BARC OCES 2025

BIOSCIENCE

MEMORY BASED QUESTIONS

Q Find resolution limit of microscope in micro metre , if lisht of wavelength 600 nm refractive index is 1.5 and (sin alpha =value 9.2 which is half of aperture angle)

Limit of resolution is given by,

$$\text{Limit of resolution} = d = \frac{0.61\lambda}{NA} = \frac{0.61\lambda}{\mu \sin\alpha}$$

where NA =Numerical Aperture of the microscope,

μ = Refractive index of the medium,

α = Half angle with the optical axis,

λ = Wavelength of light used.

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Q Food packaging se related... Which wave use ???

A] X RAY
B] INFRARED
C] UV RAYS
D]BOTH A AND B

→ preservation
↳ Kill microbes

the most suitable electromagnetic radiation for food processing sterilization is Ultraviolet (UV) rays. They effectively kill germs without the damaging effects associated with gamma rays.

Q DNA-Protein interaction studied by which technique?

DNA-protein interactions are studied using various techniques, including electrophoretic mobility shift assays (EMSA), DNA footprinting, chromatin immunoprecipitation (ChIP), and in vitro methods like southwestern blotting and yeast one-hybrid and two-hybrid assays.

Q. Gel filtration chromatography order of protein elution (molecular weight is given)

In gel filtration chromatography, proteins elute from the column in decreasing order of molecular weight, meaning larger proteins elute first and smaller proteins elute last.

Gel Filteration chromatography

40 20 10

Elution decreasing order

A > B > C

.Q Which technique is used to determine the 3d structure of proteins in solution.

A] NMR
B] CD
C] X ray crystallography

NMR can analyze proteins in solution without the need for crystallization, making it ideal for studying proteins in their natural, functional states.

Q Increased levels of interleukin-2 in tumor cells can't detected by

1)CD Markers
2)Flow cytometry
3)ELISA

CD markers are cell surface proteins that are used to identify and distinguish different cell types. While IL-2 can be involved in the activation and function of cells expressing certain CD markers (like CD25, a subunit of the IL-2 receptor), IL-2 itself is not a CD marker, so it cannot be detected by CD markers.

Due to absence of which enzyme ascorbic acid can't be synthesized in humans?

The inability of humans to synthesize L-ascor-bic acid is known to be due to a lack of L-gulono-γ-lactone oxidase, an enzyme that is required for the biosynthesis of this vitamin.

mutations in the L-gulono-γ-lactone oxidase (GLO) gene

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IgE not involved in which type of hypersensitivity.

	Hypersensitivity Types and Their Mechanisms			
	Type I	**Type II**	**Type III**	**Type IV**
Immune reactant	IgE	IgG or IgM	IgG and IgM	T cells
Antigen form	Soluble antigen	Cell-bound antigen	Soluble antigen	Soluble or cell-bound antigen
Mechanism of activation	Allergen-specific IgE antibodies bind to mast cells via their Fc receptor. When the specific allergen binds to the IgE, cross-linking of IgE induces degranulation of mast cells.	IgG or IgM antibody binds to cellular antigen, leading to complement activation and cell lysis. IgG can also mediate ADCC with cytotoxic T cells, natural killer cells, macrophages, and neutrophils.	Antigen-antibody complexes are deposited in tissues. Complement activation provides inflammatory mediators and recruits neutrophils. Enzymes released from neutrophils damage tissue.	T_H1 cells secrete cytokines, which activate macrophages and cytotoxic T cells.
Examples of hypersensitivity reactions	Local and systemic anaphylaxis, seasonal hay fever, food allergies, and drug allergies	Red blood cell destruction after transfusion with mismatched blood types or during hemolytic disease of the newborn.	Post-streptococcal glomerulonephritis, rheumatoid arthritis, and systemic lupus erythematosus	Contact dermatitis, type I diabetes mellitus, and multiple sclerosis

Cyclodextrin is used in food processing for?

1. Browning of food products
2. for enhancing texture
3. For flavour

Cyclodextrins in food processing are primarily used for flavor stabilization, masking unwanted tastes, and preventing browning, rather than for browning or enhancing texture directly.

