高雄醫學大學 109 學年度學士後醫學系招生考試試題

科目：普通生物學

I.【單選題】每題 1 分，共計 30 分。答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
1~15 題為普通生物學，16~30 題為生化概論。

(A) 1. In evolution, which academic term is defined as changes in allele frequency that can be observed within a population?
(A) Microevolution (B) Speciation (C) Genetic evolution
(D) Phenotypic evolution (E) Hybridization

(C) 2. What kind of neurotransmitter is used in the vertebrate neuromuscular junction?
(A) Glutamate (B) Dopamine (C) Acetylcholine
(D) Serotonin (E) GABA

(E) 3. Which one of the following hypothesis explains why multiple codon can code for a single amino acid?
(A) Crick (B) Franklin (C) Mendelian (D) Watson (E) Wobble

(C) 4. What is the major difference between Gram-positive and Gram-negative bacteria?
(A) Genome size (B) Lipid composition of membrane
(C) Cell wall structure (D) Protein composition
(E) Cell shape

(E) 5. Which one of the following structure is not observed in eukaryotic cells?
(A) Ribosome (B) Plasma membrane (C) Nuclear envelope
(D) Chromosome (E) Plasmid

(D) 6. _____ are gene copies resulted from gene duplication events in the same species.
(A) Twin (B) Analogs (C) Orthologs (D) Paralogs (E) Dialogs

(D) 7. Which one of the following human cell in the reproductive system is not diploid?
(A) Oogonium (B) Primary oocyte (C) Spermatogonium
(D) Polar body (E) Zygote

(C) 8. Which one of the following mechanism is not required for the control of eukaryotic gene expression?
(A) Histone modification (B) RNA splicing (C) Operon regulation
(D) Protein processing (E) DNA methylation

(C) 9. Which one of the following nutrient cycle is important for photosynthetic organisms?
(A) Water cycle (B) Nitrogen cycle (C) Carbon cycle
(D) Phosphorus cycle (E) Sulfur cycle

(B) 10. Which one of the following DNA technology could be used to edit genes in living cells?
(A) Next generation sequencing (B) CRISPR-Cas9 system (C) DNA microarray
(D) *In situ* hybridization (E) Reverse transcriptase PCR

(C) 11. The site of the thickest musculature in the heart is _____.
(A) left atrium (B) aorta (C) left ventricle
(D) right ventricle (E) right atrium

(E) 12. Which one of the following is caused by excessive nutrient runoff into lakes?
(A) Biomanipulation (B) Biological magnification
(C) Global warming (D) Top-down control (E) Eutrophication

(D) 13. The cells in the human body are in contact with an internal environment consisting of _____.
(A) blood (B) connective tissue (C) matrix
(D) interstitial fluid (E) mucous membranes

(C) 14. Which one of the following is not a part of the vertebrate innate defense system?
(A) Natural killer cell (B) Interferon (C) Antibody
(D) Complement system (E) Inflammation

(A) 15. Which one of the following signal molecule is specific to animals?
(A) Pheromone (B) Cytokinin (C) Ethylene
(D) Strigolactone (E) Nitric oxide

Ⅱ.【單選題】每題 2 分，共計 120 分。答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
31~60 題為普通生物學，61~90 題為生化概論。

(B) 31. Which one of the following is one kind of interspecific interaction along a food chain?
(A) Competition (B) Predation (C) Parasitism
(D) Mutualism (E) Positive interaction

(B) 32. Which sequence of structures through which water passes into a root is correct?
(A) Guard cell, endodermis, cortex, xylem
(B) Epidermis, cortex, endodermis, xylem
(C) Root hair, cortex, xylem, endodermis
(D) Root hair, xylem, endodermis, phloem
(E) Root hair, endodermis, cortex, xylem

(D) 33. Which one of the following is most likely to produce an Taiwanese butterfly species in the wild whose members have one of two strikingly different color patterns?
(A) Artificial selection (B) Directional selection (C) Stabilizing selection
(D) Disruptive selection (E) Sexual selection

