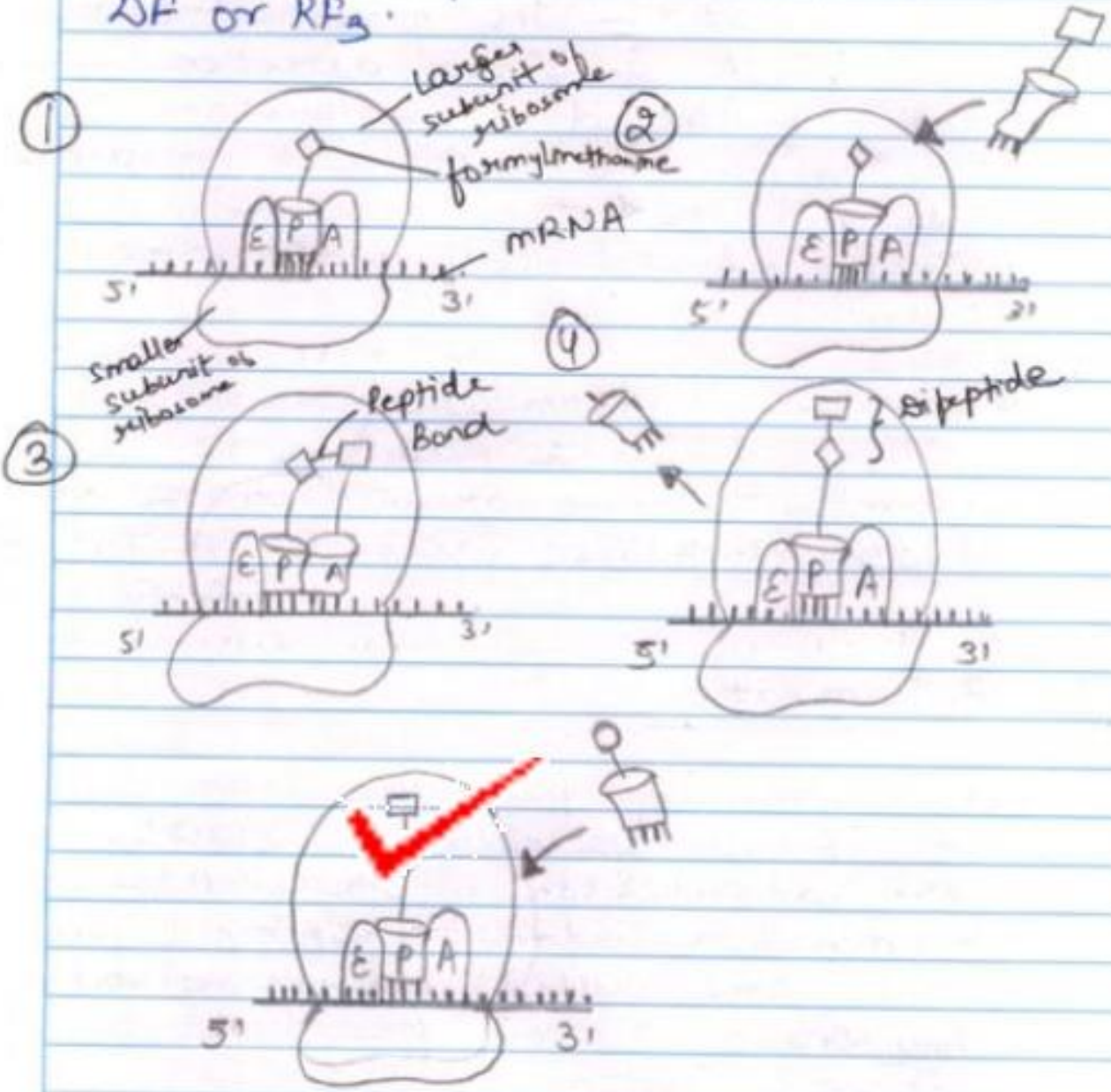
(ii) Translocation:- The movement of ribosome on mRNA in 5' to 3' direction by one codon is called Translocation. GTP hydrolysis into GDP and provides energy that shifts the dipeptide from A site to P-site. A-site now reaches the 3rd codon.

- Elongation in translation involves a number of factors, which help in the elongation process. In prokaryotes there are three elongation factors. EF-Tu, EF-Ts, EF-G.

(3) Termination

- The synthesis of polypeptide chain stops when the A-site of ribosome reaches the termination codon. There are three termination codons – UAG, UGA, UAA.
- These are called non-sense codons.
- Any one of them is present at the end of each cistron.
- For the removal of polypeptide chain from the terminal tRNA, releasing factors are required. These are RF_1, RF_2, RF_3. RF_1 specific for UAG & UAA and RF_2 for UAA.
RF_3 stimulates RF_1 and RF_2.

The ribosomal subunits dissociate with the help dissociation factor DF or RF_3.



(SEC - C)
(Ans. 9)

① Origin and migration to Thymus.

