3.10. NITROGEN METABOLISM

SYNOPSIS

INTRODUCTION

- Nitrogen is most abundant element in atmosphere. It is the chief component of proteins, enzymes, chlorophyll, nucleic acids etc.
- It's percentage in the atmosphere is 78.
- Stability of N_2 is due to triple bond between two Nitrogen atoms.
- Some Prokaryotes use Nitrogen in gaseous form.
- Higher plants absorb Nitrogen as NO_3^-, NH_4^+, and urea.
- NO_3^- is the principle form of Nitrogen absorbed by plants.

Nitrogen Cycle

- In Nitrogen cycle, the Nitrogen moves in the following sequence.
  Atmosphere $\rightarrow$ Soil $\rightarrow$ Plants $\rightarrow$ Animals $\rightarrow$ Microbes $\rightarrow$ Atmosphere
- Nitrogen cycle has Five steps.
- First step of Nitrogen Cycle is Nitrogen Fixation
- Second step of Nitrogen Cycle is Nitrogen Assimilation
- Third step of Nitrogen Cycle is Ammonification
- Fourth step of Nitrogen Cycle is Nitrification
- Fifth step of Nitrogen Cycle is Denitrification
- Dinitrogen from the atmosphere is introduced into the living system during Nitrogen Fixation
- Nitrogen fixation is two types; Abiotic & Biotic
- Abiotic Nitrogen fixation is a physico - chemical Process
- Abiotic Nitrogen Fixation is caused by lightening
- During Abiotic Nitrogen fixation the dinitrogen is converted into Nitric oxide and then to Nitrogen dioxide and finally into Nitric acid / Nitrous acid
- Acid rain having Nitric acid / Nitrous acid is non-polluting acid rain
- Percentage amount of Abiological Nitrogen fixation is less than 30%
- As a result of abiological Nitrogen fixation the atmospheric Nitrogen reaches the soil in the form of soluble nitrates
- The industrial method of abiological nitrogen fixation is **Haber - Bosch process**
- Biological dinitrogen fixation is **Diazotrophy**
- Biological Nitrogen fixation is conversion of atmospheric dinitrogen into NH_3 or NH_4^+.
- Free living Nitrogen fixing Bacteria are *Azatobactor* and Clostredium
- Symbiotic Nitrogen fixing Bacterium - *Rhizobium*
- Blue green Algae - *Nostoc* & *Anabaena*
- Conversion of Nitrates and ammonia into amino acids, proteins, enzymes, chlorophyll and Nucleic Acids in plant body is Nitrogen Assimilation
- During Nitrogen assimilation the Nitrogen is bound to other elements to produce organic nitrogen
- Ammonification is converting organic Nitrogen in the dead bodies into Ammonia
- Ammonifying bacteria are : Bacillus ramosus, *B. vulgaris, B.mycoides*
- Ammonification is a mineralization process.
  Oxidation of Ammonia into nitrates is Nitrification
- There are two steps in Nitrification
  Ammonia $\xrightarrow[I]{}$ Nitrites $\xrightarrow[II]{}$ Nitrate
- Nitrification is an oxidation process.
- Nitrofication is an exergonic process
- Energy liberated during the oxidation of NH_3 into NO_2 is 66,500 Cal.
- Energy liberated during the oxidation of NO^-_2 into NO^-_3 is - 17,500 cal.
- Nitrifying bacteria - are aerobic and chemosynthetic Eg: *Nitrosomonas / Nitrococcus / Nitrobacter*
- Denitrification is also called Nitrate respiration
- Denitrification is exergonic process (11, 000 cals of energy is released).
- The denitrifying bacteria use NO_3^- as electron acceptor in respiration (instead of O_2).
  Ex. Denitrifying Bacteria - *Thiobacillus denitrificans, Pseudomonas denitrificans, Micrococcus denitrificans.*

2. BIOLOGICAL NITROGEN FIXATION

- Bacteria and Cyanobacteria are efficient fixers of Nitrogen.
- Increase in soil fertility due to some bacteria in root nodules of legumes was first established by Baussinganlt (1938).
- Nitrogen fixation by living organisms is called Biological nitrogen fixation.
- Dinitrogen fixation is the modern term for Nitrogen fixation.

- Dinitrogenase is the modern name of Nitrogenase enzyme.
- *Azotobacter* and *Clostridium* are aerobic and anaerobic free living Nitrogen fixing bacteria respectively.
- *Rhodospirillum* is an anaerobic, photosynthetic, free living or non-symbiotic bacterium.
- *Nostoc* and *Anabaena* are examples of Nitrogen fixing Cyanobacteria. They fix nitrogen symbiotically as well as asymbiotically.
- List of symbiotic systems

	Micro -organisms	Symbiotic structures	Host
a)	Bacteria : Rhizobium sps Rhizobium sps	 Root nodules Root nodules	 Legume plants (non -legume) Parasponia
b)	Actinomycetes : Frankia sps	 Root nodules	 Non -leguminous plant-Myrica
b)	Cyanobacteria : Anabena, Nostoc Etc. Anabaena azollae A.cycadacearum Nostoc	 Lichens Leaves Coralloid roots Stem glands	 Fungi : some Actinomycetes and Basidiomycetes Pteridophytes : Azolla Gymnosperms : Cycas Angiosperms : Gunnera

Symbiotic Nitrogen fixation in Legumes

- Mutually beneficial association between two organisms is called Symbiosis.
- The microbe in the symbiotic system is called '**Microsymbiont**'.
- Rhizobium - Root nodule association is a good example of symbiosis.
- Carbohydrates are the materials supplied by Legume to Rhizobium.
- Fixed nitrogen compounds are the materials supplied to Legume by Rhizobium.
- Legume roots attract bacteria by releasing sugars, Aminoacids and Flavonoids.
- Curling factor causes curling or bending in root hairs.
- Curled root hair is called **shepherd's crook**.
- Lectin protein aids in the recognition of compatible strains of *Rhizobium*.
- Bacterium secretes Cellulase, Pectinase etc. (cell wall degrading enzymes).
- Plasmamembrane of root hair invaginates and gets filled with bacteria. This is called infection thread.
- The infection thread grows into cortex.
- Hormones secreted by cortical cells enhance cell division.
- Swollen bacteria in the root nodule are known as - Bacterioids
- Host membrane covering bacterial cells is called peribacteroid membrane.
- Establishment of vascular connection is the last step in root nodule formation.

Mechanism of biological Nitrogen fixation

- 'Nif' genes direct the synthesis of dinitrogenase.
- Fe-Mo protein and Fe protein are the two proteins of Nitrogenase.
- The summary reaction of Nitrogen fixation is

$$N_2 + 6\bar{e} + 8H^+ + 16ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16Pi$$

- Leghaemoglobin pigment protects Nitrogenase from Oxygen.
- Heterocyst protects Nitrogenases in Nostoc.
- Ferridoxin is the electron donor for Nitrogenase.
- Respiratory substrates provide electrons to Ferridoxin.

