

☒ Enzyme that balance purine and pyrimidines in de novo ribonucleotides synthesis:

- a) ATCase
- b) PRPP amidotransferase
- c) IMP dehydrogenase
- d) PRPP synthetase

☒ Histones Acetylation:

- a) Is associated with inactivation of gene transcription
- b) Is associated with activation of gene transcription
- c) Helps in tight packaging of DNA in the nucleus
- d) One of the components of replisomes
- e) Adding methyl groups on cytosine's to repress transcription

☒ With respect to DNA replication:

- a) Helicase forms double helices at the rate of 6000 rpm
- b) The beta clamp is responsible for making DNA polymerase III more processive
- c) The beta clamp is responsible for making DNA polymerase 3 more progressive
- d) Okazaki fragments are made in 3' to 5' direction
- e) Lagging strand is made in 3' to 5' direction

☒ True about Nucleotide metabolism:

- a) It uses nitrogen bases in the salvage pathway
- b) It uses CTP to make UTP
- c) It uses dTMP to make dUMP
- d) It uses DHFR to make dNDPs from NDPs
- e) Ribonucleotide reductase converts dNAPs to dNTPs

☒ Identical twins don't have same DNA due to:

- a) Recombination
- b) RNA Editing
- c) Alternative Splicing
- d) Alternative Polyadenylation

Flow of genetic information from DNA to RNA is called:

Energy source for AMP synthesis:

- a) GTP
- b) ATP
- c) UTP
- d) CTP
- e) TTP

Flow of genetic information from DNA to DNA in dogma of molecular genetics:

- a) Replication
- b) Translation
- c) Transcription
- d) Reverse Transcription

Increase absorption at 260 nm which occurs when DNA is denatured is due to:

- a) Breathing
- b) Melting
- c) Hypochromicity
- d) Hyperchromic effect
- e) Ionization

Which of the following completely inhibit PRPP amidotransferase:

- a) High amounts of AMP and GMP
- b) High PRPP level
- c) High amounts of AMP
- c) High amounts of GMP

Telomerase uses as template to make telomere:

- a) RNA that it carries
- b) Reverse transcriptase
- c) DNA that it carries
- d) the 3' Overhang of the parental strand

The following enzymes are involved in the catabolism of AMP to uric acid.
The correct order of their use is?

1. deaminase
2. nucleoside phosphorylase
3. nucleotidase
4. Xanthine oxidase

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

Which of the following would NOT be expected to contribute to hyperuricemia (gout)?

- A. Unusually high levels of PRPP.
- B. Inhibition of xanthine oxidase.
- C. Unusually high turnover of nucleic acids.
- D. High activity of adenosine deaminase.
- E. Deficiency of HG-PRT

Direct sources of purine ring atoms in the de novo synthesis of IMP include?

1. glutamine.
 2. a component of the tetrahydrofolate one-carbon pool.
 3. aspartate.
 4. glycine.
-
- A. 1, 2 and 3
 - B. 1 and 3
 - C. 2 and 4
 - D. 4 only
 - E. All four

Methotrexate is an inhibitor of dihydrofolate reductase, the enzyme that generates tetrahydrofolate (THF). Administration of methotrexate would inhibit?

1. de novo synthesis of UMP.
 2. conversion of dUMP to dTMP.
 3. conversion of IMP to GMP.
 4. de novo synthesis of IMP
-
- A. 1, 2 and 3

- B. 1 and 3
- C. 2 and 4
- D. 4 only
- E. All four

If a cell has an adequate supply of adenine nucleotides but requires more guanine nucleotides for protein synthesis:

- 1. Glutamine-PRPP amidotransferase will not be fully inhibited.
- 2. AMP will be a feedback inhibitor of the condensation of IMP with aspartate.
- 3. ATP will stimulate the production of GMP from IMP.
- 4. ATP will inhibit nucleoside diphosphate reductase.

- A. 1, 2 and 3
- B. 1 and 3
- C. 2 and 4
- D. 4 only
- E. All four

Involve(s) reduction and cleavage of the nitrogen-containing ring?

- A. Catabolism of guanine
- B. Catabolism of uracil

- A. A only
- B. B only
- C. Both A and B
- D. Neither A or B

Thioredoxin is involved in the?

- A. conversion of AMP to ATP.
- B. conversion of DUMP to dTMP.
- C. conversion of a ribonucleotide to a deoxyribonucleotide.
- D. inhibition of xanthine oxidase as a treatment for gout.
- E. degradation of nucleoprotein.

The major control of de novo pyrimidine nucleotide synthesis in man is?

- A. feedback inhibition of glutamine-PRPP amidotransferase.
- B. feedback inhibition of aspartate transcarbamylase.
- C. availability of N-acetyl glutamate.
- D. substrate availability.
- E. competitive inhibition of carbamoyl phosphate synthetase II.

Nucleosomes Core includes all of the following Except:

- a) H1
- b) H2A
- c) H2B
- d) H3
- e) H4

thymidylate synthase can be inhibited by:

- a) 5-flourouracil
- b) Hydroxyurea
- c) Mycophenolic acid
- d) PABA analog

Which polymerase activity removes primer in E. coli DNA:

- a) 5'-3' exonuclease
- b) 3'-5' exonuclease
- c) Endonuclease activity
- d) None of the above

Polymerase III and polymerase I, both share the following activity:

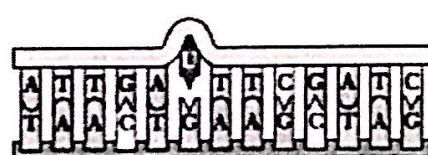
- a) 3'-5' exonuclease activity
- b) 5'-3' exonuclease activity
- c) 3'-5' polymerization activity
- d) Helicase activity

Enzyme build end of Embryonic chromosome strand:

- a. Telomerase
- b. RNA-dependant DNA polymerase
- c. Reverse Transcriptase
- d. Ribonucleoprotein
- e. All of the above

The DNA repair mechanism in this figure:

- a) Nucleotide excision repair
- b) Mismatch repair
- c) Base Excision repair
- d) Cyclobutane pyrimidine dimer repair



In the catabolism of CTP:

- A. uric acid is an end product.
- B. nitrogen will be released in the form of ammonia (ammonium ion).
- C. the nitrogen-containing ring will be oxidized.
- D. the final product will have the same type of nitrogen-containing ring as CTP.
- E. hypoxanthine will be an intermediate.

