國立中山大學九十二學年度碩士班招生考試試題

科目：普通生物學(生物科學系碩士班 甲.乙.丙組)　　

一、單選題：(請注意答案卷有一定的格式，選擇「最恰當」的一個答案，填寫在答案卷『所指定的位置』中，只有在指定位置中的答案才予以計分，50%)

1. The extracellular matrix is thought to participate in regulation of animal cell behavior by communicating via (A) DNA codes (B) plasmodesmata (C) integrins (D) the nucleus (E) lipoproteins in the membrane
2. Which of the following help to hold the DNA strands apart while they are being replicated? (A) single-stranded binding proteins (B) helicase (C) DNA polymerase (D) exonuclease (E) ligase
3. During aerobic respiration, which of the following directly donates electrons to the electron transport chain at the lowest energy level? (A) ATP (B) NADH (C) NAD^+ (D) $FADH_2$ (E) ADP + Pi
4. Which of the following is NOT a function of the Krebs cycle? (A) production of NADH (B) production of $FADH_2$ (C) splitting the carbon skeletons of glucose (D) release of carbon dioxide (E) production of ATP
5. Plasma proteins in humans have many functions. Which of the following is NOT one of them? (A) maintenance of blood osmotic pressure (B) transport of water-insoluble lipids (C) blood clotting (D) immune responses (E) oxygen transport
6. The major inhibitory neurotransmitter of the brain is (A) norepinephrine (B) acetylcholine (C) dopamine (D) cholinesterase (E) GABA
7. If a human interphase nucleus contained three Barr bodies, it can be assumed that the person (A) is a female (B) has 4 X chromosomes (C) has Turner syndrome (D) is a male (E) has Down syndrome
8. During muscle contraction, the ion that leaks out of the sarcoplasmic reticulum and induces myofibrils to contract is: (A) Ca^{2+} (B) Na^+ (C) K^+ (D) Mg^{2+} (E) Fe^{3+}
9. Which extraembryonic membrane of a chick embryo is a receptacle for uric acid wastes? (A) allantois (B) chorion (C) yolk sac (D) amnion (E) trophoblast
10. The movement of potassium into or out of an animal cell requires (A) glucose for binding and releasing ions (B) low cellular concentrations of sodium (C) an energy source such as ATP or a proton gradient (D) plant hormones embedded in the cell membrane (E) high cellular concentrations of potassium.
11. Once transcribed, eukaryotic hnRNA typically undergoes substantial alteration that includes (A) fusion into circular forms known as plasmids (B) fusion with other newly transcribed mRNA (C) excision of introns (D) linkage to histone molecules (E) union with ribosomes.
12. The thermostat of vertebrates is located in the (A) pituitary gland (B) medulla oblongata (C) hypothalamus (D) subcutaneous layer of the skin (E) heart
13. Transcription of the structural genes in an inducible operon (A) starts when the pathway's product is present (B) does not produce enzymes (C) occurs all the time (D) stops when the pathway's product is present (E) starts when the pathway's substrate is present
14. Prions are infectious particles that are unique in that they are believed to lack (A) proteins (B) mitochondria (C) a membrane (D) RNA (E) any nucleic acid
15. The process of cellular differentiation is a direct result of (A) differences in cellular genomes (B) morphogenesis (C) cell division (D) differential gene expression (E) induction

16. The principal problem with inserting an unmodified mammalian gene into the bacterial chromosome, and then getting that gene expressed, is that (A) bacteria translate polycistronic messages only (B) bacteria cannot remove eukaryotic introns (C) prokaryotes use a different genetic code from that of eukaryotes (D) bacterial DNA is not found in a membrane-enclosed nucleus and is therefore incompatible with mammalian DNA (E) bacterial RNA polymerase cannot make RNA complementary to mammalian DNA
17. Two potential devices that eukaryotic cells use to regulate transcription are DNA _____ and histone _____. (A) methylation; amplification (B) amplification; acetylation (C) acetylation; methylation (D) amplification; methylation (E) methylation; acetylation
18. Secretin (A) stimulates the gastric glands (B) stimulates the release of alkaline products by the pancreas (C) decreases the stomach's churning activity (D) is released by the salivary glands (E) stimulates the release of digestive enzymes
19. Proton pumps of bacteria probably functioned first for (A) oxidation of food (B) pH regulation (C) photosynthesis (D) ATP synthesis (E) reduction of O_2
20. A 1:2:1 phenotypic ratio in the F2 generation of a monohybrid cross is a sign of (A) pleiotropy (B) multiple alleles (C) polygenic inheritance (D) incomplete dominance (E) epistasis
21. The meshwork that forms the fabric of a blood clot mostly consists of which protein? (A) fibrinogen (B) fibrin (C) thrombin (D) prothrombin (E) collagen
22. Multicellular animals lacking true tissues are called the (A) protozoa (B) parazoa (C) hydrozoa (D) metazoa (E) eumetazoa.
23. Which of the following could be a preventive approach to reduce schistosomiasis? (A) reduce the freshwater snail population (B) carefully wash all raw fruits and vegetables (C) ensure that all meat is properly cooked (D) reduce the mosquito population (E) purify all drinking water
24. Aspirin and ibuprofen affect the production of (A) interleukins (B) hormones (C) histamine (D) prostaglandins (E) neurotransmitters
25. Osteocytes and chondrocytes are housed in small cavities called (A) lacunae (B) matrices (C) intercellular spaces (D) marrow cavities (E) Haversian sytems
26. The female gametangium of pine is called (A) antheridium (B) archegonium (C) embryo sac (D) ovary (E) sporangium
27. The plant hormone related to the " orange agent" in Vietnam War is (A) auxin (B) abscisic acid (C) cytokinin (D) ethylene (E) gibberellin
28. The plant hormone first discovered in Taiwan is (A) auxin (B) abscisic acid (C) cytokinin (D) ethylene (E) gibberellin
29. The structure just outside the plasma membrane of a plant cell with secondary cell wall is (A) cytoplasm (B) middle lamella (C) primary cell wall (D) secondary cell wall (E) vacuole
30. Which length is close to the limit of the light microscope resolution power? (A) 200 μm (B) 2 μm (C) 200 nm (D) 20 nm (E) 2 nm
31. Which statement about moss is NOT correct? (A) ganetophyte is dominant (B) male gamete needs water to fertilize egg (C) protonema is diploid (D) young sporophyte performs photosynthesis (E) sporophyte is diploid
32. Mushroom is a member of (A) Ascomycota (B) Basidiomycota (C) Chytridiomycota

