

Tentamen, Genetik (NBIA24, 91BI11, 91BI17, 92BI11, 92BI17 och TFBI11), 20/3 2015

Sist i häftet hittar du svarsblanketten. Fyll i rätt svar på denna och lämna in. Om du vill kan du behålla frågehäftet.

LYCKA TILL!

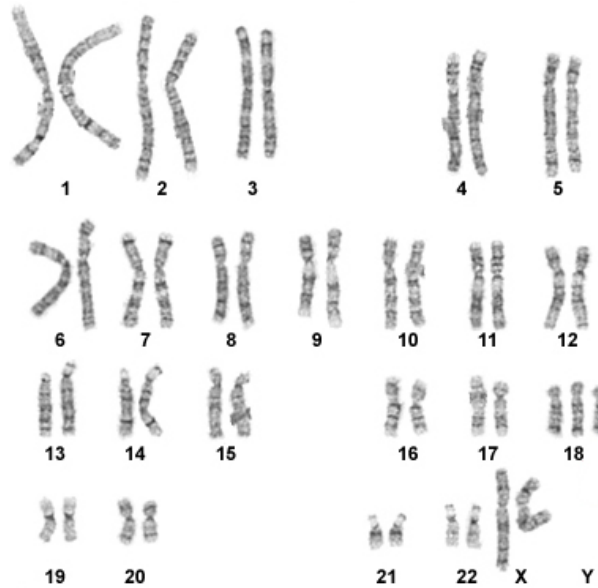
Tentatema: kanin



1. Which of the following statements about a rabbit bearing a somatic mutation is true?
 - (a) Some but not all of the rabbit's offspring will also carry the mutation.
 - (b) All of the rabbit's offspring will carry the mutation.
 - (c) Both the rabbit and its offspring will show the mutant trait.
 - (d) The rabbit but not its offspring can be affected by the mutation.
 - (e) Only the offspring and not the rabbit itself will show the mutant trait
2. Completely linked genes...
 - (a) assort randomly.
 - (b) can crossover and recombine.
 - (c) are allelic.
 - (d) co-segregate.
 - (e) will segregate independently.

3. Interactions among the human ABO blood group alleles involve **xxx** and **xxx**.
- (a) codominance; complete dominance
 - (b) codominance; incomplete dominance
 - (c) complete dominance; incomplete dominance
 - (d) epistasis; complementation
 - (e) continuous variation; environmental variation
4. The probability that two alleles are identical by descent is the
- (a) coalescent factor
 - (b) inbreeding coefficient
 - (c) relative fitness
 - (d) outcrossing rate
 - (e) relatedness constant
5. The multiple effects of a single gene on the phenotype are called
- (a) epistasis.
 - (b) pleiotropy.
 - (c) codominance.
 - (d) dihybrid.
 - (e) filial interactions.
6. A Barr body refers to
- (a) a sex-linked trait in cats.
 - (b) a recessive mutant trait in fruit flies.
 - (c) an inactivated Y chromosome.
 - (d) an inactive X chromosome in mammals
 - (e) the location of spore formation in Neurospora.
7. Two parental lines of rabbits with the genotypes $E^D E^D LL$ and $e^J e^J ll$ were crossed. The F_1 were all bred to rabbits with the genotype $e^J e^J ll$. The latter cross is called
- (a) a test cross
 - (b) a recessive cross.
 - (c) a parental cross.
 - (d) a monohybrid cross
 - (e) more than one term is correct.

8. What sex and aneuploidy does the individual with the karyotype showed in the figure have?



- (a) female with trisomy 18
 - (b) male with trisomy 18
 - (c) male with nullisomy Y and disomy X
 - (d) female with triploidy 18
 - (e) male with triploidy 18
9. Which of the following statements about dominance is true?
- (a) A dominant allele is the most common in a population.
 - (b) A dominant allele is the wildtype state of an allele.
 - (c) A dominant allele is only expressed in homozygotes.
 - (d) A dominant allele is only expressed in homozygotes and heterozygotes.
 - (e) More than one statement is correct.
10. An AB woman has a type B child. What blood type could the father **not** have?
- (a) AB
 - (b) B
 - (c) O
 - (d) A
 - (e) The father could be any of the above types

