

問答題 (68 分)

1. The α helix and the β strand are the two major elements of protein secondary structure, describe the structure of α helix and β strand in detail. (12 分)
2. Describe the principle used in salting out, gel-filtration chromatography, ion-exchange chromatography, and affinity chromatography for separation of proteins. (12 分)
3. The activity of enzymes must be regulated so they function at the proper time and place. Describe any three ways to regulate the enzymatic activity. (12 分)
4. The extraction of energy from fuels can be divided into three stages as described by Hans Krebs. Illustrate the three stages in the generation of energy from the oxidation of glucose. (12 分)
5. Compare the following pairs of terms: (20 分, 每小題 4 分)
 - (1) apoenzyme and holoenzyme
 - (2) intron and exon
 - (3) type 1 diabetes and type 2 diabetes
 - (4) protein kinase and protein phosphatase
 - (5) standard free-energy change (ΔG°) and free-energy change (ΔG)

配合題 (8 分, 每題 1 分)

Match each amino acid on the left with the appropriate side chain type on the right.

- | | |
|---------------|----------------------------|
| 1. leucine | (A) nonpolar aliphatic |
| 2. lysine | (B) nonpolar aromatic |
| 3. glutamate | (C) hydroxyl-containing |
| 4. serine | (D) sulfur-containing |
| 5. cysteine | (E) imidazole-containing |
| 6. tryptophan | (F) acidic |
| 7. histidine | (G) basic |
| 8. glycine | (H) a single hydrogen atom |

解釋名詞 (24 分, 每題 4 分)

1. ubiquitin
2. phenylketonuria
3. gluconeogenesis
4. The Bohr effect
5. Edman degradation
6. substrate level phosphorylation

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：動物生理學【生科系碩士班甲組選考】

題號：4039
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一、下表為鈉離子(Na^+)、鉀(K^+)離子孔道與乙醯膽鹼接受器(acetylcholine receptor)對於三種離子的相對通透性，根據此表請回答下列問題：(20%)

1. 請說明神經細胞的膜電位在此類乙醯膽鹼接受器開啟後會如何變化?(5%)
2. 乙醯膽鹼接受器開啟後引起膜電位變化的詳細機制為何?(15%)

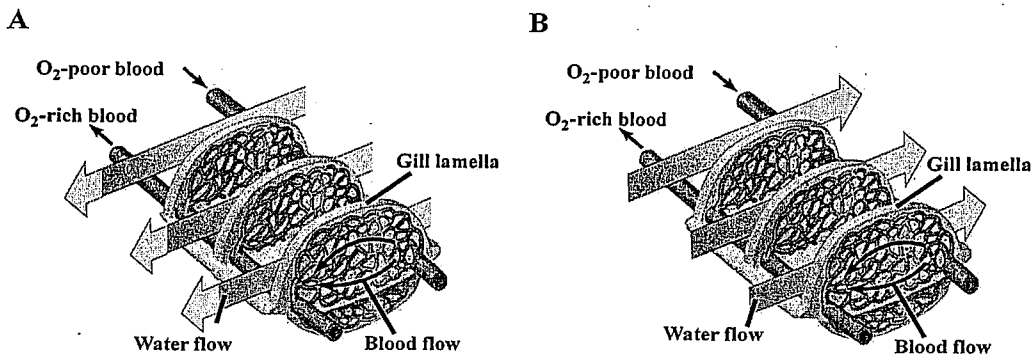
	Na^+ channel	K^+ channel	Acetylcholine receptor
Li^+	0.93	<0.01	0.87
Na^+	1.00	<0.01	1.00
K^+	0.09	1.00	1.11

二、請利用青蛙為實驗動物模式設計實驗驗證下列假說。答題內容請包含動物組別、實驗處理步驟與預期結果。(30%)