Superantigen is due to

1) MHC-1
2) MHC-2

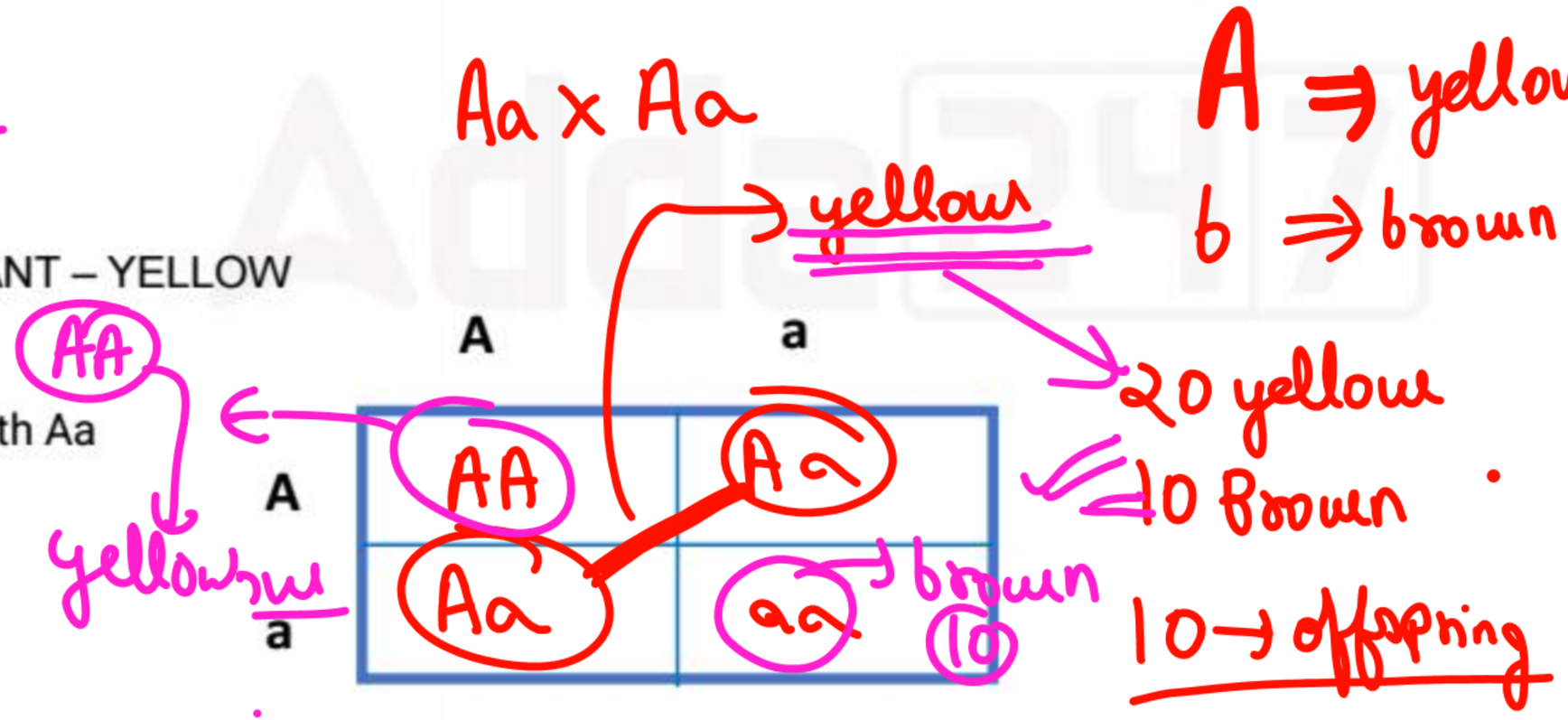
Superantigens are proteins produced by microbial pathogens (e.g., Staphylococcus aureus or Streptococcus species) that are capable of stimulating large populations of T cells in a manner unrestricted by the class II major histocompatibility complex (MHC).

Q - A is yellow is dominant over a which is brown if heterozygote parents were crossed between them the progenes are 20 yellow 10 brown survive over total 40 progeny which combination of alleles are lethal

answer AA

AA – DOMINANT – YELLOW
aa- brown

Aa crossed with Aa



If one colony of 356 black cats and 4 white cats is merged with the colony of 594 blacks cats and 54 white cats. In Hardy weinberg equilibrium, what will be proportion of white cats in future (F1) progeny??

