

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 1 頁

40 questions; 2.5 points each.

(ps : the answer for each question may one or more than one)

1. Which of the followings is *not* related to protostomes?

- (a) Bilateral symmetry
- (b) Schizocoelous
- (c) Fate of cells following earliest cleavage determinate
- (d) Radial cleavage
- (e) Mollusca

2. Ctenophora is more closely related to

- (a) Cnidaria
- (b) Porifera
- (c) Annelida
- (d) Brachiopoda
- (e) Platyhelminthes

3. Which of the following combinations of animal group and character is *incorrect*?

- (a) Reptiles—amniote egg
- (b) Agnatha—with jaws
- (c) Pisces—ctenoid scale
- (d) Proboscidea—elongated tusks
- (e) Sirenia—no hind limbs

4. Seaweeds have the following characters *except*

- (a) thallus
- (b) zoopores
- (c) syngamy
- (d) plasmodium
- (e) sporophytes

5. Character displacement is closely linked to

- (a) allopatric distribution
- (b) feeding behavior
- (c) sympatric distribution
- (d) stasipatric speciation
- (e) founder effect

6. Limbic system is related to

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 2 頁

- (a) forebrain
- (b) arousal
- (c) short-term memory
- (d) diencephalons
- (e) thalamus

7. Apomorphic character is closely related to

- (a) phenetics
- (b) evolutionary taxonomy
- (c) microevolution
- (d) paraphyly
- (e) monophyly

8. In a local population, the frequency of one of the two alleles of a target locus is 0.4, what would be the heterozygote genotype frequency?

- (a) 0.16
- (b) 0.36
- (c) 0.24
- (d) 0.48
- (e) 0.52

9. The mesopelagic zone stretches between

- (a) 0-100 m
- (b) 100-200 m
- (c) 200-1000 m
- (d) 1000-4000 m
- (e) 4000-6000 m

10. The logistic growth equation is related to the followings *except*

- (a) time span
- (b) population size
- (c) carrying capacity
- (d) environmental resistance
- (e) mortality rate

11. Nitrification is an ecological process *not* related to

- (a) ammonia
- (b) protein production
- (c) bacteria

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 3 頁

- (d) nitrite
- (e) nitrate

12. Symbiotic algae—invertebrate association does *not* involve

- (a) dinoflagellates
- (b) commensalism
- (c) grooves around the algae body
- (d) lacking locomotive flagellae
- (e) cell wall reduced in thickness

13. El Nino is *not* related to

- (a) South America
- (b) Australia
- (c) the westerly shift of severe rain storms in the Pacific Ocean
- (d) sardine population; seawater temperature

14. A r-selected species has the following characteristics *except*

- (a) Iteroparity
- (b) small body size
- (c) short generation time
- (d) Type III survivorship curve
- (e) high net reproduction rate

15. Data on age distribution for a population and age-specific clutch size can tell us about the followings *except*

- (a) type of survivorship curve
- (b) potential of population growth
- (c) reproduction history
- (d) generation time
- (e) population size

16. Information on prey-searching time, prey-handling time, hunting cost, and net energy gain can be used for testing or estimating the

- (a) competitive exclusion principle
- (b) optimal foraging theory
- (c) confounding effect
- (d) carrying capacity
- (e) founder effect

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 4 頁

17. Which of the following terms is *not* related to the remainder?

- (a) Shannon-Wiener index
- (b) Productivity hypothesis
- (c) fractal geometry
- (d) Environmental heterogeneity hypothesis
- (e) Time since perturbation hypothesis

18. Which of the following pairs of biological terms is *mismatched*?

- (a) dark-bottle—respiration
- (b) standing crop of phytoplankton—patchy distribution of phytoplankton
- (c) sea grass—epiphytic organisms
- (d) nekton—cephalopod mollusks
- (e) Interstitial animals—copepods

19. Which of the following terms is *not* related to the remainder?

- (a) Batesian mimicry
- (b) Mullerian mimicry
- (c) polymorphism
- (d) aposematic coloration
- (e) chemical weapon

20. Counter-current system is *not* found in the

- (a) fish heart
- (b) fish rete mirabile
- (c) tuna red muscle
- (d) hagfish branchial pouch
- (e) fish gill

21. Which of the following statement is *not* correct about lipid metabolism?

- (a) All the enzyme for fatty acid catabolism are located in mitochondria.
- (b) Fatty acid is synthesized from acetyl-coA in cytosol.
- (c)  $\alpha$ -glycerol phosphate is synthesized from carbohydrate.
- (d)  $\alpha$ -glycerol phosphate is linked to fatty acid to form triacylglycerols by enzymes in the granular endoplasmic reticulum.