The formation of dATP for DNA synthesis occurs primarily by?

- A. de novo synthesis beginning with dPRPP.
- B. salvaging using APRT.
- C. salvaging adenine using a nucleoside phosphorylase and dRibose 1-P.
- D. converting ADP to dADP using thioredoxin.
- E. converting dIMP to dAMP using 5,10-methylene THF.

Major controls of de novo AMP synthesis include?

- 1. allosteric inhibition by GMP.
 - 2. allosteric inhibition by AMP
 - 3. availability of PRPP.
 - 4. stimulation by GTP
- .
- A. 1, 2 and 3
 - B. 1 and 3
 - C. 2 and 4
 - D. 4 only
 - E. All four

Aspartate plays a role in all of the following EXCEPT?

- A. conversion of UTP to CTP.
- B. de novo synthesis of AMP.
- C. de novo synthesis of orotic acid.
- D. the synthesis of most proteins.

⇒ Allergenetic, an inhibitor of aspartate oxidase, inhibits synthesis of aliphatic amino acids and aromatic amino acids. It can't be converted to acid.

☒ Which compound is the branch point in de novo purine synthesis:

- a) IMP (Inosylate)
- b) Orotidylate
- c) Uridylate
- d) AMP

☒ There was a mutation in DNA polymerase ; in vitro examining has revealed an error frequency of 10^{-3} in compare to expected 10^{-6} error frequency , which activities DNA polymerase lacks most likely than the normal un-mutated one :

- A. 3' -5' exonuclease activity
- B. 3' - 5' polymerase activity
- C. 5' - 3' polymerase activity
- D. 5' -3' exonuclease activity

☒ The 3'-5' activity of DNA Polymerase I is for :

- A. Proofreading.
- B. Gap filling.
- C. Removing primers.
- D. Polymerization

☒ SnRNPs function in: (a defect in hypoxanthine-guanine phosphoribosyl

- a. Splicing
- b. RNA editing
- c. 5' Capping
- d. 3' polyadenylation

☒ deamination of Adenosine yield.....

- a. Guanosine
- b. Adenine
- c. Hypoxanthine
- d. Inosine
- e. Xanthosine

Allopurinol is an inhibitor of xanthine oxidase. Administration of allopurinol to a patient with gout and normal HG-PRT levels would be expected to lead to all of the following EXCEPT?

- A. decreased de novo synthesis of IMP.
- B. decreased urate in the urine.
- C. an increase of hypoxanthine in the blood.
- D. increased levels of PRPP.
- E. increased xanthine in the blood.

Which of the following statements about purine nucleotide metabolism is NOT CORRECT?

- A. An early step in purine biosynthesis is the formation of PRPP (phosphoribosyl 1-pyrophosphate).
- B. Inosine monophosphate (IMP) is a precursor of both AMP and GMP.
- C. Orotic acid is an intermediate in pyrimidine nucleotide biosynthesis.
- D. Humans catabolize uridine and pseudouridine by analogous reactions.
- E. Ribonucleotide reductase converts nucleoside diphosphates to the corresponding deoxyribonucleoside diphosphates.

Which of the following statements is NOT CORRECT?

- A. Metabolic disorders are only infrequently associated with defects in the catabolism of purines.
- B. Immune dysfunctions are associated both with a defective adenosine deaminase and with a defective purine nucleoside phosphorylase.
- C. The Lesch-Nyhan syndrome reflects a defect in hypoxanthine-guanine phosphoribosyl transferase.
- D. Xanthine lithiasis can be due to a severe defect in xanthine oxidase.
- E. Hyperuricemia can result from conditions such as cancer characterized by enhanced tissue turnover.

Which of the following components are found in DNA? Choose the most complete answer?

- A. A phosphate group, adenine, and ribose
- B. A phosphate group, guanine, and deoxyribose
- C. Cytosine and ribose
- D. Thymine and deoxyribose
- E. A phosphate group and adenine

B. Question of the following is based on a generic purine?

a. DNA

☒ The backbone of a DNA molecule consists of which of the following?

- A. Alternating sugars and nitrogenous bases
- B. Nitrogenous bases alone
- C. Phosphate groups alone
- D. Alternating phosphate and sugar groups
- E. Five carbon sugars alone

☒ Which of the following is the interconnecting bond that connects the nucleotides of RNA and DNA?

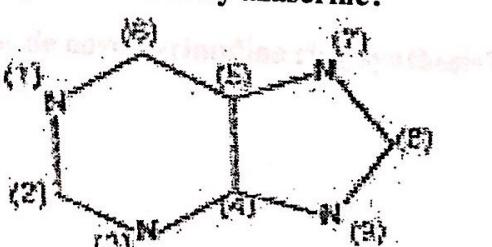
- A. N-glycosidic bonds
- B. 3'-5' phosphodiester linkages
- C. Phosphomonoesters
- D. -2' phosphodiester linkages
- E. Peptide nucleic acid bonds

☒ Which component of the DNA duplex causes the molecule to have a net negative charge at physiologic pH?

- A. Deoxyribose
- B. Ribose
- C. Phosphate groups
- D. Chlorine ion
- E. Adenine

☒ Azaserine, a drug with research applications, inhibits glutamine-dependent enzymes. Incorporation of which of the ring nitrogens (N) in the generic purine structure shown would most likely be affected by azaserine?

- A. 1
- B. 3
- C. 7
- D. 9



Oxidation of Hypoxanthine followed by Amination will produce.....