- **Population 1:** 356 black cats and 4 white cats
- **Population 2:** 594 black cats and 54 white cats

→ 648

356+4

4360

q q^2

$\frac{4}{360} \Rightarrow 0.111$

q^2

$q = \sqrt{0.111}$

$q \Rightarrow 0.105$

$p+q=1$

$p = 1-q \Rightarrow 0.895$

594 → Black 54 white cats ⇒ Total ⇒ 594 + 54

⇒ 648 cats

$q^2 = \frac{54}{648}$

$q^2 \Rightarrow 0.083$

$q = \sqrt{0.083}$

$q \Rightarrow 0.288$

$p + q = 1$

$p = 1 - 0.288$

$p \Rightarrow 0.712$

$p_1 + p_2$

360 + 648

white cats ⇒ 4 + 54

$q^2 = \frac{58}{\text{Total merged popul}}$

100 ↙

$q =$.

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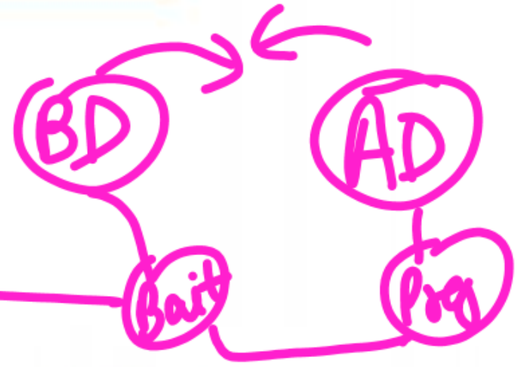
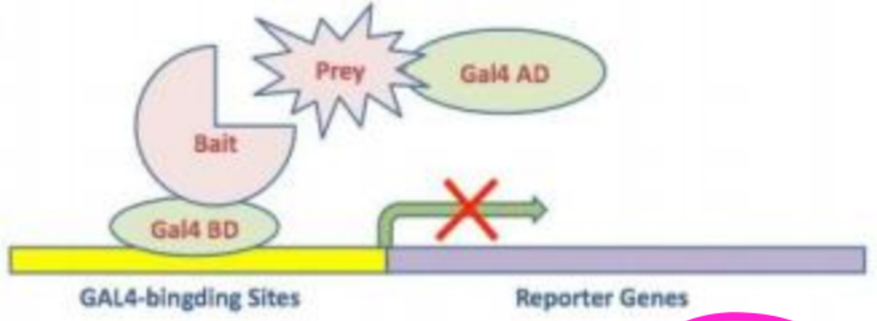
Protein-Protein

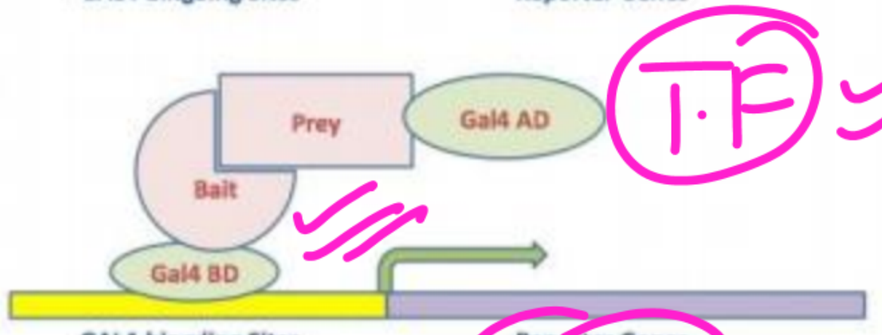
Interaction between Transcription factor and DNA



1) Yeast 2 hybrid system
2) Flow cytometry
3) Electrophoretic mobility shift assay

DNA-Protein





T.F

Ans

- EMSA is a technique used to detect protein complexes with nucleic acids.
- It's also known as a gel shift assay or band shifting assay.
- EMSA is used to study DNA-protein interactions and RNA-protein interactions.