11. Long hair (l) is recessive to short hair (L), and albino colour (a) is recessive to agouti colour (A) in rabbits. Which of the genotypes can be found in a long-haired agouti rabbit?
- (a) $ll aa$
 - (b) $LL AA$
 - (c) $ll AA$
 - (d) $LL aa$
 - (e) $Ll Aa$
12. Suppose that a diploid cell contains 8 chromosomes ($2n = 8$). How many different combinations in the gametes are possible?
- (a) 2
 - (b) 4
 - (c) 8
 - (d) 16
 - (e) 64
13. Paralytic tremour (pt) is a sex-linked recessive trait in rabbits, caused by a mutation on the X chromosome. If a non-affected buck (a male) is mated to a doe (a female) suffering from pt , their first offspring born could be a
- (a) non-affected buck.
 - (b) non-affected doe.
 - (c) pt -suffering buck.
 - (d) pt -suffering buck or non-affected doe.
 - (e) pt -suffering doe or non-affected buck.
14. If a female *Drosophila* that is heterozygous for a recessive X-linked mutation is crossed to a wild-type male, what proportion of female progeny will have the mutant phenotype?
- (a) 100 %
 - (b) 0 %
 - (c) 33 %
 - (d) 25 %

15. In rabbits, short hair (L) is dominant to long hair (l), and agouti colour (A) is dominant to himalaya colour (a^h). A pure-breeding himalaya rabbit with short hair is crossed with a pure-breeding agouti rabbit with long hair. What will the phenotype of the offspring be?
- (a) all himalaya with short hair
 - (b) all agouti with long hair
 - (c) all agouti with short hair
 - (d) all himalaya with long hair
 - (e) half himalaya with long hair, half agouti with short hair
16. A trihybrid corn plant is self-fertilized. What proportion of the offspring are trihybrid?
- (a) $1/16$
 - (b) $1/64$
 - (c) $4/64$
 - (d) $8/64$
 - (e) $16/64$
17. Ability to roll the tongue is caused by a dominant allele. A woman is a “roller,” but one of her parents is not. The woman is expecting a child with a man who is a “nonroller.” What is the probability that their child will be a “roller”?
- (a) $1/4$
 - (b) $1/3$
 - (c) $3/4$
 - (d) $1/2$
 - (e) $2/3$
18. In a Polish breed of rabbits a gene causing dwarfism occurs. All dwarf rabbits are thought to be heterozygous at the locus that controls this trait. When two dwarf individuals are mated, the offspring occur in a ratio of 2 dwarf kittens:1 normal. What is the most likely explanation for these observations?
- (a) The allele that causes dwarfism is a dominant lethal allele.
 - (b) The allele that causes dwarfism is a recessive lethal allele.
 - (c) The allele that causes dwarfism is a late-onset lethal allele.
 - (d) Dwarfism is incompletely dominant to the normal condition.
 - (e) Dwarfism is codominant to the normal condition.

19. In peacocks, males are homogametic. Cameo plumage (c) is recessive to the wild-type ($+$) and sex linked. A wild-type male is mated to a cameo female, and all the F_1 are wild-type. If these F_1 males are mated to F_1 females, what will be the ratio of wild-type to cameo females in the F_2 ?
- (a) 1:1
 - (b) 3:1
 - (c) 0:1
 - (d) 1:0
 - (e) 1:2
20. Dihybrid labradors are bred to each other. Among a large number of pups the colours segregate as 9 black: 4 yellow: 3 brown. What conclusions can you make regarding the inheritance of the coat colours?
- (a) A single codominant gene is involved
 - (b) Two genes are involved one of which is dominant lethal
 - (c) Two codominant genes are involved
 - (d) Two genes are involved of which one has an epistatic effect on the other
 - (e) Only dominant alleles are involved.
21. In rabbits 30 % of the nucleotides in the DNA is adenin (A). What percentage is expected to be guanin (G)?
- (a) 0.20
 - (b) 0.30
 - (c) 0.40
 - (d) 0.50
 - (e) 0.70
22. In a mouse species in Florida, natural selection favors the recessive homozygote (aa) and acts against the dominant phenotype (AA, Aa). What are the fitnesses of the three genotypes, AA, Aa , and aa ?
- (a) 1, 1, 1.
 - (b) 1, 1, 1 - s.
 - (c) 1, 1 - s, 1.
 - (d) 1 - s, 1, 1.
 - (e) 1 - s, 1 - s, 1.

23. The splitting of one species into two new species is called
- (a) cladogenesis.
 - (b) anagenesis.
 - (c) phyletic evolution.
 - (d) allopatric speciation.
 - (e) sympatric speciation.
24. The elder-flowered orchid occurs in two colour morphs. It offers no nectar reward and visiting insects learn more quickly to identify the more common morph as a cheater and avoid it. Which type of selection is acting upon flower colour in the elder-flowered orchid?
- (a) Positive selection
 - (b) Negative selection
 - (c) Directional selection
 - (d) Balancing selection
 - (e) Purifying selection
25. A Japanese fireman gets a somatic mutation after the earthquake at the Fukushima nuclear power plant. Which of the following statements is true?
- (a) All the fireman's children will inherit the mutation.
 - (b) Half of the fireman's children are expected to inherit the mutation.
 - (c) None of the fireman's children will inherit the mutation.
 - (d) The fireman is destined to develop cancer.
 - (e) The fireman will develop super powers that can help him fight crime.
26. On a remote island a population of rabbits of many different colours live. After a serious flooding only 10 % of the rabbits have survived. When you visit the island 10 years later the population size of the rabbits are back to what it was before the flood, but you can only find agouti and albino rabbits. The most likely reason for this is...
- (a) selection.
 - (b) bottleneck effect.
 - (c) founder effect.
 - (d) mutation.
 - (e) inbreeding depression.

