

微積分 (智財所 93)

- 注意事項：1、請將算式以及推導過程臚列清楚。
2、每題 10 分，注意時間的分配。

一、請微分： $y = \frac{10^x}{x+2}$

二、求 $y = \frac{1}{x}$ 和 $y=0, x=1$ 所夾的面積

三、定義 彈性 $e = -\frac{dQ/Q}{dP/P}$ ，試求 $P = Q^{-3}$ 的彈性為何？

四、若 $Z = \left[\frac{2x+1}{3x-1} \right]^4$ ，試求 $\frac{\partial z}{\partial x} = ?$

五、已知 $f(x) = \frac{\sin x}{1-2\cos x}$ ，試求 $\frac{df}{dx} = ?$

六、已知 $x \cos y + y \cos x = 1$ ，試求 $\frac{dy}{dx} = ?$

七、求 $\lim_{x \rightarrow \infty} \frac{x^2+1}{2x^2-3} ?$

八、試求 $\int \frac{x^5}{\sqrt{1-2x^3}} dx$

九、試求 $\int_0^1 \int_x^{x^2} \int_{xy}^{x^2 y^3} xyz dz dy dx$ 之值為何？

十、何謂「微積分基本定理」？這定理的重要性何在？

智財所生命科學考題

1. Oligomers of the Arginine-rich Motif of the HIV-1 TAT Protein Are Capable of Transferring Plasmid DNA into Cells. (共20%)

We constructed multimers of the TAT-(47-57) peptide. This polycationic peptide is known to be a protein and particle transduction domain and at the same time to comprise a nuclear localization function. Here we show that oligomers of the TAT-(47-57) peptide compact plasmid DNA to nanometric particles and stabilize DNA toward nuclease degradation. At optimized vector compositions, these peptides mediated gene delivery to cells in culture 6-8-fold more efficiently than poly-L-arginine or the mutant TAT2-M1. When DNA was precompact with TAT peptides and polyethyleneimine (PEI), Superfect, or LipofectAMINE was added, transfection efficiency was enhanced up to 390-fold compared with the standard vectors. As early as after 4 h of transfection, reporter gene expression mediated by TAT-containing complexes was higher than the 24-h transfection level achieved with a standard PEI transfection. When cells were cell cycle-arrested by serum starvation or aphidicolin, TAT mediated transfection was 3-fold more efficient than a standard PEI transfection in proliferating cells. In primary nasal epithelial cells and upon intratracheal instillation in vivo, TAT-containing complexes were superior to standard PEI vectors. These data together with confocal imaging of TAT-DNA complexes in cells support the hypothesis that the TAT nuclear localization sequence function is involved in enhancing gene transfer.

1. 請舉出 TAT peptide 的特性。 (4%)
2. TAT peptide 可能含有那些 amino acid? (4%)
3. 一般在將 gene 送進細胞時使用的原理為何? (4%)
4. 本研究結果的最重要貢獻為何? (4%)
5. 目前國際上的基因治療所遭遇的瓶頸為何? (4%)

2. Panax ginseng: a role in cancer therapy? (共20%)

Panax ginseng is a plant that has been used in traditional medicine in China for thousands of years. It is used as a general tonic or adaptogen with chronically ill patients and is frequently featured in traditional medicine prescriptions from China, Japan, and Korea used by cancer patients.

The putative active compounds are the ginsenosides, of which there are more than two dozen. These compounds are found in both Panax ginseng and in other Panax species that are used in herbal medicine. Analysis of ginsenosides is being used in developing quality control assessments for ginseng, which has frequently been adulterated due to its high cost; many currently available standardized extracts do appear to contain the amounts of ginsenosides listed on package labeling. The toxicity of ginseng appears to be low: some of the reports of toxic episodes of ginseng may actually pertain to other components of multicomponent preparations. Very low incidence of toxicity has been observed in ginseng clinical trials using well-characterized preparations.

Numerous pharmacological activities of ginseng and the ginsenosides have been explored: the authors review here the activities relating to cancer. Immune system modulation, antistress activities, and antihyperglycemic activities are among the most notable features of ginseng noted in laboratory and clinical analyses. Much testing has been done in humans to explore ginseng's purported antifatigue properties, but this area remains controversial. A number of investigations point to antitumor properties and other pharmacological activities related to cancer, but no trials have yet confirmed a clinically significant anticancer activity. Cancer patients may empirically find ginseng to be useful when they are fatigued, although clinical trials should be conducted to confirm its benefits.