(D) Deuteromycota (E) Zygomycota

33. Which of the flowing algal groups is with two additional membranes outside the usual chloroplast envelope? (A) brown algae (B) dinoflagellates (C) euglenoids (D) green algae (C) red algae
34. Seed is a mature (A) embryo (B) endosperm (C) nucellus (D) ovary (E) ovule
35. Mycorrhizae are associations of (A) animal skins and fungi (B) cyanobacteria and fungi (C) green algae and fungi (D) hosts and parasites (E) plant roots and fungi
36. Shared derived character states are (A) paralogous (B) paraphyletic (C) parsimonious (D) pleisomorphic (E) synapomorphic
37. Which is the highest level among categories listed? (A) class (B) division (C) genus (D) order (E) subphylum
38. Which of the followings is definitely a geographical variation? (A) clade (B) cline (C) clone (D) paedomorphosis (E) polymorphism
39. Which is the first barrier in reproductive process? (A) gametic isolation (B) habitat isolation (C) mechanical isolation (D) reduced hybrid fertility (E) temporal isolation
40. Which of the following species concepts is most useful in fossil study? (A) biological species concept (B) cohesion species concept (C) ecological species concept (D) morphological species concept (E) recognition species concept
41. Which of the followings is most dominant in arctic biomes? (A) chaparral (B) coniferous forest (C) desert (D) savanna (E) tundra
42. Critical period is the most important criterion to distinguish _____ and other learning? (A) associative learning (B) classical conditioning (C) habituation (D) imprinting (E) operant conditioning
43. When one male mating with one female, it is called (A) andropolygamous (B) dioecious (C) monogamous (D) polygamous (E) promisicuous
44. The distribution of rice in the cultivated field is (A) clumped (B) dispersive (C) random (D) uniform (E) varied
45. Which of the followings is NOT related to K-selected populations? (A) extensive parental care (B) long lifespan (C) long maturation time (D) low death rate (E) small size of offspring or eggs
46. Which of the followings is a density-dependent factor restricting population growth? (A) competition (B) food supply (C) predator (D) toxic waste accumulation (E) typhoon
47. Species richness is ____ in a particular place. (A) species cover percentage (B) the number of species (C) the number of species individuals (D) where the species most dominant (E) none of the above
48. When the interaction between two species is beneficial to one species but neutral to another species, it is called (A) commensalisms (B) competition (C) mutualism (D) parasitism (E) predation
49. When two or more toxic species resemble each other in color, it is called (A) Batesian mimicry (B) coevolution (C) cryptic coloration (D) Mullerian mimicry (E) resource partition
50. In an idealized pyramid of net productivity, how much percentage of the energy in each trophic level is converted into new biomass in the trophic level above it? (A) 1 % (B) 10 % (C) 25 % (D) 50 % (E) 99 %

二、問答題：（請依先後次序回答於答案卷上，50%）

1. From the viewpoint of scientific methodology, why "evolution" is regarded as a scientific discipline but "creationism" is not? (7 points)
2. Draw an angiosperm (flowering plant) embryo sac, and label its components. (10 points)
3. What is an "ecological succession"? Please describe its process, and differentiate between primary succession and secondary succession? (8 points)
4. Explain the following biological terms: (A) Genomic imprinting (B) Epigenesis (C) Koch's postulates (D) Limbic system (E) Segment polarity genes (15 points)
5. Describe as the best as you can about the 2002 Noble Prize winners in biomedical sciences and their research themes from the level of molecule to the level of organism. (10 points)

國立中山大學九十二學年度碩士班招生考試試題

科目： 生物化學 (生物科學系碩士班甲.乙組)

1. Describe the role in the living cell of each of the following: (1) DNA, (2) phospholipids, and (3) enzymes. (10 %)

2. Draw a Lineweaver-Burk plot showing the relationship between initial velocity and substrate concentration for an enzyme in the absence and presence of (1) a competitive inhibitor and (2) a noncompetitive inhibitor. (5 %)

3. Explain the biochemical basis for the following treatments: (9 %)
   (1) Allopurinol is used to treat gout.
   (2) Methotrexate is used as a cancer chemotherapeutic agent.
   (3) Mevalonate is used to treat hypercholesterolemia.

