# Designer Genes 2019 - 2020 SSSS Test's AK

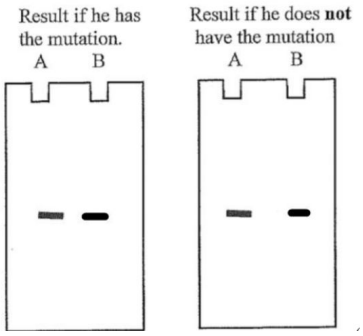
1) M phase
2) 46
3) II and III
4) a process in which allele frequencies within a population change by chance alone as a result of sampling error from generation to generation.
5) a) variation tends to occur at common sites
   b) A haplotype is a group of genes within an organism that was inherited together from a single parent. SNPs that are close together tend to be inherited together, there called haplotypes.
   c) The difference between individuals contains the genetic variants that may play a role in how people differ in their risk of disease or response to drugs.
6) Mitochondria and Y chromosomes are inherited clonally, without recombination, from one generation to the next. Mitochondria are inherited through the maternal lineage, Y chromosomes through the paternal lineage. Recombination scrambles up polymorphisms between chromosomes. Mitochondria evolve quickly enough to date divergences within a species
7) Polymorphisms are a population possesses more than one allele at a locus. Examples include peppered moths, human blood groups, and two-spotted ladybugs.
8) A mutation is defined as any change in a DNA sequence away from normal. This implies there is a normal allele that is prevalent in the population and that the mutation changes this to a rare and abnormal variant. In contrast, a polymorphism is a DNA sequence variation that is common in the population.
9) a) Figs, No spikes
   b) 16, 16, 0, 0
10) a) meiosis I b) meiosis II c) mitosis
11) a)

| Sequence | Type of mutation<br>Choose from insertion, deletion, substitution. | Effect on protein<br>Choose from missense, nonsense, frameshift, silent. |
|---|---|---|
| A | Insertion | Silent |
| B | Insertion | Frameshift |
| C | Substitution | Nonsense |
| D | Substitution | Missense D→E |
| E | Substitution | Silent |
| F | Substitution | Missense D→H |

12) 35, 35, 15
13) States that DNA from any cell of all organisms should have a 1:1 ratio (base Pair **Rule**) of pyrimidine and purine bases and, more specifically, that the amount of guanine should be equal to cytosine and the amount of adenine is equal to thymine. This pattern is found in both strands of the DNA.
14) NO ANSWER KEY
15) NO ANSWER KEY
16) DNA

# Designer Genes 2019 - 2020 SSSS Test's AK

17) mutant that cannot grow on minimal medium, requires certain supplement(s).
18) Translocation, 14, 46, down
19) Mosaicism, 46, 47, 1%
20) Cytosine
21) ¾ of the progeny would be tall
22) the four nucleotides (dATP, dGTP, dCTP, dTTP) and a heat stable DNA polymerase is needed (and salts and buffer to keep the pH stable)
23) Make copies of DNA
24) Thermal cyclers can control the temperature of the samples that are put into the machine, and can be programmed to go to different temperatures and "hold" them for different times, then repeat the cycle.
25) Kary B. Mullis
26) a) 31% b) 66%
27) p = 0.9 and q = 0.1
28) 49%
29) Rh+ allele frequency = 0.55 and rh allele frequency = 0.45
30) Condensation, heterochromatin

31) a. Pro → arg substitution at codon 250
b. C → G in the middle of the codon
c. 

d. It isn't; a substitution wouldn't noticeably change fragment length. Next,do some sort of sequencing on his gene
e. Yes , fibroblast growth receptors shouldn't be expressed in all tissues indiscriminately
32) Primary-chain of amino acids (polypeptide) Secondary-alpha helices and beta-pleated sheets,Tertiary-folded protein, Quaternary- combination of multiple folded polypeptide chains
33) Chirality
34) A
35) C
36) B, C, D
37) Anaphase
38) Normal mitosis, failure in entering next G1 phase
39) acetyl CoA
40) 2y