1. 請證明電刺激青蛙迷走神經會經由釋放化學物質來降低心跳頻率。(15%)
2. 請證明迷走神經末梢所釋放的化學物質是經由活化心肌上的乙醯膽鹼接受器來達到降低心跳的作用。(15%)

三、下圖為兩種魚類(A 與 B)的鰓微血管血流與通過鰓的水流方向關係圖，請根據此圖回答下列問題：(20%)

1. 請問哪種魚類可能比較適合生長於深層海域?(5%)
2. 請根據血流與水流的方向關係說明為何此魚類(即第一小題你所選的魚類)有生長於深海的優勢。(15%)



四、NBA 球星林書豪在面對湖人隊時頂住壓力全場得到 38 分，根據此狀況請回答下列問題：(30%)

1. 林書豪在球場面對壓力時，身體哪些荷爾蒙(hormone)會產生變化(請註明增加或降低)。(5%)
2. 這些荷爾蒙(即第一小題你回答的荷爾蒙)的變化會如何影響代謝與心血管功能。(10%)
3. 比賽後林書豪流失大量汗水，請問此時腎臟與內分泌系統會啟動何種機制保留體內的水分，請詳細說明這些機制。(15%)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：脊椎動物學【生科系碩士班丙組選考】

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1. Explain the following terms: pharynx slits, cladistics, neotype, polygyny, high-aspect ratio wings, zygodactyl, dynamic soaring, parotid glands, kinetic skull, hemipenis, hemolytic venoms, operculum, gill openings, digitgrade. (28 pts)
2. Compare and contrast the teeth of mammal orders Monotremata, Marsupialia, Primates, Rodentia, Carnivora, and Artiodactyla. (16 pts)
3. Describe the morphology and function of the following feathers: contour feathers, down feathers, semiplumes, bristles. (16 pts)
4. Discuss how amphibians practice defense and escape from predators? (14 pts)
5. Compare and contrast the following families of lizards: Gekkonidae, Lacertidae, Agamidae, Scincidae, and give one example of each in Taiwan. (16 pts)
6. Compare and contrast between Myxini and Cephalaspidomorphi. (10 pts)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：昆蟲學【生科系碩士班丙組選考】

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一、請指出中文書寫上的語法錯誤或語焉不詳處並修正之，並將修正後的中文語意翻譯為英文(20%)

本研究透過蘭嶼陸域昆蟲資源調查計畫，以系統性方式調查島上各類昆蟲物種之分布、數量、棲地環境等昆蟲資源，建立昆蟲相資料。自 2008 年 5 月至 11 月底止，分別於 5 月、7 月、9 月、11 月各進行為期一週之定量與定性昆蟲採集調查，另於 10 月進行一次 5 天之定性採集觀察。

二、(60%)

經常有些論壇大大說：某某鰱在北部的個體頭較大，中南部個體較小。若你打算測試此觀察是否為真，請問你認為這種觀察要成立的先決條件為何？可使用什麼樣的研究方法驗證？而你的假說為何？

三、(20%)

如果有一種完全變態的昆蟲的幼蟲為廣食性，其寄主植物所含的次級代謝物成份不一(有些有有些則沒有)，而這些次級代謝物被掠食者來說是忌避物質，幼蟲所累積的毒素會儲存直到成蟲羽化，而其成蟲的體色具有警戒性。請問這樣的昆蟲的體色演化會朝向單型性(monomorphic)或多型性(polymorphic)演化？為什麼？

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：免疫學【生科系碩士班甲組選考】

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Answer the following questions on the ANSWER SHEET only:

1. Describe the contributions in immunology by which Bruce Beutler, Jules Hoffmann and Ralph Steinman were honored as Nobel Prize winners? (10%)
2. Superantigens have been involved in several diseases and have been useful as research tools.
 - a. What properties of superantigens distinguish them from usual antigens? (10%)
 - b. By what mechanism are bacterial superantigens thought to cause symptoms associated with food poisoning and toxic shock syndrome? (5%)
 - c. Does the activity of superantigens exhibit MHC restriction? Explain. (5%)
3. NK cells do not express TCR molecules, yet they bind to Class I MHC molecules on potential target cells.
 - a. Explain how NK cells lacking TCRs can recognize infected cells. (10%)
 - b. What is the mechanism used by NK cells to kill target cells? (5%)
 - c. From what precursor cells do NK cells arise? (5%)
4. Despite the fact that there are no licensed vaccines for them, life-threatening fungal infections are not a problem for the common population. Why? Who may be at risk for them? (10%)
5. Scientific analyses of many antibody molecules bound to their respective antigens have revealed that the CDR3 of both the heavy and light chains make contact with the epitope. Sequence analyses reveal that the variability of CDR3 is greater than that of either CDR1 or CDR2. What mechanisms account for the greater diversity in CDR3? (15%)
6. Recent discoveries explored the central role of TLR in innate immunity.
 - a. Draw and explain the basic structure of TLR. (10%)
 - b. Describe a signal transduction pathway of TLR which results in the generation of inflammatory cytokines. (15%)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：生物統計學【生科系碩士班丙組選考】

題號：4035
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科目：生物統計學【生科系碩士班丙組選考】

一、9位慢性B型肝炎的患者一年就醫次數如下：

12, 15, 11, 17, 16, 5, 14, 18, 21

(一)求慢性B型肝炎的患者一年就醫次數的平均數，標準差，變異係數，中位數，第一四分位數(Q_1)。(10分)

(二)求就醫次數母群體平均數 95%的信賴區間。(8分)

(三)由 95%的信賴區間推論母群體平均數是否為 15。(5分)

回答以下題目請寫出假說，計算過程，及結論， $\alpha=0.05$ 。

二、血液凝結時間在服用一種新藥與控制組的數據如下：

新藥： $n_1=21$ ， $\bar{x}_1=8$ 分鐘， $s_1=1$ 分鐘

控制組： $n_2=11$ ， $\bar{x}_2=8.4$ 分鐘， $s_2=1.2$ 分鐘

假設血液凝結時間為常態分佈，母群體標準差相同，問兩組血液凝結時間是否相同？(24分)

三、一項健康促進研究調查中，依每週運動次數分為 2 組，其血管收縮壓測值由變異數分析得下表：

變異來源	平方和	自由度	平均平方和	F
處理(組間)	48.4	B	D	G
誤差(組內)	A	C	F	
總和	103.4	9		

(一)表格中空格 A 至 G 的數值各為何？(18分)

(二)有多少人接受調查？(3分)

(二)3 組收縮壓是否相同？(7分)

四、血液中同胱胺酸濃度(Y)可能受到葉酸濃度(X)的影響，以下由最小平方法求得的 7 個人簡單直線迴歸模式：

變數	自由度	估計值	標準誤差
b_0	1	50.51	4.10
b_1	a	-2.02	0.37

$$r^2 = 0.89$$

(一)線性迴歸模式為何？(6分)

(二)試解釋迴歸係數 b_1 的意義，其自由度 a = ? (7分)

(三)檢驗兩者是否有顯著的線性迴歸關係 (6分)

(四)試求相關係數 r (6分)

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科目：生物統計學【生科系碩士班丙組選考】

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T table with right tail probabilities