4. Describe two major regulation mechanisms for protein activity. (8 %)

5. Describe two methods of protein purification. (8 %)

6. Describe how glucose is completely oxidized into CO_2 and H_2O *in vivo*. (10 %)

7. *Compare* the following pairs: (50 %)
   (1) Anaerobic respiration and fermentation
   (2) $\triangle G$ and $\triangle G^{o'}$
   (3) Enzyme and ribozyme
   (4) Globular protein and fibrous protein
   (5) Hexokinase and glucokinase
   (6) Amylose and cellulose
   (7) Peripheral membrane protein and integral membrane protein
   (8) Intron and exon
   (9) Genomics and proteomics
   (10) Insulin and glucagon

I. 選擇題：試由下列（第 1-15 題）每題選出單一最好的答案。（45%）

1. Regarding messenger RNA molecules, which of the following statements is NOT correct?
   A. They are transcribed by RNA polymerase II of eukaryotic cells.
   B. They are a class of unstable RNAs that associate transiently with ribosomes.
   C. They carry genetic information from the genes to the ribosomes, which synthesize polypeptides.
   D. They are very short-lived in prokaryotic cells..
   E. Upon initiation of translation, they bind to the first charged amino acid and the large subunit of ribosomes.

2. A zinc finger is an example of
   A. a helix-turn-helix motif. B. a homeo domain. C. a copper fist.
   D. a DNA-binding protein. E. none of the choices.

3. In elongation step of translation, peptide bonds is formed by a peptidyl transferase. Which of the following molecules contains the catalytic center of peptidyl transferase and appears to have peptidyl transferase activity?
   A 28S rRNA B. 16S rRNA C. ribosomal proteins L2
   D. GTPase-activator protein (GAP) E. EF-Tu

4. The phosphodiester bond of DNA links
   A. base to base, 3'→5'. B. base to sugar, 3'→5'.
   C. sugar to sugar, 3'→5'. D. sugar to sugar, 3'→3'.
   E. sugar to sugar, 5'→3'.

5. Which of the following molecules assists proper folding of completed proteins or heat-mediated partially unfolded proteins?
   A. Activator. B. Attenuator. C. Topoisomerase.
   D. Photolyase. E. Molecular chaperones.

6. The *E. coli* enzyme DNA glycosylase is involved in
   A. Photoreactivation. B. AP repair. C. Mismatch repair.
   D. Gene conversion. E. Postreplicative repair.

7. Regarding mechanism of pre-mRNA splicing, which of the following statements is NOT cortrect?
   A. Introns of pre-mRNA have conserved sequences at splice junctions.
   B. snRNPs bind critical sites on the pre-mRNA.
   C. The snRNAs are transcribed by RNA polymerase II.
   D. The snRNAs associate with accessory proteins.
   E. The snRNPs recognize critical sites for splicing by base pairing.

8. Higher order of chromosome structure result from the interaction of histones and DNA.
   A. True. B. False.
9. Genome projects of several organisms are complete. For studying functional genomics, it is important to probe the pattern of gene expression in a given cell type. One of the techniques involved in functional genomics is
   A. DNA fingerprinting assay. B. DNase footprinting assay.
   C. Southern blot analysis. D. in vitro transcription assay.
   E. DNA microarrays and microchips.
10. Essential components involved in the transcription process in prokaryotes are
   A. rRNA, tRNA, mRNA, RNA polymerase, dNTPs, Mg^{++}.
   B. hnRNAs, RNA polymerase, dNTPs, Mg^{++}.
   C. Primary transcript, DNA polymerase, NTPs, Mg^{++}.
   D. dsDNA, RNA polymerase, NTPs, Mg^{++}.
   E. ssDNA, DNA polymerase, NTPs, Mg^{++}.
11. The main means of induction and repression of operons and individual genes in prokaryotes include the use of
   A. repressor. B. promoter. C. activator.
   D. silencer. E. all of the choices.
12. An unusual property of inosine, a modified base can be found in tRNA, is that it can base pair with A, C, G, or U.
   A. True. B. False.
13. Unlike tRNAs or rRNAs, there are a much larger range of different mRNAs in a cell. All cellular proteins are derived from mRNAs.
   A. True. B. False.
14. Eukaryotic mRNA differs from prokaryotic mRNA in that eukaryotic mRNA lacks a modified base at the 5' ned.
   A. True. B. False.
15. In general, all of the following are true of DNA methylation in eukaryotes EXCEPT it
   A. can be measured using isoschizomers.
   B. is greater in dominant genes.
   C. is greater in active genes.
   D. can be unrelated to gene transcription.
   E. can be prevented by the use of certain drugs.