(C) 34. The plant growth response to touch is known as _____.
(A) gravitropism (B) geotropism (C) thigmotropism
(D) phototropism (E) circadian rhythm

(E) 35. Which one of the following is mismatched with its function?
(A) Most B vitamins *vs* coenzymes
(B) Vitamin E *vs* antioxidant
(C) Vitamin K *vs* blood clotting
(D) Phosphorus *vs* bone formation, nucleotide synthesis
(E) Iron *vs* component of thyroid hormones

(B) 36. If blood was supplied to all of the body's capillaries at the same time, _____.
(A) resistance to blood flow would increase
(B) blood pressure would fall dramatically
(C) blood would move too rapidly through the capillaries
(D) the amount of blood returning to the heart would increase
(E) the increased gas exchange in the lungs and in the supply of O_2 to muscles would allow for strenuous exercise

(E) 37. Which one of the following will control the activity of the others mentioned below?
(A) Thyroid gland (B) Pituitary gland (C) Adrenal cortex
(D) Ovary (E) Hypothalamus

(B) 38. Some human males have three sex chromosomes (XXY) and suffer from a genetic disease known as Klinefelter's syndrome. The symptoms include a failure to develop sexually and an impairment of intelligence. This is an example of a disease of _____.
(A) point mutation (B) karyotype (C) homeostasis
(D) bacterial origin (E) old age

(E) 39. Which one of the following could provide the best data for determining the phylogeny of very closely related species?
(A) The fossil record
(B) A comparison of embryological development
(C) An analysis of their morphological differences and similarities
(D) A comparison of their ribosomal DNA sequences
(E) A comparison of nucleotide sequences in homologous genes and mitochondrial DNA

(D) 40. Which one of the following plant could be more likely to adapt hot and arid environments?
1. Arabidopsis
2. Rice
3. Sugarcane
4. Pineapple
5. Cactus
(A) 1,2 (B) 1,2,3 (C) 1,2,5 (D) 3,4,5 (E) 1,2,3,4,5

(A) 41. Which one of the following statement is correct between glycogen and cellulose?
(A) Basic subunits are both glucose.
(B) Location in the cellular level is the same.
(C) The linkage between each subunits is the same.
(D) Function in organisms are both for storage.
(E) Both are structurally branched.

(B) 42. Which one of the following is not related to paternity test?
(A) Short tandem repeats (STRs) of DNA
(B) Reverse transcription
(C) Primer
(D) DNA polymerase
(E) PCR

(C) 43. Which one of the following organelle is not included in the endomembrane system?
(A) Golgi apparatus (B) Endoplasmic reticulum (C) Proteasome
(D) Lysosome (E) Nuclear envelope

(D) 44. Which are the three people awarded for Nobel Prize to the discovery of how the cells sense and adapt to oxygen availability?
(A) James E. Rothman, Randy W. Schekman, and Thomas C. Sudhof
(B) John O'Keefe, May-Britt Moser, and Edvard I. Moser
(C) William C. Campbell, Satoshi .mura, and Youyou Tu
(D) William G. Kaelin Jr, Sir Peter J. Ratcliffe, and Gregg L. Semenza
(E) Jeffrey C. Hall, Michael Rosbash, and Michael W. Young

(C) 45. In temperate regions, which pigment is responsible for the red-yellow coloration seen in leaves during the color change in autumn?
(A) Chlorophyll *a* (B) Chlorophyll *b* (C) Carotenoids
(D) Porphyrin (E) Anthocyanin

(B) 46. If we use $^{14}CO_2$ as a radioactive tracer to track the carbon transition, which one of the following molecule could be incorporated in the last reaction of Calvin cycle?
(A) Glyceraldehyde-3-phosphate (G3P)
(B) Ribulose biphosphate (RuBP)
(C) 1,3-biphosphoglycerate (1,3-BPG)
(D) 3-phosphoglycerate (3PG)
(E) Glucose

