



馬來西亞留台成功大學校友會

主 辦

2025 年

第四十屆成大數理比賽

考生指示：

- (一) 解答所有問題。
- (二) 將正確答案在答案紙上的圓圈內“塗黑”，每題只准給一個答案。
- (三) 正確的答案得三分，錯誤的答案扣一分，不做答的零分。

INSTRUCTIONS TO CANDIDATES

1. Attempt all questions.
2. Pick the correct answer and make a mark “●” in the circle provided in the answer sheet. Only one answer is allowed for each question.
3. Three marks for a correct answer, one mark will be deducted for each wrong answer. No mark will be given to each question not attempted.

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

1. 居住在您皮膚上的細菌種類組成 _____。

The species of bacteria residing on your skin make up _____.

- (A) 群落/a community
- (B) 生態系/ an ecosystem
- (C) 族群/ a population
- (D) 個體生態/organisms ecology
- (E) 生物圈/the biosphere

2. 以下哪項對於細胞的陳述是**正確**的?

Which of the following statements about cells is **correct**?

- (A) 單細胞無法獨立存在/Single cells cannot exist independently.
- (B) 所有細胞都有細胞核/All cells have a nucleus.
- (C) 原核生物和真核生物皆由細胞組成/Both prokaryotic and eukaryotic organisms are made up of cells.
- (D) 有些細胞本質上是無生命的/Some cells are non-living in nature.
- (E) 細胞的大小直徑介於 200 至 500 微米之間/Cells are limited in size, which is between 200 to 500 micrometers in diameter.

3. 樹上的蘋果開始成熟，成熟的蘋果產生乙烯，乙烯信號促使鄰近的蘋果成熟，鄰近的蘋果進一步產生更多乙烯，導致更多蘋果成熟。

上述過程是以下哪種機制的例子?

Apples on the tree ripen, a ripe apple produces ethylene. Ethylene signals neighboring apples to ripen. Neighbor apples produce more ethylene, more apples ripen. The above process is an example of which of the following?

- (A) 冒出的特質/emergent properties
- (B) 化學循環/chemical cycling
- (C) 基因突變/gene mutation
- (D) 正回饋調節/positive feedback regulation
- (E) 負回饋調節/negative feedback regulation

4. 促成基因體學與蛋白質體學方法發展的三項關鍵研究進展為_____。

Three important research developments that have made the genomic and proteomic approaches possible are _____.

- (A) 選殖、電腦科技、基因治療/cloning, computers, and gene therapy
- (B) 電腦科技、奈米科技、生物資訊學/computers, nanotechnology, and bioinformatics
- (C) 高通量技術、生物資訊學、跨學科研究團隊/high throughput technology, bioinformatics, and interdisciplinary research teams
- (D) 聚合酶鏈式反應、幹細胞研究、合成生物學/polymerase chain reaction (PCR), stem cell research, and synthetic biology
- (E) 生物資訊學、基因治療、基因改造生物/bioinformatics, gene therapy, and genetically modified organisms

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

5. 幫助植物應對乾旱的荷爾蒙是_____。

The hormone that helps plants respond to drought is _____.

- (A) 生長素/auxin
- (B) 細胞分裂素/cytokinin
- (C) 吉貝素/gibberellin
- (D) 脫落素/abscisic acid
- (E) 乙烯/ethylene

6. 在長日照植物中，當暴露於以下哪種光照條件時，促進開花的訊息分子可能會比平常更早釋放？

The signaling molecule for flowering might be released earlier than usual in a long-day plant exposed to flashes of _____.

- (A) 夜間遠紅光照射/far-red light during the night.
- (B) 日間遠紅光照射/far-red light during the day.
- (C) 夜間紅光照射/red light during the night.
- (D) 日間紅光照射/red light during the day.
- (E) 以上皆非/none of the above.

7. 以下何者**沒有**參與在發炎反應

Which of the following do **NOT** participate in an inflammatory response?

- (A) B 細胞/B cells
- (B) 細胞素/cytokines
- (C) 巨噬細胞/macrophages
- (D) 組織胺/histamines
- (E) 以上皆非/none of the above

8. 疫苗接種可以增加下列哪一項的數目？

Vaccination increases the number of _____.

- (A) 可以識別病原體的不同受體/different receptors that recognize a pathogen
- (B) 可呈現抗原的 MHC 分子/MHC molecules that can present an antigen
- (C) 自然殺手細胞 / natural killer (NK) cells
- (D) 免疫系統可以識別的抗原表位/epitopes that the immune system can recognize
- (E) 帶有可以結合病原體受體的淋巴細胞/lymphocytes with receptors that can bind to the pathogen

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

9. 以下何者觀察表明腎上腺素在活化肝醣磷解酶時需要第二信使?

