GENETICS (遺傳學)

I. Multiple choices (choose only one answer). 70% （共 28 題，每題 2.5 分）

1. What is/are the necessary assumptions in a dihybrid cross to predict the phenotypic ratio 9:3:3:1?

a. Each gene segregates its alleles.

b. There is no linkage between the two genes.

c. Haploid gametes will contain one copy of a gene.

d. Cross fertilization of the P1 will produce an F1 that is doubly heterozygous.

e. a and d.

f. a and b.

2. When we cross two strains of a popular garden plant (one with white flowers and one with red). The F1 hybrids are all pink. The resulting F2 from self-fertilization of the F1 is a 1:2:1 ratio (white, pink, and red). What is the best hypothesis for explaining this data?

a. Flower color is controlled by a single gene with 2 alleles.

b. Flower color is controlled by 2 different genes.

c. Red is only partially dominant over white.

d. a and c.

e. b and c.

3. If one parent is genotype *BbRr* and mates with another parent who is *bbrr*, what is the probability of one *Bbrr* offspring?

a. 1/2

b. 1/4

c. 3/4

d. 1/5

e. 1

4. A prospective non-albino mother has a sibling who is albino. What is the probability that she will pass on an albino allele to her offspring?

a. 2/3

b. 1/2

c. 1/3

d. 1/4

e. Not enough information is given to answer the question.

5. Using different methods of calculating genetic map distances, you find two different values for the distance between 2 genes. Why may this be a valid finding?

a. Multiple crossovers may occur between widely separated genes.

b. The frequency of recombination between these two regions must be 50% or lower.

c. True genetic distance depends on the average number of crossovers which may be greater than the observed recombination frequency.

d. There has been a quadruple crossover event.

e. a and c.

f. a, c, and d.

6. Which of the following can effect the expression of a phenotype?

a. environment

b. epistasis

c. incomplete penetrance

d. variable expressivity

e. all of the above

7. Precursor ――――> Intermediate ―――――> Product

　　Consider the above biological pathway. Both A and B are dominant forms of two different genes. What is a functional genotype for this pathway?

a. AB

b. $AAbb$

c. $Aabb$

d. $A-B-$

e. $aabb$

8. Hemophilia is an example of an X-linked mutation. What is the probability of having a child with hemophilia if the grandmother of the mother is known to have the trait and the father is not a hemophiliac?

a. 1/2

b. 1/4

c. 1/8

d. 1/12

e. 1/16

9. A genetic mosaic is

a. a population with many different genotypes.

b. a cell with multiple copies of a gene.

c. an organism with two types of cell clones.

d. a cell that contains a Barr body.

e. an organism with multiple cells.

10. A trisomy is an event where:

a. a triploid organism is formed.

b. there is an extra chromosome in a diploid.

c. there are three extra chromosomes in a diploid.

d. three chromosomes are hypoploid.

e. three chromosomes are hyperploid.

11. F1 plants that were heterozygous for two traits are crossed. The resulting phenotypic ration is
23.3:1:1:6:8. What is the best explanation for this result?

a. The result is expected.

b. A crossover event has occurred.

c. The two genes are on the same chromosome.

d. Recombination has occurred forming new gene combinations.

e. The genes are on different chromosomes.

f. c and d.

12. You sample a number of cells that have undergone meiosis. You find 10 cells with no
crossovers, 30 with 1 crossover, 10 with 2 crossovers, and zero with three or more crossovers.
What is the map distance between these two regions?

a. 1.1

b. 1.2

c. 1.3

d. 1.0

e. 9.0

13. A mating between a true breeding red long-stamen plant with a true breeding white short-stamen plant yields an F1 . This F1 is self fertilized to produce an F2 that has 300 red long-stamen plants and 100 white short-stamen plants. What can you conclude?

a. The white short flowers are the result of recombination.

b. A chiasma has been formed.

c. Mendel's law of segregation is supported by the evidence.

d. No cross-over events between these genes has occurred.

e. The genes are tightly linked.

f. b and d.

g. d and e.

14. In a three point test cross you have 2 *gb bt cq* progeny and 4 + *bt* + progeny out of a hundred progeny. What can you conclude?

a. The order of the genes is *gb bt cq*.

b. The 6 progeny are the result of a double crossover.

c. The genes are tightly linked.

d. The order of the genes cannot be determined.

e. The order of the genes is *bt gb cq*.

f. b and d.

g. a and b.

15. Crossing yeast with two different mutations yields almost all asci with a parental ditype pattern. We can conclude that:

a. the genes are loosely linked.

b. the genes are on two different chromosomes.

c. the genes are closely linked.

d. neither of the two genotypes like the parental genotype.

e. we need more data to determine the linkage.