II I

Granulocytes, monocytes and lymphocytes size difference

- monocytes are the largest,
- granulocytes are in the middle, and
- lymphocytes are the smallest.

Decreasing ⇒ Monocytes > Granulocytes > Lymphocytes

Increasing ⇒ L < G < M

Which is the vector of kala azar disease?

The vector that transmits kala azar, also known as visceral leishmaniasis, is the female phlebotomine sandfly

Which is not a igE mediated immune response?

Type 1 hypersensitivity
Type 2 hypersensitivity
" Immune response against Wuchereria Bancrofti surface antigens"

Type 2 hypersensitivity is **not IgE-mediated**. It involves **IgG or IgM antibodies**, not IgE.

If total number of microbes present are 10000000 after 4 hours and initial number of microbes are 10000 calculate the generation time.

Step 1: Rearrange the formula to solve for the generation time (g):

$$N_t = N_0 \times 2^{(t/g)}$$

$$\frac{N_t}{N_0} = 2^{(t/g)}$$

$$\log_2\left(\frac{N_t}{N_0}\right) = \frac{t}{g}$$

$$g = \frac{t}{\log_2\left(\frac{N_t}{N_0}\right)}$$

$Nt = N_0 \times 2^{(n)}$

$\frac{t}{g} = n$ — no of generation; generation time

Step 2: Substitute the known values into the formula:

$$g = \frac{4}{\log_2\left(\frac{10,000,000}{10,000}\right)}$$

$$g = \frac{4}{\log_2(1000)}$$

$$\log_2(1000) \approx 9.97$$

$$g = \frac{4}{9.97} \approx 0.401 \text{ hours}$$

The generation time is approximately **0.401 hours**, or about **24.06 minutes.**

Use of bundle sheath cells in C4 pathway

the C4 pathway, bundle sheath cells are crucial for concentrating CO2 around RuBisCO, minimizing photorespiration and improving photosynthetic efficiency, especially in hot and dry environments

During the C4 pathway, when the C4 acid from the mesophyll cells is broken down in the bundle sheath cells, it releases CO2 - this results in increasing the intracellular concentration of CO2. So, RuBisCO functions as a carboxylase and binds with plants and carry out more carboxylation.

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Which of the following amino acid is both ketogenic & glycogenic ?

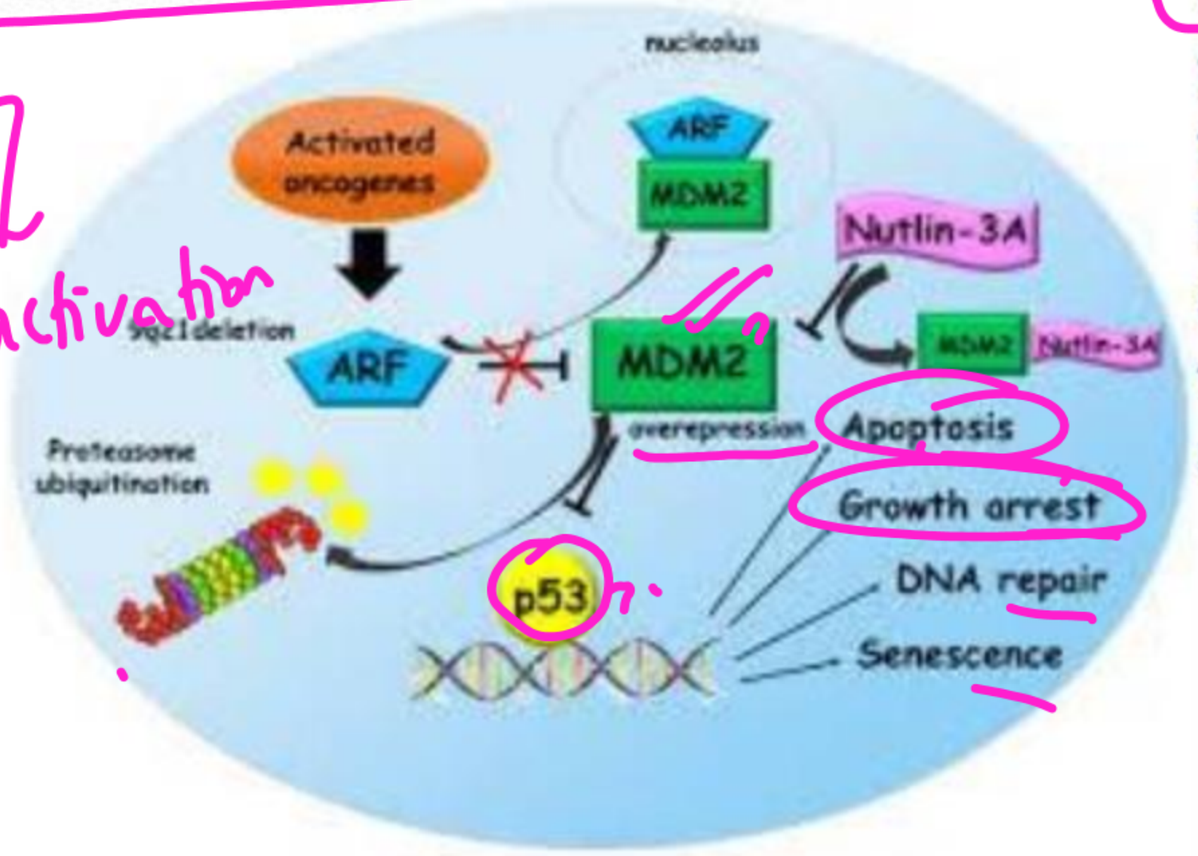
a) Phenylalanine
b) Leucine
c) lysine
d) Alanine

