

單選題：每一子題 1 分

1. Organelles other than the nucleus that contain DNA include
A) ribosomes. B) chloroplasts. C) mitochondria. D) B and C only E) A, B, and C
2. In the fractionation of homogenized cells using centrifugation, the primary factor that determines whether a specific cellular component ends up in the supernatant or the pellet is
A) the percentage of carbohydrates in the component. B) the number of enzymes in the fraction.
C) the presence or absence of lipids in the component. D) the size and weight of the component.
E) the relative solubility of the component.
3. In plants the conservation of water promotes
A) photorespiration. B) photosynthesis. C) the opening of stomata. D) the light reactions.
E) a shift to photosynthesis.
4. Which of the following statements is a correct distinction between cyclic and noncyclic electron flow? A) Only noncyclic electron flow produces ATP. B) In addition to ATP, cyclic electron flow also produces and NADPH.
C) Chemiosmosis is unique to noncyclic electron flow. D) Only cyclic electron flow can operate in the absence of photosystem II. E) Only cyclic electron flow utilizes light at 700 nm.
5. A drug designed to inhibit the response of cells to testosterone would almost certainly result in which of the following?
A) an increase in receptor tyrosine kinase activity B) a decrease in transcriptional activity of certain genes
C) an increase in cytosolic calcium concentration D) a decrease in G-protein activity
E) lower cytoplasmic levels of cAMP
6. Chemical signal pathways
A) operate in animals, but not in plants. B) use hydrophilic molecules to activate enzymes.
C) often involve the binding of signal molecules to a protein on the surface of a target cell.
D) are absent in bacteria, but are plentiful in yeast. E) involve the release of hormones into the blood.
7. Which of the following are primarily responsible for cytokinesis in plant cells?
A) cyclin-dependent kinases B) Golgi-derived vesicles C) centrioles and basal bodies D) kinetochores
E) actin and myosin
8. Vinblastine is a standard chemotherapeutic drug used to treat cancer. Because it interferes with the assembly of microtubules, its effectiveness must be related to
A) myosin denaturation and inhibition of cleavage furrow formation. B) disruption of mitotic spindle formation.
C) inhibition of DNA synthesis. D) inhibition of regulatory protein phosphorylation.
E) suppression of cyclin production.
9. Because they accumulate in the body, excess ingestion of which of the following can have toxic effects?
A) calcium and phosphorus. B) fat-soluble vitamins. C) sugars. D) water-soluble vitamins. E) proteins
10. Which of the following statements about the mammalian digestive system is *true*?
A) Enzyme production continues in the esophagus.
B) All foods begin their enzymatic digestion in the mouth.
C) The trachea leads to the esophagus and then to the stomach.
D) After leaving the oral cavity, the bolus enters the larynx.
E) The epiglottis prevents food from entering the trachea.
11. Pulse is a direct measure of
A) heart rate. B) stroke volume. C) breathing rate. D) blood pressure. E) cardiac output.

12. Which of the following blood components would interfere with the functioning of an open circulatory system but *not* a closed one?
A) red blood cells B) antibodies C) water D) electrolytes E) amino acids
13. HIV targets include all of the following *except*
A) cytotoxic T cells. B) cells bearing CD4 and fusin. C) brain cells. D) macrophages. E) helper T cells.
14. Both the eye and the respiratory tract are protected against infections by which of the following?
A) the mucous membranes that cover their surface B) the secretion of complement proteins
C) the secretion of lysozyme onto their surface D) interferons produced by immune cells
E) the release of slightly acidic secretions
15. Which of the following is true of ammonia?
A) It has low toxicity relative to urea. B) It can be stored as a precipitate. C) It is soluble in water.
D) Only A and C are true. E) A, B, and C are true.
16. *Unlike an earthworm's metanephridia, a mammalian nephron*
A) forms urine by changing the composition of fluid inside the tubule. B) is intimately associated with a capillary network. C) functions in both osmoregulation and the excretion of nitrogenous wastes.
D) processes blood instead of coelomic fluid. E) has a transport epithelium.
17. Short blood vessels connect two capillary beds lying in which of the following?
A) anterior pituitary and posterior pituitary. B) hypothalamus and thalamus
C) anterior pituitary and adrenal gland. D) posterior pituitary and thyroid gland
E) hypothalamus and anterior pituitary
18. Prolactin stimulates mammary gland growth and development in mammals and regulates salt and water balance in freshwater fish. Many scientists think that this wide range of functions indicates which of the following?
A) Prolactin is a nonspecific hormone. B) Prolactin is an evolutionary conserved hormone.
C) Prolactin has a unique mechanism for eliciting its effects. D) Prolactin interacts with many different receptor molecules. E) Prolactin is derived from two separate sources.
19. Which of the following is *not* required for internal fertilization?
A) copulatory organ B) internal development of the embryo C) sperm receptacle D) behavioral interaction
E) All of the above are necessary for internal fertilization.
20. There are five hormones regulating the human menstrual and ovarian cycles. Which of these structures secrete(s) these hormones?
A) hypothalamus B) pancreas C) ovaries D) A and C only E) A, B, and C
21. Which of the following statements is (are) *true* concerning the vitelline layer of the sea urchin egg?
A) It has receptor molecules that are specific for binding acrosomal proteins.
B) It releases calcium, which initiates the cortical reaction. C) It is outside the fertilization membrane.
D) A and B are true. E) A, B, and C are true.
22. Which mathematical situation has a parallel in embryonic limb development?
A) plotting a graph of a linear growth curve B) using X, Y, and Z coordinates to plot a graph
C) plotting a graph of an exponential growth curve D) using parallel lines to construct a parallelogram
E) $E = MC^2$
23. Integration of simple responses to certain stimuli, such as the patellar reflex, is accomplished by which of the following?
A) medulla B) hypothalamus C) corpus callosum D) cerebellum E) spinal cord
24. The postsynaptic membrane of a nerve may be stimulated by certain neurotransmitters to permit the influx of

negative chloride ions into the cell. This process will result in

- A) the membrane becoming more positive. B) membrane depolarization. C) the production of an EPSP.
D) the production of an IPSP. E) an action potential.

25. The pathway leading to the perception of sound begins with the
A) hair cells of the organ of Corti, which rests on the tectorial membrane, coming in contact with the basilar membrane.
B) hair cells of the organ of Corti, which rests on the tympanic membrane, coming in contact with the tectorial membrane.
C) hair cells of the organ of Corti, which rests on the basilar membrane, coming in contact with the tectorial membrane.
D) hair cells on the tympanic membrane that stimulate the tectorial membrane neurons leading to the auditory section of the brain.
E) hair cells of the organ of Corti coming in contact with the tectorial membrane as a result of fluid waves in the cochlea causing vibrations in the round window.

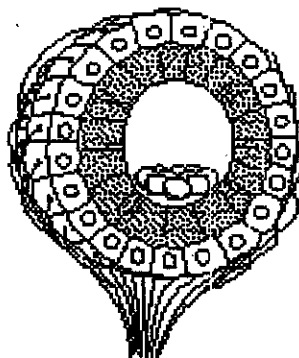


Figure 1

26. What is the structure diagrammed in Figure 1?
A) an ommatidium B) a neuromast C) a statocyst D) a taste bud E) an olfactory bulb
27. Coral reefs can be found on the southern east coast of the United States but not at similar latitudes on the southern west coast. Differences in which of the following most likely account for this?
A) ocean currents B) precipitation C) sunlight D) day length E) salinity
28. Polar regions are cooler than the equator because
A) the poles are permanently tilted away from the sun. B) there is more ice at the poles.
C) the poles have a thicker atmosphere. D) sunlight strikes the poles at an oblique angle.
E) the poles are farther from the sun.
29. Reconciliation behavior is likely to follow
A) imprinting by young animals on a member of the wrong species.
B) conflict behavior between members of a permanent social group.
C) mating behavior between a male and a female.
D) agonistic behavior between territorial males.
E) ritualized behavior.