GENETIC CODE

- DNA is the genetic material of all organisms except some viruses.
- It initiates, regulates and controls protein synthesis.
- How the number and sequence of 20 types of aminoacids in a polypeptide chain are determined by DNA / RNA is called **'genetic code'**.
- Codon is a sequence of three nucleotides specifing an amino acid and the position of aminoacid in a polypeptide chain.
- Codons contains three nucleotides hence called 'Triplet'.
- Genetic code contains 61 sensible and 3 non-sense codons.
- UUU, GGG are the codons of phenyle alanine and glycine respectively.
- Genetic code is degenerative because one aminoacid is specified by more than one codon.
- UCU, UCC, UCA, UCG, AGU, AGC are codons of Serine.
- AAA, AAG are codons of Lysine.
- Genetic code is **non-overlapping** because one base of a kind is not used more than once.
- Nucleotides are not wasted between codons hence it is called **commaless or continuous**.
- A codon always specifies only one type of aminoacid. Hence it is called **non-ambiguous**
- **AUG and GUG are starting codons**. The later is a rare initiation codon.
- **AUG** is the **first codon** in almost all mRNA molecules.
- Genetic code is common for all organisms. Hence it is called '**Universal**'.
- UAA, UGA, UAG are stop or non-sense codons.

BIOSYNTHESIS OF PROTEINS

Introduction

- Aminoacids are the building blocks of Proteins.
- Poly peptide chain is formed by linear arrangement of aminoacids.
- $R.CH.NH_2COOH$ is the structural formula of Aminoacids.
- The carboxylic group of one aminoacid is linked to aminogroup of next amino acid by peptide bond.
- Zamecnik explained the role of ribosomes in protein synthesis.
- Protein synthesis takes place on the surface of Ribosomes.
- Many ribosomes attached to one mRNA are called **polysome** or **polyribosome**.
- E.coli ribosomes are 70S. They separate into 50S and 30S subunits.
- Eukaryotic ribosomes are 80S. They separate into 60S and 40S subunits.
- Concentration of Mg^{+2} ions control association and dissociation of ribosome subunits.
- Transcription and translation are the two steps in protein synthesis

Transcription

- The transfer of genetic information in the nucleotide sequence of DNA to complementary sequence in m-RNA is called **Transcription**.
- Nucleus is the site of transcription in Eukaryotes.
- Transcriptase or RNA polymerase is the enzyme required for transcription.
- The strand of DNA acting as template for m-RNA synthesis is called Antisense strand.
- The strand of DNA not acting as template for m-RNA synthesis is called coding sense strand.
- Uracil nucleotide replaces Thyamine nucleotide during transcription of m-RNA.

Translation

- Synthesis of polypeptide chain by binding aminoacids in a sequence according to message of m-RNA is called Translation.
- Ribosomes are the sites of translation. m-RNA Ribosomes, Amino acids, specific t-RNAs participate in translation. The steps of translation are
- 1) Transfer of aminoacids to Ribosomes
  2) Initiation of polypeptide chain.
  3) Chain elongation and
  4) Chain termination
- Amino acids are activated by amynoacyl synthetase enzymes. Each of these enzymes have two binding sites.
- The activated aminoacid is called Amino acyl adenalate complex.
- This complex combines with specific t-RNA to form charged t-RNA.
- N-formyl methionine is the starting aminoacid in prokaryotes.
- The charged f - met-tRNA or aminoacyl tRNA moves to Ribosomes.
- Smaller sub-unit of Ribosome (30S) combines with IF_3 followed by IF_1.
- IF_2 combines with GTP. This joins with 30S ribosome combined with IF_1 and IF_3.
- $(30S + IF_3) + IF_1 + (IF_2 + GTP)$ combines with mRNA and f met tRNA to form initiation complex.
- The larger subunit of ribosomes combines with smaller subunit. This is accompanied by hydrolysis of GTP and release of IF_1, IF_2 and IF_3 factors.
- The released IF_1, IF_2, IF_3 factors are recycled.
- In the larger sub-unit of Ribosome f-met t-RNA is positioned at 'P' site. The A site is vacant.
- The regular addition of aminoacids increasing the length of polypeptide chain is called chain elongation.
- The second t-RNA carrying activated aminoacid attaches to second codon of m-RNA with its anticodon. This attachment takes place in the presence of EF-T and GTP.
- EF-T factor is released by hydrolysis of GTP.
- Peptide bond is synthesized between carboxyl group of first aminoacid and amino group of second amino acid by the removal of water.
- Peptidyl transferase mediates the synthesis of peptide bond.
- The growth of peptide chain is always from free carboxylic end to free Amino end $(C \rightarrow N)$.
- The t-RNA with dipeptide is at 'A' site.
- The ribosome moves one codon length in $5' \rightarrow 3'$

direction. This leads to ejection of f-met t-RNA and movement of t-RNA with dipeptide to 'P' site. The A site becomes vacant.

- The third t-RNA with activated aminoacid attaches to 'A' site in a process similar to attachment of second t-RNA with aminoacid.
- The ribosome again moves one codon length in in 5'→3' direction. This leads to ejection of second t-RNA and positioning of t-RNA with tripeptide at 'P' site.
- The movement of Ribosome relative to m-RNA is called translocation. This takes place in 5'-3' direction.
- The translocation takes place in the presence of EFG and GTP.
- Number of aminoacids in the polypeptide chain equals to number of sense codons.
- Chain termination occurs when UAA or UAG or UGA occupy 'A' site. They are recognised by RF_1, RF_2 factors.
- When the stop codon occupies the process comes to an end.
- Release of polypeptide chain from ribosome does not require GTP.

1. NITROGEN CYCLE

LEVEL - I

665. Most of the plants can not absorb this form of nitrogen
1. NO_3 2. NH_4^+
3. Dinitrogen 4. Urea

666. Nitrogen is available to majority of plants in soil in the form of
1. N_2 & NO_3 2. N_2& NH_4^+
3. N_2 4.NO_3^-& NH_4^+

667. Plants most effectively utilize this form of Nitrogen
1. NO_2^- 2. N_2
3. NO^-_3 4. Urea

668. The enzyme needed for conversion of Nitrate to Nitrite is
1. Nitrate reductase 2. Nitrite reductase
3. Nitrite oxidase 4. Nitrate oxidase

669. The enzyme needed for converting Nitrite to Ammonium
1. Nitrate Oxidase 2. Nitrite reductase
3. Nitrite oxidase 4. Nitrate reductase

