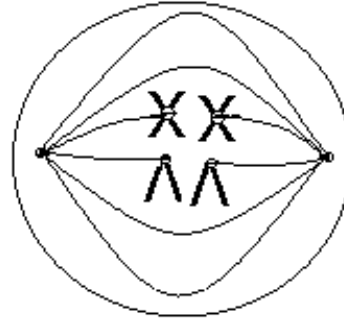


1. Crossing-over occurs in
 - a. metaphase II
 - b. anaphase I
 - c. prophase I
 - d. prophase II

2. Which statement about meiosis is NOT correct
 - a. during prophase I and prophase II chromosomes consist of two chromatids
 - b. homologous chromosomes pair during prophase I
 - c. DNA is replicated before meiosis II
 - d. the final product cells can have different alleles

3. Humans (*Homo sapiens*) have 46 chromosomes ($2N=46$) in most of the cells in their body. How many chromosomes do human gametes contain?
 - a. 21
 - b. 23
 - c. 46
 - d. 92



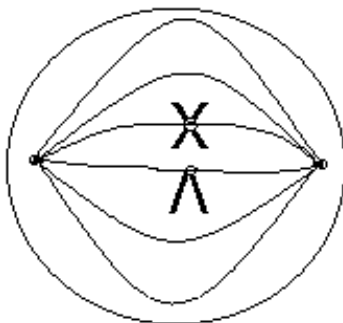
5. The diagram above shows a cell that is probably in
 - a. anaphase II of meiosis
 - b. anaphase I of meiosis
 - c. anaphase of mitosis
 - d. either anaphase I or II of meiosis

6. Which statement comparing sexual and asexual reproduction is NOT correct?
 - a. asexual organisms have greater potential for rapid population growth
 - b. sexual organisms may be able to evolve more rapidly in changing environments
 - c. sexual organisms may have greater resistance to disease
 - d. asexual organisms may have fewer recessive mutations

7. Tongue-rolling is the product of a dominant allele (T). If you can roll your tongue then your genotype is
 - a. TT
 - b. Tt
 - c. tt
 - d. Tt or TT

8. Albinism in hamsters is due to a recessive allele. If the mating of an albino and a nonalbino produces an albino offspring, what proportion of their future offspring is expected to be albino?
 - a. 0
 - b. 1/4
 - c. 1/2
 - d. 3/4
 - e. all

9. If a woman of blood type AB has a child of blood type AB then what blood type could be **ruled out** for the father?
 - a. O
 - b. A
 - c. B
 - d. AB



4. The diagram above shows a cell that is probably in
 - a. metaphase I
 - b. prophase I
 - c. metaphase II
 - d. anaphase I

10. Given what is known about the biochemical basis for albinism, a cross between two albinos always results in offspring that are
- 50% albinos
 - 100% albinos
 - 100% nonalbinos
 - unknown without knowing the parents' genotypes
11. Red-green colorblindness is a sex-linked recessive trait. If a man who is noncolorblind marries a noncolorblind woman whose father was colorblind, what proportion of their sons and daughters should be colorblind?
- all sons, 1/2 daughters
 - no sons, 1/2 daughters
 - 1/2 sons, no daughters
 - 1/2 sons, 1/2 daughters
12. For a single trait with two alleles, one dominant and one recessive, a cross between two heterozygotes will typically result in
- all offspring with the dominant phenotype
 - all offspring with the recessive phenotype
 - a phenotypic ratio of 3 recessive to 1 dominant
 - a phenotypic ratio of 3 dominant to 1 recessive
13. From the following cross $AaBb \times AaBb$, where A is dominant to a and B is dominant to b, what proportion of offspring are expected to be homozygous recessive for both traits?
- 1/4
 - 3/8
 - 1/16
 - 3/16
14. In pigeons, checkered plumage (C) is dominant to plain (c), and red feather color (R) is dominant to brown (r). These 2 genes assort independently. What proportion of the offspring from the cross
- $$CcRr \times CcRr$$
- should be checkered brown?
- 3/16
 - 1/16
 - 3/4
 - 9/16
15. In the Thibodaux mosquito, large wings (W) is dominant to small wings (w), flexible antennae (A) is dominant to rigid antennae (a), and red eyes (E) is dominant to white eyes (e). If the 3 genes (W/w, A/a, and E/e) are all on different chromosomes, what proportion of the offspring should have large wings, flexible antennae, and red eyes from the cross:
- $$WwaaEe \times WwAaEe ?$$
- 3/8
 - 3/32
 - 1/32
 - 9/32
16. In fruit flies (*Drosophila*), two different genes influence the appearance of wings. The allele for the presence of wings (w^+) is dominant to the absence of wings (w). The allele for colored wings (C) is dominant to the allele for colorless wings (C^+). Given the cross : $w^+wC^+C \times w^+wC^+C^+$, what phenotypes and what proportions are expected among the progeny?
- 3/8 colored wings, 3/8 colorless wings, 1/4 wingless
 - 9/16 colorless wings, 3/16 colored wings, 1/4 wingless
 - 9/16 colored wings, 3/16 colorless wings, 4/16 wingless
 - 3/8 wingless, 3/8 colorless wings, 1/4 colored wings
17. For a trait like skin color in humans, where uppercase alleles (A, B, C) increase melanin production and lowercase alleles (a, b, c) reduce melanin production, which genotype will produce the darkest skin color?
- AABbCcDdEe
 - AaBbCCDDEe
 - AABBCcdee
 - AaBbccDdEe
18. Which statement about allelic interactions is NOT correct?
- recessive alleles usually code for a protein that does not function normally
 - recessive alleles are always rarer than dominant alleles in a population
 - codominant alleles produce different functional proteins
 - two parents with a dominant phenotype can produce a child with a recessive phenotype

