

What is the Black queen hypothesis?

- A. Selection for streamlined genomes will result in all members of a community producing only a subset of the required leaky goods.
- B. Parasites are the first thing to evolve, after life springs up *de novo*.
- C. Life is like an arms race, where all life forms have to run faster and faster just to stay in place.
- D. DNA based organisms took over from the RNA world, after DNA was created by a virus in an act of genome warfare.
- E. None of the above.

Two BLASTp hits have E-values of 0.0 and $1e-67$. Which of these statements is true?

- A) $1e-67$ is a very large negative number, giving a highly significant match
- B) E-values of 0 aren't possible
- C) $1e-67$ is a very small positive number, indicating a significant match
- D) an unexpected intein probably corrupted the PSSM, and it zeroed out
- E) these proteins almost certainly are ATPase subunits from an extinct Archaeon
- F) you forgot to format the database first (makeblastdb), a common mistake
- G) the only way to tell if these hits are significant is to look at the percent identity of the high-scoring segment pairs (HSPs)
- H) $1e-67$ looks like an isoelectric point, meaning that the query sequence is likely from an extremophilic organism living in deep-sea hydrothermal vents
- I) these values should be interpreted as 0% and 67% homology, respectively, indicating that horizontal transfer occurred recently

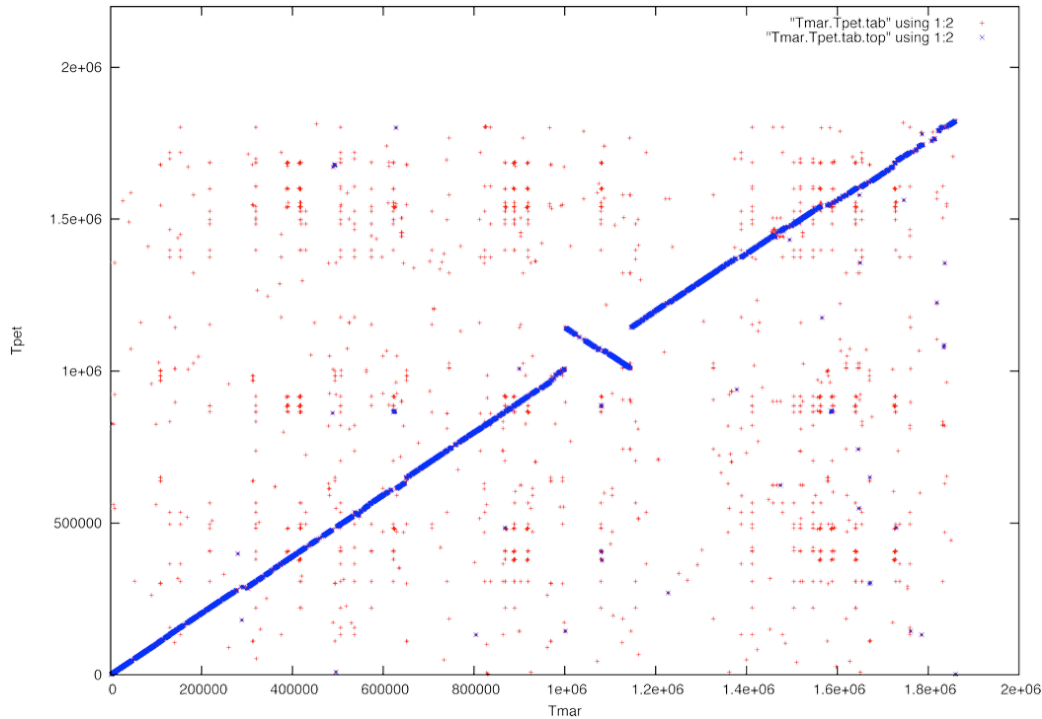
What is it called when one strand of DNA has more Guanine than the other strand?

- A. This is not possible, because G must equal C
- B. Compositional heterogeneity
- C. Strand bias
- D. Among Site Rate Variation
- E. HGT

Which of the following IS an example how a new gene can be created?

- a) Through mutations in non-coding DNA
- b) Left over DNA of viruses or other genetic parasite being repurposed
- c) Genome rearrangement shuffling exons and bringing together existing domains into a new combination
- d) Gene duplication followed by neofunctionalization
- e) All of the above

Refer to the following gene plot. The axes give the genes locations in the *Thermotoga maritima* and *Thermotoga petrophila* genomes, respectively. R: all significant blast hits, blue top scoring blast hits only.



What mechanism is this graph depicting when blue dots appear on the downward sloping diagonal?