II. 配合題：下列 16-25 題之名詞請自 A-J 選出最適當之定義。(20%)

16. ___ alternative splicing 21. _____ retrotransposon

17. _____ clone
18. _____ domain
19. _____ homology
20. _____ reading frame
22. _____ trans-acting
23. _____ transition
24. _____ transfection
25. _____ transversion

A. Type of eukaryotic mobile DNA element whose movement in the genome is mediated by an RNA intermediate and involves a reverse transcription process.
B. A mutation in which one purine is replaced with the other purine, or a pyrimidine is replaced by the other pyrimidine.
C. A population of identical cells or DNA molecules descended from a single progenitor.
D. Experimental introduction of foreign DNA into eukaryotic cells in culture, usually followed by expression of genes in the introduced DNA.
E. A mutation event such as G→T or G→C.
F. Property of a regulatory gene that allows it to act even when on a different segment of DNA from the gene being regulated, implies that the gene encodes a regulatory protein.
G. The production of different proteins from the same RNA transcript by splicing it in different ways.
H. Region of a protein with a distinct tertiary structure and characteristic activity.
I. The phase in which nucleotides are read in sets of three to encode a protein.
J. Similarity in the sequence of a protein or nucleic acid or in the structure of an organ that reflects a common evolutionary origin.

III. 問答題（第 26-29 題）：

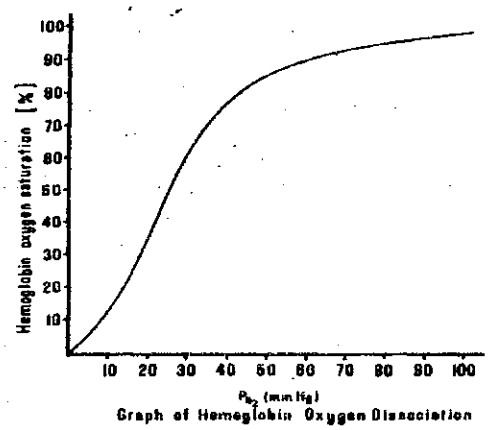
26. An operon usually contains a series of clustered genes which are transcribed into a single mRNA. The genes in a given operon often encode for several enzymes active in a single metabolic pathway. How can these metabolic related enzymes be produced under one operon and one single mRNA molecule? （5%）

27. (A) What is an enhancer? (B) What are the similarities and differences between an enhancer and a promoter? (C) Describe the features of enhancers. (10%)

28. (10%) Contrast and compare prokaryotic and eukaryotic gene expression with respect to:
   A. degree of coupling of transcription and translation
   B. number of gene products on a primary transcript
   C. number of proteins arising from the translation of a primary transcript
   D. organization of genes in operons
   E. presence of introns and alternative splicing

29. Define RNA interference and discuss its role in the cell and its application to the research of molecular cell biology. (10%)

1. In recording cell membrane potential, scientists found that cells are typically inside negative. Explain how this condition arises. (10%)
2. Compare action potentials recorded from skeletal muscle and cardiac muscles. Indicate the major differences and explain the causes of the difference. (15%)
3. Hypothalamus has been considered the master of neuroendocrine systems. Pleases list all the functions you know about hypothalamus. (15%)
4. The following arterial blood gas data was obtained from a male patient. : $PaCO_2$ = 50mmHg, PaO_2 = 87 mmHg, pH=7.37, $[HCO_3^-]$ = 27.5mmol/L
   (a). Describe the acid-base status of this patient. (5%)
   (b). Distinquish between the respiratory and metabolic components of acid-base balance. (5%)
   (c). What are some of the causes of acid-base disturbances. (5%)
5. Explain how kidney can regulate systemic blood pressure. (15%)
6. Explain the cardiovascular changes (including cardiac output and arterial blood pressure) associated with exercise in mammals. (15%)
7. The diagram below is an oxygen-hemoglobin dissociation curve. (15%)
   (a) What direction would this curve be shifted by increases in hydrogen ions, CO_2, body temperature and blood DPG (2,3 diphosphoglycerate)?
   (b) What would the curve change when small amount of carbon monoxide has been administered



Graph of Hemoglobin Oxygen Dissociation

國立中山大學九十二學年度碩士班招生考試試題

科目：免疫學　　(生物科學系碩士班甲組選考)

問答題：

1. Describe in detail how the immune system fights against the extracellular and intracellular bacterial infections? (20%)
2. From the immunological point of view, please explain why the infection of SARS virus resulted in such a dreadful disease among certain human population. (10%)
3. What is allelic exclusion? Why is it important in the immune response? (10%)
4. Describe the mechanisms for the induction of autoimmunity. (10%)
5. Describe what are the co-stimulatory signal and how it operates in activation of T cell. (10%)
6. Describe how the influenza viral antigen presented during influenza viral infection? (10%)