# Designer Genes 2019 - 2020 SSSS Test's AK

41) 16, 24
42) 8
43) Alignment of tetrads at the equator
44) ¾
45) 4
46) a) Epistasis b) 1 only sharp pinned progeny c) 9 sharp-spined : 3 dull-spined : 4 spineless
47) One gene influences two or more seemingly unrelated phenotypic traits.
48) a) polygenic inheritance b) pleiotropy c) epastis, the Takis gene masks or interferes with the expression of another d)Albinism, red hair
49) ¼
50) Crossing over and independent assortment
51) a) pericentric inversion
    b) nonreciprocal translocation
    c) tandem duplication
    d) terminal deletion
    e) reciprocal translocation
    f) reverse tandem duplication
    g) paracentric inversion
    h) robertsonian translocation
    i) terminal tandem duplication
52) Acrocentric, 13, 14, 15, 21, 22, down/patau syndrome
53) Transitions: Change from a purine to a purine or a pyrimidine to a pyrimidine. Examples: A to G; G to A; C to T; T to C Transversions: Change from a purine for a pyrimidine or vice versa. Examples: A to C or T; G to C or T; C to A or G; T to A or G.
54) Missense mutation: b, e, f, k
    Silent mutation: a, h
    Frameshift mutation: c, g
    Nonsense mutation: i, j
    Synonymous mutation: a, h
    Suppressor mutation: d
55) Discrete trait: Traits with two or more distinct phenotypes (ex. pea shape)
    Continuous trait: Traits with a range of variation (ex. height)
56) Mechanisms which allow for equal gene expression in males and females
57) a.) telocentric
    b.) acrocentric
    c.) submetacentric
    d.) metacentric
    e.) centromere
    f.) p arm
    g.) Q arm
58) Metacentric, submetacentric, acrocentric
59) N terminus

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60) C terminus

61) N - C terminus

62)

| | | |
|---|---|---|
| i) | yes | yes |
| ii) | no | yes |
| iii) | no | no |
| iv) | no | yes |

63) RNA. There are two OH groups on the sugar. DNA has one OH group on the sugar.

64) Prokaryotes only contain three different promoter elements: -10, -35 promoters, and upstream elements. Eukaryotes contain many different promoter elements: TATA box, initiator elements, downstream core promoter element, CAAT box, and the GC box to name a few.

Eukaryotes have three types of RNA polymerases I, II, and III, and prokaryotes only have one type.

Eukaryotes form and initiation complex with the various transcription factors that dissociate after initiation is completed. There is no such structure seen in prokaryotes.

Transcription and translation occurs simultaneously in prokaryotes and in eukaryotes the RNA is first transcribed in the nucleus and then translated in the cytoplasm.

RNAs from eukaryotes undergo post-transcriptional modifications including: capping, polyadenylation, and splicing. These events do not occur in prokaryotes.

mRNAs in prokaryotes tend to contain many different genes on a single mRNA meaning they are polycistronic. Eukaryotes contain mRNAs that are monocistronic.

Termination in prokaryotes is done by either rho-dependent or rho-independent mechanisms. In eukaryotes transcription is terminated by two elements: a poly(A) signal and a downstream terminator sequence

65) mRNA in eukaryotes are coded by an 80s ribosomes while mRNA in prokaryotes are coded by the 70s ribosome.

mRNA usually codes for one protein (monocistronic) in Eukaryotes however in prokaryotes, mRNA can code for several proteins (polycistronic).

Eukaryotes have 9 initiation factors, Prokaryotes have 3 initiation factors.

Translation occurs with transcription in prokaryotes while in eukaryotes the process is discontinuous.

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In prokaryotes a single release factor is used: eRF1 however in eukaryotes two released factors are used: RF1 and RF2.