- A. Recombination between two points in the genome leading to an inversion
- B. Deletion or Insertion
- C. Translocation
- D. Paralogs
- E. All of the above

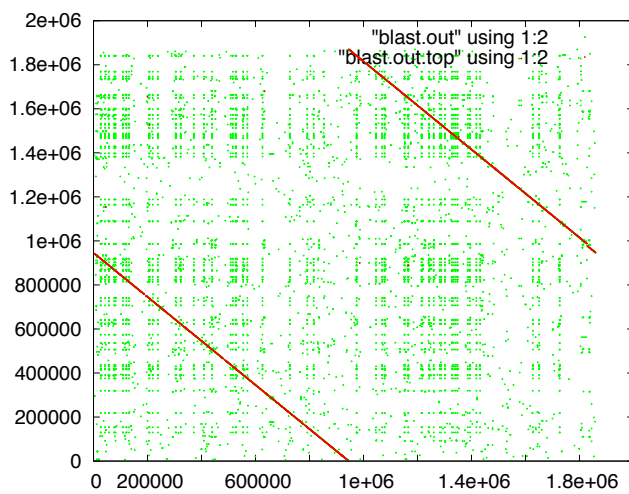
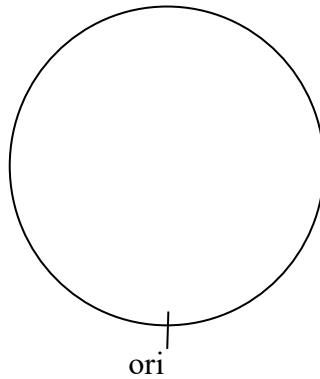
After plotting the blast hits from the two genomes, what does the blue line represent?

- A. The location of all genes in one genome versus the location of the top scoring blast hit in the other genome
- B. The location of all genes in one genome versus the location of ALL the blast hits in the other genome
- C. The location of the gene in the environment
- D. A and B
- E. None of the above

What do the red dots represent?

- A. False positives
- B. False negatives
- C. Partial matches
- D. Paralogs in the genome
- E. Orthologs in the genome

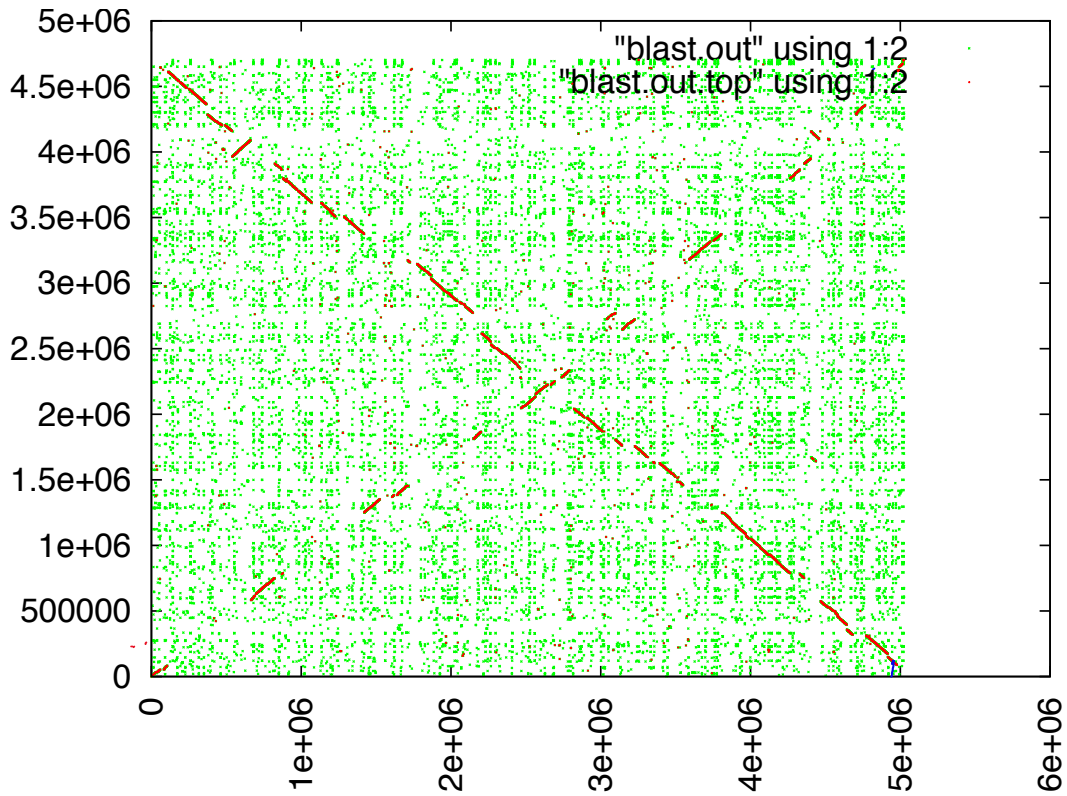
Map the genome rearrangement shown onto the circular genome below:



What might have happened in the genome plot given above?

- A. One massive genome inversion, involving half of the genome
- B. One round of whole genome duplication, so that every gene is present in one of the two genomes twice and only once in the other
- C. Two identical genomes were used, but the origin of replication was miscalled in one.
- D. There is a strong strand bias.
- E. The forward strand of one genome was sequenced, while the reverse strand of the other was sequenced

How many genome rearrangement events are needed to produce the following graph?



a

- A. 1 B. 2 C. 3 D. 4 E. 5 F. 6 or more

Draw Venn diagrams for the logical operators AND, NOT, OR