22. Which of the following statement is *not* a characteristic for receptor?

- (a) Lipid-soluble messengers bind to receptor, and the activated receptor functions as a transcription factor to alter the rate of transcription of specific gene.
- (b) The signal transduction pathways triggered by activated plasma membrane receptors

國立中山大學96學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共8頁第5頁

- may influence gene expression by activating transcription factors.
- (c) The receptors inside cells bind to messengers may activate the transduction pathway involve second messengers and protein kinases.
- (d) The receptor, via a G protein, may directly open or close an adjacent ion channel.
23. The unbound neurotransmitters in synaptic cleft can not be removed by
- (a) actively transported back into the axon terminal.
- (b) diffusing away from the receptor site.
- (c) facilitated diffusion into the nearing glial cells.
- (d) enzymatically transformed into ineffective substances.
24. Which of the following statement is *not* correct about hair cells in the organ of Corti?
- (a) The hair cells are mechanoreceptors.
- (b) The hair cells transform the pressure waves in the cochlea into action potentials.
- (c) The activity of hair cells are regulated by efferent nerve fibers from the brainstem.
- (d) Movement of the hair cells' stereocilia open the ion channels in the hair cells' plasma membrane.
25. Which of the following statement is *not* correct about hormone?
- (a) The response to a hormone is highly specific, involving only the target cells for that hormone.
- (b) Up-regulation is an increase in the number of a hormone's receptors.
- (c) Up-regulation is often resulting from a prolonged exposure to high concentrations of the hormone.
- (d) Hormones can cause up-regulation and down-regulation of their own receptors.
26. Which of the following statement is *not* correct about the control mechanism of brain blood supply?
- (a) It has well auto-regulation system.
- (b) The distribution of brain blood is controlled by local metabolic factors.
- (c) The artery CO<sub>2</sub> concentration increase may induce the blood vessel contract.
- (d) Autonomic neurons may not influence the blood vessel of this area.
27. Which of the following is *not* correct about the formation of concentrated urine ?
- (a) Distal convoluted tubule is highly permeable to water
- (b) Vasopressin increases the permeability of the cortical collecting ducts to water.
- (c) The countercurrent multiplier system forms the osmolarity gradient of interstitial fluid.
- (d) The hairpin-loop structure of the vasa recta prevents the countercurrent gradient from being washed away.

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 6 頁

28. Which of the following statement is correct about the calorogenic effect?
- (a) The calorogenic effect of thyroid hormone acts on all body tissues.
  - (b) The calorogenic effect of epinephrine may be related to the stimulation of protein catabolism.
  - (c) Ingested carbohydrate produces the greatest food-induced thermogenesis.
  - (d) The factor that can most increase calorogenic effect is altered skeletal-muscle activity.
29. Which of the following statement is correct about the function of testosterone?
- (a) Testosterone must first undergo transformation to dihydrotestosterone in epididymis then act on target cells of the accessory reproductive organs.
  - (b) Testosterone must first undergo transformation to estrogen to act on its target cells in the brain.
  - (c) Testosterone act on Leydig cells to promote spermatogenesis.
  - (d) Testosterone is unable to influence the epiphyseal plate closure.
30. Which of the following statement is correct about the alternate complement pathway?
- (a) It's specific immune defense.
  - (b) Alternate complement pathway initiated as the result of the surface protein of the microbes.
  - (c) The initiation complement protein of alternate complement pathway is C1.
  - (d) Alternate complement pathway can produces membrane attack complex.
31. Which is not belonging to plants?
- (a) alga
  - (b) cyanobacteria
  - (c) cobia
  - (d) lichen
32. Which of the following statement is *incorrect* about plant cell wall?
- (a) composed of polysaccharide
  - (b) composed of protein
  - (c) ion binding
  - (d) no function for cell metabolism
33. Photosynthesis is essential for plant life. Which of the following statement is *not* correct about photosynthesis?
- (a) Chloroplast is the organelle for photosynthesis in eukaryotic plants.
  - (b) Light energy is converted to chemical energy through chlorophyll excitation in

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 7 頁

photosynthetic reaction center.

- (c)  $\text{HCO}_3^-$  is the substrate for the first enzyme reaction in the dark fixation.
- (d) ATP is generated in the electron transport flow.

34. Nitrogen is an essential nutrient for plants. Which of the following statement is *not* correct about nitrogen assimilation by plant cells?

- (a) nitrate is reduced to nitrite by the catalysis of nitrite reductase
- (b) ammonium is incorporated into amino acid via GS/GOGAT pathway
- (c) photosynthesis is associated with nitrogen assimilation
- (d) nitrogen gas can be reduced to ammonium by nitrogenase, known as  $\text{N}_2$  fixation.