670. Proteins are made up of
1. Amino Acids 2.Carboxylic acids
3. Hydrocarbons 4.Organic acids

671. Percentage of N_2 in atmosphere
1. 40% 2. 30% 3. 50% 4. 78%

672. Conversion of Atmospheric Nitrogen into Ammonium is
1.Ammonification 2.Nitrogen fixation
3.Nitrate reduction 4.Nitrification

673. Nitrogen fixation today is also known as
1.Nitrate reduction 2.Ammonium synthesis
3.Dinitrogen fixation 4.Nitrification

674. The last step in Nitrogen cycle is
1) Nitrogen Assimilation 2) Denitrification
3) Nitrification 4) Nitrogen fixation

675. Haber - Bosch process is equal to
1) Abiological N_2 fixation 2) Biological N_2 fixation
3) Nitrification 4) Denitrificaion

676. The first intermediate compound formed in Abiological N_2 fixation
1) Nitrogen dioxide 2) Nitrate
3) Nitric oxide 4) Ammonia

677. Nitrate respiration is carried out by
1) *Bacillus ramosus* 2) *Nitrococcus*
3) *Azatobacter* 4) *Thiobacillus denitrificans*

678. Nitrifying Bacteria are
1) Anearobic & photosynthetic
2) Aerobic & photosynthetic
3) Aerobic & chemosynthetic 4) Aerobic and photosynthetic

679. *Bacillus ramosus* takes part in this event of N_2 cycle
1) Nitrogen fixation 2) Nitrification
3) Ammonification 4) Dinitrification

680. Terminal electron acceptor during respiration in denitrifying bacteria is
1) O_2 2) H_2S 3) H_2O 4) NO_3^-

681. Which one of the following is added to the soil from volcanic eruptions
1) NO_3^- 2) Ammonia
3) Nitrous oxide 4) Amino acid

682. Nitrification is conversion of
1) NO_3^- to N_2
2) Ammonia to NO_3^-
3) NO_3^- to Ammonia 4) N_2 to NO_3^-

683. Conversion of Ammonia into Amino Acids occurs during
1) Ammonification 2) Denitrification
3) Nitrogen Assimilation 4) Nitrification

684. The substrate of Ammonification is
 1) Organic Nitrogen 2) N_2
 3) NO_3^- 4) Ammonia
685. Which of the following crops increases the soil fertility?
 1) Oil crop 2) Fibre crop
 3) Tobacco 4) Legume
686. This is a physico chemical process
 1) Abiological N_2 fixation
 2) Biological N_2 fixation
 3) Any type of N_2 fixation
 4) Denitrification
687. This is a type of mineralization process
 1) N_2 fixation 2) N_2 assimilation
 3) Ammonification 4) Amination
688. Energy released during Denitrifying process is
 1) 1000 cals 2) 50,000 cals
 3) 100 cals 4) 11,000 cals
689. The correct sequence in which the chemicals are formed in Abiological N_2 fixation is
 1) $N_2 \rightarrow 2NO_2 \rightarrow HNO_3 \rightarrow 2NO$
 2) $2NO \rightarrow N_2 \rightarrow 2NO_2 \rightarrow HNO_3$
 3) $N_2 \rightarrow 2NO \rightarrow 2NO_2 \rightarrow HNO_3$
 4) $2NO_2 \rightarrow N_2 \rightarrow 2NO \rightarrow HNO_3$
690. This is not a form of organic Nitrogen
 1) Ammonia 2) Protein
 3) Amino acid 4) Nucleic Acid
691. Soluble Nitrates are formed in the soil when Nitric acid combines with
 1) Halogen 2) Alkali radicals
 3) O_2 4) Water
692. Ratio of biological and abiological N_2 fixation is
 1) 1 : 1 2) 2 : 1
 3) 1 : 2 4) 7 : 3
693. Nitrogen from the atmosphere is introduced into the living system by the first step of N_2 cycle by
 1) One method 2) Many methods
 3) Two methods 4) Five methods
694. The substance used by the *Thiobacillus* in the fifth step of N_2 cycle is
 1) Ammonia 2) Nitrate 3) N_2 4) Amino acids
695. The end products of fifth step of N_2 cycle will become the substrate of this step in N_2 cycle
 1) First step 2) Third step
 3) Fourth step 4) Second step
696. Process of converting organic Nitrogen into Ammonia is
 1) Fourth step of N_2 cycle
 2) Third step of N_2 cycle
 3) Fifth step of N_2 cycle
 4) Second step of N_2 cycle
697. The end products formed in the first step of N_2 cycle are
 1) Amino acids & proteins 2) N_2 and O_2
 3) Nitrates (or) Ammonia
 4) Organic Nitrogen

LEVEL II

698. These organisms can use molecular nitrogen
 1. Some Prokaryotic microorganisms
 2. Bryophytes
 3. Pteridophytes
 4. Gymnosperms
699. Nitrogen fixing organisms are
 1.Free living (or) Symbiotic 2.Free living only
 3.Symbiotic only 4.Heterotrophic
700. In the root nodules, of Legumes some swollen structures are present. They are
 1. Bacteroids 2. Nucleoids
 3. Heterocysts 4. Phelloids
701. These are exergonic processes
 a) Nitrification b) Denitrification
 c) Biological N_2 fixation
 1) a, b & c are correct 2) a & b only are correct
 3) 'a' alone is correct 4) b & c only are correct
702. The sources from which Ammonia is generated in nitrogen cycle are
 a) Mineralisation b) Volcanic eruption
 c) Nitrogenous excretory compounds of animals.
 The correct combination is
 1) a, b & c 2) a & c only
 3) a & b only 4)b & c only
703. Organic nitrogen is formed in this step of Nitrogen Cycle
 1) First step 2) Fifth step
 3) Fourth step 4) Second step
704. The equilibrium of nitrogen in the atmosphere is maintained by this step of nitrogen cycle.
 1) Ist step 2) III rd step
 3) V th step 4) IVth step
705. Which of the following organism play an important role in the 3rd step of N_{2}- cycle
 1) Saprophytic 2) Parasitic
 3) Autotrophic 4) Symbiotic

706. The use of nitrate by denitrifying Bacteria in their metabolism can be observed in this process
1) absorption of nutrients
2) absorption of water
3) respiration
4) photosynthesis

707. Number of oxygen molecules used by Nitrobacter to produce four nitrate ions is
1) 1 2) 4 3) 2 4) 3

708. Ratio of number of nitrites and number of water generated by Nitrosomonas for oxidation of 2 Ammonia
1) 1:1 2) 2:1 3) 1:2 4) 3:2

709. The end products formed during nitrfication from Ammonia are
1) NO_3^- & H^+ 2) NO_3^-
3) H_2O & HNO_3 4) NO_3^-, H_2O & H^+

710. Assertion: Denitrification is an exergonic process
Reason : 11,000 calories of energy is liberated in 5th step of Nitrogen Cycle

711. Assertion (A) : Fourth step of nitrogen cycle is exergonic process
Reason (R) : Energy is liberated during nitrification