解釋名詞: 30%, 每題 3 分

1. MHC restriction
2. Affinity maturation
3. IL-1
4. C1q
5. T-cell epitope
6. Complete Freund's adjuvant
7. MALT
8. Delayed type hypersensitivity
9. Ig class switching
10. Positive selection

Multiple Choice (2 points each)

1. Why are blue filters used on the light source of light microscopes?
   a. to make clear cells appear blue
   b. decrease resolution
   c. they decrease reflection
   d. they cause the specimen to fluoresce
   e. they allow only shorter wavelengths of light to pass through

2. What dye in the Gram stain do Gram positive bacteria retain?
   a. sarfanin b. iodine c. crystal violet d. methylene blue e. malachite green

3. The technique of heat-fixing a specimen is:
   a. used to prepare a hanging drop
   b. a procedure used in electron microscopy but not in light microscopy
   c. only used in simple-stain techniques
   d. used to make wet mounts
   e. a procedure that causes the microbial cells to adhere to the slide

4. A microbiologist uses a stain on specimen that when viewed on a microscope shows clear cells against a stained background. Which of the following pertains to this stain:
   a. it had to involve a basic dye
   b. it is designed to stain cell walls rich in lipids
   c. the microbiologist probably overdecolorized the cells
   d. it is called a negative stain
   e. the specimen was improperly heat-fixed

5. Lipopolysaccharide:
   a. is found in all bacterial cell walls
   b. can induce fever and dilation of blood vessels in infected patients
   c. is extremely thick in gram positive bacteria
   d. is found in the periplasmic space
   e. is found in cells that will appear purple after the gram stain

6. Which one of the following allows bacterial cell motility?
   a. plasmid b. cilia c. flagella d. pill e. capsule

7. Which term is used to describe flagella that are found all over the surface of the bacterial cell:
   a. amphitrichous b. peritrichous c. lophotrichous d. monotrichous e. atrichous

8. If a student accidentally inoculates a bacterial culture into a hypertonic solution instead of balanced nutrient broth, which of the following describes the inoculated culture:
   a. the solution has a lower solute concentration compared to the cells
   b. the solution has a higher water concentration compared to the cells
   c. water will leave the cells
   d. water will enter the cells
   e. the cells will burst

9. Which of the following movements require the cell to use ATP:
   a. facilitated diffusion b. movement from an area of high to low concentration
   c. osmosis d. diffusion e. movement from an area of low to high concentration

10. A microbiologist detects a thick polysaccharide structure tightly bound to the external cell wall surface of a prokaryotic cell. Which pertains to the cell:
   a. can easily attach to a surface b. motile c. resistant to heat and harsh chemicals
   d. resistant to being phagocytized e. photosynthetic

11. Where would you expect to find an exoenzyme participating in a chemical reaction:
   a. inside mitochondria b. in the cytoplasm c. inside the lysosome
   d. outside the cell membrane e. inside the cell membrane

12. Which pathway begins with a reaction that produces citric acid:
    a. fermentation b. glycolysis c. photosynthesis d. Kreb's cycle
    e. electron transport chain

13. Laboratory analysis of an unknown microorganism shows that the organism has the following characteristics: 1. utilizes glucose to form lactic acid 2. grows in an anaerobic environment. This organism's utilization of glucose could be termed:
    a. photosynthesis b. respiration c. biosynthesis d. facultative e. fermentation

14. What is the name of the biochemical sequence that degrades glucose to pyruvate yielding ATP:
    a. Kreb's cycle b. glycolysis c. respiration d. fermentation e. photosynthesis

15. Before entering the Krebs cycle what must first happen to pyruvate:
    a. addition of oxalaocetic acid
    b. addition of citric acid
    c. removal of carbon as CO_2 and addition of coenzyme A
    d. transfer of electrons to oxygen
    e. accept of electrons from NADH

16. A microorganism in a polluted lake that is oxidizing proteins and other organic compounds for carbon and electron sources while utilizing light energy would be termed a:
    a. chemoautotroph b. chemoheterotroph c. photoautotroph d. photoheterotroph
    e. cyanobacteria

17. In what phase of a bacterial growth curve do cell deaths equal new cells formed?
    a. log phase b. lag phase c. stationary phase d. decline phase e. generation phase

18. A bacterium that can grow with or without the presence of oxygen is called a (n):
    a. microaerophile b. facultative anaerobe c. obligate anaerobe d. obligate aerobe
    e. capnophile

19. A microbiology student noticed that a culture broth tube was very turbid at the surface but clear throughout the rest of the tube. What can this student correctly conclude:
    a. the broth is sterile b. the organisms cannot tolerate oxygen c. the organisms are aerobes
    d. the organisms should be put in a candle jar
    e. the organisms cannot produce superoxide dismutase and/or catalase

20. A medium which contains substances whose exact chemical composition is known is called a(n) _____ medium:
    a. selective b. complex c. natural d. differential e. synthetic defined