- a. Xanthine
- b. Adenine
- c. Guanine
- d. Cytosine
- e. Thymine

the Anchor point of Pyrimidine ring to the pentose sugar is:

- a. C2
- b. N1
- c. N3
- d. N9
- e. C5

how many ATP equivalent required for activation of Ribose-5-P?

- a. 1
- b. 2
- c. 4
- d. None

which of the following can increase the availability of 5'phosphoribosyl-1'pyrophosphate?

- a. Inorganic phosphate
- b. AMP
- c. IMP
- d. OMP
- e. UMP

which of the following is not required for de novo pyrimidine ring synthesis?

- a. Bicarbonate
- b. Glutamate
- c. Aspartate
- d. None of the above

the committed intermediate to pyrimidine synthesis is?

- a. Carbamoyl- phosphate
- b. Carbamoyl-Aspartate
- c. Dihydroorotate
- d. Orotate
- e. OMP

A 42-year-old male patient undergoing radiation therapy for prostate cancer develops severe pain in the metatarsal phalangeal joint of his right big toe. Monosodium urate crystals are detected by polarized light microscopy in fluid obtained from this joint by arthrocentesis. This patient's pain is directly caused by the overproduction of the end product of which of the following metabolic pathways?

- A. De novo pyrimidine biosynthesis
- B. Pyrimidine degradation
- C. De novo purine biosynthesis
- D. Purine salvage
- E. Purine degradation

Which one of the following enzymes of nucleotide metabolism is correctly paired with its pharmacologic inhibitor?

- A. Dihydrofolate reductase-methotrexate
- B. Inosine monophosphate dehydrogenase-hydroxyurea
- C. Ribonucleotide reductase-5-fluorouracil
- D. Thymidylate synthase-allopurinol
- E. Xanthine oxidase-probenecid

A 1-year-old female patient is lethargic, weak, and anemic. Her height and weight are low for her age. Her urine contains an elevated level of orotic acid. Activity of uridine monophosphate synthase is low. Administration of which of the following is most likely to alleviate her symptoms?

- A. Adenine
- B. Guanine
- C. Hypoxanthine
- D. Thymidine
- E. Uridine

What laboratory test would help in distinguishing an orotic aciduria caused by ornithine transcarbamylase deficiency from that caused by uridine monophosphate synthase deficiency?

Blood ammonia level would be expected to be elevated in ornithine transcarbamylase deficiency but not in uridine monophosphate synthase deficiency.

- Which of the following is/are aspects of the overall regulation of de novo purine nucleotide synthesis?

- A AMP, GMP, and IMP shift PRPP amidotransferase from a small form to a large form.
B. PRPP amidotransferase shows hyperbolic kinetics with PRPP.
C. AMP inhibits the conversion of IMP to GMP.
D. Change in glutamine concentration is a major regulator.
E. Direct interconversion of AMP to GMP maintains balance of the two.

There are two distinct immunodeficiency diseases that lead to the formation of uric acid as the end product. Mutation in genes for adenosine deaminase (ADA) leads to severe combined immuno-deficiency (SCID) in which both T-cells and B-cells are affected. Defects

in purine nucleoside phosphorylase (PNP) affect only T-cells. These two enzymes are in the pathways for degradation of nucleic acids. Gene therapy has had some success in treating ADA deficiency.

- In nucleic acid degradation, all of the following are correct except:

- A. there are nucleases that are specific for either DNA or RNA.
B. nucleotidases convert nucleotides to nucleosides.
C. the conversion of a nucleoside to a free base is an example of a hydrolysis.
D. because of the presence of deaminases, hypoxanthine rather than adenine is formed.
E. both DNA and RNA degradation lead to uric acid.

- The best estimate of the turnover of DNA comes from a measurement in urine of

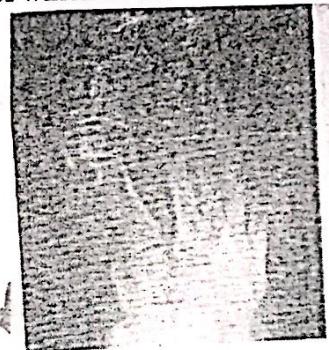
- A. uric acid.
B. NH_4^+ , and CO_2
C. β -alanine.
D. β -aminoisobutyrate.
E. cytidine

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- the regulation of the following enzyme maintains purine and pyrimidine balance in mammals?
- CPS II
 - Aspartate Transcarbamoylase (ATCase)
 - Dihydroorotate dehydrogenase
 - Glutamine- PRPP amidotransferase
- which of the following forms of folate is required for the synthesis of Cytosine nucleotide?
- N5,N10 Methylene THF
 - N10-formyl THF
 - N5-Methyl THF
 - N5,N10 Methenyl THF
 - None of the above
- the ultimate reducing agent required for Ribonucleotide reductase reaction is?
- 2 Cysteine SH groups
 - Thioredoxin
 - NADH
 - NADPH
 - FADN₂
- which of the following Pyrimidine nucleotide will not be formed in the presence of Methotrexate?
- Thymidylate
 - Uridylate
 - Cytidylate
 - OMP
 - All of the above
- How many different binding sites do Ribonucleotide reductase have?
- 1
 - 2
 - 3
 - 4

- Your 56-year-old male patient presents with intense redness, heat, and pain over his right great toe at the metatarsophalangeal joint. Fluid from this joint shows birefringent crystals. An X-ray of the foot is shown below. This disease is caused by the degradation of an excessive amount of which of the following?

- A. Adenine
- B. Thymine
- C. Uracil
- D. Cytosine
- E. Ribose-5-phosphate



- Your 60-year-old female patient has psoriasis and has been treated with methotrexate for several years. She has no other medical problems and her preventive screenings, including fecal occult blood tests and colonoscopy, have all been normal. She has developed an anemia. Which of the following would you expect to find when working up her anemia?