1. 按照著者的說法，人參可能經由那些作用來治療癌症病人？(5%)
2. 人參的臨床試驗結果仍有互相矛盾之處，你可否提出可能的解釋？(5%)
3. 假如中醫師根據臨床經驗告訴你，癌症病人開完刀不可以吃人參，否則容易產生癌症的轉移，你是否可以提出合理的假說來解釋其機轉？(5%)
4. The toxicity of ginseng appears to be low, 作者為何不敢說人參沒有毒性？請提出你的看法。(5%)

3. Targeting glycosylation as a therapeutic approach. (共20%)

N- and O-glycosylation of glycoproteins make up 1–2% of the human genome. In the case of N-linked GLYCANS, more than 30 enzymes, located in the cytosol, the ENDOPLASMIC RETICULUM (ER) and the GOLGI APPARATUS, are required to generate, attach and process the oligosaccharides. Many functions have been described for protein glycosylation, including promoting protein folding in the ER1, stabilizing cell-surface glycoproteins, and providing recognition epitopes that activate the innate immune system. It is therefore not surprising that genetic mutations that decrease or eliminate the activity of GLYCOSYLTRANSFERASES and GLYCOSIDASES can lead to serious physiological disorders and can be lethal in animals as well as in humans.

Increased understanding of the role of protein- and lipid-linked carbohydrates in a wide range of biological processes has led to interest in drugs that target the enzymes involved in glycosylation. But given the importance of carbohydrates in fundamental cellular processes such as protein folding, therapeutic strategies that modulate, rather than ablate, the activity of enzymes involved in glycosylation are likely to be a necessity. Two such approaches that use imino sugars to affect glycosylation enzymes now show considerable promise in the treatment of viral infections, such as hepatitis B, and glucosphingolipid storage disorders, such as Gaucher disease.

1. 何謂 protein glycosylation? (4%)
2. protein glycosylation 會提供細胞什麼功能? (4%)
3. glycosylation inhibitors 將來臨床尚有何用途? (4%)
4. glycosylation 的研究方法可能有那些? (4%)
5. 真核細胞和原核細胞的 glycosylation 有差異嗎? 請說明之. (4%)

4. Translation control: bridging the gap between genomics and proteomics?. (共20%)

mRNA profiling enables the expression levels of thousands of transcripts in a cell to be monitored simultaneously. Nevertheless, analyses in yeast and mammalian cells have demonstrated that mRNA levels alone are unreliable indicators of the corresponding protein abundances. This discrepancy between mRNA and protein levels argues for the relevance of additional control mechanisms besides transcription. As translational control is a major mechanism regulating gene expression, the use of translated mRNA in profiling experiments might depict the proteome more closely than does the use of total mRNA. This would combine the technical potential of genomics with the physiological relevance of proteomics.

1. What is mRNA profiling? Please give two techniques that are used to profile mRNA. (5%)
2. What is proteomics? Please give three techniques that are used in proteomics. (5%)
3. The mRNA level does not corresponding to the protein level in cells. Please give three reasons to explain how might this inconsistency happened. (5%)
4. In this abstract, the author suggests that the use of translated mRNA would be a better choice than total mRNA in correlating the profile of proteome. Explain it. (5%)

5. DNA vaccination: a potential weapon against infection and cancer. (共20%)

DNA vaccination is a novel approach for inducing immunity against target antigens. It provides a direct link between identification of genes encoding these antigens and incorporation of the gene sequences into a vaccine vehicle. Identification of candidate genes is proceeding very rapidly both for infectious organisms and for cancer cells. One advantage is that DNA appears to activate all pathways of immunity, especially cytotoxic T-cell responses, which have been difficult to induce with protein vaccines. For viruses, including those which have caused problems for blood transfusion, DNA vaccination could be used for prevention. However, for chronic infection, or for cancer, vaccination will be performed in a therapeutic setting. For this situation, it is probable that immune-activating sequences will have to be included in the vaccine. The ease of manipulation of gene sequences, together with the increasing knowledge of the operation of the immune system, means that we now have the tools to take vaccines into the next exciting stage of development.

1. What is DNA vaccination? (5%)
2. What are the advantages of use DNA instead of protein as a vaccine? (5%)
3. According to DNA vaccination strategy, please explain how could DNA be used in viral prevention and cancer therapeutics? (5%)
4. Assuming you are assigned by our government to develop a vaccine for SARS virus. Please describe how to utilize DNA vaccination techniques to achieve this goal. (5%)

選擇題 (一題 6 分)

(請注意 = 共 14 題選擇, 1 題問答)

1. 風險中立者之效用曲線 (U) 具有何種特性?

- (A) 效用曲線為 concave
- (B) 邊際效用遞減不變
- (C) $U[(a+b)/2] < (U(a)+U(b))/2$
- (D) 不參加公平賭局
- (E) 以上皆非

2. 已知某一商品之需求曲線與供給曲線如下,

$$D(p) = 6 - P \quad ; \quad S(p) = 3 + 2P$$

今對該商品每一單位課徵 0.5 元的稅收, 則課稅前之均衡數量為多少? 課稅後之均衡價格為多少?

- (A) 5 ; 2.25
- (B) 3 ; 3.75
- (C) 1 ; 2.25
- (D) 1 ; 3.75
- (E) 以上皆非

3. 從量稅會對獨占廠商產生何種影響?

- (A) 減少產量
- (B) 抬高價格
- (C) 利潤減少
- (D) 以上皆是
- (E) 以上皆非

4. 以下對 Stackelberg 模型的敘述何者錯誤?