21. If a food product is not prepared properly to kill microbes before canning, which type of microbe is most likely to grow in the canned food
    a. microaerophile b. capnophile c. aerobe d. anaerobe e. acidophile

22. A pour plate is made with 1 ml of a 1/1000 dilution of milk. After incubation, 50 colonies are counted. How many bacteria/ml are in the milk:
    a. 5 b. 50 c. 500 d. 5,000 e. 50,000

23. What does ligase do during replication of DNA:
    a. makes copies of mRNA from DNA b. removes damaged sections of DNA
    c. joins together mRNA d. joins together DNA segments
    e. digests mRNA when it is no longer needed

24. What is the inducer for the lactose operon:
    a. tryptophan b. the z gene c. lac repressor d. lactose e. glucose

25. A bacterium that undergoes a mutation causing it to be nutritionally deficient is called a(n):
    a. progeny b. wild types c. prototrophs d. auxotrophs e. mutagen

26. Which of the following best describes a prophage:
    a. a phage about to enter lytic cycle within a bacterial cell
    b. a plasmid
    c. a phage that has inserted its genetic material into bacterial DNA
    d. a virus infecting yeast only
    e. a gene coding for the production of pili

27. Which method of gene transfer can transfer the greatest amount of genetic material:
    a. specialized transduction b. transformation c. generalized transduction
    d. bacteriophage e. conjugation

28. A unicellular heterotroph with a nucleus and cilia should be placed in which kingdom?
    a. Fungi b. Monera c. Protista d. Plantae e. Animalia

29. Which of the following is the BEST method to determine bacteriophage concentration in a sample
    a. spectrophotometer b. plaque assay c. light microscopy d. animal inoculation
    e. biochemical tests

30. Prions:
    a. are infectious particles not destroyed by DNase or RNase
    b. are infectious pieces of RNA
    c. are also called viroids
    d. are easily inactivated at 90?C
    e. is the name given to latent viruses

31. The protein outer coat of a virus particle is called a:
    a. nucleocapsid b. capsomere c. genome d. capsid e. cell wall

32. Which of the following viruses is capable of reverse transcription of their nucleic acid followed by integration of this DNA as a provirus into the host chromosome:
    a. Herpes simplex b. papillomavirus c. HIV d. Hepatitis B virus e. rabies virus

33. What do all prophages and proviruses have in common:
    a. have reverse transcriptase b. integrate into host DNA c. are oncogenic
    d. are infectious proteins without nucleic acid e. infect only bacterial cells

34. Malaria, typhus, plague and Lyme disease are all diseases:
    a. caused by protozoans b. caused by insects c. transmitted by mosquitoes
    d. involving helmiths e. in which the pathogens are transmitted by arthropods

35. Some protozoa form a thick-walled structure that provides protection against harsh conditions: This structure is called a/an:
    a. pellicle b. spore c. capsule d. plasmodium e. cyst

36. Before use, surgical instruments must be:
    a. disinfected b. pasteurized c. sanitized d. sterilized e. boiled

37. If the phenol coefficient of disinfectant A is 7.5, and the phenol coefficient of disinfectant B is 0.5, and the phenol coefficient of disinfectant C is 50.0, what conclusion can be made:
    a. disinfectant B is more effective than phenol
    b. disinfectant C is less effective than phenol
    c. disinfectant A is less effective than phenol
    d. of the three test agents, disinfectant C has the greatest effect compared to phenol
    e. agent C was exposed to the test microbes for a longer time than agents A & B

38. If a microbiology lab sets up a Kirby-Bauer assay, which of the following will pertain to this test:
    a. pathogen is added to serial dilutions of various antimicrobial
    b. after incubation, an agar plate with the pathogen will show various zones of inhibition reflecting the microbe's sensitivity or resistance to each drug
    c. minimum inhibitory concentrations of various drugs will be determined
    d. the lab will be able to tell if a pathogen was killed or merely inhibited by each drug
    e. a patient's serum is tested for its bactericial action

39. Endotoxins differ from exotoxins in that only endotoxins:
a. are proteins b. are secreted during the log growth phase c. are usually sensitive to heat
d. have a specific site of action in animals e. are found only in gram negative bacteria

40. Pili or fimbria enable bacteria to establish infections on mucosal surfaces because they:
a. inhibit phagocytosis b. dissolve mucin c. attach bacteria to cell surfaces
d. damage cytoplasmic membrane of blood cells e. induce fever

41. An elderly patient in a nursing home comes down with influenza and then a week later develops a pneumonia caused by *Streptococcus pneumoniae*. The pneumonia that develops is considered a/a
a. septicemia b. mixed infection c. secondary infection d. subclinical infection
e. focal infectio

42. Which type of disease is acquired by a larger percentage of the population at one time or a greater number than past history indicates:
a. epidemic b. sporadic c. endemic d. indigenous e. zoonoses

43. A disease that occurs naturally in animals while a human serves as an accidental host is called:
a. epidemic b. endemic c. zoonosis d. pandemic e. nosocomial