19. Which statement about inheritance is NOT correct?
- behavioral traits are often determined by a combination of genetic and environmental factors
 - although each individual can only bear 2 different alleles there can be more than 2 alleles for a gene
 - a trait like height may be influenced by many genes that each have a small effect
 - for sex-linked recessive traits, females exhibiting the trait are usually more common than males
20. If skin color was influenced by three genes (A, B, & C), each with two alleles (A/a, B/b, C/c), one allele that added to melanin production (A, B, C) and another that did nothing (a, b, c), how many different skin colors could be produced?
- 5
 - 7
 - 9
 - 11
 - can't be determined
21. Given the cross AaBb x aabb and the resulting progeny numbers:
- | | |
|---------|---------|
| AaBb-12 | aabb-14 |
| Aabb-89 | aaBb-85 |
- What is the recombination frequency between the two genes?
- 12%
 - 13%
 - 14%
 - 15%
22. Given the same cross as above, which expresses the linkage pattern of genes in the dihybrid (AaBb) parent?
- Ab/aB
 - AB/ab
 - Aa/Bb
 - aa/BB
23. Given three linked genes, gene A 4 units from G, G 12 units from Q, and Q 15 units from A, what is the order of the three genes on the chromosome?
- G-A-Q
 - A-G-Q
 - A-Q-G
 - G-Q-A
24. If a trait's heritability is 0.5, this means
- at least 50% of all members of a the population will show the trait
 - it has partial dominance
 - it has codominance
 - about 50% of the variation in the population is due to genetic differences
25. Which statement about DNA replication is NOT correct?
- it requires triphosphate nucleotides
 - in prokaryotic cells there is a single origin of replication
 - DNA polymerase adds new nucleotides in the 3' to 5' direction
 - DNA synthesis is semiconservative
26. What is the role of RNA polymerase in DNA replication?
- it synthesis mRNA
 - it forms peptide bonds
 - it synthesizes primers
 - it unites DNA fragments
27. Okazaki fragments
- are composed of 1/2 old and 1/2 new DNA
 - are composed of both RNA and DNA
 - are found on the leading strand
 - are found after a motorcycle accident
28. If you were to allow a culture of bacteria to replicate for many generations in a medium containing heavy nitrogen (^{15}N) and then transferred a sample of your culture to a medium containing light nitrogen (^{14}N) and allowed the cells to replicate their DNA exactly 2 times, what proportion of the DNA would you expect to contain only light nitrogen (eg. $^{14}\text{N}/^{14}\text{N}$)?
- 100%
 - 50%
 - 25%
 - 12.5%