35. Plant tropism is related to

- (a) gravity
- (b) light
- (c) indole-3 acetic acid (IAA)
- (d) postauxium

36. Plant is the primary producer. Which of the following statement is correct?

- (a) an important component for ecosystem
- (b) because it is the primary producer, it can not be consumed by other organisms.
- (c) blooming by elevated nutrient concentrations
- (d) forest exhibits higher productivity comparing to other ecosystem

37. Phenolic compounds are one of the secondary metabolites in plants. The functions of phenolic compounds are

- (a) defense chemicals
- (b) as the component of protein
- (c) a precursor for nucleic acid synthesis
- (d) nutrient

38. Plant hormone controls plant growth and development. Which of the following statement is *not* correct?

- (a) Abscisic acid is considered the stress hormone.
- (b) Ethylene is synthesized via the Yang cycle.
- (c) Cell division is controlled by Cytokinin.
- (d) Lower plants such as algae do not have plant hormone.

39. Which of the following statement is *not* correct about transgenic plants?

- (a) can be achieved by the Agrobacterium-mediated transformation

國立中山大學 96 學年度碩士班招生考試試題

科目：普通生物學【海生所碩士班】

共 8 頁 第 8 頁

- (b) it is the genetically modified organism
- (c) it is not necessary for environmental risk assessment
- (d) it can be used for the production of animal protein.

40. What kind of plants can be found in the marine?

- (a) algae
- (b) rice
- (c) mangrove
- (d) lichen



# 國立中山大學 96 學年度碩士班招生考試試題

科目：科學英文閱讀測驗【海生所碩士班】

共 3 頁 第 1 頁

請詳細閱讀下面文章後，以簡略的方式以中文寫出每一段的主要內容。文中比較專有名詞，請使用已知之相對中文俗名。評分方式以對原文的理解、表達通順為主。

總分 100 分

## Paper 1 (60 分)

The structure of marine benthic communities is influenced by natural and anthropogenic disturbances (Connell 1978, Grigg, 1983, Sousa 1984, Hughes 1989, 1994, Done 1992, Witman 1992, Karlson and Hurd 1993, Connell 1997, Hughes and Connell 1999); the temporal variation of communities is governed by a variety of interacting physical, biological and anthropogenic processes that vary in frequency, intensity and spatial scale (Levin 1992, Karlson and Hurd 1993). Studies document that turf and macroalgal covers will increase following natural and anthropogenic disturbances (Glynn 1983, Done 1992, Shulman and Robertson 1996). Abiotic factors, such as nutrients, water temperature, irradiance, hydrodynamism, salinity, and sediment movement and deposition, are recognized fluctuation as playing a fundamental role in influencing the structure and abundance of benthic macroalgae (Tsai et al. 2004, Tsai et al. 2005, Hwang et al. 2004, McQuaid and Branch 1984, Kautsky and van der Maarel 1990, McQuaid and Dower 1990, Lüning 1993, Vidondo and Duarte 1995, Andrew and Viejo 1998).

Typhoon as a tropical storm is an important disturbance on the spatio-temporal structure of communities in the tropical and subtropical waters of Asia (Hutchinson and Williams 2003). In the rocky shores of Hong Kong, typhoon is a primary cause for the creation of free space, where mid-shore assemblage succession occurs with a fast recovery to undisturbed condition forced by annual, summer die-off events (Hutchinson and Williams 2003). Taiwan, localized on the western North Pacific, is also frequently struck by typhoons in hot summer (May-September). During September 6-16, 2001, Taiwan was struck by the onslaught of Typhoon Nari, an unusual autumn storm which brought torrential rains and the record-breaking 24-48 hour accumulated rainfalls more than 2000 mm in some parts of Taiwan caused widespread flooding (Sui et al. 2002). It has been documented that Nari heavy rainfalls on Taiwan were due to warm sea surface temperature, Nari unique track and very slow moving speed, and the steep terrain of Taiwan (Sui et al. 2002, Yang and Huang 2004). Nari also brought strong sea waves to coastal areas, clearing most benthic marine organisms and opening up free spaces. The creation of free space allows many species to recruit, leading to the succession of benthic community after Typhoon Nari. It is interesting for us to examine how benthic community succeeds and which factors involve this succession post this unusual storm occurring in the autumn in northeastern Taiwan. Even the impacts of tropical cyclone on marine benthic community have been extensively studied worldwide, the succession of benthic community after pulse typhoon disturbance is