30. In the 14th century, _____ was responsible for the death of more than one-third of the entire European population of humans.
A) pneumonia B) bubonic plague C) AIDS D) influenza E) tuberculosis
31. Population ecologists follow the fate of same-age cohorts in order to
A) determine the factors that regulate the size of a population. B) determine a population's carrying capacity.
C) determine if a population is regulated by density-dependent processes. D) determine the birth rate and death rate of each age group in a population. E) determine if a population's growth is cyclical.
32. The growing season would generally be shortest in which of the following biomes?
A) taiga B) temperate broadleaf forest C) savanna D) tropical rain forest E) temperate grassland
33. Which marine zone would have the lowest rates of primary productivity (photosynthesis)?
A) abyssal B) intertidal C) neritic D) continental shelf E) pelagic
34. In the territorial behavior of the stickleback fish, the red belly of one male elicits attack from another male by functioning as
A) a pheromone. B) a sign stimulus. C) an imprint stimulus. D) a fixed action pattern. E) a search image.
35. Life history strategies usually result from
A) environmental pressures. B) natural selection. C) conscious choice. D) A and B only
E) A, B, and C
36. A recent study of ecological footprints (described in the text) concluded that
A) it is not possible for technological improvements to increase Earth's carrying capacity for humans.
B) current demand by industrialized countries is much smaller than the ecological footprint of those countries.
C) the ecological footprint of the United States is larger than the ecological capacity of its land.
D) Earth's carrying capacity would increase if per capita meat consumption increased.
E) Earth's carrying capacity for humans is about 10 billion.
37. Which of the following members of a marine food chain is most analogous to a grasshopper in a terrestrial food chain?
A) shark B) zooplankton C) phytoplankton D) detritivore E) fish
38. Which of the following statements about the biogeographical aspects of diversity is *not* correct?
A) Species richness on an island reaches an equilibrium point when immigration equals extinction.
B) Island equilibrium theory applies to the relatively short period of time when colonization is the important process determining species composition; over a longer time, actual speciation affects the composition.
C) A species may be limited to a particular range because it never dispersed beyond that range, or it dispersed but failed to survive in other locations.
D) The magnitude of photosynthesis is the factor that accounts for the major variations in species diversity over large areas of Earth.
E) The patterns of continental drift are important considerations in the study of the past and present distributions of species.
39. Which of the following organisms fix nitrogen in aquatic ecosystems?
A) legumes B) chemoautotrophs C) cyanobacteria D) fungi E) phytoplankton
40. Which of the following statements is correct about biogeochemical cycling?
A) The phosphorus cycle is a sedimentary cycle that involves the weathering of rocks.
B) The carbon cycle has maintained a constant atmospheric concentration of CO₂ for the past million years.
C) The carbon cycle is a localized cycle that primarily reflects the burning of fossil fuels.
D) The phosphorus cycle involves the rapid recycling of atmospheric phosphorus.
E) The nitrogen cycle involves movement of nitrogen very little of which is chemically altered by either the

biotic or abiotic components of the ecosystem.

41. Which of the following strategies would most rapidly increase the genetic diversity of a population in an extinction vortex?
- A) Introduce new individuals transported from other populations of the same species.
 - B) Sterilize the least fit individuals in the population.
 - C) Establish a reserve that protects the population's remaining habitat.
 - D) Control and reduce populations of the endangered population's predators and competitors.
 - E) Capture all remaining individuals in the population for captive breeding followed by reintroduction to the wild.
42. Which of the following would a landscape ecologist consider in designing a nature reserve?
- A) patterns of landscape use by humans
 - B) possible edge effects related to human activities
 - C) human economic concerns
 - D) A and B only
 - E) A, B, and C
43. A person exposed to a new cold virus would not feel better for one to two weeks because
- A) antigen receptors are not the same.
 - B) phagocytic cells must first be activated by the complement system.
 - C) it takes up to two weeks to stimulate immunologic memory cells.
 - D) specific B cells and T cells must be selected prior to a protective response.
 - E) V-J gene rearrangement must occur prior to a response.
44. Hormone X produces its effect in its target cells via the cAMP second messenger system. Which of the following will produce the greatest effect in the cell?
- A) a molecule of hormone X injected into the cytoplasm of the cell
 - B) a molecule of activated, cAMP-dependent protein kinase injected into the cytoplasm of the cell
 - C) a molecule of cAMP injected into the cytoplasm of the cell
 - D) a molecule of hormone X applied to the extracellular fluid surrounding the cell
 - E) a molecule of cAMP applied to the extracellular fluid surrounding the cell
45. It is very difficult to sneak up to a grasshopper and catch it. Why?
- A) They have binocular vision.
 - B) They have excellent hearing for detecting predators.
 - C) They have compound eyes with multiple ommatidia.
 - D) They have a camera-like eye with multiple fovea.
 - E) They have eyes with multiple fovea.
46. Which of the following is the best explanation for the inability of an animal cell to reduce the Ca^{2+} concentration in its cytosol compared with the extracellular fluid?
- A) low oxygen concentration around the cell
 - B) loss of transcription factors
 - C) low levels of protein kinase in the cell
 - D) blockage of the synaptic signal
 - E) insufficient ATP levels in the cytoplasm
47. All of the following represent adaptations by terrestrial animals to drying conditions *except*
- A) salt glands.
 - B) increased thirst.
 - C) efficient kidneys.
 - D) anhydrobiosis.
 - E) impervious surfaces.

Use the data in Table 1 to answer question 48.

The data were obtained from a study of the length of time spent in each phase of the cell cycle by cells of three eukaryotic organisms designated beta, delta, and gamma.

Table 1: Minutes Spent in Cell Cycle Phases

Cell Type	G ₁	S	G ₂	M
Beta	18	24	12	16
Delta	100	0	0	0
Gamma	18	48	14	20

48. The best conclusion concerning delta is that the cells
 A) contain only one chromosome that is very short. B) contain no DNA. C) contain no RNA.
 D) divide in the G₁ phase. E) are actually in the G₀ phase.
49. Which of the following is a characteristic of the early stages of local inflammation?
 A) attack by cytotoxic T cells B) release of histamine C) fever
 D) antibody- and complement-mediated lysis of microbes E) arteriole constriction
50. Which of the following is *not* a component of an insect's defense against infection?
 A) phenoloxidase activation, leading to the formation of large deposits around parasites
 B) production of antimicrobial peptides C) activation of natural killer cells
 D) a protective exoskeleton E) phagocytosis by hemocytes
51. sexual reproduction and asexual reproduction are different in that
 A) individuals reproducing asexually transmit 100% of their genes to their progeny, whereas individuals reproducing sexually only transmit 50%.
 B) asexual reproduction produces offspring that are genetically identical to the parents, whereas sexual reproduction gives rise to genetically distinct offspring.
 C) asexual reproduction involves a single parent, whereas sexual reproduction involves two.
 D) asexual reproduction only requires mitosis, whereas sexual reproduction always involves meiosis.
 E) all of the above
52. Referring to a plant sexual life cycle, which of the following terms describes the process that leads *directly* to the formation of gametes?
 A) sporophyte meiosis B) gametophyte mitosis C) gametophyte meiosis D) sporophyte mitosis
 E) alternation of generations
53. The F₁ offspring of Mendel's classic pea cross always looked like one of the two parental varieties because
 A) one allele was completely dominant over another. B) each allele affected phenotypic expression. C) the traits blended together during fertilization. D) no genes interacted to produce the parental phenotype. E) different genes interacted to produce the parental phenotype.
54. Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. This suggests
 A) that the parents were true-breeding for contrasting traits.
 B) incomplete dominance. C) that a blending of traits has occurred. D) that the parents were both heterozygous. E) that each offspring has the same alleles.
55. New combinations of linked genes are due to which of the following?
 A) nondisjunction B) crossing over C) independent assortment D) mixing of sperm and egg E) both A and C
56. Which of the following statements is (are) true?
 A) The closer two genes are on a chromosome, the higher the probability that a crossover will occur between them.
 B) The observed frequency of recombination of two genes that are far apart from each other has a maximum value of 50%.
 C) Two of the traits that Mendel studied—seed color and flower color—are linked on the same chromosome.
 D) Only B and C are correct.
 E) A, B, and C are correct.
57. What does transformation involve in bacteria?
 A) the creation of a strand of DNA from an RNA molecule B) the creation of a strand of RNA from a DNA molecule
 C) the infection of cells by a phage DNA molecule D) the type of semiconservative replication shown by DNA
 E) assimilation of external DNA into a cell