712. Assertion (A) : Denitrification is nitrate respiration
Reason (R) : Nitrate is the respiratory substrate in denitrification

713. Assertion (A) : Ammonification is mineralisation process
Reason (R) : Microminerals are added to the soil in it

714. Assertion (A) : Organic nitrogen is formed in the 1st step of nitrogen cycle
Reason (R) : Nitrate and Ammonia are converted into proteins during nitrogen assimilation

715. Assertion (A) : Bacillus ramosus is ammonifying bacterium
Reason (R) : Bacillus ramosus is a saprophyte

716. Assertion (A) : Nitrogen equllibrium in atmo sphere is maintained by organisms of 5th step of nitrogen cycle
Reason (R) : Denitrification is nitrate respiration

717. Assertion (A): Soil fertility is increased by legume crops
Reason (R) : Legumes have nodular roots with rhizobium

718. This is not an Asymbiotic N_2-fixing bacterium
1.*Rhizobium* 2.*Clostridium*
3.*Rhodospirillum* 4.*Azatobacter*

719. Example of Cyanobacteria
1.*Nostoc* and *Rhizobium*
2.*Anabaena* and *Azatobactor*
3.*Rhizobium* and *Azatobactor*
4.*Nostoc* and *Anabaena*

720. *Nostoc* fixes Nitrogen in
1.*Casuarina* and *Alnus* 2.Legumes
3.*Psychotria* 4.*Gunnera*

721. The sequence of compounds during Nitrification is as follows
1) $NO_3^- - NH_3 - NO_2^-$
2) $NO_2^- - NH_3 - NO_3^-$
3) $NH_3 - NO_3^- - NO_2^-$
4) $NH_3 - NO_2^- - NO_3^-$

722. Number of H_2O liberated for conversion of $2NH_3$ into $2NO_3$ is
1) 2 2) 1 3) 4 4) 3

723. Number of steps involved in the fourth stage of Nitrogen cycle is
1) 2 2) 10 3) 6 4) 3

724. Amount of energy liberated during Nitrification of ammonia from two molecules of NH_3
1) 60,000 cals 2) 17,500 cals
3) 67,500 cals 4) 84,000 cals

725. These organisms are involved in first, third, fourth and fifth steps of nitrogen cycle
a) *Micrococcus denitrificans*
b) *Escherechia* c) *Bacillus vulgaris*
d) *Nitrosomonas* e) *Nostoc* f) *Candida*
1) a, b, c, d, e & f 2) a, b, c, d & e
3) a, c & e only 4) a, c, d & e only

726. Number of Oxygen molecules required for the convertion of atmospheric nitrogen into nitrates during biological nitrogen fixation is
1) 2 2) 4 3) 1 4) 3

727. Number of oxidation reactions in Nitrification
1) 3 2) 4 3) 2 4) 1

728. Match the following related to nitrogen cycle.

Table I	Table II
1) First step	A) Oxidation
2) Third step	B) Formation of moleuclar nitrogen
3) Fourth step	C) Mineralization
4) Fifth step	D) Reduction of Dinitrogen

1) 1-D, 2-C, 3-A, 4-B
2) 1-D, 2-C, 3-B, 4-A
3) 1-A, 2-C, 3-B, 4-D
4) 1-B, 2-A, 3-D, 4-C

2. BIOLOGICAL NITROGEN FIXATION

LEVEL - I

729. The enzyme Nitrogenase is present in
1.All green plants and bacteria
2.Nitrogen fixing microorganisms
3.All Bacteria 4.All green plants

730. This is an aerobic asymbiotic Nitrogen fixing bacterium
1.*Clostridium* 2.*Rhizobium*
3.*Glomus* 4.*Azatobactor*

731. This is an Anaerobic, Non-photosynthetic, asymbiotic N_2 - fixing bacterium
1.*Azatobactor* 2.*Clostridium*
3.*Rhodospirillum* 4.*Rhizobium*

732. This is an Anaerobic, Photosynthetic Asymbiotic N_2 - fixing bacterium
1. *Azatotobactor* 2. *Clostridium*
3. *Rhodospirillum* 4. *Rhizobium*

733. The symbiotic N_2 - fixing bacterium in Legume root nodules is
1. *Klebsiella* 2. *Actinomycetes*
3. *Anabaena* 4. *Rhizobium*

734. In *Cycas* the Nitrogen fixing organisms are found in
1. All roots 2. Coralloid roots
3. Leaves 4. Roots and leaves

735. N_2 - fixing organisms in *Cycas* are
1.*Klebsiella* 2. *Rhizobium*
3. *Nostoc* and *Anabaena* 4. *Actinomycetes*

736. Materials provided by Legume to bacteroids in root nodule are
1. Nitrate 2. Carbohydrate
3. Protein 4. Hormones

737. *Rhizobium* enters the legume root through
1. Root cap cells 2. Root hairs
3. Meristematic cells 4. Root cap & Root hair

738. The infection thread streches and reaches
1. Pericycle 2. Inner cortical cells
3. Phloem 4. Xylem

739. The formation of Nodule in legume root is due to cell divisions in
1. Cortical cells 2. Pericycle
3. Epidermis 4. Endodermis

740. The Pigment protecting Nitrogenase by regulating oxygen concentration in root nodule is
1. Xanthophyll 2. Carotene
3. Haemoglobin 4. Leghaemoglobin

741. Unique character of legumes is the assimilation of nitrogen in the form of
1) Molecular Nitrogen 2) Organic Nitrogen
3) Ammonia 4) Nitrates

742. Name an aquatic pteridophyte that is useful in nitrogen economy of Indian soils
1) *Salvinia* 2) *Marsilea*
3) *Azolla* 4) *Isoetes*

743. A non legume plant on whose roots *Rhizobium* forms nodules is
1) *Parasponia* 2) *Casuarina*
3) *Coriandrum* 4) *Pisum*

744. Whcih pigment is essential for nitrogen fixation by leguminous plants
1) Anthocyanin 2) Phycocyanin
3) Leghaemoglobin 4) Phycoerythrin

745. Nitrogen in the form of molecular nitrogen is absorbed by
1. All prokaryotes 2. Some prokaryotes
3. All eukaryotes 4. Some eukaryotes

746. The organic substance obtained by *Rhizobium* from Fabaceae members is
1. Nitrate 2. Ammonia 3. N_2 4. Sugar

747. Red pigment present in roots of legumes
1. Phycoerythrin 2. Xanthophyll
3. Leg haemoglobin 4. Phytochrome

748. Rhodospirillum is
1. Aerobic bacterium
2. Anaerobic, Photosynthetic bacterium
3. Anaerobic, Photosynthetic Cyanobacterium
4. Symbiotic bacterium