44. A pregnant, HIV positive woman transmits the virus to her fetus. This is an example of:
a. horizontal transmission b. vector transmission c. droplet nuclei
d. vertical transmission e. a sexually transmitted disease

45. Lysozyme and the antibiotic penicillin have similar mechanisms of action in that they both cause damage to the bacterial:
a. cell membrane b. capsule c. cell wall d. DNA e. ribosomes

46. Neonates acquiring immunoglobulins from mother's breast milk is an example of which type of immunity:
a. natural active b. artificial active c. natural passive d. artificial passive
e. innate immunity

47. All of the following cause hemorrhagic fevers EXCEPT:
a. Ebola virus b. Hantaviruses c. Arenaviruses d. Marburg virus e. Yellow fever viruses

48. The process of forming nitrites from ammonia is called:
a. photosynthesis b. nitrogen fixation c. denitrification d. nitrification e. sulfate reduction

49. Most numerous microorganisms in the soil:
a. viruses b. protozoans c. algae d. bacteria e. fungi

50. When analyzing a water sample to see if it's potable, the presence of which of the following will help in the determination:
a. nitrifying bacteria b. anaerobes c. algae d. oxygen levels e. coliforms

國立中山大學九十二學年度碩士班招生考試試題

科目： 植物生理學 (生物科學系碩士班乙組選考)

Questions: 100%

1. Describe the chemiosmotic synthesis of ATP in isolated chloroplast.
2. Describe the crassulacean acid metabolism.
3. Describe the chemiosmotic-polar diffusion model for polar transport of IAA in tissues.
4. Describe the action of phytochrome.
5. Describe the relationship between IAA and root gravitropism.

I. 解釋名詞，並舉例說明之：每一子題 5 分（共 40 分, 40%）

1. functional response
2. haplodiploidy
3. cohort life table
4. character displacement
5. Batesian mimicry
6. intrasexual selection
7. tolerance model
8. per capita rate of increase

II. 問答題，每一子題 15 分（共 60 分, 60%）

9. What are the short-term and long-term effects of tropical deforestation?

10. Describe the various types of wetlands and explain the ecological and economic value of wetlands in the world.

11. Describe circadian rhythms and their relation to the biological clock of animals. What are the adaptive values of seasonal synchronization for a seasonal breeder?

12. What are advantages and disadvantages of sexual and asexual reproduction? Discuss from the ecological and evolutionary points of views.

國立中山大學九十二學年度碩士班招生考試試題

科目：植物分類學（生科系丙組選考）

問答題

一、請就系統發生學（phylogeny）的探討上，形態與分子特徵二者之優缺點加以討論。（15 分）

二、請敘述如何應用形態與分子證據去探討植物的雜交問題。（20 分）

三、在植物分類上，松葉蕨（*Psilotum*）之分類地位爲何，請討論之。（15 分）

四、請列出台灣之原生植物五種（不同科）之中名、學名與科名，並作檢索表區分此五種植物。（20 分）

五、染色體資料，有那些可應用於植物之系統分類上，請討論之。（15 分）

六、一張具有科學研究價值的植物標本，最好具有那些資訊？又至少應包含那些項目？請討論之。（15 分）

國立中山大學九十二學年度碩士班招生考試試題

科目：生物統計學(生物科學系丙組選考)

1. Explain the following terms:
   Type I error, null hypothesis, statistical power, continuous probability distribution (10 pts)

2. There were 1500 SARS cases in Hong Kong, which has a population of approximate 6,000,000 in April 2003. What is the probability of a family of 5 observing 3 or more cases in April? What is the probability of exactly 4 cases? (15%)

3. The final grades of students from two classes of biostatistics are shown below:
   Class 1 90, 80, 70, 70, 60, 60
   Class 2 100, 100, 90, 90, 80, 80, 70
   a. Calculate the sample variance for each class. Is there a significance difference in variances between classes?
   b. Is there a significant difference of mean grades between two classes?
   (30%)

4. The following are the body lengths and weights of 5 rats.

	1	2	3	4	5
body length	18	20	22	20	19
weight	120	130	140	132	125

Compute the correlation coefficient and test whether it is significantly different from zero. (25 pts)

5. The seeds of peas of F_2 generation in Mendel's experiment were thought to follow a 9:3:3:1 ratio of round, yellow; round, green; wrinkled, yellow; wrinkled, green phenotypes. The observed frequencies are shown below:

round, yellow	round, green	wrinkled, yellow	wrinkled, green
315	108	101	32

Test the hypothesis that the sample comes from a population having the proposed ratio. (20 pts)

國立中山大學九十二學年度碩士班招生考試試題

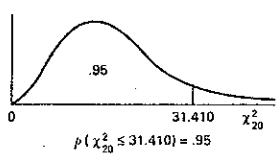
科目：生物統計學(生物科學系丙組選考)

TABLE IV Critical Values of F^1

Values of $F_{0.05}$

Degrees of freedom for denominator	Degrees of freedom for numerator: 1	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	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.29	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 F Percentiles of the Chi-Square Distribution