58. In trying to determine whether DNA or protein is the genetic material, Hershey and Chase made use of which of the following facts?
A) DNA does not contain sulfur, whereas protein does. B) DNA contains phosphorus, but protein does not.
C) DNA contains nitrogen, whereas protein does not. D) A and B only E) A, B, and C
59. A mutation results in a defective enzyme A. Which of the following would be a consequence of that mutation?
A) an accumulation of A and no production of B and C E) an accumulation of A and B and no production of C
C) an accumulation of B and no production of A and C D) an accumulation of B and C and no production of A E) an accumulation of C and no production of A and B
60. If A, B, and C are all required for growth, a strain mutant for the gene encoding enzyme B would be capable of growing on which of the following media?
A) minimal medium B) minimal medium supplemented with "A" C) minimal medium supplemented with "B"
D) minimal medium supplemented with "C" E) answers B and C
61. Viruses are referred to as obligate parasites because
A) they cannot reproduce outside of a host cell. B) viral DNA always inserts itself into host DNA. C) they invariably kill any cell they infect. D) they can incorporate nucleic acids from other viruses. E) they must use enzymes encoded by the virus itself.
62. Which of the following statements about the lysogenic cycle of lambda (λ) phage is incorrect?
A) After infection the viral genes immediately turn the host cell into a lambda-producing factory, and the host cell then lyses.
B) Most of the prophage genes are silenced by the product of a particular prophage gene.
C) The phage genome replicates along with the host genome.
D) Certain environmental triggers can cause the phage to exit the host genome, switching from the lysogenic to the lytic cycle.
E) The phage DNA is incorporated by genetic recombination (crossing over) into a specific site on the host cell's DNA.
63. Which of the following statements concerning the eukaryotic chromosome is false?
A) It is composed of DNA and protein. B) The nucleosome is the most basic structural subunit. C) The number of genes on each chromosome is different in different cell types. D) It consists of a single linear molecule of double-stranded DNA. E) Active transcription occurs on euchromatin.
64. Why do histones bind tightly to DNA?
A) Histones are positively charged, and DNA is negatively charged. B) Histones are negatively charged, and DNA is positively charged. C) Both histones and DNA are strongly hydrophobic.
D) Histones are covalently linked to the DNA. E) Histones are highly hydrophobic, and DNA is hydrophilic.
65. What is the enzymatic function of restriction enzymes?
A) to add new nucleotides to the growing strand of DNA B) to join nucleotides during replication C) to join nucleotides during transcription D) to cleave nucleic acids at specific sites E) to repair breaks in sugar-phosphate backbones
66. Bacteria containing recombinant plasmids are often identified by which process?
A) examining the cells with an electron microscope B) using radioactive tracers to locate the plasmids C) exposing the bacteria to an antibiotic that kills cells lacking the plasmid D) removing the DNA of all cells in a culture to see which cells have plasmids E) producing antibodies specific for each bacterium containing a recombinant plasmid.
67. A eukaryotic protein can be made in bacteria by inserting the gene encoding the protein into a(n)
A) protein plasmid. B) expression vector. C) yeast artificial chromosome (YAC). D) PCR vector. E) restriction plasmid.
68. One striking difference between development in plants and development in animals is the importance of cell

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- _____ in animal embryos.
A) division B) differentiation C) growth D) movement E) death
69. A cell that remains entirely flexible in its developmental possibilities is said to be
A) differentiated. B) determined. C) totipotent. D) genomically equivalent. E) epigenetic.
70. Catastrophism, meaning the regular occurrence of geological or meteorological disturbances (catastrophes), was Cuvier's attempt to explain the existence of
A) evolution. B) the fossil record. C) uniformitarianism. D) the origin of new species. E) natural selection.
71. "Improving the intelligence of an adult through education will result in that adult's descendants being born with a greater native intelligence." This statement is an example of
A) Darwinism. B) Lamarckism. C) uniformitarianism. D) scala naturae. E) Malthusianism.
72. Even in Darwin's time, the blending hypothesis was incompatible with observed facts. If the blending hypothesis were true, then what should one expect to observe over the course of generations?
A) Phenotypic polymorphisms should increase. B) Genetic variation should increase. C) Members of a breeding population should become more uniform in phenotype. D) Neutral variation should decrease. E) Genetic polymorphisms should increase.
73. Successfully breeding two individual organisms at a zoo and obtaining fertile offspring for several generations is no guarantee that the same could occur in nature (i.e., in the wild). Which species concept becomes difficult to confirm because of this fact?
A) biological B) ecological C) morphological D) phylogenetic E) paleontological
74. Which of the following is not considered an intrinsic isolating mechanism?
A) sterile offspring B) ecological isolation C) geographic isolation D) gametic incompatibility E) timing of courtship display
75. Some molecular data place the giant panda in the bear family (Ursidae) but place the lesser panda in the raccoon family (Procyonidae). The morphological similarities of these two species must therefore be due to
A) inheritance of acquired characteristics. B) sexual selection. C) inheritance of shared derived characters. D) convergent evolution. E) possession of shared primitive characters.
76. If organisms A, B, and C belong to the same class but to different orders and if organisms D, E, and F belong to the same order but to different families, which of the following pairs of organisms would be expected to show the greatest degree of structural homology?
A) A and B B) A and C C) B and D D) C and F E) D and F
77. Which of the following has not yet been synthesized in laboratory experiments studying the origin of life?
A) liposomes B) liposomes with selectively permeable membranes C) oligopeptides and other oligomers D) protobionts that use DNA to program protein synthesis E) amino acids
78. What characteristic would all protobionts have had in common?
A) the ability to synthesize enzymes B) a surrounding membrane or membrane-like structure C) RNA genes D) a nucleus E) the ability to replicate RNA
79. Which of the following statements about bacterial cell walls is false?
A) Bacterial cell walls differ in molecular composition from plant cell walls.
B) Cell walls prevent cells from bursting in hypotonic environments.
C) Cell walls prevent cells from dying in hypertonic conditions.
D) Bacterial cell walls are similar in function to the cell walls of many protists, fungi, and plants.
E) Cell walls provide the cell with a degree of physical protection from the environment.
80. If penicillin is an antibiotic that inhibits enzymes from catalyzing the synthesis of peptidoglycan, then which prokaryotes should be most vulnerable to inhibition by penicillin?
A) mycoplasmas B) gram-positive bacteria C) archaea D) gram-negative bacteria E) spore-bearing

