Fresh pineapple contains the enzyme "bromelain" that hydrolyzes peptide bonds in proteins. The cooking direction for gelatin (one type of protein) dessert/cake says not to add fresh pineapple. However, canned pineapple where pineapple is heated to high temperature can be added. Why?

- ○ All of these.
- ○ Bromelain present in excess amount in fresh pineapple that's why it will hydrolyze peptide bonds of gelatin and therefore can't be used to prepare dessert/cake.
- ◉ Bromelain present in canned pineapple gets denatured because of heat so it is no longer active and can be used to make gelatin dessert/cake. ✓
- ○ Fresh pineapple contains more acids that will denature gelatin as a result of that it can't be used to make gelatin dessert/cake.

- Antimicrobial peptides
- Antibody of a single specificity ✓
- The antigen it recognizes
- Antibody of multiple specificity

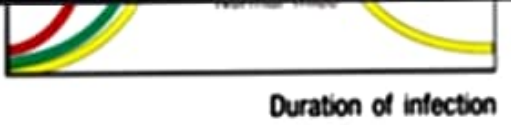
✓ **Correct** 1/1 Points

- Dendritic cells: connection between innate and adaptive immune system
- Helper T cell: kills pathogen-infected cells ✓
- Plasma cell: antibody secretion
- Effector B cell: plasma cell

✓ **Correct** 1/1 Points

- only express tissue-specific genes and don't express any housekeeping genes
- All of the above
- continuously divide to produce new muscle and nerve cells
- normally don't divide as they are differentiated cells ✓

✓ **Correct** 1/1 Points



Duration of infection

- Curves in red and green correspond to mouse that possess weak adaptive immune system and strong innate immune system, respectively.
- Curves in red and green correspond to mouse that lack adaptive immune component and innate immune component, respectively.
- Curves in red and green correspond to mouse that lack innate immune component and adaptive immune component, respectively. ✓
- Curves in red and green correspond to mouse that possess a strong adaptive immune response and a weak innate immune response, respectively.

✓ **Correct** 2/2 Points

20

In sexually reproducing organisms, which of the following two events, occurring in every generation of diploid organisms, ensure conservation of diploid nature?

- (i) Reductional Meiotic division during gamete formation; (ii) Mitotic division of gametes
- (i) Mitotic division of gametes; (ii) Fertilization of haploid gametes
- (i) Reductional Meiotic division during gamete formation; (ii) Fertilization of haploid gametes ✓
- (i) Fertilization of haploid gametes; (ii) chromosome number duplication in Zygote

✓ **Correct** 1/1 Points

18

The following question is given as part of an equation on the top right.

If the reaction A + B→ C is first order with respect to A and first order with respect to B, then the rate equation for the forward reaction would be?

- (●) Rate=k[A][B] ✓
- ( ) Rate=ka[A]+kb[B]
- ( ) Rate=k[A]
- ( ) Rate=k[B]

- ○ Reverse transcriptase
- ○ RNA polymerase
- ◉ Ribosome ✓
- ○ DNA polymerase

✓ **Correct** 1/1 Points

13

Sperms are produced by single meiotic division of diploid progenitor cells. How many of these diploid cells would be required to generate 4000 sperms?

15

When a single egg (ovum) is fertilized by multiple sperms, it is called Polyspermy. Polyspermy is very rare in human reproduction because of a very tight regulatory mechanism prevents it in the ovum. What will happen if an ovum is fertilized by two sperms?

A plaque assay was performed in triplicates (i.e. 3 sets of same dilution) to determine the titer of influenza virus. In the sets corresponding to 10^5 dilution, 25, 20 and 30 plaques were developed. Considering that 0.1 ml of virus inoculum was used for the plaque assay what should be final titer of the virus?

- 30 x 10^5 pfu/ml
- 2.5 x 10^7 pfu/ml ✓
- 25 x 10^5 pfu/ml
- 3.0 x 10^7 pfu/ml

✓ **Correct** 2/2 Points

10

How does HIV infection lead to "immune deficiency"?

- HIV infects B cells, hence directly affect antibody production.
- HIV infects innate immune cells like macrophage and dendritic cells, hence interferes with the innate immunity.

- Vasodilation
- Inactivation of macrophages ✓
- Increased vascular permeability
- Influx of white blood cells

✓ **Correct** 1/1 Points

4

Which of the following tests could be performed to detect the presence of viral nucleic acid in patient body fluid?