27. How many tetrads occur in *Drosophila melanogaster* (eight chromosomes) at metaphase I of meiosis?
- (a) one
 - (b) two
 - (c) four
 - (d) eight
 - (e) sixteen
28. The attachment point of microtubules to chromosomes is called
- (a) kinetochore.
 - (b) centromere.
 - (c) telomere.
 - (d) chromatin.
 - (e) aster.
29. In a germ-line cell from a female grasshopper (XX-XO sex determination system), when do the homologous X chromosomes segregate?
- (a) during mitosis
 - (b) during meiosis I, anaphase
 - (c) during meiosis II, anaphase
 - (d) They do not segregate; gametes contain a copy of X and a copy of Y.
30. During which mitotic phase do the sister chromatids separate and go towards opposite poles of the cell?
- (a) Interphase
 - (b) Prophase
 - (c) Metaphase
 - (d) Anaphase
 - (e) Telophase

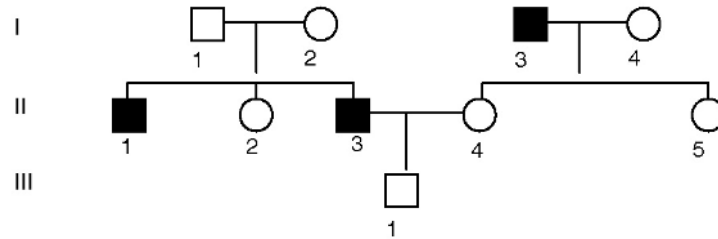
31. Identify the stage of cell division and the diploid number of the cell in the figure below.



- (a) anaphase of mitosis $2n = 6$
 (b) anaphase I of meiosis, $2n = 6$
 (c) anaphase II of meiosis, $2n = 6$
 (d) anaphase I of meiosis, $2n = 12$
 (e) anaphase II of meiosis, $2n = 12$
32. Compared to a two-point testcross, a three-point testcross:
- (a) is more accurate.
 (b) is less accurate.
 (c) is equally accurate.
 (d) measures different things.
 (e) is possible only in yeast.
33. Trihybrid F_1 female rabbits carrying the mutations long hair (l), Dutch spotting (du), English spotting (en) were test crossed with the phenotypes given below found in the F_2 . Which were the haplotypes of the trihybrid?
- | | | | |
|-----------------|-----|--------------------------------------|------|
| wild type | 1 | Dutch and English spotted | 12 |
| Dutch spotted | 150 | Dutch spotted, long hair | 1001 |
| English spotted | 998 | English spotted, long hair | 154 |
| long hair | 14 | Dutch and English spotted, long hair | 0 |
- (a) wildtype only
 (b) wildtype and $l\ en\ du$
 (c) en and $du\ l$
 (d) $l\ du$
 (e) du and $en\ l$
34. Using the information given in 33, which locus is in the middle on the chromosome?
- (a) Dutch spotted
 (b) English spotted
 (c) long hair
 (d) none, only two genes linked
 (e) none, all genes are unlinked

35. Using the information given in 33, what is the distance between *l* and *En* locus?
- (a) 1.2
 - (b) 13.0
 - (c) 13.1
 - (d) 14.2
 - (e) 86.9
36. Which statement best summarizes our current understanding of the origin of the Y chromosome?
- (a) The Y chromosome is thought to have arisen spontaneously in an ancestor of mammals millions of years ago.
 - (b) The Y chromosome is thought to have arisen as a broken fragment of an autosome.
 - (c) The Y chromosome is thought to have arisen as a broken fragment of the X chromosome.
 - (d) The Y chromosome is thought to have been derived along with the X chromosome from a pair of autosomes.
37. A red-eyed female fly is crossed with a red-eyed male to produce all red-eyed females, 1/2 red-eyed males, and 1/2 white-eyed males. In this case, which situation best describes the parental red-eyed female?
- (a) homozygous dominant for autosomal trait
 - (b) homozygous recessive for autosomal trait
 - (c) homozygous dominant for X-linked trait
 - (d) homozygous recessive for X-linked trait
 - (e) heterozygous for X-linked trait