(A) 47. Compare to the function of plasmodesmata in plant cells, which structure serve the same function in animal cells?
(A) Gap junctions (B) Middle lamella (C) Hemidesmosomes
(D) Tight junctions (E) Basal lamina

(C) 48. If the genus *Oryza* is monophyletic, which one of the following is correct?
(A) *Oryza* all have nearly identical appearance.
(B) *Oryza* cannot be classified in a single family or order.
(C) All species of *Oryza* are descended from a common ancestor.
(D) All species of plant are classified as being in a single order.
(E) All species of *Oryza* grow in similar habitats.

(D) 49. Nitrogen fixation is observed in some plant species. Which one of the following statement is correct about nitrogen fixation?
(A) N_2 will be converted to NO_3^-.
(B) Nitrifying bacteria are able to fix nitrogen gas.
(C) This occurs in aerobic environment.
(D) This may produce hydrogen gas.
(E) This is catalyzed by nitrate reductase.

(C) 50. A circular 3518 bp plasmid DNA has EcoRI restriction sites at position 86 and 1435; PstI sites at position 1108 and 2950; and a BamHI site at position 2623. Which one of the following choices is not correct?
(A) EcoRI digestion yields two bands in agarose gel.
(B) When digestion with EcoRI and BamHI, three bands will be observed in agarose gel.
(C) After digestion with EcoRI, PstI and and BamHI, five bands will be observed in agarose gel.
(D) When digestion with EcoRV and PstI, only two bands will be observed in agarose gel.
(E) BamHI digestion yields only one band in agarose gel.

(E) 51. Endosymbiotic events had occurred multiple times during evolution. Which one of the following organism contain endosymbiont organelles?
1. Green algae
2. Red algae
3. Chlorarachniophytes
4. Euglenids
5. Arabidopsis
6. Rice
7. Mouse
8. Human
(A) 1,2 (B) 3,4 (C) 1,2,3,4 (D) 1,2,3,4,5,6 (E) 1,2,3,4,5,6,7,8

(A) 52. Which one of the following statement about the immune system is correct?
(A) The innate immunity is found in all animals and plants.
(B) The adaptive immune response is activated before the innate response and develops quickly.
(C) The helper T cells recognize peptide antigens in major histocompatibility complex MHC class I molecules on dendritic cells.
(D) Perforin triggers blood vessels to dilate and become more permeable.
(E) The complement system provides innate defense by interfering with viruses and helping activate macrophages.

(A) 53. In Australia, marsupials fill the niches that placental mammals fill in other parts of the world because _____.
(A) after Pangaea broke up, they diversified in physical isolation from placental mammals
(B) they originated in Australia
(C) they evolved from monotremes that migrated to Australia about 50 million years ago
(D) human-caused environmental changes have favored the success of marsupials
(E) they are better adapted and have outcompeted placental mammals (eutherians)

(A) 54. What is the function of the cilia in the trachea and bronchi?
(A) To sweep mucus with trapped particles up and out of the respiratory tract.
(B) To increase the surface area for gas exchange.
(C) To vibrate when air is exhaled to produce sounds.
(D) To dislodge food that may have slipped past the epiglottis.
(E) To sweep air into and out of the lungs.

(C) 55. Which one of the following statement is correct description about the COVID-19 virus?
(A) During COVID-19 virus reproduction, spike glycoproteins are assembled into the virus along with reverse transcriptase.
(B) Successful entry of a virus into a cell depends on the inactivation of envelope glycoproteins by host cell proteases.
(C) COVID-19 virus replication entails ribosome frameshifting during genome translation, and the synthesis of both genomic and multiple subgenomic RNA species.
(D) COVID-19 virus are enveloped DNA viruses that are spherical in shape and characterized by crown-like spikes on the surface.
(E) Persons often die of opportunistic diseases because COVID-19 virus destroys T cells.