- A. A macrocytic anemia (due to folate deficiency)
- B. A microcytic anemia
- C. Thalassemia
- D. Spherocytes
- E. A low vitamin B₁₂ level

- A researcher wants to develop a method of labeling purines with ¹⁵N for use in future spectroscopic studies. Purine synthesis will be done in a test tube using only the enzymes necessary to synthesize purines via the de novo pathway. Which starting materials should be labeled with the heavy nitrogen in order to maximize ¹⁵N incorporation into purines?

- A. Aspartate, glycine, and glutamate
- B. Aspartate, glycine, and N5-formimino tetrahydro-folate
- C. Asparagine, glycine, and glutamine
- D. Asparagine, glutamate, and glutamine
- E. Aspartate, glycine, and glutamine

The conversion of nucleoside 5'-monophosphates to nucleoside 5'-triphosphates?

- A. is catalyzed by nucleoside kinases.
- B. is a direct equilibrium reaction.
- C. utilizes a relatively specific nucleotide kinase and a relatively nonspecific nucleoside diphosphate kinase.
- D. generally uses GTP as a phosphate donor.
- E. occurs only during the S phase of the cell cycle.

The synthesis of the coenzymes NAD, FAD, and coenzyme A have in common?

- A. the same vitamin.
- B. PRPP.
- C. AMP.
- D. ATP.
- E. a nucleotidase.

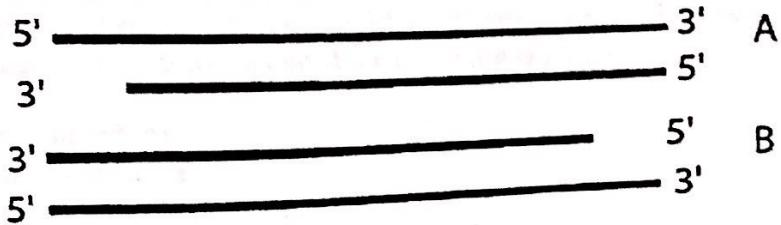
Next 2 Questions: Hereditary orotic aciduria is characterized by severe anemia, growth retardation, and high levels of orotic acid excretion. The defect may be in orotate phosphoribosyl transferase, orotidine decarboxylase, or both. The preferred treatment for this disease is dietary uridine, which reverses the anemia and decreases the formation of orotic acid.

Elements involved in the effectiveness of the dietary treatment include:

- A. conversion of exogenous uridine to UMP by uridine phospho-transferase.
- B. UTP from exogenous uridine providing substrate for synthesis of CTP.
- C. inhibition of carbamoyl phosphate synthetase II by UTP.
- D all of the above.
- E. none of the above.

In the de novo synthesis of pyrimidine nucleotides

- A. reactions take place exclusively in the cytosol.
- B a free base is formed as an intermediate.
- C. PRPP is required in the rate-limiting step.
- D. UMP and CMP are formed from a common intermediate.
- E. UMP inhibition of OMP-decarboxylase is the major control of the process



choose the correct answer in regard to the figure shown ?

- a. The ends of both chromosomes A and B are completed by telomerase.
- b. The ends of both chromosomes A and B are completed by 5' - 3' polymerase activity.
- c. The end of chromosome A is completed by telomerase while that of B by 5' - 3' polymerase.
- d. The end of chromosome B is completed by telomerase while that of A by 5' - 3' polymerase

The two purine nucleotides found in RNA?

- A. are formed in a branched pathway from a common intermediate.
- B. are formed in a sequential pathway.
- C. must come from exogenous sources.
- D. are formed by oxidation of the deoxy forms.
- E. are synthesized from nonpurine precursors by totally separate pathways.

The type of enzyme known as a phosphoribosyltransferase is involved in all of the following except?

- A. salvage of pyrimidine bases.
- B. the de novo synthesis of pyrimidine nucleotides.
- C. the de novo synthesis of purine nucleotides.
- D. salvage of purine bases.

Deoxyribonucleotides?

- A. cannot be synthesized so they must be supplied preformed in the diet.
- B. are synthesized de novo using PRPP
- C. are synthesized from ribonucleotides by an enzyme system involving thioredoxin.
- D. are synthesized from ribonucleotides by nucleotide kinases.
- E. can be formed only by salvaging free bases.

A patient has been recently diagnosed with colorectal cancer. The physician treats the patient with a combination of chemotherapeutic drugs, one of which is 5-fluorouracil (5-FU). 5-FU is effective as an anticancer drug because it inhibits which one of the following enzymes?

- A. Dihydrofolate reductase
- B. Thymidylate synthase
- C. Amidophosphoribosyl transferase
- D. 5'-phosphoribosyl 1-pyrophosphate (PRPP) synthetase
- E. UMP synthase

A 6-month-old infant is seen by the pediatrician for developmental delay. Blood work shows Megaloblastic anemia, although measurements of B12 and folate are in the high normal range. Urinalysis demonstrates, upon standing, the formation of a crystalline substance. Supplementation of the child's diet with uridine reversed virtually all of the clinical problems. The crystalline substance was most likely composed of which of the following?

- A. Uracil
- B. Thymine
- C. Orotate
- D. Aspartate
- E. Cytosine

Considering the patient in the previous question, after uridine treatment the crystals were no longer found in the urine. This is due to which of the following?

- A. Inhibition of the enzyme producing the crystalline molecule
- B. Bypassing the mutated step of the pathway
- C. Inhibition of aspartate transcarbamoylase
- D. Inhibition of nitrogen fixation by carbamoyl phosphate synthetase I
- E. Inhibition of carbamoyl phosphate synthetase II

Considering the patient in the last two problems, the observed megaloblastic anemia results from which of the following?

- A. Interference with folate metabolism
- B. Interference with B12 absorption
- C. Inhibition of ribonucleotide reductase
- D. Lack of thymidine for DNA synthesis
- E. Lack of adenine for DNA synthesis

Infinity

Your patient has sickle cell disease and is being treated with hydroxyurea. After 2 weeks on the drug, you find greatly reduced levels of most blood cell types, and the patient is removed from the drug to allow his blood cell counts to stabilize. One potential reason for this side effect of hydroxyurea treatment is its ability to alter the synthesis of which of the following metabolites?