$p(\chi^2_{20} \leq 31.410) = .95$

d.f.	$\chi^2_{.005}$	$\chi^2_{.025}$	$\chi^2_{.05}$	$\chi^2_{.90}$	$\chi^2_{.95}$	$\chi^2_{.975}$	$\chi^2_{.99}$	$\chi^2_{.995}$
1	.0000393	.000982	.00393	2.706	3.841	5.024	6.635	7.879
2	.0100	.0506	.103	4.605	5.991	7.378	9.210	10.597
3	.0717	.216	.352	6.251	7.815	9.348	11.345	12.838
4	.207	.484	.711	7.779	9.488	11.143	13.277	14.860
5	.412	.831	1.145	9.236	11.070	12.832	15.086	16.750
6	.676	1.237	1.635	10.645	12.592	14.449	16.812	18.548
7	.989	1.690	2.167	12.017	14.067	16.013	18.475	20.278
8	1.344	2.180	2.733	13.362	15.507	17.535	20.090	21.955
9	1.735	2.700	3.325	14.684	16.919	19.023	21.666	23.589
10	2.156	3.247	3.940	15.987	18.307	20.483	23.209	25.188
11	2.603	3.816	4.575	17.275	19.675	21.920	24.725	26.757
12	3.074	4.404	5.226	18.549	21.026	23.336	26.217	28.300
13	3.565	5.009	5.892	19.812	22.362	24.736	27.688	29.819
14	4.075	5.629	6.571	21.064	23.685	26.119	29.141	31.319
15	4.601	6.262	7.261	22.307	24.996	27.488	30.578	32.801
16	5.142	6.908	7.962	23.542	26.296	28.845	32.000	34.267
17	5.697	7.564	8.672	24.769	27.587	30.191	33.409	35.718
18	6.265	8.231	9.390	25.989	28.869	31.526	34.805	37.156
19	6.844	8.907	10.117	27.204	30.144	32.852	36.191	38.582
20	7.434	9.591	10.851	28.412	31.410	34.170	37.566	39.997
21	8.034	10.283	11.591	29.615	32.671	35.479	38.932	41.401
22	8.643	10.982	12.338	30.813	33.924	36.781	40.289	42.796
23	9.260	11.688	13.091	32.007	35.172	38.076	41.638	44.181
24	9.886	12.401	13.848	33.196	36.415	39.364	42.980	45.558
25	10.520	13.120	14.611	34.382	37.652	40.646	44.314	46.928
26	11.160	13.844	15.379	35.563	38.885	41.923	45.642	48.290
27	11.808	14.573	16.151	36.741	40.113	43.194	46.963	49.645
28	12.461	15.308	16.928	37.916	41.337	44.461	48.278	50.993
29	13.121	16.047	17.708	39.087	42.557	45.722	49.588	52.336
30	13.787	16.791	18.493	40.256	43.773	46.979	50.892	53.672
35	17.192	20.569	22.465	46.059	49.802	53.203	57.342	60.275
40	20.707	24.433	26.509	51.805	55.758	59.342	63.691	66.766
45	24.311	28.366	30.612	57.505	61.656	65.410	69.957	73.166
50	27.991	32.357	34.764	63.167	67.505	71.420	76.154	79.490
60	35.535	40.482	43.188	74.397	79.082	83.298	88.379	91.952
70	43.275	48.758	51.739	85.527	90.531	95.023	100.425	104.215
80	51.172	57.153	60.391	96.578	101.879	106.629	112.329	116.321
90	59.196	65.647	69.126	107.565	113.145	118.136	124.116	128.299
100	67.328	74.222	77.929	118.498	124.342	129.561	135.807	140.169

TABLE II Critical Values of t^1

d.f.	$t_{.100}$	$t_{.050}$	$t_{.025}$	$t_{.010}$
1	3.078	6.314	12.706	31.821
2	1.886	2.920	4.303	6.965
3	1.638	2.353	3.182	4.541
4	1.533	2.132	2.776	3.747
5	1.476	2.015	2.571	3.365
6	1.440	1.943	2.447	3.143
7	1.415	1.895	2.365	2.998
8	1.397	1.860	2.306	2.896
9	1.383	1.833	2.262	2.821
10	1.372	1.812	2.228	2.764
11	1.363	1.796	2.201	2.718
12	1.356	1.782	2.179	2.681
13	1.350	1.771	2.160	2.650
14	1.345	1.761	2.145	2.624
15	1.341	1.753	2.131	2.602
16	1.337	1.746	2.120	2.583
17	1.333	1.740	2.110	2.567
18	1.330	1.734	2.101	2.552
19	1.328	1.729	2.093	2.539
20	1.325	1.725	2.086	2.528
21	1.323	1.721	2.080	2.518
22	1.321	1.717	2.074	2.508
23	1.319	1.714	2.069	2.500
24	1.318	1.711	2.064	2.492
25	1.316	1.708	2.060	2.485
26	1.315	1.706	2.056	2.479
27	1.314	1.703	2.052	2.473
28	1.313	1.701	2.048	2.467
29	1.311	1.699	2.045	2.462
inf.	1.282	1.645	1.960	2.326