749. Heterocysts are found in
1) all diazotrophs 2) all algae
3) nitrogenfixing cyanobacteria
4) nitrogen fixing bacteria and bluegreen algae

750. Scientist who first described the role of ribosomes in protein synthesis ?
1. Chargaff 2. Zamecnik
3. Khorana 4. Ochoa

751. Infection thread formation in root nodule is by
1. Outward foldings of cell membrane
2. Inward foldings of cell membrane
3. Outward foldings of cell wall
4. Inward foldings of cell wall

752. Which of the following element plays an important role in nitrogen fixation? **JIPMER 2004**
1. Zinc 2. Molybdenum'
3. Manganese 4. Copper

LEVEL II

753. This is not an asymbiotic N_2-fixing bacterium
1.*Rhizobium* 2.*Clostridium*
3.*Rhodospirillum* 4.*Azatobacter*

754. Example of Cyanobacteria
1.*Nostoc* and *Rhizobium*
2.*Anabaena* and *Azatobactor*
3.*Rhizobium* and *Azatobactor*
4.*Nostoc* and *Anabaena*

755. Angiosperm with Nostoc colonies is
1.*Casuarina* and *Alnus* 2.Legumes
3.*Psychotria* 4.*Gunnera*

756. The substance secreted by roots of legumes
1. Proteins and lipids 2. Hormones and Sugar
3. Sugars and Aminoacids
4. Lipids and Nucleic acids

757. The movement shown by *Rhizobium* while reaching the root hair
1. Chemotactic 2. Chaemotropic
3. Chaemonastic 4.Geotropic

758. The enzymes secreted by *Rhizobium* during its entry into root hair
1. Cellulases and Pectinases
2. Cellulases and Phosphotases
3. Pectinases and Phosphotases
4. Proteases and oxidases

759. End products of phosphoroclastic cleavage are
1) Pyruvic acid 2) Acetyl phosphate
3) CO_2 and acetyl phosphate
4) ethyl alcohol and CO_2

760. Infection thread is
1. An outgrowth on root hair
2. A secretion product of root hair
3. A tubular invagination of cell membrane filled with Rhizobium
4. A secretion product of *Rhizobium*

761. Infection thread is filled with
1. Excretory substances
2. Secretory substances
3. Dead Rhizobium cells .
4. Living Rhizobium cells

762. The enzyme necessary for Nitrogen fixation is found in the
1. Vascular tissues 2. Bacteriods
3. Cortex 4. Endodermis

763. The overall reaction of biological N_2 fixation
1. $N_2 + 9e^- + 8H^+ + 16\ ATP \rightarrow 2NH_4 + 16\ ADP + 16\ Pi$
2. $N_2 + 8e^- + 8H^+ + 8\ ATP \rightarrow 2\ NH_3 + 8ADP + 8\ Pi$
3. $N_2 + 6e^- + 8H^+ + 16\ ATP \rightarrow 2NH_3 + H_2 + 16\ ADP + 16\ Pi$
4. $N_2 + 8e^- + 8H^+ + 10\ ATP \rightarrow 2NH_3 + H_2 + 10ADP + 10\ Pi$

764. Number of protein components in Dinitrogenase
1. 2 2. 1
3. 4 4. 3

765. The Micro-elements present in Dinitrogenase
1. Fe 2. Mg
3. Fe & Mg 4. Fe & Mo

766. Biological Nitrogen fixation in legume roots is sensitive to
1. CO_2 2. CO
3. O_2 4. H_2O

767. Study the following table

Host	**Microbe**	**Symbiotic structure**
i) *Alnus*	Frankia	Root nodule
ii) *Cycas*	*Azotobacter*	Corolloid root
iii) Red gram	Actinomycetes	Root nodule
iv) *Gunnera*	*Nostoc*	Stem gland

Which two hosts and microsymbionts are **correct** combinations
1. i & ii 2. ii & iii
3. i & iii 4. i & iv

768. Peribacteroid membrane is
1. membrane of infection thread
2. membrane surrounding bacteroid formed by the bacterium itself
3. membrane surrounding bacteroid formed by host
4. membrane of rhizobium living freely in soil

769. Find the correct matching

LIST-I	**LIST-2**
1. *Parasponia*	A) *Nostoc*
2. *Myrica*	B) *Rhizobium*
3. *Gunnera*	C) *Frankia*
4. *Azolla*	D) *Anabaena azollae*
5. *Cycas*	E) *Anabaena cycadacearum*

	1	2	3	4	5
1.	A	B	C	D	E
2.	B	C	A	D	E
3.	B	A	C	D	E
4.	B	C	A	E	D

770. Assertion (A): Rhizobium is a Bacillus type of aerobic bacterium
Reason (R) : It fixes nitrogen in anaerobic conditions

771. Assertion (A) : Corolloid roots fix atmospheric nitrogen
Reason (R) : Nitrogen fixing blue green algae are present in coralloid roots of cycas

772. Assertion (A): Shortage of microelements decreases nitrogen fixation
Reason (R): Nitrogenase enzyme contains iron and Molybdenum

773. Assertiion (A) : Nitrogen fixtion is carried out by Prokaryotes only

Reason (R) : Nitrogenase synthesis is directed by 'nif' gene

774. Assertion (A) : Bacteroid respiration is catalysed by dinitrogenase

Reason (R) : Leg haemoglobin helps to transport oxygen into bacteriod at carefully controlled rates

775. Study the following nitrogen fixing bacteria. Match them correctly

Table-I	Table-II
A) Nostoc	I) Anaerobic bacterium
B) Clostridium	II) Photosynthetic bacterium
C) Rhodospirillum	III) Cyanobacterium
D) Azotobacter	IV) Aerobic bacterium

The correct combination

1. A-III, B-I, C-II, D-IV 2. A-II, B-I, C-III, D-IV
3. A-I, B-II, C-III, D-IV 4. A-II, B-I, C-IV, D-I

776. Assertion (A) : Anabena azollae is symbiotic microorganism

Reason (R) : It is present in leaf cells of Azolla

777. How many ATP molecules are required to convert four nitrogen molecules into Ammonia molecules during diazotrophy

1. 16 2. 32 3. 64 4. 128

778. How many ATP molecules are required to form 4 NH_3 molecules from nitrogen molecules by dinitrogenase enzyme ?

1. 8 2. 16 3. 32 4. 48

779. Which is **wrong** statement regarding lectins ?

1. The host recognizes compatible bacteria
2. They are plant lipids
3. They are proteins
4. They are produced by legumes

780. Bacteriods are

1) Mobile bacteria
2) Bacterial cells infected by Viruses
3) Nitrosomonas of soil
4) Non motile bacteria present in the root nodules of legumes