(E) 56. Which one of the following statement about nervous system is correct?
(A) Parasympathetic nervous system is activated when the person feels nervous.
(B) The hallmark of Parkinson's disease is the neurofibrillary tangles surrounding amyloid plaques.
(C) The occipital lobe plays the role in biological clock regulation.
(D) The parietal lobe of the cerebral cortex play the role in comprehending language.
(E) The cerebellum helps coordinate motor, perceptual, and cognitive functions.

(D) 57. In flowering plant, which one of the following is reflected to be an important plant hormone that helps plants adapt with environmental stresses?
(A) Auxin (B) Cytokinin (C) Ethylene
(D) Abscisic acid (E) Prostaglandin

(E) 58. In gene therapy, _____ can be used as a vector to deliver normal genes directly into the cells of the body.
(A) transposons (B) mutagens (C) amniocentesis
(D) bacteria (E) viruses

(C) 59. Female Pheasant-tailed Jacanas (水雉) aggressively court males and, after mating, leave the clutch of young for the male to incubate. This sequence may be repeated several times with different males until no available males remain. Which one of the following term will best describe this behavior?
(A) Monogamy (B) Polygyny (C) Polyandry
(D) Promiscuity (E) Paternity

(D) 60. What is the effective population size (Ne) for a population of Black Bears with 500 males and 300 females?
(A) 300 (B) 400 (C) 500 (D) 750 (E) 800

生　物

曾正(曾蘇賢)老師提供

試題分佈

範疇	題數	題目
基礎生化	1題	第41題
細胞學	3題	第5、43、47題
生物能量學	4題	第40、44、45、46題
細胞遺傳學	1題	第7題
古典遺傳學	1題	第38題
分子生物學	6題	第3、8、10、42、50、58題
動物生理學	12題	第2、11、13、14、15、35、36、37、52、54題 第55、56題
生物分類學	1題	第4題
演化論 (含行為學)	8題	第1、6、33、39、48、51、53、59題
生態學	4題	第9、12、31、60題
植物生理學	4題	第32、34、49、57題

試題評析

1. 此次高醫後西醫生物試題簡直是大放送，整份試卷考的都是重點中的題目。
2. 課外題僅有武漢肺炎病毒、2019諾貝爾生理／醫學獎得主，這些早就在課堂上補充過了，高醫居然又作球給考生們，那麼同學也就別客氣了。
3. 第50題，題目突然跑出 EcoRV，不知是誤植或故意設計，但是不影響本題仍應予以送分。另外第57題，植物壓力激素有ABA及乙烯，此題亦具有爭議！
4. 一如往常老師所交代：分生、演化、生態、生物能量學及簡單的動物生理學等內容皆是後西醫易考內容，同學應予以熟讀。事實也證明完全命中。
5. 本班優等生，生物可拿到70分以上高分，中等生亦有65～70分之間的好成績。

試題評析

(A) 1. In evolution, which academic term is defined as changes in allele frequency that can be observed within a population?
(A) Microevolution (B) Speciation (C) Genetic evolution
(D) Phenotypic evolution (E) Hybridization

解析
Microevolution係指族群中對偶基因頻率在世代之間發生改變。
[命中生物總復習第(一)回講義 p.44]

(C) 2. What kind of neurotransmitter is used in the vertebrate neuromuscular junction?
(A) Glutamate (B) Dopamine (C) Acetylcholine
(D) Serotonin (E) GABA

解析
脊椎動物負責骨骼肌收縮的神經傳遞物質為ACh。
[命中生物總復習第(一)回講義 p.158補充]

(E) 3. Which one of the following hypothesis explains why multiple codon can code for a single amino acid?
(A) Crick (B) Franklin (C) Mendelian (D) Watson (E) Wobble

解析
因為Wobble effect故造成了同一個胺基酸由多個不同的密碼子(codons)來指定。
[命中生物總復習第(一)回講義 p.27補充]