- (A) N5-methyltetrahydrofolate
- (B) 5' phosphoribosyl 1' amine
- (C) PRPP
- (D) Adenosylcobalamin
- (E) DUMP

An 18-month-old infant has had a history of recurrent bacterial and viral infections. The child has failure to thrive, developmental delay, and tremors. Physical exam shows a lack of peripheral lymphoid tissue. Blood work shows lymphopenia, but normal levels of B-cells and circulating immunoglobulins. This child most likely has a defect in which of the following enzymes?

- (A) Hypoxanthine guanine phosphoribosyltransferase (HGPRT)
- (B) Adenine phosphoribosyltransferase (APRT)
- (C) Adenosine deaminase (ADA)
- (D) Adenosine kinase
- (E) Purine nucleoside phosphorylase

Individuals with gout are given allopurinol for long-term management of the disease. In such individuals, which of the following bases would accumulate in the urine?

- A. Urate and xanthine
- B. Guanine and adenine
- C. Hypoxanthine and guanine
- D. Xanthine and guanine
- E. Hypoxanthine and xanthine

A 1-year-old boy was brought to the pediatrician due to a developmental delay, biting of his lips and fingers, and the presence of orange crystals in his diapers. Enzymatic analysis shows loss of 99% of the activity of a particular enzyme. The defective enzyme in this disorder would normally utilize which of the following as a substrate?

- A. Adenine
- B. Guanine
- C. Adenosine
- D. Guanosine
- E. GMP

Considering the patient in the previous question, the orange sand in the diapers was composed of which of the following?

- A. Xanthine
- B. Hypoxanthine
- C. Guanine
- D. Adenine
- E. Urate

A 6-month-old boy was brought to the pediatrician due to frequent bacterial and viral infections. Blood work shows the complete absence of B and T cells. Radiographic analysis shows a greatly reduced thymic shadow. Treatment of the child with enzyme replacement therapy reverses the deficiencies. This enzyme has which of the following activities?

- A. Converts IMP to XMP
- B. Converts adenine to AMP
- C. Converts guanine to GMP
- D. Converts adenosine to inosine
- E. Converts guanosine to inosine

Concerning the patient in the previous questions, which metabolite will accumulate in the blood cells?

- A. dUTP
- B. dCTP
- C. dATP
- D. dGTP
- E. dTTP

Concerning the patient discussed in the last two questions, one possible reason for the lack of immune cells is inhibition of which of the following enzymes?

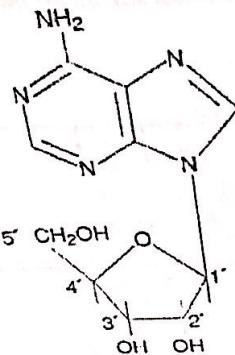
- A. ADA
- B. Purine nucleoside phosphorylase
- C. Hypoxanthine guanine phosphoribosyltransferase
- D. Adenine phosphoribosyltransferase
- E. Ribonucleotide reductase

A penicillin-allergic child was given a sulfonamide for otitis media. Human cells are resistant to sulfonamides due to which of the following?

- A. Sulfonamides are specific for prokaryotic DNA polymerases
- B. Sulfonamides are specific for prokaryotic RNA polymerases
- C. Sulfonamides inhibit a metabolic pathway not present in eukaryotic cells
- D. Sulfonamides inhibit bacterial ribonucleotide reductase, but not eukaryotic ribonucleotide reductase
- E. Sulfonamides inhibit prokaryotic mismatch repair, but not eukaryotic mismatch repair

What structure is this??

- A. Purine nucleotide
- B. Purine
- C. Pyrimidine nucleoside
- D. Purine nucleoside
- E. Deoxyadenosine



Which molecular feature listed causes duplex DNA to exhibit a near constant width along its long axis?

- A. A purine nitrogenous base always pairs with another purine nitrogenous base.
- B. A pyrimidine nitrogenous base always pairs with another pyrimidine nitrogenous base.
- C. A pyrimidine nitrogenous base always pairs with a purine nitrogenous base.
- D. Repulsion between phosphate groups keeps the strands a uniform distance apart
- E. Attraction between phosphate groups keeps the strands a uniform distance apart.

A single-stranded DNA molecule contains 20% A, 25% T, 30% G, and 25 % C. When the complement of this strand is synthesized, the T content of the resulting duplex will be which one of the following?

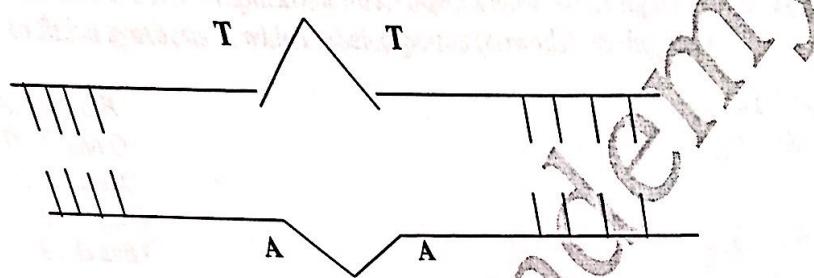
- A. 20 %
- B. 22.5%
- C. 25%
- D. 27.5 %
- E. 30%

السلسلة الأولى 20A	G 30	T 20
السلسلة المكملة 20T	C 30	A 20
Total T = 45		
45/200 = 22.5%		

The strain defective in DNA Pol I is expected to synthesize DNA

- a. Which is indistinguishable from that of the wild-type strain.
- b. only in the continuous manner characteristic of the leading strand.
- c. Which retains the RNA primers in the discontinuous (lagging) strand.
- d. only in the discontinuous manner characteristic of the lagging strand.
- e. with a higher intrinsic error frequency.

Which of the following repair systems can repair the lesion shown?