16. In *Neurospora*, there are different patterns of segregation for genes during meiosis. A first division segregation pattern indicates that :

a. there has been crossing over.

b. the two alleles are in each of the daughter nuclei of ascospore division.

c. no crossing over has taken place.

d. there is linkage between the genes.

17. A mutation for curly wings exists in *Drosophila* on chromosome 1. Flies are sampled that are deleted for a section for chromosome 1 and maintain the curly gene on their other chromosome 1. The flies all have curly wings. What can you conclude?

a. The deletion does not affect gene function.

b. The deletion is near the curly gene.

c. The curly gene is on the deleted fragment.

d. The deletion has affected other gene functions.

e. There is not enough information to draw a conclusion.

18. A pedigree reveals that two genes, one for blue eyes and one for obesity, are linked in humans. What would be true about the pedigree?

a. Blue eyes and obesity will be linked as a result of crossing over.

b. Many people in the pedigree will be both blue-eyed and obese.

c. The lod for these genes will be near 0.

d. There will be many brown eyed, thin people in the pedigree.

e. a and c.

f. d and c.

19. You cross two yeast strains with two different mutations on the same chromosome. You detect a single crossover event. What type of asci is most likely?

a. parental ditype

b. nonparental ditype

c. tetratype

d. You need more information about the results of the cross.

e. both parental and nonparental ditypes

20. Nonparental ditype asci are the result of:

a. tightly linked genes.

b. no crossing over events between tightly linked genes.

c. a two-strand crossover between loosely linked genes.

d. a four-strand double crossover event.

e. a tetratype event.

21. You are interested in determining how far a certain gene is from its centromere in *Neurospora*. You find 90 asci with a first division segregation pattern and 25 asci with a second division segregation pattern. What is the map distance from gene to centromere?

a. 0.21 Morgan

b. 0.11 Morgan

c. 14 centiMorgan

d. 39 centiMorgan

e. 0.15 centiMorgan

22. An Lod score of 3 is found for two loci. What does this tell you?

a. the data are 1000 times more likely under a model of independent assortment than a model of linkage.

b. There is no evidence for linkage.

c. The data are 1000 times more likely under a model of linkage than of independent assortment.

d. There is strong evidence for linkage.

e. a and b.

f. c and d.

23. The principle characteristics of nucleotides are:

a. a 5-carbon sugar, two different classes.

b. a cyclic nitrogen base, five different classes.

c. a sulfate group

d. they are capable of forming large polynucleotides

e. all polynucleotides maintain a double-stranded conformation.

f. a, b, and d

g. c and e

24. The functions associated with telomeres are to:

a. prevent deoxyribonucleases from degrading the ends of linear DNA molecules.

b. prevent the fusion of chromosomal ends with other DNA molecules.

c. facilitate replication of chromosomes without the loss of termini.

d. ensure the appropriate segregation of chromosomes.

e. provide chromosomal anchorage to spindle-fibers.

f. a, b, and c

g. d and e

25. Satellite DNA is:

a. repetitive.

b. prokaryotic.

c. randomly distributed throughout the genome.

d. expressed.

e. identified on the bases of density-gradient centrifugation.

f. a and e

26. Proofreading activities of *E. coli* DNA polymerases is carried out by:

a. Pol I, on the same peptide as polymerase activity, by 5'->3' exonuclease activity.

b. Pol I, on a single subunit, by 3'->5' exonuclease activity.

c. Pol III, on the same peptide as polymerase activity, by 5'->3' exonuclease activity.

d. Pol III, on a single subunit, by 5'->3' exonuclease activity.

27. The majority of eukaryotic pre-mRNA's, which encode peptides, undergo which of the following modifications?

a. Addition of a 7-Methyl guanosine cap to the 5'-end of the transcript.

b. Poly (U) tails are added to the 3' ends of the transcripts.

c. Exons are spliced out of the primary transcripts'and degraded in the nucleus.

d. Editing of U residues.

e. none of the above

28. If a tRNAala alters its anticodon to the sequence to 3'-AUU-5', which of the following mutations can be suppressed?

a. missense

b. missense only if alanine does not adversely affect protein structure

c. nonsense (only the 5'-AAU-3' codon)

d. nonsense (only the 5'-UAA-3' codon)

e. none of the above

II. Short Answer/Essay

1. What is the goal of the human genome project? (7%)

2. Briefly explain the following terms: (15%)
   RFLP, SSCP, YAC, PCR, STS

3. What are some of the ethical and social questions that have emerged with the advances in modern genetics? (give relevant examples in: genetics and medicine, genetics and society, and the misuse of genetics). (8%)