29. If you allowed virus particles to infect cells which atoms or molecules would you NOT expect to be transferred from the virus particle to the cytoplasm of the cell?
- phosphorus
 - sugars
 - nitrogen
 - sulfur
30. In a sample of double stranded DNA 20% of the bases are G. From Chargaff's Rule you know
- 30% of all bases are T
 - 30% of all bases are C
 - 20% of all bases are A
 - 80% of all base pairs are A-T base pairs
31. To transcribe the mRNA sequence, AGCUAG, you must use which DNA strand as the sense (template) strand?
- TCGATC
 - AGCTAG
 - AGCATG
 - UCGAUC
32. The mRNA sequence, AUGUUCACCUGG, codes for which polypeptide?
- Met-Leu-Thr
 - Met-Phe-Arg-Cys
 - Met-Phe-Thr
 - Met-Phe-Thr-Trp
33. If you were told that a single polypeptide was 3 amino acids long and consisted of the following sequence of amino acids
- Met - Arg - Leu
- which mRNA sequence could serve as the mRNA for this polypeptide?
- AUGAGACUGUAA
 - AUGAGCCUUUAG
 - AUGAGACUGUGG
 - AUGCGAUCCUGA
34. Which statement about transcription is NOT correct?
- for each gene, only one DNA strand is used to make the mRNA
 - the enzyme responsible is RNA polymerase
 - in eukaryotes the primary transcript is usually shorter than the mature mRNA
 - the first nucleotides transcribed are part of a noncoding leader sequence
35. Which anticodon would NOT be found on a tRNA carrying Arg?
- UCC
 - UCU
 - UCA
 - GCA
36. Which statement about the genetic code is NOT correct?
- 61 codons code for amino acids
 - the code is degenerate
 - some codons code for more than one amino acid
 - most amino acids are coded by more than one codon
37. Which statement about the process of translation is NOT correct?
- the small ribosomal subunit associates with the mRNA before the large subunit
 - the first tRNA to associate with the ribosome carries the amino acid fMet
 - a release factor would be found at the A site when translation stops
 - new amino acids to be added to the polypeptide are found at the P site
38. During translation of a polypeptide with the sequence Met-Asn-Tyr, when the mRNA codon AAC is found at the A site, what codon is found at the P site?
- UAA
 - UAC
 - AUG
 - AAU
39. Which statement about the lac operon of E. coli is NOT correct?
- the repressor protein associates with the operator in the presence of lactose
 - the catabolite activator protein binds to the promoter in the presence of cAMP
 - transcription can only occur when glucose levels are low
 - transcription can only occur when ATP levels are low
- Essay** Choose A or B to answer.
- Describe how the events of meiosis account for (1) Mendel's Law of Segregation and (2) Mendel's Law of Independent Assortment.
 - Describe the semidiscontinuous model of DNA replication. Include all enzymes and proteins needed for complete synthesis of DNA

Codon Chart

		Second Letter						
		U	C	A	G			
F	U	UUU-Phe	UCU-Ser	UAU-Tyr	UGU-Cys	U	T	
		UUC-Phe	UCC-Ser	UAC-Tyr	UGC-Cys			C
		UUA-Leu	UCA-Ser	UAA-Stop	UGA-Stop			A
		UUG-Leu	UCG-Ser	UAG-Stop	UGG-Trp			G
s	C	CUU-Leu	CCU-Pro	CAU-His	CGU-Arg	U	i	
		CUC-Leu	CCC-Pro	CAC-His	CGC-Arg			C
		CUA-Leu	CCA-Pro	CAA-Gln	CGA-Arg			A
		CUG-Leu	CCG-Pro	CAG-Gln	CGG-Arg			G
L	A	AUU-Ile	ACU-Thr	AAU-Asn	AGU-Ser	U	L	
		AUC-Ile	ACC-Thr	AAC-Asn	AGC-Ser			C
		AUA-Ile	ACA-Thr	AAA-Lys	AGA-Arg			A
		AUG-Met	ACG-Thr	AAG-Lys	AGG-Arg			G
e	G	GUU-Val	GCU-Ala	GAU-Asp	GGU-Gly	U	e	
		GUC-Val	GCC-Ala	GAC-Asp	GGC-Gly			C
		GUA-Val	GCA-Ala	GAA-Glu	GGA-Gly			A
		GUG-Val	GCG-Ala	GAG-Glu	GGG-Gly			G

Key

1	c	11	d	21	b	31	a
2	c	12	d	22	a	32	c
3	b	13	c	23	a	33	a
4	c	14	a	24	d	34	c
5	b	15	d	25	c	35	c
6	d	16	a	26	c	36	c
7	d	17	b	27	b	37	d
8	c	18	b	28	b	38	c
9	a	19	d	29	d	39	a
10	b	20	b	30	a	40	