- a. mismatch repair.
- b. base excision repair.
- c. nucleotide excision repair.
- d. direct repair by photolyase
- e. uridine glycosidase.

Which one of the following double-stranded DNA molecules has the lowest melting** temperature (T_m)?

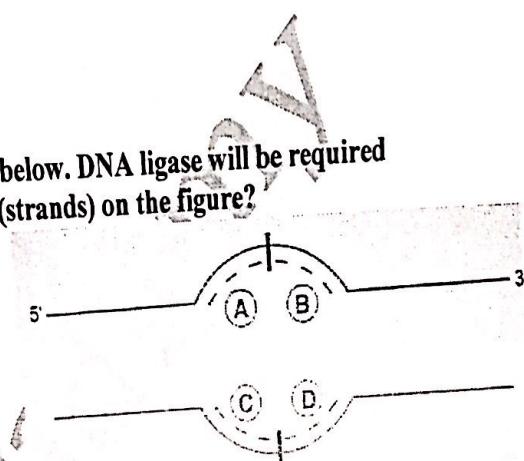
- a. GCGCGCGC
CGCGCGCG
- b. GCCATGGC
CGGTACCG
- c. GGAATTCC
CCTTAAGG
- d. GAAATTTC
CTTTAAAG
- e. ATATATAT
TATATATA

Analysis of a cell line that rapidly transforms into a tumor cell line demonstrated an increased mutation rate within the cell. Further analysis indicated that there was a mutation in the DNA polymerase enzyme that synthesizes the leading strand. This inactivating mutation is likely to be in which of the following activities of this DNA polymerase?

- A. 5'-3' exonuclease activity
- B. 3'-5' exonuclease activity
- C. Phosphodiester bond making capability
- D. Uracil-DNA glycosylase activity
- E. Ligase activity

Consider the DNA replication fork shown below. DNA ligase will be required to finish synthesis at which labeled points (strands) on the figure?

- A. A and B
- B. C and D
- C. A and C
- D. D and B
- E. B and C



The sequence of part of a DNA strand is the following:
ATTCGATTGCCAACGT- When this strand is used as a template for DNA synthesis, the product will be which one of the following?

- A. TAAGCTAACGGGTGCA
- B. UAAGCUAACGGGUGCA
- C. ACGUGGGCAAUCGAAU
- D. ACGTGGGCAATCGAAT
- E. TGCACCCGTTAGCTTA

The sequence of part of a DNA strand is the following: 5'-
ATTCGATTGCCAACGT-3'. When this strand is used as a template for DNA synthesis, the product will be which one of the following?

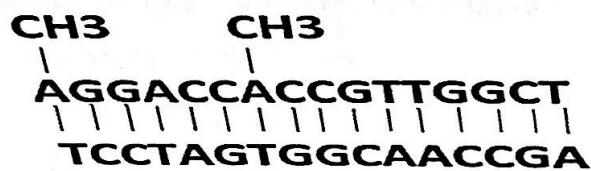
- A. 5'-TAAGCTAACGGGTGCA-3'
- B. 5'-UAAGCUAACGGGUGCA-3'
- C. 5'-ACGUGGGCAAUCGAAU-3'
- D. 5'-ACGTGGGCAATCGAAT-3'
- E. 5'-TGCACCCGTTAGCTTA-3'

Infinity

Place the following components of the chromosome in hierachal order starting with the smallest component and ending with the largest.

- 1- solenoid
 - 2- base pair
 - 3- nucleosome.
 - 4- nucleotide
 - 5- metaphase chromosome.
 - 6- Condensed scaffold form.
- a. $2 < 4 < 3 < 1 < 6 < 5$.
 - b. $4 < 2 < 3 < 1 < 6 < 5$.
 - c. $2 < 4 < 3 < 6 < 1 < 5$.
 - d. $4 < 2 < 3 < 1 < 5 < 6$.
 - e. $4 < 2 < 3 < 6 < 1 < 5$.

what is the mechanism of repair in this DNA lesion?



- a. Mismatch repair.
- b. Excision repair.
- c. recombination.
- d. glycosylation.

A strain of E.coli has a mutation eliminating the 3' to 5' exonuclease activity of DNA Pol III. This strain is expected to show?

- a. an increased mutation frequency.
- b. a decreased mutation frequency.
- c. an inability to join Okazaki fragments together.
- d. Continuous strand synthesis.
- e. an inability to remove RNA primer.

- A woman visits her physician due to fever and pain upon urination. Urinary analysis shows bacteria, leukocytes, and leukocyte esterase in the urine, and the physician places the woman on a quinolone antibiotic (ciprofloxacin). The bacterial enzyme inhibited by this drug is which of the following?
- DNA polymerase a
 - Topoisomerase II (gyrase)
 - Ligase
 - Primase
 - Helicase
- The isolation of nascent Okazaki fragments during DNA replication led to the surprising discovery of uracil in the fragment. The uracil is present due to which of the following?
- Deamination of cytosine
 - Chemical modification of thymine
 - An error in DNA polymerase
 - Failure of mismatch repair
 - The need for a primer
- For the following DNA sequence, determine the sequence and direction of the complementary strand. 5'- ATCGATCGATCGATCG - 3'
- 5' ATCTATCGATCGATCG-3'
 - 3'- ATCGATCGATCGATCG-5'
 - 5'- CGAUCGAUCAUCGAU-3'
 - 5'- CGATCGATCGATCGAT 3'
 - 3'- CGATCGATCGATCGAT-5'
- In DNA, the bond between the deoxyribose sugar and the phosphate is which of the following?
- A polar bond
 - An ionic bond
 - A hydrogen bond
 - A covalent bond
 - A van der Waals bond
- How many double-stranded DNA molecules 8 base pairs long are theoretically possible?

الـ DNA لغة من اربع احرف
A, G, C, and T
احتمالات السلسل الممكن تكوينها = طول السلسلة⁴

- A. 12
- B. (B) 32
- C. 64
- D. 256
- E. 65,536 (4^8)

The backbone of a DNA strand is composed of which of the following?

