

Take Home Exam 2 Answers.

Question 1

Assuming equal frequency of the different building blocks, two random protein sequences are on average _____ and nucleotide sequences are on average _____?

- A. 25% identical and 5% identical.
- B. 5% identical and 25% identical.**
- C. 25% identical and 40% identical.
- D. 95% identical and 75% identical.
- E. None of the above.

Question 2

How might mutual aid be selected for?

- A. Trick question: it cannot be selected for, because even if a stingy species is going extinct, it cannot decide to stop being stingy.
- B. When cooperation results in more offspring for both, the entire community thrives and spreads.
- C. When cooperation is between close relatives, like siblings, helping each other survive leads to some of your own genes being passed on.
- D. When one bird helps defend another bird's nest, that second bird will remember and return the favor when the first bird is under attack.
- E. B-D.**

Question 3

Match the terms on the left with the definitions on the right

1. The process of making a protein from an RNA template

C. Translation

2. A molecular parasite that splices itself out at the RNA level

I. Intron

3. A molecular parasite that splices itself out at the DNA level

F. Does Not Exist

4. The process of making RNA from DNA

A. Transcription

5. RNA that binds an A.A. & matches it with mRNA triplet

E. tRNA

6. A molecular parasite that splices itself out at the protein level

B. intein

7. An RNA copy of a gene, used in the process of making proteins

D. mRNA

8. Part of a host gene's transcript left after RNA parasite is spliced out

J. exon

9. The host protein, which is spliced back together

H. extein

10. RNA that makes up the ribosome and catalyzes protein synthesis

G. rRNA

11. Process of creating a new DNA molecule, from DNA strand

K. replication

Question 4

Sequences that do not show significant similarity-

A. are not homologous

B. might never-the-less be homologous

C. are homologous

Question 5

The universe and the earth are approximately how old, respectively?

A. 20 billion years old and 500 million years old

B. 14 billion years old and 4.5 billion years old

C. 16 billion years old and 6 billion years old

D. 2 billion years old and 450 million years old

E. 1 million years old and 4500 thousand years old

Question 6

True/False Life could have inhabited the Earth prior to 3.5 billion years ago and LUCA sometime before 3.5 billion years ago.

True

False

Question 7

True/False- Social Darwinism is correct in that charity has stopped evolution in our species.

True

False

Question 8

True/False- The Modern Synthesis does not give any weight to the effects of mutations themselves.

True

False

Question 9

True/False- The finding that the ribosomal protein alone is responsible for the catalysis of translation is an argument against the RNA world hypothesis.

True

False

Question 10

True/False- When inteins first begin to decay they lose the DNA-binding domain first, while the protein-binding domain must stay functional or it will destroy the function of the host proteins.

True

False

Question 11

Two random nucleotide sequences with equal frequencies of A, G, T, and Cs without alignment have an average percent identity of 25%. How would the average percent identity change, if the frequencies for the nucleotides are not equal. Use composition with 20%G 20%C and 30%A,30%T as an example

$$\text{Pmatch} = P(\text{A in strand 1}) * P(\text{A in strand 2}) + P(\text{T in strand 1}) * P(\text{T in strand 2}) + P(\text{C in strand 1}) * P(\text{C in strand 2}) + P(\text{G in strand 1}) * P(\text{G in strand 2}) = 2 * 0.3^2 + 2 * 0.2^2 = 0.18 + 0.08 = 0.26$$

Question 12

Which of the following features of life is inescapable and will surely be found in all alien life discovered?

- A. DNA
- B. RNA
- C. The central dogma (DNA → RNA → Proteins)
- D. Ester linked lipid bilayers
- E. Parasites**
- F. All of the above

Question 13

Who drew the first phylogenetic trees?

- A. Lamarck**
- B. Darwin
- C. Mayr
- D. Henning
- E. Peter Simon Pallas

Question 14

Why did Darwin consider the term "Coral of Life"?

A. Because an herbarium specimen of a red algae that was wrongly labeled as a coral looked very similar to a phylogenetic tree.

B. Because he recognized that fusion of lineages is an important process in evolution of species, and fan corals often have strands that fuse, in contrast, tree branches only branch and never fuse.

C. Because a tree has living cells in the root, stem and leaves, whereas a phylogenetic tree has living representatives only at the tips.

Question 15

Inteins often are composed of which of the following domains?

A self-splicing domain

A domain that binds the NAG-trimer

An ATP binding domain that uses the Rossmann fold

An ATP binding domain that uses the GRASP nucleotide binding domain

A homing endonuclease domain

Question 16

What were/was the name of the scientist(s) that first used ribosomal RNAs to study the relationship between organisms and discovered the the third domain (aka Ur-kingdom) of life?

Carl Woese and George Fox

Question 17

What were the names of the scientists who first proposed the Gaia hypothesis?

Lovelock and Margulis

Question 18

The Jukes Cantor model describes the evolution of sequences. Which of the following are unrealistic assumptions that the this model makes

All sites have an equal probability to undergo a substitution event.

All possible transitions and transversions (in case of DNA) occur with the same frequency.

Sequences divergence is not limited by saturation.

The frequency of the different nucleotides is the same

Question 19

0 out of 1 points

True/False Among Site Rate Variation (ASRV) means that some sites will undergo multiple substitutions while other sites do not undergo any substitutions. Due to ASRV, protein and nucleotide sequences take longer to become saturated with substitutions than without ASRV.

True

False

Question 20

What does the Gaia hypothesis say?

A. Earth's plants control the planet's temperature by selection for flower color

B. All life on Earth descended from ONE common ancestor

C. The unit of life is the entire Earth and the entire biosphere is alive, because no single species can exist in complete isolation. The ecosystems on the Earth are protected by negative feedback loops that help maintain homeostasis.

D. Mars cooled faster than the Earth and therefore was a more habitable place for life earlier. Life arose first on Mars and traveled to Earth on meteorites

E. Large glaciers and ice ages result from a runaway cold-house, where the Earth gets colder because glaciers reflect more light from the surface

F. Zircon crystals in 3.8 billion year old rocks were produced by ancient life over 4 billion years ago. The zircon crystals are formed by running water and the bias in carbon isotope ratios indicates the presents of life.