66) In eukaryotes there are multiple origins of replication, however in prokaryotes there is only one origin of replication.

DNA gyrase is required in prokaryotic DNA replication however in eukaryotes DNA gyrase is not required.

DNA replication is continuous in prokaryotes but in eukaryotes it occurs in the S phase.

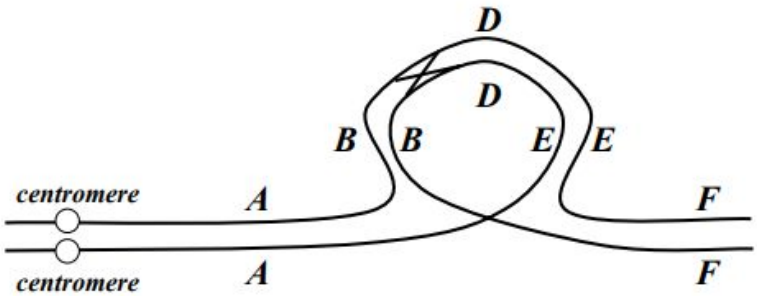
DNA replication takes place in the cytoplasm of prokaryotes however in eukaryotes it takes place in the nucleus.

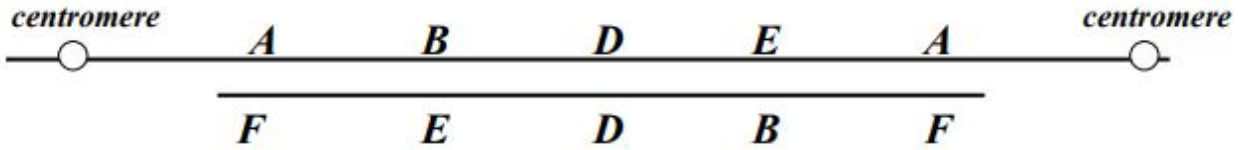
67) a)AbD and aBd b) A - D - B, The rarest classes (aBD and Abd) represent double crossovers. The allele that is different from the parental types is in the middle.
c) $R_{ab}$ = 350/1000 = 35%
$R_{ad}$ = 100/1000 = 10%
$R_{bd}$ = 250/1000 = 25%
d) Answer: 0.5% because double recombinants are: Abd (2) ABD (3)
Frequency = (2+3)/1000 = 5/1000 = 0.5%
e) Answer: 2.5%
$R_{ad} \times R_{bd}$ = 10% x 25% = 2.5%

68) a)
b)

The order of genes along one homolog is
centromere – A – B – D – E – F

c)




d) No; decentric will be pulled to opposite sites during anaphase, resulting in chromosome breakage; acentric cannot attach to spindle OR may be lost

69) a) A r = 1/2 of recombinant progeny = 1/2 (30%) = 15%
b)The probability of obtaining a parental chromosome (non-recombinant) in this region is the product of the probability of no recombination between A & R (70%) and the probability of no recombination between R & B (90%). This would mean that (70%)(90%) = 63% should be "parental" and 1/2 (63%) = 31.5% would be expected for a single parental class.

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70) Late prophase or metaphase
71) 17%
72) 6%. Wild type (heterozygous for normal wings and red eyes) × recessive homozygote with vestigial wings and purple eyes
73) D—A—B—C
74) a)

Avery, McCarty, and MacLeod: (1944) DNA is the substance that causes bacterial transformation. Chemicals from heat-killed S cells were purified. The chemicals were tested for the ability to transform live R cells. The transforming agent was found to be DNA.

Griffith: (1928) first experiment suggesting that bacteria are able to transfer genetic information via transformation.

Hershey and Chase: (1952) DNA is a genetic material. Phage with labeled proteins or DNA was allowed to infect bacteria. It was shown that the DNA, but not the protein, entered the bacterial cells, and was therefore concluded to be the genetic material

Meselson and Stahl: Proved that DNA replication is semiconservative. Grew bacteria in a medium containing ″heavy″ nitrogen (15N) and then transferred them to a medium containing 14N.