- A. Sugars and bases
- B. Phosphates and sugars
- C. Bases and phosphates
- D. Nucleotides and sugars
- E. Phosphates and nucleosides

Which of the following enzymes is required to actively enhance the separation of DNA strands during replication?

- A. Helicase
- B. 3' to 5' exonuclease
- C. DNA ligase
- D. Primase
- E. AP endonuclease

If a 1,000-kilobase fragment of DNA has 10 evenly spaced and symmetric replication origins and DNA polymerase moves at 1 kilobase per second, how many seconds will it take to produce two daughter molecules (ignore potential problems at the ends of this linear piece of DNA)?

- A. 20
- B. 30
- C. 40
- D. 50
- E. 100

Which of the following is the interconnecting bond that connects the nucleotides of RNA and DNA?

- A. N-glycosidic bonds
- B. 3'-5' phosphodiester linkages
- C. Phosphomonoesters
- D. -2' phosphodiester linkages
- E. Peptide nucleic acid bonds

- Which component of the DNA duplex causes the molecule to have a net negative charge at physiologic pH?
- A. Deoxyribose
 - B. Ribose
 - C. Phosphate groups
 - D. Chlorine ion
 - E. Adenine
- The model for DNA replication first proposed by Watson and Crick posited that every newly replicated double-stranded daughter duplex DNA molecule?
- A. Was composed of the two strands from the parent DNA molecule
 - B. Contained solely the two newly synthesized strands of DNA
 - C. Contained two strands that are random mixtures of new and old DNA within each strand
 - D. Was composed of one strand derived from the original parental duplex and one strand that was newly synthesized
 - E. Was composed of nucleotide sequences completely distinct from either parental DNA strand

- Which entry below correctly describes the approximate number of bp of DNA....., which is separated into.....chromosomes in A typical diploid human cell in a nonreplicating state?

- A. 64 billion, 23
- B. 6.4 trillion, 46
- C. 23 billion, 64
- D. 64 billion, 46
- E. 6.4 billion, 46

- What is the name of the unusual repeated stretch of DNA localized at the tips of all eukaryotic chromosomes?

- A. Kinetochore
- B. Telomere
- C. Centriole
- D. Chromomere
- E. Micromere

Given that DNA polymerases are unable to synthesize DNA without a primer, what molecule serves as the primer for these enzymes during DNA replication?

- A. Five carbon sugars
- B. Deoxyribose alone
- C. A short RNA molecule
- D. Proteins with free hydroxyl groups
- E. Phosphomonoester

Which of the following terms is used for the discontinuous DNA replication that occurs during replication is catalyzed via the production of small DNA segments?

- A. Okazaki fragments
- B. Toshihiro pieces
- C. Onishi oligonucleotides
- D. Crick strands
- E. Watson fragments

What molecule or force supplies the energy that drives the relief of mechanical strain by DNA gyrase? 23

- A. Pyrimidine to purine conversion
- B. Hydrolysis of GTP
- C. Hydrolysis of ATP
- D. Glycolysis
- E. A proton gradient molecule or force.

Telomeres are complexes of DNA and protein that protect the ends of linear chromosomes. In most normal human somatic cells, telomeres shorten with each division. In stem cells and in cancer cells, however, telomeric length is maintained. In the synthesis of telomeres?

- A. telomerase, a ribonucleoprotein, provides both the RNA and the protein needed for synthesis.
- B. the RNA of telomerase serves as a primer. (hint: no is serves as template)
- C. the RNA of telomerase is a ribozyme.
- D. the protein of telomerase is a DNA-directed DNA polymerase.
- E. the shorter $3 \rightarrow 5$ strand gets extended. (hint: the parental strand is extended)
- F. the direction of synthesis is $3 \rightarrow 5$

While studying the structure of a small gene that was sequenced during the Human Genome Project, an investigator notices that one strand of the DNA molecule contains 20 As, 25 Gs, 30 Cs, and 22 Ts. How many of each base is found in the complete double-stranded molecule?

- A. A= 40, G= 50, C= 60, T =44
- B. A= 44, G= 60, C= 50, T= 40
- C. A= 45, G =45, C = 52, T=52
- D. A= 50, G= 47, C = 50, T= 47
- E. A= 42, G= 55, C = 55, T= 42

List the order in which the following enzymes participate in prokaryotic replication?

- A. Ligase
- B. Polymerase I (3' \rightarrow exonuclease activity)
- C. Polymerase I (5' \rightarrow exonuclease activity)
- D. Polymerase I (5' \rightarrow polymerase activity)
- E. Polymerase III
- F. Primase

1- F, E, C, D, B, A

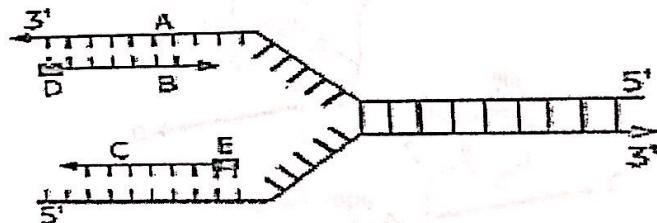
2- F, C, D, B, A, E

3- F, E, C, B, A, D

4- None of the above.

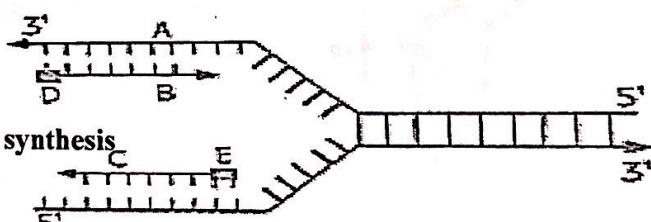
In this diagram of the process of DNA replication at a replication fork, the strand labeled B is the?