781. Nitrogen fixation in soil is carried out by

1) *Azotobacter* 2) *Thiobacillus*
3) *Nitrosomonas* 4) *Nitrobacter*

782. A Nitrogen fixing prokaryote living in the apogeotropic roots of *Cycas*

1) *Rhizobium* 2) *Nostoc*
3) *Azotobacter* 4) *Clostridium*

783. The membrane bound thread in whcih the Rhizobia are embedded and which grows in the cortical tissue is called

1) Shepherd's crook 2) Hypertrophy
3) Rhizomorph 4) Infection thread

784. *Nostoc* makes a symbiotic association with a Bryophyte called

1) *Riccia* 2) *Funaria*
3) *Azolla* 4) *Anthoceros*

785. Element Molybdenum is associated with

1) Nitrogen metabolism 2) Fat metabolism
3) Carbohydrate metabolism
4) Water absorption

786. The following is the constituent of nitrogenase

1) Magnesium 2) Molybdenum
3) Manganese 4) Potassium

787. Which of the following plants can not fix atmospheric nitrogen directly

1) Pea 2) Bean
3) Horse gram 4) Castor

788. In diazotrophs, the 'nif' genes are responsible for producing which part of dinitragenase?

I) Mg - protein II) Mo Protein
III) Fe protein IV) Mo Fe protein
1) I and IV 2) II and III
3) II and IV 4) III and IV

789. Biological Nitrogen fixation in legume roots is sensitive to

1) CO_2 2) CO 3) O_2 4) H_2O

790. Initial infection by Rhizobium occurs in

1) Epiblemal cells 2) Root hairs
3) Cortical cells 4) Cuticle

GENETIC CODE

LEVEL - I

791. Initiating codons are found in

1. m RNA 2. DNA
3. t-RNA 4. r -RNA

792. The codon at which the process of polypetide chain synthesis begins is

1. Non-ambiguous codon
2. Degenarate codon
3. Universal codon
4. Initiating codon (Starting codon)

793. The starting codons are

1. AUG & UAA 2. GUG & AUG
3. UAA & GUG 4. UAA & UGA

794. A codon that will not code for any amino acid is

1. Terminating codon
2. Degenarate codon
3. Starting codon 4. Initiating codon

795. The terminating codons are

1. UAA,UAG,AUG 2. UAA,AUG,GUG
3. UAA,UAG,GUG 4. UAA,UAG,UGA

796. Assertion (A) : The genetic code is universal

Reason (R) : Code is a Triplet code

797. Assertion (A) : An mRNA of 64 triplet codons codes for only 63 aminoacids

Reason (R) : One non-sense codon will be at the end of mRNA

798. The central dogma of molecular biology was proposed by
1) Beadle 2) Crick
3) Lederberg 4) Ingram

LEVEL II

799. The genetic information from cell to cell and from one generation to next generation is passed by
1. RNA 2. DNA 3. Protein 4. zDNA

800. A codon is a set of
1. Nitrogen bases coding for 3 Amino Acids
2. Two Nitrogen bases coding for one Amino Acid
3. Three Nitrogen bases coding for Three amino acids
4. Three succesive nitrogen bases coding for one amino acid

801. According to Triplet code the total number of sensible codons
1. 64 2. 16 3. 61 4. 3

802. The number of different types of amino acids taking part in Protein synthesis
1. 16 2. 20 3. 64 4. 32

803. When one amino acid is coded by more than one codon it is
1. Universal code 2. Commaless
3. Degenarate 4. Accessory

804. In Non- over lapping code one Nitrogen base will be a part of
1. 3 codons 2. 2 codons
3. 4 codons 4. 1 codon

805. All organisms have the same genetic code. This is known as
1. Non-overlapping code 2. Overlapping code
3. Universal code 4. Degenarate code

806. This Nitrogen base normally found in RNA but is absent in starting and Terminating codons
1. Thymine 2. Cytosine
3. Both Thymine and Cytosine 4. Uracil

807. When one nitrogen base cannot participate in more than one codon, it is called
1. Genetic code is non-ambiguous
2. Genetic code is non-overlapping
3. Genetic code is universal
4. Genetic code is degenerative

808. Genetic code is universal. Which one of the following justifies the property
1. No letters are wasted in between the codons
2. One amino acid may have more than one codon
3. One codon codes for the same amino acid in all places
4. m-RNA of plant can form same protein in animals

809. Assertion (A) : The genetic code is degenerate.
Reason (R) : UUU codes for phenylalanine in all living organisms

810. Assertion (A) : UAA, UGA and UAG are non-sense codons
Reason (R) : They do not specify any aminoacid

811. Assertion (A) : Genetic code is universal
Reason (R) : Genetic code is in the form of triplet codon

812. Assertion (A) : Genetic code is in the form of triplet codons
Reason (R) : In singlet and doublet codons, total codons formed are less than types of amino acids

813. Assertion (A) : One amino acid may be coded by more than one codon
Reason (R) : Genetic code is universal

814. Assertion (A): The number of polypeptide chains is equal to number of initiator codons.
Reason (R) : The number of polypeptide chains may not be equal to number of nonsense codons

815. How many codons do not specify any amino acid
1. 61 2. 64 3. 3 4. 20

816. Genetic code is
1. Triplet, universal, ambiguous and over lapping degenerate
2. Triplet, universal, non-ambiguous and non-degenerate
3) Triplet, universal, non-ambiguous and non-overlapping degenerate
4) Triplet, universal, ambiguous and non-degenerate

817. From six nitrotgenous base sequence of AUGUUU only two codons are formed, this property of genetic code is called
1) Universality of code 2) Commaless
3) Non-overlapping 4) Commaless & overlapping

818. Assertion (A) : Genetic code is degenerate
Reason (R) : 20 codons made up of 60 nucleotides

819. The genetic code that directs protein synthesis in humans is found in
1) All animals, but not in plants
2) Virtually all organisms
3) All animals, but not in plants
4) All multicellular organisms but not in unicellular organisms

820. Assertion (A) : Genetic code is degenerate
Reason (R) : All the codons code for a type of amino acid

821. Assertion (A) : A polynucleotide chain of RNA with 30 nitrogen bases has ten codons
Reason (R) : A set of 3 nitrogen bases coding for an amino Acid is a triplet

822. Assertion (A) : Codons are present in the poly-nucleotide chain of DNA and RNA
Reason (R) : A set of 3 nitrogen bases coding for an amino acid is a triplet

823. Consider the following codons
a) GGG b) AGC c) AGU d) AUG
e) UUU f) UCU
How many of these codons recognise serine?
1) 3 2) 1
3) 2 4) 6

BIOSYNTHESIS OF PROTEINS

LEVEL - I

824. The amino acid coded by initiating codon is
1. Glycine 2. Valine
3. N - formyl Methionine 4. Tryptophan

825. The chemical bond formed between amino acids in a polypeptide chain
1. Phosphotidic bond 2. Glucosidic bond
3. Sulphydril bond 4. Peptide bond