Watson and Crick: (1953) Discovered the double helix of DNA. They used X - ray diffraction to study DNA at King's College in London

Erwin Chargaff: (1950) In DNA from any species, the amount of adenine equals the amount of thymine, and the amount of guanine equals the amount of cytosine.

b) Griffith, Avery, McCarty, and MacLeod, Erwin Chargaff, Hershey and Chase, Watson and Crick, Meselson and Stahl

75) DNA has phospur while protein does not
76) adding numerous short DNA sequences such as TTAGGG, which form a hairpin turn
77) A telomere is a region of repetitive nucleotide sequences at each end of a chromosome, which protects the end of the chromosome from deterioration or from fusion with neighboring chromosomes.
78)

a.) naked DNA
b.) nucleosome
c.) chomatsomes
d.) solenoid
e.) 30 nm fibre
f.) chromatin
g.) chromosome

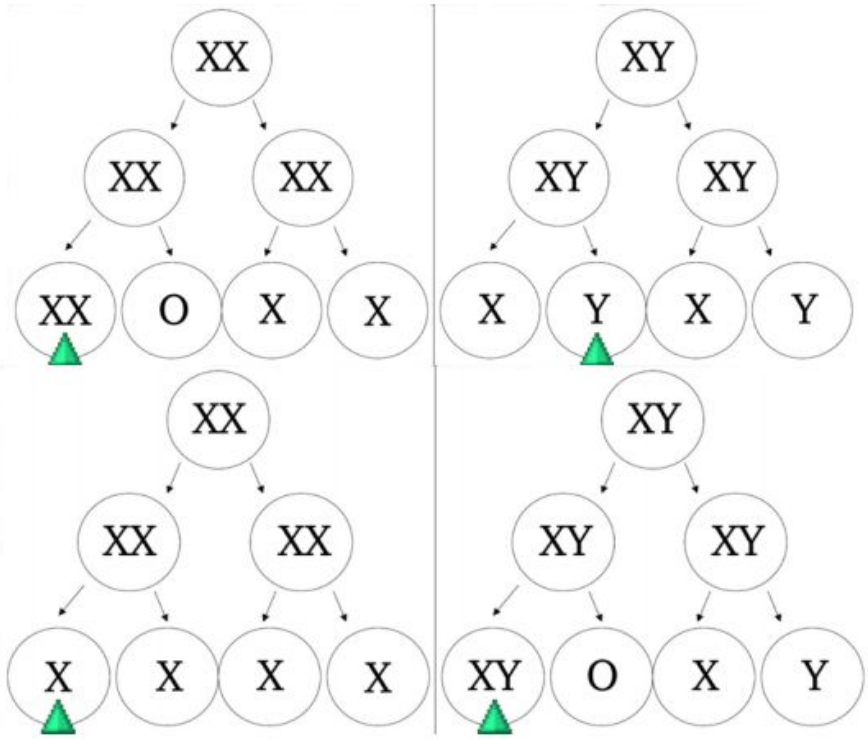
# Designer Genes 2019 - 2020 SSSS Test's AK

79) a)
   a. Metaphase plate
   b. Spindle fiber
   c. Centrosome
   d. Pole
   e. Spindle
   f. Kinetochore

   b) C

80)
   a) 1.58
   b) (1.58/2)*100 = 79%
   c) Reaction may not have occurred every time, or incorrect setup

81)




82) Mutation in control element/transcription factor/enhancer. A decrease in symptoms than in regular down syndrome.

83)
   a) Genetic drift is the change in allele frequency in a gene pool. Genetic drift is the change in allele frequency in a population. Gene flow is the process of alleles moving from one population to another.
   b) no mutation, random mating, no gene flow, infinite population size, and no selection

84) a) restriction enzyme recognition sites between the alleles
   b) C