bacteria

81. The strongest evidence for the endosymbiotic origin of eukaryotic organelles is the similarity between extant prokaryotes and which of the following?
A) nuclei and chloroplasts B) mitochondria and chloroplasts C) cilia and mitochondria D) mitochondria and nuclei E) mitochondria and cilia.
82. Which process allows nucleomorphs to be first reduced, and then lost altogether, without the loss of any genetic information from the host cell that ultimately surrounds the nucleomorph?
A) conjugation B) horizontal gene transfer C) binary fission D) phagocytosis E) meiosis
83. A researcher wants to develop an assay (test) that will distinguish charophyceans and land plants from chlorophyte green algae. Which of the following chemicals would be the best subject for such an assay?
A) chlorophyll b -an accessory photosynthetic pigment B) carotenoids-a class of accessory photosynthetic pigments C) amylopectin-a starch-like food storage material D) glycolate oxidase-an enzyme of peroxisomes that is associated with photorespiration E) flavonoids-a class of phenolic compounds that is often associated with chemical signaling
84. Which of the following characteristics, if observed in an unidentified green organism, would make it unlikely to be a charophycean?
A) phragmoplast B) peroxisome C) apical meristem D) chlorophylls a and b E) rosette cellulose-synthesizing complex
85. Which of the following is an ongoing trend in the evolution of land plants?
A) decrease in the size of the leaf B) reduction of the gametophyte phase of the life cycle C) elimination of sperm cells or sperm nuclei D) increasing reliance on water to bring sperm and egg together E) replacement of roots by rhizoids
86. In addition to seeds, which of the following characteristics are unique to the seed-producing plants?
A) a haploid gametophyte retained within tissues of the diploid sporophyte B) lignin present in cell walls C) pollen D) A and C only E) A, B, and C
87. If all saprobic fungi in an environment were to suddenly die, which group of organisms should benefit as a whole?
A) plants B) protists C) prokaryotes D) animals E) mutualistic fungi
88. In septate fungi, what structures allow cytoplasmic streaming to distribute needed nutrients, synthesized compounds, and organelles throughout the hyphae?
A) chitinous layers in cell walls B) pores in septal walls C) complex microtubular cytoskeletons D) two nuclei E) tight junctions that form in septal walls between cells
89. Both animals and fungi are heterotrophic. What distinguishes animal heterotrophy from fungal heterotrophy is that only animals derive their nutrition
A) from organic matter. B) by preying on animals. C) by ingesting it. D) by consuming living, rather than dead, prey. E) by using enzymes to digest their food.
90. The number of legs an insect has, or the number of vertebrae in a vertebral column, or the number of joints in a digit (such as a finger) are all strongly influenced by _____ genes.
A) haploid B) introns within C) heterotic D) heterogeneous E) Hox
91. Evidence of which structure or characteristic would be most surprising to find among fossils of the Ediacaran fauna?
A) true tissues B) mineralized hard parts C) bilateral symmetry D) cephalization E) embryos
92. Which chemical is not normally found in any sponges?
A) chitin B) spongin C) calcium carbonate D) silica E) cribrastatin

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93. Which of these are characteristics of all chordates during at least a portion of their development?
A) a dorsal, hollow nerve cord B) pharyngeal clefts C) post-anal tail D) A and B only E) A, B, and C
94. What do hagfishes and lampreys have in common with the extinct conodonts?
A) lungs B) the jawless condition C) bony vertebrae D) their mode of feeding E) swim bladders
95. An evolutionary adaptation that increases exposure of a plant to light in a dense forest is
A) closing of the stomata. B) lateral buds. C) apical dominance. D) absence of petioles. E) intercalary meristems.
96. Which of the following is not a function of the plasma membrane proton pump?
A) hydrolyzes ATP B) produces a proton gradient C) generates a membrane potential D) equalizes the charge on each side of a membrane E) stores potential energy on one side of a membrane
97. Which of the following is of least concern to a researcher in a mineral nutrition experiment?
A) purity of the chemicals used to make the nutrient solutions B) purity of the water used to make the nutrient solutions C) chemical inertness of the container used to make and store the nutrient solutions D) ability of a laboratory balance to weigh very small quantities of chemicals E) medium in which the test seedlings were grown
98. Which of the following is true in plants?
A) Meiosis occurs in gametophytes to produce gametes. B) Meiosis occurs in sporophytes to produce spores.
C) The gametophyte is the dominant generation in flowering plants. D) Plants exist continually as either sporophytes or gametophytes. E) Male gametophytes and female gametophytes have the same structure.
99. If protein synthesis was blocked in etiolated cells, what would be necessary for any de-etiolation to occur?
A) reception of light by phytochrome B) activation of protein kinase 1 by cAMP C) activation of protein kinase 2 by Ca^{2+} D) post-translational modification of existing proteins E) A, B, and C.
100. Which of the following is a problem faced by animals as they increase in size?
A) decreasing surface-to-volume ratio B) reproducing in aqueous environments C) the tendency for larger bodies to be more variable in metabolic rate D) A and B only E) A, B, and C.

Biochemistry

This examination consists of 9 questions with clear description. Please read them carefully and try to answer them as detail as possible.

1. Gene expression is controlled through the interaction of proteins with specific nucleotide sequences in double-stranded DNA. a. List the kinds of noncovalent interactions that might take place between a protein and DNA. b. How do you suppose a particular protein might specifically interact with a particular nucleotide sequence in DNA? That is, how might proteins recognize specific base sequences within the double helix? (10%)

2. Fill in the space in the following table under the "type of reaction catalyzed by the enzyme". (10%)

Classification	Type of reaction catalysed by the enzyme
Oxydoreductase	
Transferase	
Hydrolases	
Isomerases	
Ligase	

3. What are the first-order and secondary order reactions and how to calculate their velocities? (10%)

4. Carbonic anhydrase catalyses the following reaction:



The reaction involves in four major steps. Please describe these steps below. (10%)

5. Serine protease destroys polypeptides by cleaving peptide bond. There are six clear steps in the catalytic reactions. What are they? (10)

6. There are ten different reactions in glycolysis, catalyzed by ten different enzymes. Write down the names of these enzymes and the reactions they catalyzed. (10%)

7. Bacterial resistance is an inheritance characteristic acquired via certain routes. Describe complex transposon Tn5 and the biochemical mechanism of bacterial resistance. (10%)

8. Signal transduction is an efficient way to stimulate cell proliferation and migration. There are many transduction pathways in eukaryotes and they are usually consisted of a group of conserved proteins. Use hepatocyte growth factor (HGF) as an example to describe the common biochemical event in signal transduction. (15%)

9. Telomerase is an enzyme to guarantee stable chromosomes in eukaryotic. Deficiency of this enzyme results in aging and early death. Describe the biochemical mechanism of this enzyme. (15%)

國立中山大學 95 學年度碩士班招生考試試題

科目：免疫學【生科系碩士班甲組選考】

共 1 頁 第 1 頁

Answer the following questions:

1. What are the advantages of a baby's being born before its immune system has matured? Describe the development of the immune system of a newborn baby and explain why newborn babies are resistant to many infections. (20 分)
2. Discuss the cost-effectiveness of vaccine immunization for avian influenza from the nature of the virus and from public health points of view. Describe what kinds of people are among the high risk groups and why they should be vaccinated at the first stage before a major pandemic outbreak occurs? (20 分)
3. How are lymphocytes able to produce millions of different types of antibodies from only a few hundred copies of immunoglobulin genes? (20 分)
4. How does the immune system perform self-versus-nonsel self recognition? How is tolerance to self antigens achieved? What might cause an immune attack of self antigens? Discuss the use of bone marrow transplantation for the treatment of autoimmune diseases and effects of the treatment on autoimmunity. (30 分)
5. How does the nature of epitopes recognized by B-cells differ from those recognized by T-cells? (10 分)