826. In Eukaryotes transcription - the first stage of protein synthesis - takes place in
1. Cytoplasm 2. Ribosomes
3. Nucleus 4. Nucleolus

827. During translation m RNA is attached to
1. Larger sub unit of ribosome
2. Smaller sub unit of ribosome
3. 70 s ribosome
4. Either to larger/smaller sub unit

828. Activation of amino acid requires this enzyme
1. Amino acid phosphorylase
2. Aminoacyl t- RNA synthetase
3. t RNA phosphorylase 4. Peptidyl transferase

829. Amino acid is attached to this part of t RNA
1. DHU loop 2. Central loop
3. 5' terminal 4. 3' terminal

830. Number of active sites on Amino acyl t - RNA synthetase is
1. 0 2. 1 3. 2 4. Many

831. The two active sites of Amino acyl t- RNA synthetase are occupied by
1. One amino acid and one t RNA
2. Two amino acids
3. Two t RNA
4. Two amino acids and two t RNA

832. The Anticodon of t RNA is complementary to codon in
1. m RNA 2. Ribosome 3. DNA 4. B-DNA

833. Energy for chain elongation is supplied in the form of
1. Free energy 2. Inorganic phosphate
3.ATP 4. GTP

834. Decoding site in ribosome is
1. Peptidyl transferese 2. P - site
3. A - site 4. A,P sites

835. Transfer of genetic information from DNA molecule to m-RNA is called
1. Transcription 2. Transgenesis
3. Translation 4. Transformation

836. During protein synthesis, amino acid gets attached to t-RNA with the help of **(JIPMER 1998)**
1. m-RNA 2. amino acyl synthetase
3. Transmutase 4. r-RNA

837. Which one of the following is considered as an interpreter of genetic code?
1) Adaptor RNA 2) Messenger RNA
3) Ribosomal RNA 4) hn - RNA

LEVEL II

838. Terminating codons are useful for terminating the synthesis of
1. DNA 2. RNA
3. Polypeptide chain 4. Amino acid

839. These are found in transcription
1. DNA & m RNA 2. DNA & r RNA
3. m RNA & r RNA 4. DNA & t RNA

840. Transcription enzyme is
1. DNA polymerase 2. RNA polymerase
3. Peptidyl transferase 4. Helicase

841. Idenfity the correct statement regarding protein synthesis
1) ATP are formed during the activation of amino acid
2) GTP is required for translocation step
3) Terminating codon is present at the end of polypeptide chain
4) CCA' end of t-RNA identifies codon on m-RNA

842. This will bind with smaller sub unit of ribosomes initially.
1. RF_1 2. RF_2
3. RF_1 & RF_2 4. RF_3

843. Activation of amino acid is
1. Amino acid combining with ATP
2. Amino acid combining with r RNA
3. Amino Acid combining with enzyme
4. Amino acid combining with t RNA

844. In tRNA CCA sequence is found at
1. 3rd' loop 2. 3' terminal
3. 5' terminal 4. Anticodon loop

845. The triplet of nitrogen bases in the central loop of t RNA
1. Codon 2. Genetic code
3. Anticodon 4. Terminal codon

846. Peptide bond between first and second amino acids is formed between
1. COOH of first amino acid and COOH of second amino acid
2. COOH of first amino acid with amino group of second amino acid
3. Amino group of first amino acid with amino group of second
4. Amino group of first with COOH of second amino acid

847. A Dipeptide has
1. Two amino acids and one peptide bond
2. Two amino acids and two peptide bonds
3. Three amino acids and two peptide bonds
4. Two amino acids and three peptide bonds

848. Peptidyl transferase is useful for
1. transfering t RNA to m RNA
2. transfering amino acid to t RNA
3. joining t RNA with m RNA
4. Combining two amino Acids

849. Terminating codons are useful for ending the process of
1. Translation 2. Transcription
3. Translocation 4. Replication

850. This group is free in the last amino acid of polypeptide chain
1. Amino group 2. Methyl group
3. Carboxyl group 4. Nitrate group

851. In biosynthesis of proteins energy in the form of GTP is needed for
i) Translocation
ii) Formation of initiation complex
iii) Release of polypeptide
iv) Activation of aminoacid
1. I & II 2. III & IV
3. III & I 4. I, II & IV

852. Aminoacyl tRNA binds with
1. t-RNA 2. Ribosomes
3. m-RNA 4. DNA

853. Which of the following are bound together by hydrogen bonds
1. t-RNA and m-RNA
2. t-RNA and amino acid
3. amino acid and amino acid
4. Adenine and sugar

854. Decoding site is
1. Peptidyl site of ribosome
2. Acylation site of ribosome
3. Anticodon of t-RNA
4. Second site of Amino acyl t-RNA synthetase

855. Which enzyme is not associated with protein synthesis
1. Amino acyl t-RNA synthetase
2. Peptidyl transferase
3. DNA polymerase 4. RNA polymerase

856. Which doesn't participate in peptide bond formation
1. COOH of 1^{st} amino acid
2. NH_2 of last amino acid
3. NH_2 of first amino acid
4. COOH of second amino acid

857. In the cells that are actively synthesizing proteins, ribosomes are held together to form groups by
1. Mg^{++} 2. Ca^{++}
3. m-RNA 4. Polypeptide chain

858. COOH group of amino acid joins with which nucleotide of t-RNA
1. Adenine nucleotide 2. Guanine nucleotide
3. Uracil nucleotide 4. Cytosine nucleotide

859. GTP is converted into GDP and ip = during
1. conversion of GAP to 1, 3 BPGA
2. Conversion of fumaric acid to malic acid
3. conversion of RuP to RuBP
4. Translocation of t-RNA

860. Last t-RNA in protein synthesis moves from
1. A site to P site with dipeptide
2. P site to A site with polypeptide
3. A site to P site with polypeptide
4. A site to P site without amino acid

861. Releasing factors help in
1. Translocation
2. Termination of polypeptide chain
3. Initiation of polypeptide chain
4. Elongation of polypeptide chain

862. In E.coli, a furnished polypeptide has 163 amino acids of which the first amino acid. How many nucleotides of DNA are required to code this polypeptide
1) 492 2) 489 3) 54 4) 486

863. Assertion (A) : Anticodon in any t-RNA is UAC
Reason (R) : All m-RNAs start with AUG triplet

864. Assertion (A) : Peptide bond formation takes places always in 50S Ribosomes
Reason (R) : Peptidyle transferase is located in 50S ribosome.