(E) 5. Which one of the following structure is not observed in eukaryotic cells?
(A) Ribosome (B) Plasma membrane (C) Nuclear envelope
(D) Chromosome (E) Plasmid

解析
Plasmid通常是存在於原核細胞中，通常真核細胞不具有(但 yeast 具有Plasmid)。
[命中生物總復習第(一)回講義 p.62]

(D) 6. _____ are gene copies resulted from gene duplication events in the same species.
(A) Twin (B) Analogs (C) Orthologs (D) Paralogs (E) Dialogs

解析
Paralogs gene係藉由基因重覆而存在於相同基因組中。
[命中生物總復習第(一)回講義 p.93]

(D) 7. Which one of the following human cell in the reproductive system is not diploid?
(A) Oogonium (B) Primary oocyte (C) Spermatogonium
(D) Polar body (E) Zygote

解析
除了Polar body 為 1n，其餘細胞皆為 2n。
[命中生物總復習第(一)回講義 p.14補充]

(C) 8. Which one of the following mechanism is not required for the control of eukaryotic gene expression?
(A) Histone modification (B) RNA splicing (C) Operon regulation
(D) Protein processing (E) DNA methylation

解析

Operon model 通常是細菌基因 (而非真核基因)，表現調控的機制。
[命中生物總復習第(一)回講義 p.30]

(C) 11. The site of the thickest musculature in the heart is _____.
(A) left atrium (B) aorta (C) left ventricle
(D) right ventricle (E) right atrium

解析

心臟中以左心室的肌肉最厚。
[命中生物總復習第(一)回講義 p.32、33]

(C) 14. Which one of the following is not a part of the vertebrate innate defense system?
(A) Natural killer cell (B) Interferon (C) Antibody
(D) Complement system (E) Inflammation

解析

抗體係由 B細胞製造，不屬於先天防禦機制。
[命中生物總復習第(一)回講義 p.35]

(B) 32. Which sequence of structures through which water passes into a root is correct?
(A) Guard cell, endodermis, cortex, xylem
(B) Epidermis, cortex, endodermis, xylem
(C) Root hair, cortex, xylem, endodermis
(D) Root hair, xylem, endodermis, phloem
(E) Root hair, endodermis, cortex, xylem

解析

H_2O藉由通過 Epidermis → cortex → endodermis → xylem 而至中柱。
[命中生物總復習第(一)回講義 p.9補充]

(C) 34. The plant growth response to touch is known as _____.
(A) gravitropism (B) geotropism (C) thigmotropism
(D) phototropism (E) circadian rhythm

解析

植物回應碰觸的方向型生長稱為 thigmotropism。
[命中生物總復習第(一)回講義 p.43]

(E) 35. Which one of the following is mismatched with its function?
(A) Most B vitamins *vs* coenzymes
(B) Vitamin E *vs* antioxidant
(C) Vitamin K *vs* blood clotting
(D) Phosphorus *vs* bone formation, nucleotide synthesis
(E) Iron *vs* component of thyroid hormones

解析

thyroid hormone 的組成是需要 I 元素而非 Fe。

[命中生物總復習第(一)回講義 p.42]

(D) 40. Which one of the following plant could be more likely to adapt hot and arid environments?

1. Arabidopsis
2. Rice
3. Sugarcane
4. Pineapple
5. Cactus

(A) 1,2 (B) 1,2,3 (C) 1,2,5 (D) 3,4,5 (E) 1,2,3,4,5

解析

適應熱且乾燥環境的植物為 C4 plant (甘蔗)及 CAM 植物 (鳳梨、仙人掌)。

[命中生物總復習第(一)回講義 p.12補充]

(C) 43. Which one of the following organelle is not included in the endomembrane system?

(A) Golgi apparatus (B) Endoplasmic reticulum (C) Proteasome
(D) Lysosome (E) Nuclear envelope

解析

Proteasome 非內膜系統組成，而是分解 protein 的裝置。

[命中生物總復習第(一)回講義 p.5]

(D) 44. Which are the three people awarded for Nobel Prize to the discovery of how the cells sense and adapt to oxygen availability?