- Antibody test
- RT-PCR test ✓
- Plaque assay
- Antigen test

- Enzyme will not bind to substrate.
- Enzyme will catalyze product formation but they will remain bound to the enzyme.
- Reaction will not proceed beyond enzyme-substrate complex formation. ✓
- Enzyme catalyzed reaction will be faster than uncatalyzed reaction.

✓ **Correct** 1/1 Points

✓ **Correct** 2/2 Points

5

When [S] = 0.1 * KM, the velocity of an enzyme catalyzed reaction is approximately

- 0.5 * Vmax
- 0.3 * Vmax
- 0.9 * Vmax
- 0.1 * Vmax ✓

✓ **Correct** 1/1 Points

6

In an enzyme catalyzed reaction, if the transition state has lower free energy than that of the products, what will be the outcome of the reaction?

- ○ Specificity
- ◉ All of the above ✓
- ○ Distinction between self and foreign
- ○ Memory

✓ **Correct** 2/2 Points

9

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- HIV infects B cells, hence directly affect antibody production.
- HIV infects innate immune cells like macrophage and dendritic cells, hence interferes with the innate immunity.
- HIV infects CD4 T cells, hence impact the adaptive immune system. ✓
- HIV infects cytotoxic T cells, hence interferes with the final clearing of infected cells.

✓ **Correct** 1/1 Points

11

Methanol poisoning can be treated with ethanol which actually slows down the formation of formaldehyde. This is an example of

- Uncompetitive inhibition
- Allosteric regulation
- Non-competitive inhibition
- Competitive inhibition ✓

✓ **Correct** 1/1 Points

- 500
- 1000 ✓
- 2000
- 4000

✓ **Correct** 1/1 Points

14

In a virus growth curve, "eclipsed period" denotes the phase when

- virus proteins are synthesized
- virus genetic materials are replicated
- progeny virus particles are assembled
- all of the above ✓

✓ **Correct** 2/2 Points

zygote will be tetraploid (4n).

- (●) In the resulting zygote, each chromosome will be present in three copies. ✓
- ( ) The resulting zygote will develop into a normal human being.
- ( ) The zygote will develop into a monster.

✓ **Correct** 1/1 Points

16

In India, the incidence of cervical cancer caused by the infection of human papilloma virus (HPV) is very high. HPV can be considered as a/an

17

An enzyme enhances the rate of a reaction by 10^12 fold at 25 degree C. What is the energetic stabilization of the transition state by this enzyme? R = 8.314 J/mol*K

19

Carbonic anhydrase exhibits typical enzyme kinetics expected of similar enzymes. Which of the following is the quantity described by the value KM?

- The half maximum reaction rate with enzyme catalysis.
- The enzyme concentration necessary to achieve half maximum reaction rate.
- The time it takes to reach half maximum reaction rate under standard conditions.
- The substrate concentration necessary to achieve half maximum reaction rate. ✓

✓ **Correct** 2/2 Points

- immunological memory
- antigen presentation ✓
- generation of antibody
- immunological surveillance in innate pathway

✓ **Correct** 2/2 Points

22

Following curves represent the load of pathogen (in y axis) over time (y axis). The curve in yellow represents the result of a healthy mouse. Other two curves represent some kind of defects in the immune system of respective mouse. What could be the defect that delivers these results?

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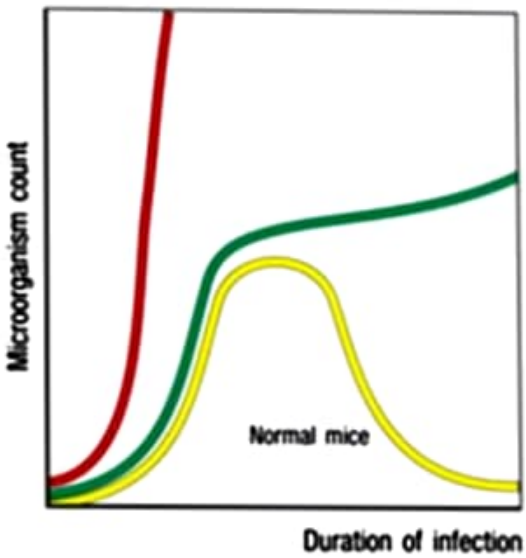


Curves in red and green correspond to mouse that possess weak adaptive immune system and strong innate immune system, respectively.

23

For an efficient enzyme, what relative values of KM and kcat are correct?

- ○ High KM and high kcat
- ◉ Low KM and high kcat ✓
- ○ High KM and low kcat
- ○ Low KM and low kcat

✓ **Correct** 1/1 Points

24

Which one of the following statements is false?