df/p	0.4	0.25	0.1	0.05	0.025	0.01	0.005	0.0005
1	0.32	1.00	3.08	6.31	12.71	31.82	63.66	636.62
	0.29	0.82	1.89	2.92	4.30	6.96	9.92	31.60
3	0.28	0.76	1.64	2.35	3.18	4.54	5.84	12.92
4	0.27	0.74	1.53	2.13	2.78	3.75	4.60	8.61
5	0.27	0.73	1.48	2.02	2.57	3.36	4.03	6.87
6	0.26	0.72	1.44	1.94	2.45	3.14	3.71	5.96
7	0.26	0.71	1.41	1.89	2.36	3.00	3.50	5.41
8	0.26	0.71	1.40	1.86	2.31	2.90	3.36	5.04
9	0.26	0.70	1.38	1.83	2.26	2.82	3.25	4.78
10	0.26	0.70	1.37	1.81	2.23	2.76	3.17	4.59
11	0.26	0.70	1.36	1.80	2.20	2.72	3.11	4.44
12	0.26	0.70	1.36	1.78	2.18	2.68	3.05	4.32
13	0.26	0.69	1.35	1.77	2.16	2.65	3.01	4.22
14	0.26	0.69	1.35	1.76	2.14	2.62	2.98	4.14
15	0.26	0.69	1.34	1.75	2.13	2.60	2.95	4.07
16	0.26	0.69	1.34	1.75	2.12	2.58	2.92	4.02
17	0.26	0.69	1.33	1.74	2.11	2.57	2.90	3.97
18	0.26	0.69	1.33	1.73	2.10	2.55	2.88	3.92
19	0.26	0.69	1.33	1.73	2.09	2.54	2.86	3.88
20	0.26	0.69	1.33	1.72	2.09	2.53	2.85	3.85

F Table for right tailed alpha=0.05

df2/df1	1	2	3	4	5	6	7	8	9	10
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4
3	10.1	9.6	9.3	9.1	9.0	8.9	8.9	8.8	8.8	8.8
4	7.7	6.9	6.6	6.4	6.3	6.2	6.1	6.0	6.0	6.0
5	6.6	5.8	5.4	5.2	5.1	5.0	4.9	4.8	4.8	4.7
6	6.0	5.1	4.8	4.5	4.4	4.3	4.2	4.1	4.1	4.1
7	5.6	4.7	4.3	4.1	4.0	3.9	3.8	3.7	3.7	3.6
8	5.3	4.5	4.1	3.8	3.7	3.6	3.5	3.4	3.4	3.3
9	5.1	4.3	3.9	3.6	3.5	3.4	3.3	3.2	3.2	3.1
10	5.0	4.1	3.7	3.5	3.3	3.2	3.1	3.1	3.0	3.0
11	4.8	4.0	3.6	3.4	3.2	3.1	3.0	2.9	2.9	2.9
12	4.7	3.9	3.5	3.3	3.1	3.0	2.9	2.8	2.8	2.8

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F Table for right tailed $\alpha=0.025$

df2/df1	1	2	3	4	5	6	7	8	9	10
1	647.8	799.5	864.2	899.6	921.8	937.1	948.2	956.7	963.3	968.6
2	38.5	39.0	39.2	39.2	39.3	39.3	39.4	39.4	39.4	39.4
3	17.4	16.0	15.4	14.1	14.9	14.7	14.6	14.5	14.5	14.4
4	12.2	10.6	10.0	9.6	9.4	9.2	9.1	9.0	8.9	8.8
5	10.0	8.4	7.8	7.4	7.1	7.0	6.9	6.8	6.7	6.6
6	8.8	7.3	6.6	6.2	6.0	5.8	5.7	5.6	5.5	5.5
7	8.1	6.5	5.9	5.5	5.3	5.1	5.0	4.9	4.8	4.8
8	7.6	6.1	5.4	5.1	4.8	4.7	4.5	4.4	4.4	4.3
9	7.2	5.7	5.1	4.7	4.5	4.3	4.2	4.1	4.0	4.0
10	6.9	5.5	4.8	4.5	4.2	4.1	3.9	3.9	3.8	3.7
11	6.7	5.3	4.6	4.3	4.0	3.9	3.8	3.7	3.6	3.5
12	6.6	5.1	4.5	4.1	3.9	3.7	3.6	3.5	3.4	3.4

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：分子生物學【生科系碩士班甲組選考、乙組選考】

題號：4033

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一、配合題：每題 2 分 (10 points)