Which of the following observations suggests that a second messenger is required to activate glycogen phosphorylase by epinephrine?

- (A) 腎上腺素直接與肝醣磷解酶結合/epinephrine binds directly to glycogen phosphorylase
- (B) 當腎上腺素與肝醣磷解酶在無細胞系統中結合時，肝醣分解發生/glycogen breakdown occurs when epinephrine and glycogen phosphorylase are combined in a cell-free system
- (C) 只有在完整細胞中施加腎上腺素時，肝醣分解才會發生/glycogen breakdown occurs only when epinephrine is administered to intact cells
- (D) 在無細胞系統中，若沒有腎上腺素，肝醣磷解酶處於不活化狀態/glycogen phosphorylase is inactive in the absence of epinephrine in a cell-free system
- (E) 以上皆非 none of the above

10. 為以下哪種訊號傳遞方式最能描述「細胞分泌訊號分子，影響鄰近細胞」的局部訊號傳遞?

A type of localized signaling in which a cell secretes a signal molecule that affects neighboring cells is best described as which of the following?

- (A) 賀爾蒙訊息傳遞/hormonal signaling
- (B) 自體分泌訊息傳遞/autocrine signaling
- (C) 旁分泌訊息傳遞/paracrine signaling
- (D) 細胞與細胞接觸依賴性訊息傳遞/cell-cell contact-dependent signaling
- (E) 突觸訊息傳遞/synaptic signaling

11. 哪種技術可以用於檢測特定蛋白質的表達量，並確認其分子量大小?

Which technique can be used to detect the expression of a specific protein and determine its molecular weight?

- (A) 核糖核酸定序/Ribonucleic acid (RNA) sequencing
- (B) 質譜分析/Mass spectrometry
- (C) CRISPR-Cas9 基因編輯技術/CRISPR-Cas9 gene editing
- (D) 西方墨點法/Western blot
- (E) 聚合酶鏈式反應/Polymerase chain reaction (PCR)

12. 細胞內哪種結構負責標記錯誤折疊的蛋白質，並將其送往蛋白酶體進行降解?

Which cellular structure tags misfolded proteins and directs them to the proteasome for degradation?

- (A) 內質網/Endoplasmic reticulum
- (B) 核糖體/Ribosome
- (C) 泛素/Ubiquitin
- (D) 高爾基體/Golgi apparatus
- (E) 粒線體/Mitochondrion

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

13. 人體中的 B 細胞在免疫反應中的主要功能是什麼？

What is the primary function of B cells in the human immune response?

- (A) 分解外來入侵的細菌/Breaking down invading bacteria
- (B) 抑制過度活躍的免疫反應/Suppressing overactive immune responses
- (C) 分泌細胞激素以招募其他免疫細胞 / Secreting cytokines to recruit other immune cells
- (D) 直接攻擊受感染細胞/Directly attacking infected cells
- (E) 產生抗體以對抗病原體/Producing antibodies to fight pathogens

14. 何種 RNA 分子可直接影響基因表達，並常用於基因沉默研究？

Which type of ribonucleic acid (RNA) can directly regulate gene expression and is commonly used in gene silencing research?

- (A) 傳訊 RNA/ Messenger RNA (mRNA)
- (B) 核糖體 RNA /Ribosomal RNA (rRNA)
- (C) 轉運 RNA /Transfer RNA (tRNA)
- (D) 微小 RNA /MicroRNA (miRNA)
- (E) 長鏈非編碼 RNA /Long non-coding RNA (lncRNA)

15. 在細胞內，蛋白質的正確折疊主要依賴於哪種分子？

Which type of molecule is primarily responsible for proper protein folding in cells?

- (A) 轉錄因子/transcription factors
- (B) 分子伴侶蛋白/chaperone proteins
- (C) 內質網/endoplasmic reticulum
- (D) 核糖體/ribosomes
- (E) 脂質雙層/lipid bilayer

16. 人體的免疫系統如何記住以前感染過的病原體？

How does the human immune system remember previously encountered pathogens?

- (A) 透過神經細胞記錄/By the nerve cells recording the information.
- (B) 由肝臟儲存免疫訊息/By the liver storing immune information.
- (C) 透過 T 細胞和 B 細胞的記憶功能/Through the memory function of T cells and B cells.
- (D) 依靠腸道細菌/By relying on gut bacteria.
- (E) 透過紅血球攜帶資訊/By red blood cells carrying information.

17. 端粒酶的作用是什麼？

What is the function of telomerase?