- ◉ Origin and maturation of T cells take place in thymus ✓
- ○ Origin of T cells take place in bone marrow but mature in thymus

- [x] Origin and maturation of T cells take place in thymus ✓
- [ ] Origin of T cells take place in bone marrow but mature in thymus
- [ ] Origin and maturation of B cells take place in bone marrow
- [ ] Blood cells are originated from hematopoietic stem cells present in bone marrow

✓ **Correct** 1/1 Points

25

Spermatogonial stem cells are present in human testes and produce only sperm cells. What type of stem cells are they?

- [ ] Multipotent stem cells
- [ ] Pluripotent stem cells

✓ **Correct** 1/1 Points

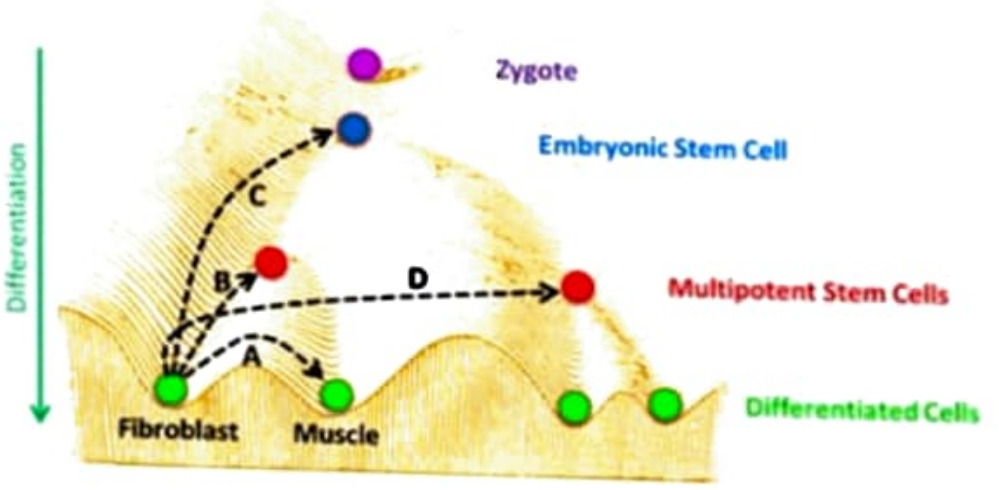
25

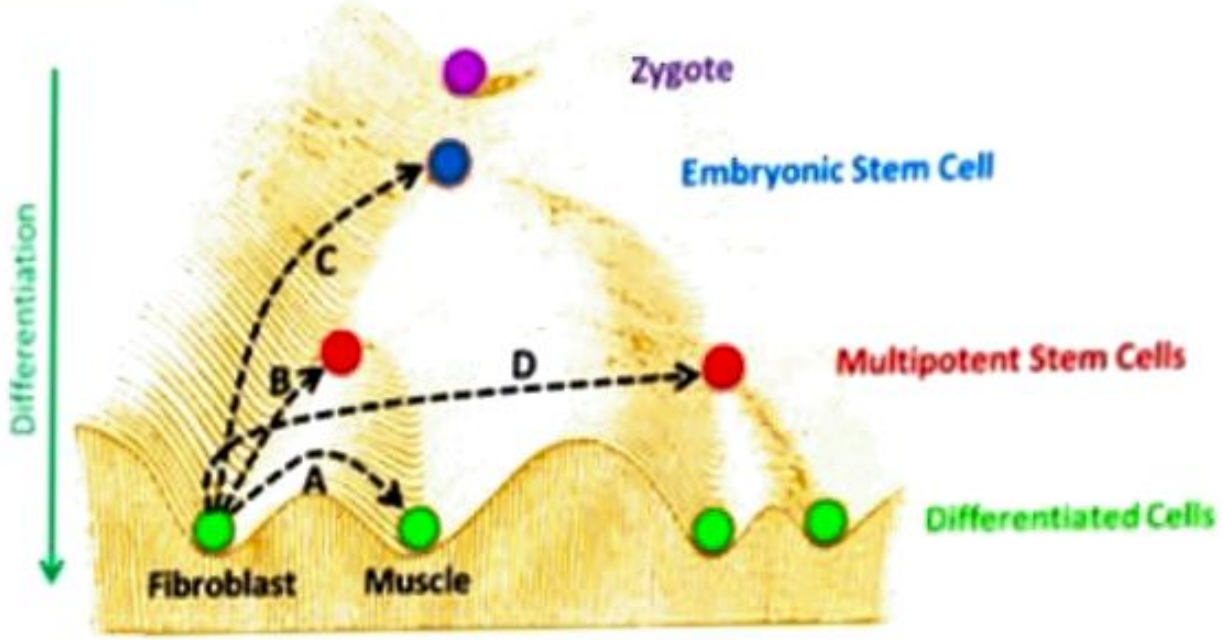
Spermatogonial stem cells are present in human testes and produce only sperm cells. What type of stem cells are they?