(A) James E. Rothman, Randy W. Schekman, and Thomas C. Sudhof
(B) John O'Keefe, May-Britt Moser, and Edvard I. Moser
(C) William C. Campbell, Satoshi .mura, and Youyou Tu
(D) William G. Kaelin Jr, Sir Peter J. Ratcliffe, and Gregg L. Semenza
(E) Jeffrey C. Hall, Michael Rosbash, and Michael W. Young

解析

2019年 Nobel prize (for physiology or medicine)得主為

(1) William G. Kaelin Jr。

(2) Sir Peter J. Ratcliffe

(3) Gregg L. Semenza

因其發現細胞如何感應並適應O_2的利用

[命中生物總復習第(一)回講義 p.10, p11補充；總復習生物能量學上課時補充]

(A) 47. Compare to the function of plasmodesmata in plant cells, which structure serve the same function in animal cells?

(A) Gap junctions (B) Middle lamella (C) Hemidesmosomes
(D) Tight junctions (E) Basal lamina

解析

plant cell 的 plasmodesmata之功能等同animal cell 的 gap junction。

[命中生物總復習第(一)回講義 p.6]

(C) 48. If the genus *Oryza* is monophyletic, which one of the following is correct?
(A) *Oryza* all have nearly identical appearance.
(B) *Oryza* cannot be classified in a single family or order.
(C) All species of *Oryza* are descended from a common ancestor.
(D) All species of plant are classified as being in a single order.
(E) All species of *Oryza* grow in similar habitats.

解析
單系群的定義係由來自一共同祖先的所有後代組成。
[命中生物總復習第(一)回講義 p.92補充]

(E) 51. Endosymbiotic events had occurred multiple times during evolution. Which one of the following organism contain endosymbiont organelles?
1. Green algae
2. Red algae
3. Chlorarachniophytes
4. Euglenids
5. Arabidopsis
6. Rice
7. Mouse
8. Human
(A) 1,2 (B) 3,4 (C) 1,2,3,4 (D) 1,2,3,4,5,6 (E) 1,2,3,4,5,6,7,8

解析
內共生胞器係指粒線體(動／植物)、葉綠體(植物／部份原生生物)。
[命中生物總復習第(一)回講義 p.50]

(D) 57. In flowering plant, which one of the following is reflected to be an important plant hormone that helps plants adapt with environmental stresses?
(A) Auxin (B) Cytokinin (C) Ethylene
(D) Abscisic acid (E) Prostaglandin

解析
植物的壓力激素有二：
(1)ABA (H_2O缺乏時)
(2) Ethylene (浸沒、受傷時)
[命中生物總復習第(一)回講義 p.43]

(E) 58. In gene therapy, _____ can be used as a vector to deliver normal genes directly into the cells of the body.
(A) transposons (B) mutagens (C) amniocentesis
(D) bacteria (E) viruses

解析
人體基因治療中最經常利用的載體是病毒
[命中生物總復習第(一)回講義 p.63補充]

(C) 59. Female Pheasant-tailed Jacanas (水雉) aggressively court males and, after mating, leave the clutch of young for the male to incubate. This sequence may be repeated several times with different males until no available males remain. Which one of the following term will best describe this behavior?
(A) Monogamy (B) Polygyny (C) Polyandry
(D) Promiscuity (E) Paternity

解析
此為一雌多雄 (polyandry)的代表例
[命中生物第(十二)回講義 p.162]

(D) 60. What is the effective population size (Ne) for a population of Black Bears with 500 males and 300 females?
(A) 300 (B) 400 (C) 500 (D) 750 (E) 800

解析
Ne = $\frac{4 \times 500 \times 300}{500+300}$ **= 750**
[命中生物第(九)回講義 p.197]