- T-cells originate from the hepatopiotic stem cells (HSC).
- These stem cells give rise to common ~~lymphoid~~ lymphoid progenitors ~~give~~ which migrate to thymus.
- Once in thymus, they are called thymocytes.

② Maturation and Development in Thymus.

Maturation of T-cell involves the develop of full T-cell receptor (TCR) and the expression of Co-reppersons $CD4^+$ and $CD8^+$ cells. and the ability to distinguish ~~self~~ self and non-self antigens.

① Double Negative stage

- Early thymocytes lack both $CD4^+$ and $CD8^+$, hence double negative.
- These cells undergo gene arrangement at TCR-β chain locus.

succesful rearrangement form pre-TCR which allow further development.

② Double Positive Stage

- Now cell express both CD4⁺ and CD8⁺ co-receptors.
- Cells also express a full TCR receptor.
- They undergo two selection process :-

① Positive selection

- Occurs in the cortex of thymus.
- Thymocytes interact with cortical endothelial cells representating self MHC molecules
- Only cells that moderately recognize self MHC survive.

② Negative selection

- Occurs in the medulla of thymus.
- Thymocytes binds strongly to the self-peptides presented by MHC on medullary epithelial cells.
- It removes self-reactive T-cells.

③ Single Positive Stage.

Depending on the reaction between the TCR and MHC molecules, thymocytes down-regulate one of the co-receptors.

- Cells recognizing MHC class I become $CD8^+$ cytotoxic T-cells.
- Cells recognizing MHC class II become $CD4^+$ helper T-cells.
- **Differentiation of T-cells in the Periphery**

Mature single positive T-cells exit from the thymus and comes out in lymphoid organs and blood waiting to encounter an antigen.
When stimulated by an antigen, T-cells divide and form clone of T-cells.
Clone of T-cells contain effector T-cells and memory T-cells

- Effector T-cells include Cytotoxic T-cells, helper T-cells and suppressor T-cells.
- Memory T-cells retains the sent sensitization for the future response.

Helper T-cells

They assist other immune cells by secreting cytokines. They themselves divide into various subtypes depending on the cytokine they are exposed to

1. Th_1 → Induce cellular immunity.
2. Th_2 → Induce humoral immunity.

Th_{17} → Regulate inflammation.

Cytotoxic T-cells.

Cytotoxic T-cells kill the cells infected with virus and represent there peptide fragments on their cell surface. Cytotoxic T-cells destroy cells by releasing Perforins and Granzymes.

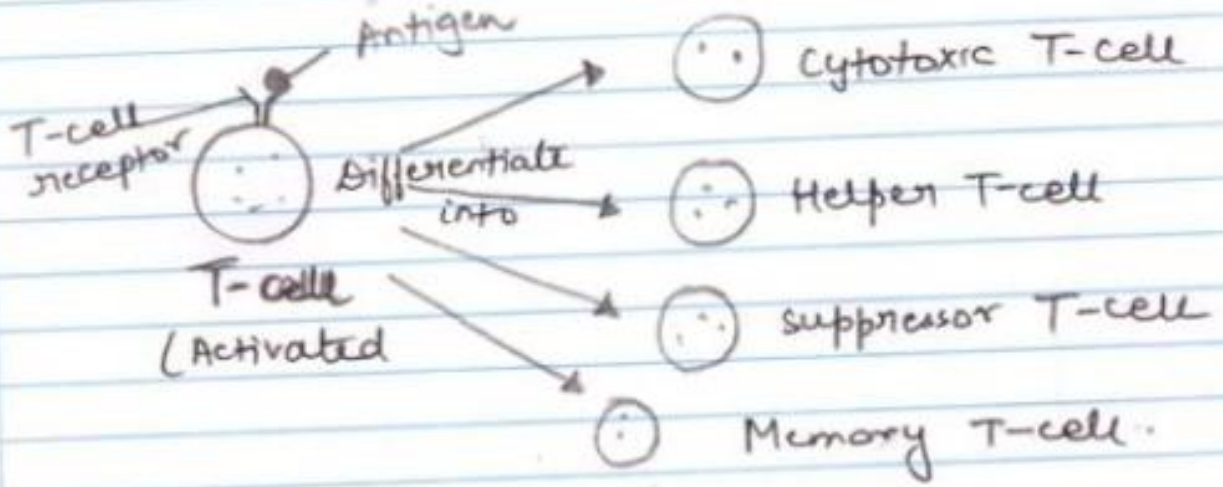
- Perforins :- Creates pores in the cell membrane of target cell. Water and ions enter and cell burst.
- Granzyme :- Granzyme enters the cells by endocytosis and initiate apoptosis

Suppressor T-cells :-

These cells suppress immune response by releasing substances that suppress the activity of other B-cells and T-cells.

Memory T-cells.

Memory T-cells are sensitized by the antigen & retains the repetization for the future immune response.



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23

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