1. According to Poiseulli's law the rate of blood flow through the circulatory system can be affected by several factors.
 - (a). List all factors, based on Poiseulli's law, that will influence blood flow. (10%)
 - (b). Explain how each parameter you listed will affect the blood flow in the vessel (5%).
 - (c). Describe briefly the techniques to be used to determine each parameters. (10%)
2. Antidiuretic hormone (ADH) level in the plasma is critical to the formation of a concentrated urine in mammals.
 - (a). What are the factors that control ADH release? (10%)
 - (b). What are the mechanisms by which ADH act on renal tubular cells to influence urine concentration? (10%)
 - (c). Why ADH can also be used to elevate blood pressure in some situations. (5%)
3. Compare and contrast the characteristics of an action potential and a generator potential (or a receptor potential). (10%)
4. Answer the following questions:
 - (a). Compare the transport of oxygen and carbon dioxide in the blood. Indicate in your description the significances of hemoglobin in blood gas transport. (10%)
 - (b) What will be the interactions of oxygen and carbon dioxide on gas transport functions of hemoglobin? (10%)
5. What would be the status of a person's blood gases and acid-base balances in the arterial blood if he has been hyperventilated artificially for few minutes? (10%)
6. Answer the following questions:
 - (a). Indicate schematically the locations of thalamus and hypothalamus.(5%)
 - (b). List major functions of thalamus in the brain. (5%)

國立中山大學 95 學年度碩士班招生考試試題

科目：分子生物學【生科系碩士班甲、乙組選考】

共 3 頁 第 1 頁

- I. 選擇題：自下列 1~10 選擇題各題選出一正確的答案：第 1~第 5 題每題 3 分；第 6~第 10 題每題 2 分。共 25 分。
- The pioneering experiments on prokaryotic transcription revealed important concepts of how gene expression was regulated. For example, in the *lac* operon they found that mutations in *lacO* would affect binding of _____ and result in _____ expression.
[A] activator; constitutive.
[B] repressor; constitutive.
[C] activator; alternative.
[D] repressor; alternative.
[E] operator; repressive.
 - Being the reservoir of the genetic material, DNA is traditionally thought as a very stable molecule. However, it is subject to many types of rearrangement for genetic variability. Which of the followings contribute most to the rearrangement?
[A] Replication and repair.
[B] Transcription and translation.
[C] Amplification and transduction.
[D] Recombination and transposition.
[E] Splicing and alternative splicing.
 - A student is working on a research project. Which DNA hybridization experiment is most useful when he/she wants to: (1) detect the presence and localization of a certain gene's expression within a cell?; and (2) detect the presence and localization of a gene segment in a restriction digest of genomic DNA.
[A] dot blot; Southern blot.
[B] PCR; Southern blot.
[C] Northern blot; Southern blot.
[D] Western blot; Northern blot.
[E] *in situ* hybridization; Southern blot.
 - Modification of the N-terminal tails of the histones is important because it changes the accessibility of chromatin. What types of modifications are involved?
 - Phosphorylation
 - Alkylation
 - Methylation
 - Glycosylation
 - Acetylation[A] i, iii, v [B] i, ii, iii [C] i, iii, iv [D] ii, iii, iv [E] i, iii, iv
 - RNA splicing is a process which mediates removing introns from the pre-mRNA. RNA splicing is carried out by a large complex, the spliceosome, which consists of all the following components EXCEPT
[A] U2 snRNP, which binds to the branch point site in the intron.
[B] U4 snRNP, along with U5 snRNP, interacts with U6 snRNP.
[C] U1 snRNP, which recognizes and interacts with the 3' splice site.
[D] proteins that react with the sera of patients with systemic lupus erythematosus.
[E] snRNPs containing several different snRNAs, range between 100 and 300 nucleotide long.

國立中山大學 95 學年度碩士班招生考試試題

科目：分子生物學【生科系碩士班甲、乙組選考】

共 3 頁 第 2 頁

6. The mutant hemoglobin protein is produced in patients suffering sickle cell anemia. This mutant protein results from a GAG→GUG codon change. What type of mutation is it?
[A] Nonsense
[B] Sense
[C] Silent
[D] Transition
[E] Transversion
7. The components of the prokaryotic translation initiation complex shown in the followings are correct EXCEPT
[A] 30S and 50S ribosomal subunits.
[B] mRNA.
[C] Met-tRNA^{Met}
[D] Translation initiation factors.
[E] Guanosine triphosphates.
8. In most eukaryotic genes, the splice sites in pre-mRNA could be localized by two conserved sequences at the ends of intron sequences. Which of the followings represents the 5' end sequence and the 3' end sequence?
[A] GG and AA.
[B] AG and GA.
[C] GC and GA.
[D] GU and AG.
[E] AU and AG.
9. Which of the following set of RNAs is not involved in or is not the product of post-transcriptional processing?
[A] Small nuclear RNA, guide RNA, small interfering RNA
[B] Ribosomal RNA, messenger RNA, transfer RNA
[C] Antisense RNA, microRNA, recognition RNA
[D] Ribozyme, leader RNA, spliced RNA
10. To perform a polymerase chain reaction experiment, which of the followings is not a right component?
[A] Ribonucleoside triphosphates
[B] A thermostable DNA polymerase
[C] Primers
[D] DNA template
[E] A buffer containing appropriate salts and ions

國立中山大學 95 學年度碩士班招生考試試題

科目：分子生物學【生科系碩士班甲、乙組選考】

共 3 頁 第 3 頁

II. 配合題(11-12)：請自下列名詞選出最適合第 11 題至第 12 題有關真核轉錄作用及後轉錄 RNA 處理、轉譯作用之名詞，按照參與各作用順序列出名詞代號(譬如 a,b,c 等)回答。共 18 分。

- | | | |
|----------------------|----------------------------|-------------------|
| a. 5'capping | b. Small ribosomal subunit | c. Stop codon |
| d. Intron lariat | e. 5' end of Pre-mRNA | f. Promoter |
| g. 3'polyadenylation | h. Large ribosomal subunit | i. Polypeptide |
| j. Aminoacyl-tRNA | k. RNA polymerase II | l. Initiator tRNA |
| m. Messenger RNA | n. Spliced exons | o. Splice sites |
| p. Spliceosome | q. Transcription factor | |

11. Eukaryotic transcription and RNA processing: _____ (11分)

12. Translation: _____ (7分)

III. 解釋名詞 (第 13 題至第 17 題)：每題 3 分。

13. Riboswitch
14. Housekeeping genes
15. Heterochromatin
16. Hyperchromicity
17. P element

IV. 問答題 (第 18 題至第 21 題)：共 42 分。

18. Give the amino acid names, in three-letter code or full name, of the following one-letter code amino acids. (7%)

GREATLY

19. What experimental data helped Watson and Crick to conclude the structure of DNA double helix? (10%)

20. There are two important molecular biology techniques which accelerate research progress in various fields of biological sciences. These two techniques are recombinant DNA construction and site-directed mutagenesis. (i) What major features in a plasmid vector one can use to construct a recombinant DNA which will express protein of a specific gene? (ii) What is site-directed mutagenesis and how to it? (15%)

21. Describe the roles played by homologous recombination and site-specific recombination in organisms. (10%)

Plant physiology

1. Term explanation 40%

- (1) aquaporin
- (2) apoptosis
- (3) auxin response elements
- (4) cytokinin
- (5) plasmodesmata
- (6) T-DNA
- (7) De-differentiation
- (8) acid growth