38. The following pedigree shows the occurrence of a trait in rabbits. Use it for questions 38 - 41.



- Could the trait followed in the pedigree be caused by an autosomal dominant disease? Why or why not?
- Yes, all individuals fit the autosomal dominant inheritance pattern.
 - No, the offspring of I-1 and I-2 contradict an autosomal dominant inheritance.
 - No, the offspring of I-3 and I-4 contradict an autosomal dominant inheritance.
 - No, the offspring of II-3 and II-4 contradict an autosomal dominant inheritance.
39. If the pedigree is for an autosomal recessive trait, which individuals are definitely heterozygous?
- I-1, I-2, II-2, II-4, and II-5
 - I-1, I-2, II-4, II-5, III-1
 - II-2, II-4, II-5, II-3
 - II-2, II-4, II-5, III-1
40. If the trait followed in the pedigree is autosomal recessive, what is III-1's genotype?
- either homozygous dominant or heterozygous
 - definitely heterozygous
 - definitely homozygous dominant
41. If the trait followed in the pedigree is X-linked recessive allele, what is III-1's genotype?
- hemizygous for a dominant allele
 - hemizygous for a recessive allele
 - definitely heterozygous
 - definitely homozygous dominant
 - either heterozygous or homozygous dominant

42. A population of rabbits segregates for the two alleles E^D (dominant black) and e^J (Japanese brindling, a mosaic distribution of yellow and black). The rabbits are genotyped for the E locus and the genotypes were found to occur in the following numbers: $E^D E^D = 25$, $E^D e^J = 20$, $e^J e^J = 55$. Therefore, $p = f(E^D)$ is
- (a) 0.25.
 - (b) 0.35.
 - (c) 0.45.
 - (d) 0.50.
 - (e) 0.55.
43. For the Hardy-Weinberg equilibrium to hold exactly, population size must be
- (a) big.
 - (b) very big.
 - (c) very, very big.
 - (d) infinite.
 - (e) size does not come into play in this situation.
44. In a rabbit population fulfilling all the assumptions of the Hardy-Weinberg equilibrium, allelic frequencies
- (a) will not change from generation to generation.
 - (b) change randomly from year to year.
 - (c) change infinitesimally from year to year.
 - (d) change only in females from year to year.
 - (e) change only in males from year to year.
45. In a sample of 200 rabbits from a large randomly mating population with no selection for coat colour, 167 had the agouti colour while 33 had the chinchilla colour (recessive condition). Assuming no other coat colour alleles segregated in the population, what is your best estimate of the chinchilla allele frequency?
- (a) 0.08
 - (b) 0.17
 - (c) 0.29
 - (d) 0.41
 - (e) cannot be determined

46. Suppose that in a rabbit population the frequency of the recessive Japanese brindling colour is $1/400$. Assume the presence of only a dominant allele (E^D) and a recessive allele (e^J) in the population and that the population is at Hardy-Weinberg equilibrium. What is the frequency of the recessive allele?
- (a) $1/1600$
 - (b) $1/400$
 - (c) $1/40$
 - (d) $1/20$
47. When several loci control a phenotype and each locus has an allele that contributes an equivalent small increment to that phenotype, we call the inheritance pattern
- (a) narrow sense.
 - (b) broad sense.
 - (c) realized.
 - (d) true.
 - (e) additive.
48. How can heritability be measured?
- (a) Compare individuals with different degrees of relatedness.
 - (b) Eliminate one of the variance components.
 - (c) Analyze regression observed from parents to offspring.
 - (d) All of the above methods can be used to measure heritability.
49. Average adult weight in a population of rabbits was 1.5 kg. Breeders were chosen whose average adult weight was 1.8 kg. Their offspring had a mean adult weight of 1.6 kg. Assuming that there is no covariance (interaction) of environment and genotype, what is the narrow-sense heritability?
- (a) 0.33
 - (b) 0.40
 - (c) 0.45
 - (d) 0.50
 - (e) 1.5
50. In a population of rabbits the variance in ear length was 1.1. The rabbits were cloned and the clones were reared under identical conditions. The variance in ear length of the clones were 0.8. What was the genotypic variance for ear length in this population?
- (a) 0.27
 - (b) 0.3
 - (c) 0.73
 - (d) 0.8
 - (e) 1.1

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1. D
2. D
3. A
4. B
5. B
6. D
7. A
8. A
9. D
10. E
11. C
12. D
13. D
14. B
15. C
16. D
17. D
18. B
19. A
20. D
21. A
22. E
23. A
24. D
25. C
26. B
27. C
28. A

29. B
30. D
31. B
32. A
33. C
34. B
35. C
36. D
37. E
38. B
39. B
40. B
41. A
42. B
43. D
44. A
45. D
46. D
47. E
48. D
49. A
50. D