# 國立中山大學 96 學年度碩士班招生考試試題

科目：科學英文閱讀測驗【海生所碩士班】

共 3 頁 第 2 頁

far from understood in the subtropical waters of Taiwan. Because benthic macroalgae tend to integrate the effects of long-term exposure to adverse conditions, macroalgal assemblages are used in this study to characterize and monitor benthic communities and to understand the mechanisms by which natural and anthropogenic factors may alter the structure of biotic communities in the areas frequently hit by pulse typhoon disturbances. In an attempt to check the interannual variations in macroalgal species compositions and their abundance on the rocky shores in northeastern Taiwan before and after Typhoon Nari, the survey from 2001-2003 was first analyzed by the univariate indices using Shannon-Wiener species diversity index ( $H'$ ) and evenness ( $J'$ ), and also by the  $k$ -dominance curve. The differences in species structure between assemblages were also analyzed by multivariate test using non-metric multidimensional scaling (nMDS) method and analysis of similarity (ANOSIM). The comparisons of data between macroalgal compositions and abiotic variables were made to figure out the potential abiotic factors influencing the macroalgal succession after an unusual autumn storm Typhoon Nari.

## Paper 2 (40 分)

Salinity fluctuation has been considered to be the primary factor limiting the growth of macroalgae from rocky intertidal regions and estuaries (Lobban and Harrison 1997). Therefore, it is becoming important to understand how algae respond and adapt to such stress. The physiological and biochemical responses of algae to salinity stress, including osmotic adjustment, ion homeostasis and compartmentation, metabolite accumulation, growth and development, photosynthesis, and respiration, have been extensively studied (Kirst 1990; Parida and Das 2005). It is known in higher plants that the generation of reactive oxygen species (ROS) could be enhanced by salinity, thus leading to oxidative stress (Singha et al. 1990; Hernández et al. 1993; Fadzilla et al. 1997; Wang et al. 1998; Rios-Gonzalez et al. 2002). In general, ROS is produced from chloroplast and mitochondrion electron transport flow and also from peroxisome and membrane-bound. It is known that oxidative stress results from the disruption of cellular homeostasis of ROS production from the excitation of  $O_2$  to form singlet oxygen ( $O_2^1$ ) and the transfer of 1, 2 or 3 electrons to  $O_2$  to form superoxide ( $O_2^-$ ), hydrogen peroxide ( $H_2O_2$ ) and hydroxyl radical ( $HO^\cdot$ ), respectively (Halliwell and Gutteridge 1989); the generating ROS causes oxidative destruction of the cell components through oxidative damage of membrane lipids, nucleic acid and protein (Davis 1987; Wise and Naylor 1987; McKersie and Leshem 1994; Imlay and Linn 1998). To counteract the toxicity of ROS, the defense systems in scavenging of cellular ROS have been developed in plants to cope with oxidative stress via the non-enzymatic and enzymatic systems (Noctor and Foyer 1998; Asada 1999). Small

# 國立中山大學 96 學年度碩士班招生考試試題

科目：科學英文閱讀測驗【海生所碩士班】

共 3 頁 第 3 頁

antioxidant molecules such as water-soluble ascorbate (AsA) and glutathione (GSH) and water-insoluble  $\alpha$ -tocopherol and carotenoids are the main non-enzymatic agents for ROS scavenging (Noctor and Foyer 1998; Smirnov and Wheeler 2000; Munné-Bosch and Alegre 2002). Several enzymes are involved in the detoxification of ROS; superoxide dimutase (SOD; EC 1.15.1.1) can convert  $O_2^-$  to  $H_2O_2$  and then  $H_2O_2$  is removed by ascorbate peroxidase (APX; EC 1.11.1.11) and glutathione reductase (GR; EC 1.6.4.2) in the ascorbate-glutathione cycle (AGC) (Asaka 1999). APX utilizes AsA to reduce  $H_2O_2$  by the oxidation of AsA to the monodehydroascorbate (MDHA) radical, which is reduced to AsA either by photosynthetic electron flow through ferredoxin or by NAD(P)H-dependent monodehydroascorbate reductase (MDHAR; EC 1.6.5.4). If NAD(P)H is limited, MDHA would be spontaneously disproportionated to AsA and dehydroascorbate (DHA) (Mittler 2002) and then DHA will be reduced to generate AsA by dehydroascorbate reductase (DHAR; EC 1.8.5.1) using GSH as an electron donor; the GSSG formed after GSH oxidization is reduced to GSH by GR utilizing reducing equivalents from NAD(P)H. Catalase (CAT; EC 1.11.1.6) (Willekens et al. 1997) and several kinds of peroxidase (POX; EC 1.11.1.7) (Asaka and Takahashi 1987) are also involved in  $H_2O_2$  removal. Several reports have shown there is a close association of antioxidant capacity and salinity tolerance in higher plants (Dionisio-Sese and Tobita 1998; Hernandez et al. 1999; Amor et al. 2005; Kim et al. 2005). It is likely that the ability in scavenging ROS and preventing and repairing their damaging effects on macromolecules is critical for salt tolerance plants.