- (A) 是一種逐步賽局 (sequential game)
- (B) 由產量的決定來進行賽局
- (C) 由價格的決定來進行賽局
- (D) 有 leader 與 follower
- (E) 以上皆非

5. 下列何者對台灣匯率制度描述正確?

- (A) 是間接報價
- (B) 是 currency board 制度
- (C) 遠期匯市同時有無本金遠匯及有本金遠匯
- (D) 台灣利率比美國利率高, 故台灣利率下跌, 有助於匯率升值
- (E) 以上皆非

6. 實質景氣循環理論 (real-business-cycle theory) 利基於古典理論的基本假設，此理論主張：

- (A) 勞動供給的變動是引起景氣循環的一個原因。
- (B) 實質總供給為利率的函數
- (C) 生產技術進步會引起產量的增加，造成好的景氣。
- (D) 以上皆是
- (E) 以上皆非

7. 在開放總體之下，採行固定匯率制度，則擴張性貨幣政策在下列那一種情況下最有效(使產出增加最多)

- (A) 資本完全移動
- (B) 資本不完全移動
- (C) 資本完全移動和資本不完全移動都一樣無效
- (D) 資本完全移動和資本不完全移動都一樣有效
- (E) 以上皆非

8. 假定簡單的凱因斯模型的消費、投資、政府支出、及租稅函數分別為：

$$C = 80 + 0.8Y_D$$

$$I = 150$$

$$G = 100$$

$$T = 100$$

試求算均衡的所得？

- (A) 1150；
- (B) 1200；
- (C) 1250；
- (D) 1300
- (E) 以上皆非

9. 以下敘述何者為是？

- (A) Phillip Curve 告訴我們：失業率與物價上漲率成正向關係。
- (B) 貨幣政策效果受存款準備率影響。
- (C) Lucas 認為政府可以藉由貨幣政策刺激景氣。
- (D) 當投資陷阱產生時，財政政策無效。
- (E) 以上皆非

10. 貨幣政策的信用傳遞過程的 credit crunch 指的是

- (A) credit 的 demand 減少
- (B) credit 的 supply 減少
- (C) 同時減少
- (D) 同時增加
- (E) 以上皆非

11. 台灣目前貨幣政策中間目標為

- (A) 重貼現率
- (B) 央行可轉讓定存單
- (C) M2
- (D) 同拆利率
- (E) 以上皆非

12. All of the following household expenditures are included in consumption expenditure EXCEPT

- (A) purchase of corporate stock
- (B) purchase of hair styling
- (C) payment to a dentist for filling a tooth
- (D) purchase of a new purse

13. Which of the following will cause the demand curve for real money to shift to the left?

- (A) An increase in real GDP.
- (B) The expanded use of credit cards.
- (C) An increase in the price level.
- (D) An increase in the quantity of money supplied.

14. Firms A and B can conduct research and development (R&D) or not conduct it. R&D is costly but can increase the quality of the product and thus possibly increase sales. The payoff matrix is the economic profits of the two firms and is given below, where the numbers are millions of dollars. A's best strategy is to

- (A) conduct R&D regardless of what B does
- (B) conduct R&D only if B does not conduct R&D
- (C) conduct R&D only if B conducts R&D
- (D) not conduct R&D regardless of what B does

		Firm A	
		R&D	No R&D
Firm B	R&D	A: \$25 B: \$15	A: -\$3 B: \$60
	No R&D	A: \$60 B: -\$3	A: \$50 B: \$35

問答 (16分)

1. 說明 inflation targeting 與 monetary targeting 的差別?

1. 預售屋應記載與不得記載事項第 23 條就賣方與工程承攬人財務糾紛之處理及他項權利之清理規定：「(一) 賣方與工程承攬人發生財務糾紛，賣方應於產權移轉登記前解決；如因賣方曾設定他項權利予第三人時，賣方應於取得買方之金融機關貸款時，即負責清理塗銷之。倘逾買方所定相當期限仍未解決，買方得解除本契約，雙方並同意依違約之處罰規定處理。(二) 解約時賣方應將所收價款按法定利息計算退還買方。」請分析此一條文的涵義。(33%)
2. 畫家甲在公園為遊客畫肖像為生，每張畫索價新臺幣七百元整，路過的乙同意以此代價由甲為其畫像，畫好後由於兩人為畫框價款無法協議，竟然發生口角，甲怒而不願將畫好之畫交付，乙也不願付款掉頭而去。一星期後乙又經過該地，發現甲竟將其畫像當成樣品展示，上前理論，要求甲應毀去該畫，以保障其權益，甲不同意，試析其法律關係？(34%)
3. 甲以電報送給乙一份效期一天的買賣要約，同一天內甲要約之貨品價格大漲，致此要約對甲極為不利。甲乃立即驅車前往乙處，在乙處僅遇乙之菲傭丙。甲以矇騙方式，使丙將該已送達但尚未開啓之電報交付於甲。乙於一個月後始知悉此事，乃立即以電報表示承諾，試析其法律關係。(33%)