The amino acid that is both ketogenic and glucogenic among the options provided is phenylalanine.

- **Leucine and lysine**: are exclusively ketogenic.
- **Alanine**: is primarily glucogenic.

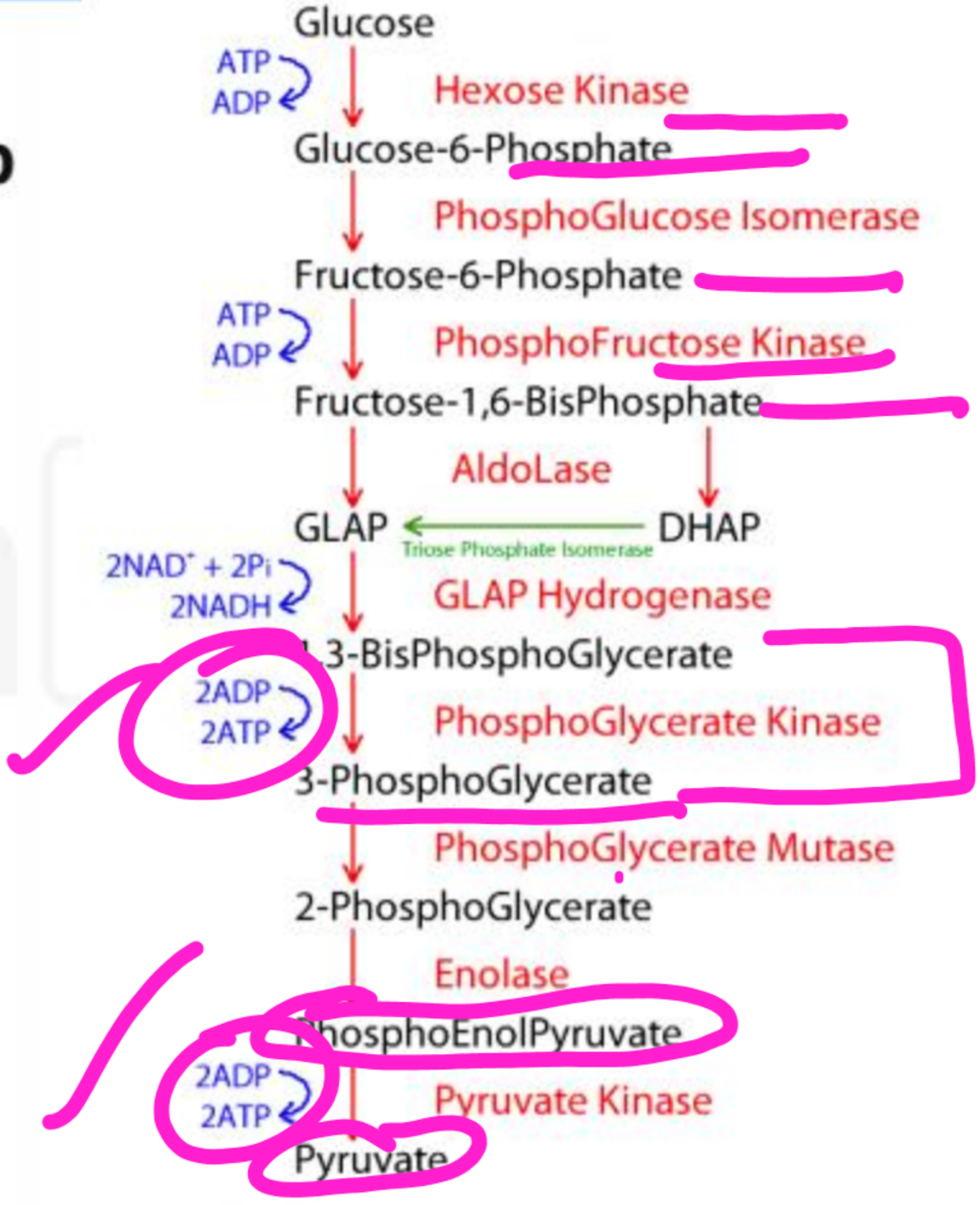
If mdm is mutated, what will be its effect