2. Describe the disadvantages of C_3 plants. 15 %

3. Describe the relationship between blue light response and stomatal movement. 15 %

4. Describe the model for the induction of α -amylase synthesis in barley aleurone layers by gibberellin. 15 %

5. Describe the model of ethylene signaling in *Arabidopsis*. 15 %

國立中山大學95學年度碩士班招生考試試題

科目：微生物學【生科系碩士班乙組選考】

共3頁第1頁

選擇題 (每題請選出一個最恰當的答案, 每題2分)

- 1) Endotoxins are
A) Associated with gram-positive bacteria. B) Specific in their method of action.
C) Part of the gram-negative cell wall. D) Excreted from the cell. E) None of the above.
- 2) Which of the following best describes what happens when a bacterial cell is placed in a solution containing 5% NaCl? A) Sucrose will move into the cell from a higher to a lower concentration.
B) The cell will undergo osmotic lysis. C) Water will move out of the cell.
D) Water will move into the cell. E) No change will result; the solution is isotonic.
- 3) Which group of microorganisms is most likely to spoil a freshwater trout preserved with salt?
A) Psychrophiles B) Halophiles C) Anaerobes D) Thermophiles E) None of the above
- 4) A viroid is
A) A complete, infectious virus particle. B) A naked, infectious piece of RNA.
C) A capsid without a nucleic acid. D) A provirus. E) None of the above.
- 5) Which of the following lacks a cell wall?
A) *Borrelia* B) *Nocardia* C) *Mycobacterium* D) *Clostridium* E) *Mycoplasma*
- 6) Which of the following is not true about enzymes?
A) Enzymes are made of proteins. B) Enzymes lower the activation energy of a reaction.
C) Enzymes increase the number of collisions in a chemical reaction.
D) Enzymes are not used up in a reaction. E) None of the above.
- 7) In bacteria, photosynthetic pigments are found in
A) Chloroplasts. B) Cytoplasm. C) Chromatophores. D) Mesosomes. E) None of the above.
- 8) You have isolated a bacterium that grows in a medium containing only inorganic nutrients. Ammonia is oxidized to nitrate ion. This bacterium is A) Gram-negative. B) Using anaerobic respiration.
C) A chemoautotroph. D) A photoautotroph. E) A photoheterotroph.
- 9) During which growth phase will gram-positive bacteria be most susceptible to penicillin?
A) Lag phase B) Log phase C) Death phase D) Stationary phase
E) The culture is equally susceptible during all phases.
- 10) Which of the following is not a characteristic of spirochetes?
A) Gram-negative B) Possess an axial filament C) Helical shape D) Easily observed with brightfield microscopy
E) Difficult to culture in vitro
- 11) A nosocomial infection is
A) Acquired during the course of hospitalization. B) Always present but not apparent at the time of hospitalization.
C) Always caused by medical personnel. D) Only a result of surgery. E) Always caused by pathogenic bacteria.
- 12) Biochemical oxygen demand (BOD) is a measure of
A) The number of bacteria present in a water sample. B) The amount of oxygen present in a water sample.
C) The amount of organic matter present in a water sample.
D) The amount of undissolved solid matter present in a water sample. E) All of the above.
- 13) Which of the following is not an end-product of fermentation?
A) Lactic acid B) Ethyl alcohol C) Glycerol D) Acetone E) Pyruvic acid
- 14) Bacteria can increase the Earth's temperature by
A) Generating a great deal of heat in metabolism. B) Producing CH_4 , which is a greenhouse gas.
C) Using the greenhouse gas CO_2 . D) Providing nutrients for plant growth. E) Oxidizing CH_4 .
- 15) The appearance of gram-negative bacteria after addition of the decolorizing agent in the Gram stain:
A) Purple B) Red C) Brown D) Colorless E) None of the above
- 16) Transient microbiota differ from normal microbiota because transient microbiota
A) Cause diseases. B) Are found in a certain location on the host. C) Are acquired by direct contact.
D) Are present for a relatively short time. E) None of the above.

- 17) You are observing a cell through a microscope and note that it has no apparent nucleus. You conclude that it most likely
 - A) Has a peptidoglycan cell wall.
 - B) Has a cellulose cell wall.
 - C) Moves by pseudopods.
 - D) Is part of a multicellular animal.
 - E) None of the above.
- 18) Which of the following is not a chemical component of a bacterial cell wall?
 - A) Cellulose
 - B) Peptidoglycan
 - C) Teichoic acids
 - D) Peptide chains
 - E) N-acetylmuramic acid
- 19) The source of nutrients in nutrient agar is
 - A) Agar.
 - B) Nutrient.
 - C) Peptone and beef extract.
 - D) Peptone and NaCl.
 - E) All of the above.
- 20) Actinomycetes differ from fungi because actinomycetes
 - A) Are chemoheterotrophs.
 - B) Lack a membrane-bounded nucleus.
 - C) Require light.
 - D) Are decomposers.
 - E) Cause disease.
- 21) Transformation is the transfer of DNA from a donor to a recipient cell
 - A) By a bacteriophage.
 - B) By cell-to-cell contact.
 - C) By crossing over.
 - D) As naked DNA in solution.
 - E) By sexual reproduction.
- 22) The resolution of a microscope can be improved by changing the
 - A) Condenser.
 - B) Fine adjustment.
 - C) Wavelength of light.
 - D) Diaphragm.
 - E) Coarse adjustment.
- 23) Some viruses, such as Human Herpes Virus 1, infect a cell without causing symptoms; these are called
 - A) Latent viruses.
 - B) Lytic viruses.
 - C) Phages.
 - D) Slow viruses.
 - E) Unconventional viruses.
- 24) A strictly fermentative bacterium produces energy
 - A) By glycolysis only.
 - B) By aerobic respiration only.
 - C) By fermentation or aerobic respiration.
 - D) Only in the absence of oxygen.
 - E) Only in the presence of oxygen.
- 25) Methane made from biomass is produced by
 - A) Anaerobic respiration.
 - B) Fermentation.
 - C) The Krebs cycle.
 - D) Oxidation.
 - E) None of the above.
- 26) Which of the following is a characteristic of *Clostridium*?
 - A) Endospore-forming bacilli
 - B) Mycobacteria
 - C) Gram-negative aerobic cocci
 - D) Anaerobic gram-negative rods
 - E) None of the above
- 27) The antibodies found in mucus, saliva, and tears are
 - A) IgG.
 - B) IgM.
 - C) IgE.
 - D) IgD.
 - E) IgA.
- 28) A culture medium consisting of agar, human blood, and beef heart is a
 - A) Chemically defined medium.
 - B) Complex medium.
 - C) Selective medium.
 - D) Differential medium.
 - E) Reducing medium.
- 29) Which concentration of ethyl alcohol is the most effective bactericide?
 - A) 100%
 - B) 70%
 - C) 50%
 - D) 40%
 - E) 30%
- 30) *Mycoplasma* differ from other bacteria because they
 - A) Grow inside host cells.
 - B) Lack a cell wall.
 - C) Are acid-fast.
 - D) Are motile.
 - E) None of the above.
- 31) *Helicobacter* can grow in the stomach because it
 - A) Hides in macrophages.
 - B) Makes a capsule.
 - C) Makes NH_3 .
 - D) Makes HCl.
 - E) None of the above.
- 32) Which of the following is generally not true of prokaryotic cells?
 - A) They have a semirigid cell wall.
 - B) They are motile by means of flagella.
 - C) They possess 80S ribosomes.
 - D) They reproduce by binary fission.
 - E) None of the above.
- 33) Encephalitis and meningitis are difficult to treat because
 - A) They are not caused by bacteria.
 - B) Antibiotics damage tissues.
 - C) Antibiotics cannot penetrate the blood-brain barrier.
 - D) The infections move along peripheral nerves.
 - E) All of the above.
- 34) Aerobic respiration differs from anaerobic respiration in which of the following respects?
 - A) Anaerobic respiration is glycolysis.
 - B) The final electron acceptors are different.
 - C) Aerobic respiration requires the electron transport chain.
 - D) Aerobic respiration gets electrons from the Krebs cycle.
 - E) Aerobic respiration produces more ATP.