865. Assertion (A) : Translation takes place on ribosome surface
Reason (R) : Synthesis of polypeptide is catalysed by peptidyl transferase

866. Assertion (A) : Ochre, amber and opal are non-sense codons
Reason (R) : Terminating codons will not specify any amino acids

867. Assertion (A) : Every charged tRNA will beocme peptidyl tRNA
Reason (R) : All charged tRNAs have amino acid attached to them

868. Assertion (A) : Peptidyl tRNA is formed at A site in Ribosome
Reason (R) : P site is the peptidyl site in Ribosome

869. Assertion (A) : Second amino acid can bind with COOH of first amino acid
Reason (R) : The amino group of methionine is blocked by formyl group in prokaryotes

870. Assertion (A) : Movement of Ribosome on mRNA is in $5' \rightarrow 3'$ direction
Reason (R) : EFG is needed for Translocation

871. Assertion (A) : IF_1, IF_2 & IF_3 are proteins
Reason (R) : IF_1, IF_2 & IF_3 are needed for chain initiation

872. Assertion (A) : tRNA has pseudohelix structures
Reason (R) : Purines and Pyrimidines in tRNA are in equal proportion

LEVEL III

873. The number of codons in m RNA that can be coded at a time in ribosome is
1. Two codons 2. One codon
3. 3 codons 4. Many

874. m RNA has this base sequence AUG AAA GCG UAU AGU The first, fourth and sixth nitrogen bases are deleted. The polypeptide chain formed on this m RNA will have
1. 4 amino acids 2. 5 amino acids
3. Three amino acids
4. Polypeptide chain is not formed

875. An m RNA has this base sequence AUG UUA GAA UAC UAA The 5 th nitrogen base from the left is deleted. The chain has
1. 5 amino acids
2. Polypeptide chain is not formed
3. 4 Amino Acids 4. 3 amino Acids

876. Translocation refers to
1. Transport of water in Xylem
2. Movement of organic substances in phloem
3. Movement of ribosome over m-RNA
4. Movement of organic substances in phloem and movemnt of ribosomes on mRNA

877. A template of DNA having nitrogen base sequence TAC TCC CCA AAA .. is transcribed into m-RNA, what is the nitrogen base sequence on anti-codon of 2nd t-RNA
1. A G G 2. C C A
3. U C C 4. G G T

878. Find the **true** matching

1. N and N	A) Hydrogen bonds
2. AA - AA	B) Ester bonds
3. Codon - anticodon	C) Covalent bonds
4. tRNA-AA	D) Peptide bonds

1. 1-D, 2-C, 3-B, 4-A
2. 1-D, 2-C, 3-A, 4-B
3. 1-C, 2-E, 3-B, 4-A
4. 1-C, 2-D, 3-A, 4-B

879.

LIST-I	**LIST-II**
A) IF-3	Z) Activation of Amino acid
B) EF-G	Y) Translocation
C) RF-2	X) Termination
D) IF-1	W) 30 S Ribosomes
E) ATP	V) m-RNA-30s +fmet r-RNA

Correct match is
1. A-V, B-X, C-Y, D-W, E-Z
2) A-W, B-X, C-Y, D-V, E-Z
3. A-W, B-Y, C-X, D-V, E-Z
4. A-V, B-Y, C-X, D-W, E-Z

880. Study the following :

Table - I	**Table - II**
A) t-RNA	I) Proteins
B) m-RNA	II) Pigment
C) Leghaemoglobin	III) Decider of amino acid position
D) Lectins	IV) Carrier of amino acid

Correct match is
1. A-IV, B-III, C-II, D-I 2. A-IV, B-III, C-I, D-II
3. A-II, B-III, C-IV, A-I 4. A-I, B-III, C-IV, D-II

881. Identify the **correct** sequence of events in biosynthesis of proteins

I) Transcription
II) Activation of amino acid
III) Initiation of polypeptide chain
IV) Formation of charged t-RNA

1. I, II, III & IV 2. IV, III, II, I
3. I, II, IV & III 4. III, II, IV, I

882. Heterocysts are formed in

1. *Anabaena* 2. *Rhizopus sexualis*
3. *Spirogyra farlowii* 4. *Spirogyra jogensis*

883. The **correct** sequence of

(A) Types of nitrogen bases in DNA
(B) Types of nitrogen bases in RNA
(C) Types of AA take part in protein synthesis
(D) Types of functional codons
(E) Types of proteins is

1. 4 - 4 - 20 - 61 - Many
2. 4 - 4 - 20 - 64 - Many
3. 5 - 5 - 20 - 61 - Many
4. 4 - Many - 20 - 61 - Many

884. A polypeptide chain with 21 amino acids is synthesized in E.coli. What could be the length of m-RNA forming it including non-sense codon ?

1. 224.4 A° 2. 244.4 A°
3. 448.8 A° 4. 444.4 A°

885. There are 99 nitrogen bases present in mRNA of E.Coli. If this mRNA is translated, then what will be the number of amino acids in the resulting polypeptide chain?

1) 33 2) 31 3) 92 4) 32

886. What is **true**

1. Total codons formed by doublet codon = 64
2. Total codons formed by triplet codon = 61
3. The pink pigment leg - haemoglobin prevents oxygen reaching dinitrogenase
4. There are 20 types of proteins in cell

887. Which is true after second translocation in protein synthesis

1. 2^{nd} t-RNA moves from A site to P site
2. 3^{rd} t-RNA with dipeptide moves from A-site to P site
3. 3^{rd} t-RNA with tripeptide moves from A-site to P site
4. 3^{rd} t-RNA with tripeptide moves from P-site to A site

888. Pick up the **wrong** statement

1. amino acid is attached to the tail of t-RNA
2. One lateral loop of t-RNA recognizes Amino acyl + RNA synthetase
3. t-RNA transfers amino acids from cytoplasm to ribosomes
4. COOH group of second amino acid participates in first peptide bond formation

889. Select the **wrong** statement

1. 61 codons code for 20 different types of amino acids
2. Least number of t-RNAs required for proteins synthesis is 20
3. 20 types of amino acids can form thousands of proteins
4. m-RNA is linear and short lived

890. Which is true

1. Number of amino acids = Peptide bonds
2. Number of functional codons= Total codons + 1
3. Number of types of nitrogen bases = No.of nitrogen bases in codon + 1
4. Total codons = Functional codons - 1

891. Nitrobacter converts

1) Nitrates into molecular nitrogen
2) Nitrites into nitrates
3) Ammonia into nitrite 4) Hydroxyl amine

892. An important constituent of proteins after CHON is

1) Mo 2) P 3) S 4) Mn

893. Assertion (A) : Any mRNA has 64 codons
Reason (R) :Anticodons exist on tRNA

894. Assertion (A) : Azotobacter is aerobic bacterium
Reason (R) : Mitochondria are present in it

895. The P site of large subunit of ribosome can be occupied directly by a tRNA with

1. Serine 2) Proline
3) Phenyl alanine 4) Methionine

896. If a cell is treated with a chemical that blocks nucleic acid synthesis which of the following processes would be effected first

1) DNA replication 2) tRNA synthesis
3) mRNA synthesis 4) Protein synthesis