- (A) 保護染色體末端，延長細胞壽命/Protecting chromosome ends and extending cell lifespan.
- (B) 促進蛋白質合成/Enhancing protein synthesis.
- (C) 產生 ATP/Produce ATP.
- (D) 分解細胞膜/Breaking down the cell membrane.
- (E) 以上皆是/All of the above.

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

18. CRISPR-Cas9 基因編輯技術的主要作用是什麼？

What is the main function of the CRISPR-Cas9 gene editing technology?

- (A) 脫氧核糖核酸合成/DNA synthesis.
- (B) 干擾病毒 RNA 的合成/Interfering with viral RNA synthesis.
- (C) 剪切 DNA 並改變基因序列/Cutting DNA and modifying genetic sequences.
- (D) 蛋白質合成/Protein synthesis.
- (E) 能量轉換/Energy conversion.

19. 目前 mRNA 疫苗（如 COVID-19 疫苗）如何幫助免疫系統對抗病毒？

How do mRNA vaccines (such as COVID-19) help the immune system fight viruses?

- (A) 讓細胞製造病毒蛋白，幫助免疫系統辨識/ Instructing cells to produce viral proteins, helping the immune system recognize the virus.
- (B) 讓人體產生病毒的 DNA /Making the human body to produce viral DNA.
- (C) 刺激白血球吞噬病毒/Stimulating white blood cells to engulf viruses.
- (D) 直接消滅體內的病毒/Directly destroying viruses in the body.
- (E) 讓體內產生病毒的 RNA/Generating viral RNA inside the body.

20. 免疫系統中，T 細胞的主要功能是什麼？

What is the primary function of T cells in the immune system?

- (A) 產生抗體/Producing antibodies.
- (B) 幫助或殺死受感染細胞/Helping or killing infected cells.
- (C) 儲存免疫記憶/Storing immune memory.
- (D) 運輸氧氣/Transporting oxygen.
- (E) 促進細胞分裂/Promoting cell division.

21. 在核小體中，DNA 纏繞在哪種結構上？

In a nucleosome, the DNA is wrapped around _____.

- (A) 組蛋白/Histones.
- (B) 聚合酶分子/Polymerase molecules.
- (C) 核糖體/Ribosomes.
- (D) 胸腺嘧啶二聚體/Thymidine dimer.
- (E) 染色質重塑複合體/Chromatin remodeling complex.

2025 年第四十屆成大數理比賽 – 生物
40th NCKU Science and Mathematics Competition 2025 - Biology

22. 以下關於 RNA 處理的敘述，哪一項是正確的？

Which of the following is **true** of RNA processing?

(A) 外顯子在 mRNA 離開細胞核前被切除/

Exons are cut out before mRNA leaves the nucleus

(B) RNA 兩端會被加上額外的核苷酸/

Nucleotides are added at both ends of the RNA

(C) 核酶可能透過添加 5' cap 來發揮作用/

Ribozymes may function by adding a 5' cap

(D) RNA 剪接會為 mRNA 添加 Poly-A 尾巴/

RNA splicing adds a poly-A tail to the mRNA

(E) 剪接體參與內含子的移除/

The spliceosome is involved in the removal of introns

23. 增強子的功能是以以下哪一種作用的例子？

The functioning of enhancers is an example of _____.

(A) 真核生物與原核生物的啟動子功能/a eukaryotic and prokaryotic promoter function

(B) 基因表現的轉錄調控/transcriptional control of gene expression

(C) 起始因子刺激轉譯的過程/the stimulation of translation by initiation factors

(D) 後轉譯調控以活化特定蛋白質/post-translational control that activates specific proteins

(E) 表觀遺傳修飾調控基因表達/epigenetic modifications regulating gene expression

24. 體內平衡通常依賴負回饋，因為正回饋：

Homeostasis typically relies on negative feedback because positive feedback:

(A) 需要反應但不需要刺激/requires a response but not a stimulus.

(B) 推動生理過程達到終點，而非維持平衡點/drives processes to completion rather than to a balance point.

(C) 只在正常範圍內運作，而不會超越該範圍/acts within, but not beyond, a normal range.

(D) 可以降低但無法增加變數/can decrease but not increase a variable.

(E) 主要發生於神經系統而非內分泌系統/occurs mainly in the nervous system rather than the endocrine system.

25. 在靜脈壁中，哪種結構負責血管收縮和改變血流？

Which of the following elements present in the wall of a vein is responsible for vasoconstriction and altered blood flow?

(A) 內皮層/Endothelium

(B) 瓣膜/Valves

(C) 彈性纖維/Elastic fibers

(D) 結締組織/Connective tissue

(E) 平滑肌/Smooth muscles

END OF PAPER