- 35) The specificity of an antibody is due to
 A) Its valence. B) The H chains. C) The L chains. D) The constant portions of the H and L chains.
 E) The variable portions of the H and L chains.
- 36) All of the following are treated with antibiotics except
 A) Plague. B) Tularemia. C) Lyme disease. D) Tetanus. E) Yellow fever.
- 37) All of the following are true about archaea except
 A) They are prokaryotes. B) They lack peptidoglycan in their cell walls.
 C) Some are thermoacidophiles; others are extreme halophiles. D) They evolved before bacteria.
 E) Some produce methane from carbon dioxide and hydrogen.
- 38) Where are phospholipids most likely found in a prokaryotic cell?
 A) Flagella B) Around organelles C) Plasma membrane D) Ribosomes E) both B and C
- 39) *Escherichia coli* belongs to the
 A) Proteobacteria. B) Gram-positive bacteria. C) Green sulfur bacteria. D) Spirochetes. E) Actinomycetes.
- 40) Oil-degrading bacteria are naturally present in the environment but cannot degrade an oil spill fast enough to avoid ecological damage. The actions of these bacteria can be speeded up by
 A) Providing more oil for them. B) Providing sugar as a carbon source.
 C) Providing nitrogen and phosphorus. D) Adding water. E) All of the above.
- 41) Immunity due to injection of an antigen.
 A) Innate resistance B) Naturally acquired active immunity C) Naturally acquired passive immunity
 D) Artificially acquired active immunity E) Artificially acquired passive immunity
- 42) In which of the following animals would you expect to find a specialized organ that holds cellulose-degrading bacteria and fungi?
 A) Cat B) Dog C) Termite D) Human E) Wolf
- 43) You have isolated a motile, gram-positive cell with no nucleus. You can assume that the cell
 A) Has 9 pairs + 2 flagella. B) Has a mitochondrion. C) Has a cell wall.
 D) Lives in an extreme environment. E) Has a chloroplast.
- 44) The first antibiotic discovered was
 A) Quinine. B) Salvarsan. C) Streptomycin. D) Sulfa drugs. E) Penicillin.
- 45) What is the fate of pyruvic acid in an organism that uses aerobic respiration?
 A) It is reduced to lactic acid. B) It is oxidized in the Krebs cycle.
 C) It is oxidized in the electron transport chain. D) It is catabolized in glycolysis.
 E) It is reduced in the Krebs cycle.
- 46) Cyanobacteria are an example of this type.
 A) Chemoautotroph B) Chemoheterotroph C) Photoautotroph D) Photoheterotroph E) None of the above
- 47) Ethanol for automobile fuel can be produced from corn by
 A) Fermentation. B) Anaerobic respiration. C) The Krebs cycle. D) Oxidation. E) None of the above.
- 48) Drugs, such as AZT and ddC, currently used to treat AIDS act by
 A) Stimulatory T_H cells. B) Stopping DNA synthesis. C) Promoting antibody formation.
 D) Neutralizing the virus. E) All of the above.
- 49) The phylogenetic classification of bacteria is based on
 A) rRNA sequences. B) Gram-reaction. C) Cell morphology D) Habitat. E) All of the above.
- 50) The *lac* operon
 A) Hydrolyzes lactose. B) Produces constitutive enzymes. C) Produces inducible enzymes.
 D) Produces repressible enzymes. E) None of the above.

問答題 (共六題 100 分)

1. Compare and contrast the adaptations of plants to low-nutrient and high-nutrient environment. (15 分)
2. How do you conduct a series of experiments to test that the phenotypic variations among individuals from several populations of a species result from genetic or environmental variables? (15 分)
3. What are life history parameters of a species? Compare and contrast life history variations among and within species? (20 分)
4. Explain how species richness on islands can be explained by the island equilibrium model. In addition, discuss the weakness of the island equilibrium model. (20 分)
5. Summarize and discuss our current understandings of population cycles in the snowshoe hare and lynx. (20 分)
6. How to define invasive species. How do invasive species and introduced species be differentiated? What are the known impacts of introduced species? (10 分)

1. a. Differentiate between digitgrade and plantigrade. Give one animal as an example of each.
b. Describe the following glandular structures in mammals: Sebaceous glands, apocrine glands, sweat glands and mammary glands. (20 %)
2. Compare the differences among the following families, and list a species that is a resident in Taiwan in each family:
Rhacophoridae, Hylidae, Microhylidae, Ranidae, Bufonidae (15%).
3. Compare the reproductive system of mammals, birds, reptiles, and amphibians. (14%)
4. Discuss the distribution of ratites (ostriches, rheas, cassowaries, kiwis, and tinamous). What are the characteristics they share, and what they differ? (15%)
5. Explain the following terms: anadromous, ganoid scales, heterocercal tail, leptocephalus larvae, adipose fin, mesopelegic, spines, Weberian apparatus. (16%)
6. Describe the following locomotion patterns of snakes: rectilinear mode, curvilinear mode, sidewinding mode, and concertina mode. (10%)
7. Compare the typological species concept and biological species concept. (10%)

1. Explain the following terms:

Type II error, alternative hypothesis, discrete probability distribution, sampling distribution.
(16 pts)

2. The following table gives the test results and the pathological finding of cancer (15 %):

Test	Pathological finding of cancer	
	Yes	No
Positive	100	20
Negative	60	80

Calculate the following probabilities:

- a. $P(\text{Positive})$ b. $P(\text{cancer yes})$ c. $P(\text{Negative and cancer No})$
d. $P(\text{Positive or cancer Yes})$ e. $P(\text{cancer No}|\text{Positive})$

3. The final grades of students from two classes of biostatistics are shown below (assume that data are normally distributed, and the means have equal variances) (24%):

Class 1 90, 80, 70, 70, 60

Class 2 100, 90, 90, 80, 80, 70

- a. Calculate the mean grades of each class.
b. Find out the 95% confidence for the means.
c. Is there a significant difference of mean grades between two classes?

4. The heights of three species of trees are shown below (24%):

Species	Height (m)
1	3.2, 3.4, 3.5
2	4.0, 4.4, 3.2, 4.5
3	6.0, 7.1, 7.5

- a. Is there a difference of heights among three species of trees? $\alpha=0.05$
b. Use Tukey's procedure to do a pairwise comparison.

5. The level of knowledge of conservation between biology and non-biology students is investigated. (21 %)

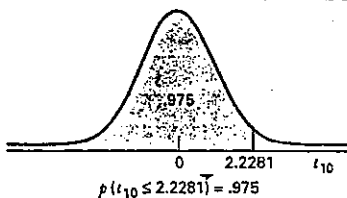
Department	Knowledge of conservation	
	Good	Poor
Biology	8	2
Non-biology	2	3

- a. What is the odds ratio of good knowledge of Biology students over non-biology students?
b. Calculate the expected frequency for each cell.
c. Is there a relationship between knowledge of conservation and department using Fisher's exact test?