- A. template strand
- B. B- lagging strand
- C. leading strand
- D. Okazaki fragment
- E. RNA primer



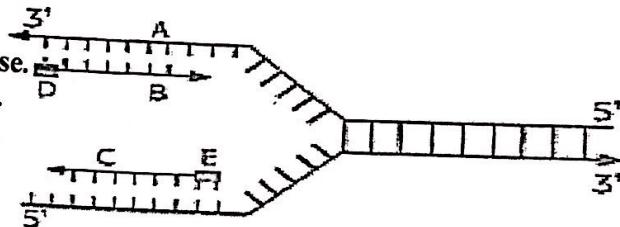
In this diagram of the process of DNA replication at a replication fork, DNA strand labeled A is:

- A. A newly synthesized RNA segment.
- B. An RNA primer.
- C. Provides the original sequence for DNA synthesis
- D. A leading strand.
- E. A lagging strand.



- In this diagram of the process of DNA replication at a replication fork, the black boxes labeled D and E are:

- A- Built by DNA dependent RNA polymerase.
- B- Built by DNA dependent DNA polymerase.
- C- Built by RNA dependent RNA polymerase.
- D- Built by RNA dependent DNA polymerase
- E- Newly synthesized DNA strand.



The following structure is the primary structure of DNA, based on this structure answer the following 4 questions:

- The end of DNA labelled A is:

- A. N-terminus
- B. C-terminus
- C. 5'end.
- D. 3'-end
- E. Cannot be determined.

- The base labelled B is:

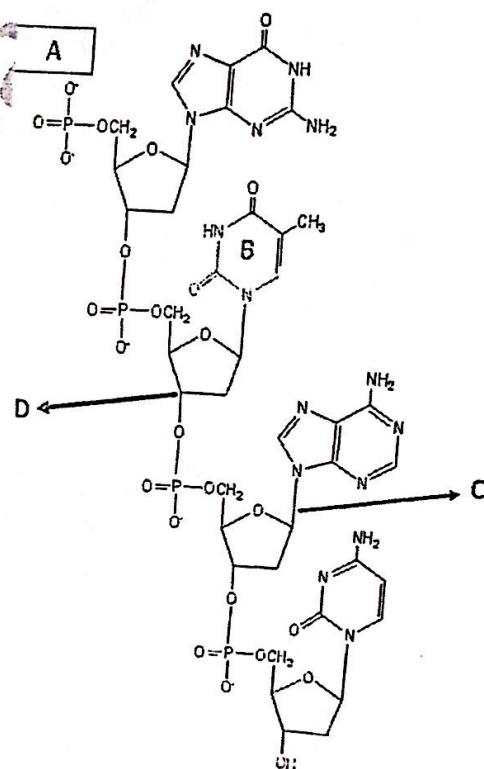
- A. Adenine.
- B. Thymidine.
- C. Guanine
- D. Thymine
- E. Thiamine

- The bond labelled C is:

- A. N1-C5' N-B-glycosidic bond.
- B. N1-C9' N-B-glycosidic bond.
- C. N9-C1' N-p-glycosidic bond.
- D. 3-5' phosphodiester bond.
- E. Hydrogen bond.

- The number of the atom labelled D is:

- A. 1'
- B. 3
- C. 3'
- D. 5
- E. 5'



33-if the RNA sequence of the telomerase of a given eukaryote is AUGCUU what is the parental strand sequence at the telomere area?

- A. UACGAA
- B. TACGAA
- C. AACGAT
- D. TACGUU
- E. Cannot be determined

☒ If the RNA sequence of the telomerase of a given eukaryote is 5'-AUGCUU-3'. What is the parental strand sequence at the telomere area?

- A 5'-UACGAA-3'
- B. 5'- STTACGAA -3'
- C. 5'- AACGAT- 3'
- D. 5'- AAGCAT-3'**
- E. Cannot be determined

True regarding regulation of the Ribonucleotide reductase?

- a. The correct order of substrate binding to the active site is UDP, CDP, ADP then GDP
- b. The correct order of regulators binds to the substrate specificity site is ATP, dTTP, then dGTP
- c. The correct order of regulators binds to the activity site is ATP, dTTP, then dGTP
- d. When dATP in the activity site and dGTP in the substrate specificity site the enzyme catalyze the reduction of ADP to dADP

The antibiotic rifampicin (derived from rifamycin) which is used to treat TB among other things, what is the mechanism of reaction?

- a-inhibits the beta subunit of DNA polymerase
- b-inhibit RNA polymerase
- c- inhibits beta subunit of RNA polymerase
- d- inhibits topoisomerase
- e- inhibits telomerase

youngest cell of the following according to telomere length is:

- a. 10 kbp
- b. 5 kbp
- c. 2 kbp
- d. 7Kbp

the DNA pol-1 activity that can excise mismatched nucleotides :

- a- $5' \rightarrow 3'$ exonuclease
- b- $3' \rightarrow 5'$ exonuclease
- c- $5' \rightarrow 3'$ polymerizing activity
- d- $3' \rightarrow 5'$ polymerizing activity

Which of the following oligonucleotides forms the most stable duplex with the DNA fragment 5'GTTGACTGCA3' ?

- a. 5'CAACTGACGT 3'
- b. 5'TGCAGTCAAC 3'
- c. 5'CAACGGGCGT 3'
- d. 5'TGCAGGCAAC 3'
- e. 5'ACGTCAGTTG 3'

Most of the DNA in the eukaryotic nucleus is packaged in nucleosomes with

- a. histones
- b. ribonuclear proteins
- c. ribosomal proteins
- d. topoisomerases
- e. DNA a,b proteins

A double -stranded DNA fragment contains 0.2 mole-fraction of A (adenine) . The mole-fractions of other bases G (guanine), and T (thymine) are ?

- a. T=0.2, G=0.3, and C=0.3
- b. T=0.3, G=0.2, and C=0.3
- c. T=0.3, G=0.3, and C=0.2
- d. T=0.2, G=0.4, and C=0.2
- e. not possible to calculate with the information given.

DNA replication originates at the indicated origin of replication.
Which segment(s) serve as template(s) for leading strand synthesis?