- Multipotent stem cells
- Pluripotent stem cells
- Unipotent stem cells ✓
- Differentiated cells

✗ **Incorrect** 0/2 Points

Multicellular organisms, like humans, develop from a single cell (zygote) by progressive restriction of developmental potential during the course of differentiation. The process can be summarized in a landscape model shown in the figure. Cells at different levels of differentiation are shown at different heights and in different colors. You have learned about stem cell technology where a differentiated cell can be used to generate completely different cell type by a pluripotent reprogramming. Which of the arrows in the figure depict the process of pluripotent reprogramming?





- C ✓
- D
- A
- B

✓ **Correct** 2/2 Points

29

Metastasis is one of the hallmark signatures of Cancer. What does it mean?

- Formation of blood vessels in tumor
- Evading (escaping) apoptosis
- Accelerated cell division
- Invasion and tumor formation at a new site ✓

✓ **Correct** 1/1 Points

✓ **Correct** 1/1 Points

31

Cancer cells share many features of stem cells, for example unlimited proliferation. Then why can't we use cancer cells, instead of stem cells, for biomedical applications?

- ○ Cell division is uncontrolled in cancer cells
- ◉ All the reasons are true ✓
- ○ DNA damage repair pathways don't work properly in cancer cells
- ○ Cancer cells have mutations

✓ **Correct** 1/1 Points

32

Which of the following best describes the general characteristic features of all stem cells?

32

Which of the following best describes the general characteristic features of all stem cells?

- Self-renewal; symmetric division; multipotency
- Self-renewal; asymmetric division; pluripotency ✓
- Self-renewal; differentiation; morphogenesis
- Pluripotency; multipotency; unipotency

✓ **Correct** 2/2 Points

33

Dr. Lucas wants to clone his pet dog Elli. He collected ovum from Elli and removed its nucleus. He took a differentiated cell from his friend's dog named Dory, carefully collected the nucleus from it and injected it into Elli's empty egg. When embryo started growing, he implanted it into Dory's uterus. To his surprize, the cloning

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- Elli could have been cloned only when her empty ovum was injected with her own differentiated cell nucleus.
- Elli's ovum was already fertilized.
- Dr Lucas should have implanted the developing embryo into Elli's uterus, not Dory's.
- Dr Lucas should have injected Elli's differentiated cell nucleus into Dory's empty egg. ✓

34

Convalescent plasma therapy uses blood from people who've recovered from an illness to help others recover. Blood plasma from people who have recovered from COVID19 has antibodies against viral proteins. When administered in a new patient, the antibodies will fight the virus. What type of immunity is this?

- ○ Innate immunity
- ○ Active immunity
- ○ Autoimmunity
- ◉ Passive immunity ✓

✕ **Incorrect** 0/1 Points

35

During development of multicellular organisms, cellular differentiation is mediated by transcriptional regulation of tissue specific genes. 'Regulatory DNA se-

35

During development of multicellular organisms, cellular differentiation is mediated by transcriptional regulation of tissue specific genes. 'Regulatory DNA sequences' play a major role in this process. Their function is equivalent to _____ of 'lac operon' in bacteria?

- (●) Repressor
- ( ) Inducer
- ( ) Operator ✓
- ( ) Promoter

✓ **Correct** 2/2 Points

36

An undergraduate student is doing an internship in School of Bioscience. She has designed an inhibitor by mimicking the substrate structure of the enzyme. In order to test if the design is successful she performed Michaelis-Menten kinetics and found the following.

For uninhibited reaction: Vmax = 5

36

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For uninhibited reaction: Vmax = 5 mM/sec; Km = 1 mM

For inhibited reaction: Vmax = 2 mM/sec; Km = 0.4 mM

What kind of inhibitor has she designed?

37

Fresh pineapple contains the enzyme "bromelain" that hydrolyzes peptide bonds in proteins. The cooking direction for gelatin (one type of protein) dessert/cake says not to add fresh pineapple. However, canned pineapple where pineapple is heated to high temperature can be added. Why?

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