1)P53 will be inhibited



blocking MDM2 with targeted therapies leads to p53 reactivation and p53-mediated cell-cycle arrest or apoptosis that can be translated into clinically significant tumor shrinkage

Atp formation in the glycolysis step between



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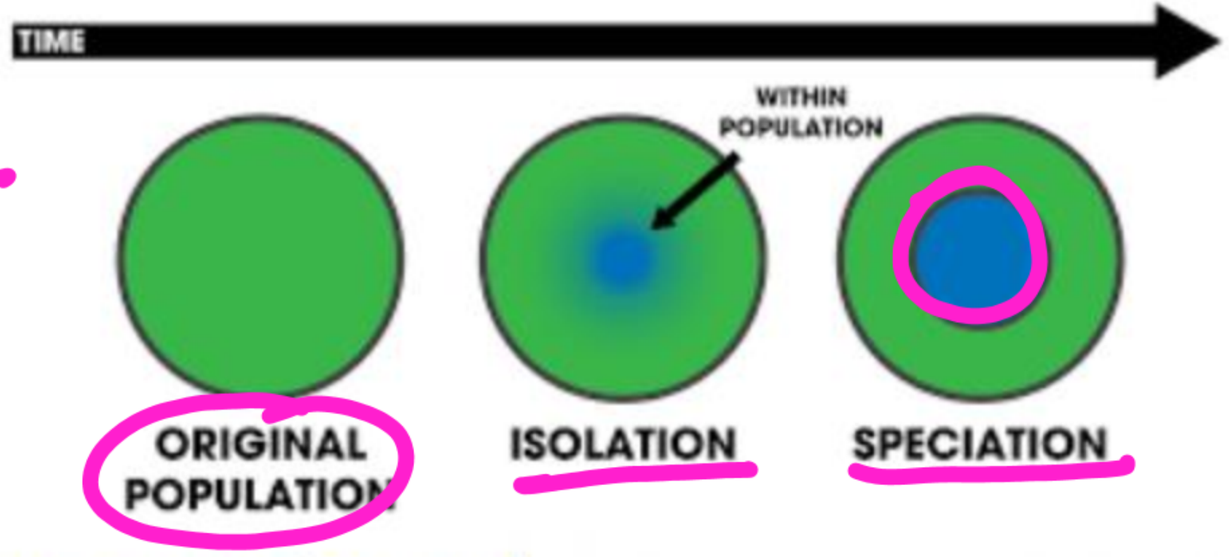
Q species having a common ancestor and are evolved and living in the same area is what ?

A allopatric speciation
B sympatric speciation
C sibling species
D sub species



Species that evolve from a common ancestor and live in the same area, without geographic isolation, are undergoing sympatric speciation

Q - Which amino acid is both glucogenic and ketogenic?