TABLE IV Critical Values of F'
Values of $F_{0.05}$

1	Degrees of freedom for numerator																		
	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞	
1	161	200	216	225	230	234	237	239	241	242	244	246	248	249	250	251	252	253	254
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.5	19.5	19.5	19.5	19.5	19.5
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.37
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.62	2.55	2.49	2.45	2.38	2.31	2.23	2.20	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

TABLE E Percentiles of the t Distribution



d.f.	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$
1	3.078	6.3138	12.706	31.821	63.657
2	1.886	2.9200	4.3027	6.965	9.9248
3	1.638	2.3534	3.1825	4.541	5.8409
4	1.533	2.1318	2.7764	3.747	4.6041
5	1.476	2.0150	2.5706	3.365	4.0321
6	1.440	1.9432	2.4469	3.143	3.7074
7	1.415	1.8946	2.3646	2.998	3.4995
8	1.397	1.8595	2.3060	2.896	3.3554
9	1.383	1.8331	2.2622	2.821	3.2498
10	1.372	1.8125	2.2281	2.764	3.1693
11	1.363	1.7959	2.2010	2.718	3.1058
12	1.356	1.7823	2.1788	2.681	3.0545
13	1.350	1.7709	2.1604	2.650	3.0123
14	1.345	1.7613	2.1448	2.624	2.9768
15	1.341	1.7530	2.1315	2.602	2.9467
16	1.337	1.7459	2.1199	2.583	2.9208
17	1.333	1.7396	2.1098	2.567	2.8982
18	1.330	1.7341	2.1009	2.552	2.8784
19	1.328	1.7291	2.0930	2.539	2.8609
20	1.325	1.7247	2.0860	2.528	2.8453
21	1.323	1.7207	2.0796	2.518	2.8314

TABLE H Percentage Points of the Studentized Range for 2 Through 20 Treatments Upper 5% Points

Error df	2	3	4	5	6	7	8	9	10
1	17.97	26.98	32.82	37.08	40.41	43.12	45.40	47.36	49.07
2	6.08	8.33	9.80	10.88	11.74	12.44	13.03	13.54	13.99
3	4.50	5.91	6.82	7.50	8.04	8.48	8.85	9.18	9.46
4	3.93	5.04	5.76	6.29	6.71	7.05	7.35	7.60	7.83
5	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99
6	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49
7	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16
8	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92
9	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74
10	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60
11	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49
12	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39
13	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32
14	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25
15	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20

一、解釋名詞：每題 4 分。

- 1、allopolyploid
- 2、androecium
- 3、basionym
- 4、bootstrap value
- 5、consensus tree
- 6、cymose inflorescence
- 7、epitype
- 8、herbarium
- 9、karyotype
- 10、multiple fruit
- 11、palynology
- 12、paraphyly
- 13、perigynous flower
- 14、pollination
- 15、taxon
- 16、temporal isolation

二、問答題。每題 12 分。

- 1、請說明裸子植物與被子植物的區別點。
- 2、請說明禾本科、莎草科與燈心草科的區別點。
- 3、請說明台灣本島在北迴歸線附近由海邊至高山頂的植被帶分布，並舉出每一植物帶的代表性植物兩種。

國立中山大學 95 學年度碩士班招生考試試題

科目：昆蟲學【生科系碩士班丙組選考】

共 3 頁 第 1 頁

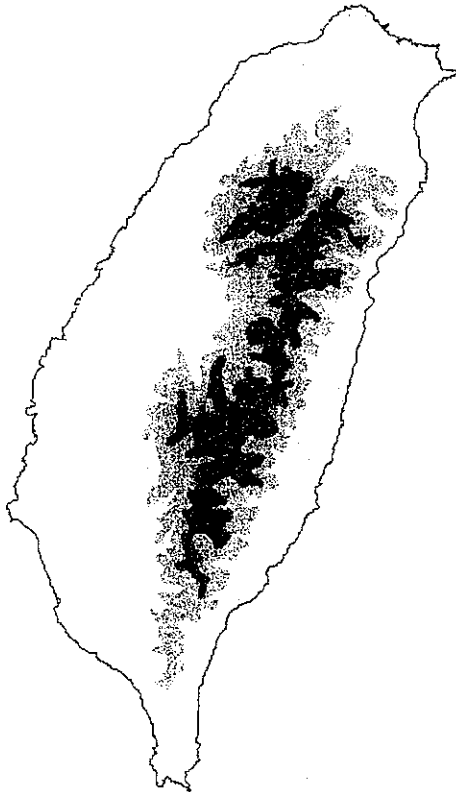
作答提醒：以下問題皆非出自課本與考古題，旨在瞭解你是否適合至本系進行昆蟲學研究。回答問題請注意書寫邏輯、論述完整性、錯別字(含拼字)。請勿當填充題回答。

一、請就你對保育類昆蟲與台灣自然環境的瞭解就以下問題作答 (共 25 分)

(1) 以下何者為保育類物種(請圈選)：黃裳鳳蝶、珠光鳳蝶、紫豔大白星天牛、紐氏缺翅蟲、大田蟹、微翅跳蛙、渡邊氏長吻蠟蟬、獨角仙、姬兜蟲、長角大鍬形蟲、曙鳳蝶、夸父翠灰蝶、蘭嶼筒胸[虫修]

(2) 請挑選以上保育類昆蟲中之三種，敘述你所知道的分類地位(至科)、棲息環境(大約海拔、植被型)與生態需求(如寄主植物等)

(3) 在已獲得保育類昆蟲利用許可以及林務局與國家公園各轄區採集證的前提下，你需要在一趟至多 10 天的 field work 中採到如上三種保育類昆蟲，請在地圖上標明你認為可能採集到這些昆蟲的地點(至鄉或特定山區聚落或路段，若有必要至離島，請自行畫出離島位置)，並詳述你將如何安排行程。請注意這些昆蟲是否可能在同一季節出現。



國立中山大學95學年度碩士班招生考試試題

科目：昆蟲學【生科系碩士班丙組選考】

共3頁第2頁

二、以下是台灣各機構學校昆蟲學研究人員的名字與專長，請就你的認知進行配對（注意有些老師的專長不只一項）（15分）

趙榮台	神經生態
王重雄	生物防治
林仲平	昆蟲病毒
楊恩誠	系統分類
李後晶	行為學
侯豐男	染色體演化
楊正澤	生物多樣性
丁照棟	基因體演化
張念台	植物保護
楊平世	森林昆蟲學

三、請將以下有關昆蟲演化的英文敘述翻譯成妥切的中文（注意中英文標點分段可能不同）（20分）

Insect evolution is characterized by rapid adaptation with selective pressures exerted by environment. Rapid adaptation is furthered by their high fecundity. It appears the rapid radiations, and to this day the appearance of new species result in insects filling all available environmental niches. Insect evolution is closely related to the evolution of flowering plants. Insect adaptations include feeding on flowers and related structures with some 20% of extant insects depend on flowers, nectar or pollen for their food source. This symbiotic relationship is even more paramount in evolution considering that about 2/3 of flowering plants are insect pollinated. Insects are also vectors of many pathogens that may even have been responsible for the decimation or extinction of some mammalian species.

四、請將以下有關昆蟲取食機制的中文翻譯成通順的英文 (注意中英文標點分段可能不同) (20 分)

昆蟲取食植物有一連串之步驟：(1)首先昆蟲須尋找植物生長的棲所，藉環境因子之刺激，例如光、顏色、濕度等，尋找到植物生長的環境；(2)尋找寄主植物，藉植物所揮發之氣味、反射之顏色等刺激，昆蟲利用嗅覺、視覺之反應器，偵測尋找到植物；(3)昆蟲利用嗅覺、視覺之感受器，辨識、確定寄主植物；(4)接受寄主植物，經由嘗試之後，繼續取食；(5)寄主植物含有昆蟲所需之營養，所含之化合物不會對昆蟲有害。

五、請問你閱讀過那些昆蟲圖鑑型出版物？它們的內容談些什麼？你認為以昆蟲系統分類學專業眼光來說這些圖鑑的優缺點(任何方面)為何？(20 分)