Ans - Threonine, tryptophan, phenylalanine, isoleucine, and tyrosine

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Q - Which type of mutations in Ras-GEF and Ras-GAP will lead to uncontrolled cell proliferation?

1. GEF inactive
2. GEF active all time
3. GAP active
4. GAP inactive all time

ANSWER – 2 AND 4

Q - Which amino acids has 2 ionizable groups –

1. arginine,
2. histidine,
3. tyrosine,
4. leucine

ANSWER – 4

Leucine is diprotic amino acid, hence has two ionizable group

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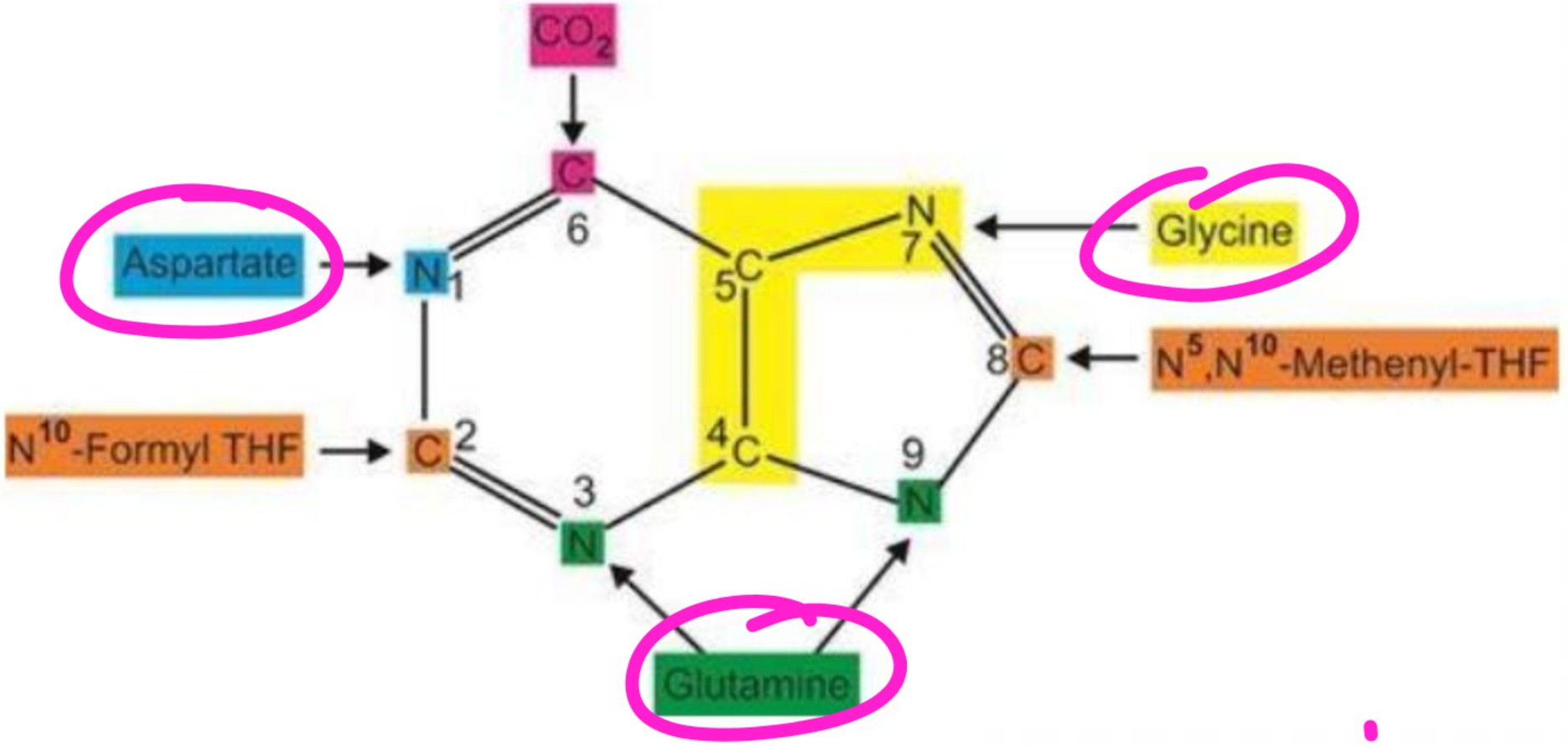
Q - In purine 1,3,7,9 atom in purine come from.

ANS – 1 – ASPARATATE

3 – GLUTAMINE

7 – GLYCINE

9 - GLUTAMINE


CO_2
Aspartate
Glycine
N^{10}-Formyl THF
N^5,N^{10}-Methenyl-THF
Glutamine
1
2
3
4
5
6
7
8
9

Q - Bacterical two component signalling system (which amino acid residue in response regulator protein is phosphorylated

ANS - Asparatate

Q – In C2 Cycle, glyoxylate comes from -

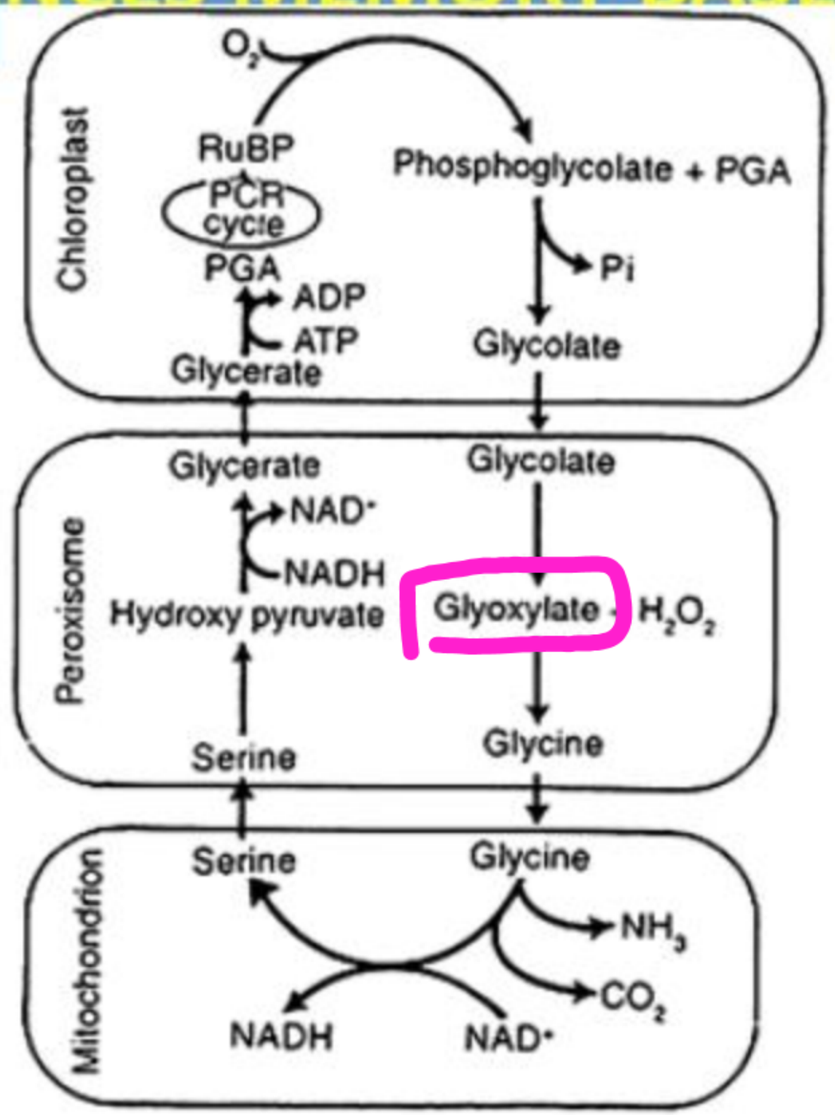


Fig. 5.10. Photorespiration.

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Q - RUBISCO is activated by

1. Phosphorylation
2. Carbamylation
3. Dephosphorylation
4. Glycosylation

ANSWER – 2

Synthesized RuBisCO does not have a fully functional active site . It needs to be activated by a CO_2 molecule that carbamylates its catalytic Lys to bind Mg^{2+} that completes the activation process. The mechanism of RuBisCO activation by the CO_2 molecule is presented in this work

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