For the following enzymes involved in DNA replication indicate which activities from the right-hand **Activities** column match. **Note there may be more than one activity that matches a particular enzyme so list as many as apply, also each enzyme will have at least one activity**

	Enzymes	Activities
1.	DNA polymerase III	A. DNA template dependent
2.	Ligase	B. breaks hydrogen bonds between base pairs
3.	Primase	C. 5' to 3' DNA polymerase
4.	Helicase	D. 3' to 5' exonuclease
5.	Telomerase	E. 5' to 3' RNA polymerase
		F. joins two DNA fragments
		H. requires an RNA primer

二、是非題：正確敘述請答 (O)，若是不正確敘述請答 (X)，每題 2 分 (20 points)

1. Epigenetic inheritance is the transfer of information that is not based on DNA sequence from parent to progeny.
2. An open-reading frame is a long stretch of nucleotide sequence that contains no chain-terminating (stop) codons.
3. About half of the human genes identified by sequencing can be assigned a function by homology to previously characterized genes, and the other half represent new genes of unknown function.
4. Analysis of single nucleotide polymorphisms (SNPs) may enable physicians to tailor treatment strategies to match the genes of individual patients.
5. The consequences of errors in transcription are less than those of errors in DNA replication.
6. The differences in the patterns of proteins produced in different specialized cell types are accurately reflected in the patterns of expressed mRNAs.
7. Many gene regulatory proteins in eucaryotes can act even when they are bound to DNA thousands of nucleotide pairs away from the promoter that they influence.
8. By far the most important advantage of cDNA clones over genomic clones is that they can contain the complete coding sequence of a gene.
9. Loss-of-function mutations are usually recessive.
10. If two mutations have a synthetic phenotype, it usually means that the mutations are in genes whose products operate in the same pathway.

三、選擇題：選出一個正確的答案，每題 2 分 (40 points)

1. A gene can be defined as a segment of DNA that codes for

(a) a protein.	(b) a functional product.	(c) mRNA.
(d) mRNA or rRNA.	(e) mRNA, rRNA, or tRNA.	
2. Introns can encode

(a) small nuclear RNAs.	(b) microRNAs.	(c) sequences that control RNA processing
(d) All of the above.	(e) None of the above.	

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科目：分子生物學【生科系碩士班甲組選考、乙組選考】

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3. Synthesis of different proteins from the same gene is due to
 - (a) intron shuffling.
 - (b) exon shuffling.
 - (c) alternative splicing.
 - (d) exon splicing.
 - (e) alternative transcription.
4. Telomeres are
 - (a) microtubule binding sites in the center of chromosomes.
 - (b) chromosome structures that form during telophase.
 - (c) sites at the ends of chromosomes where DNA replication begins.
 - (d) chromosome end structures required for complete replication of linear chromosomes.
 - (e) sites at the ends of chromosomes where microtubules bind.
5. To sequence the human genome, the International Human Genome Sequencing Consortium
 - (a) used the shotgun approach to sequence fragments and assemble them in order using overlaps between the sequences.
 - (b) used BAC clones as substrates for sequencing.
 - (c) sequenced cloned DNA and then mapped it by FISH.
 - (d) All of the above
6. The main difference between the genomes of the bacteria *Haemophilus influenzae* and *E. coli* is that
 - (a) the genome of *H. influenzae* is a circular molecule and that of *E. coli* is linear.
 - (b) the *H. influenzae* genome encodes a larger number of genes.
 - (c) a higher percentage of the genome of *H. influenzae* contains genes encoding proteins.
 - (d) the genome of *E. coli* is approximately three times the size of *H. influenzae*.
7. Bioinformatics is defined as
 - (a) an electronic copy of genomic sequences that is exchanged between scientists across the world.
 - (b) a quantitative understanding of integrated dynamic behavior of complex biological systems and processes.
 - (c) a field of biology that lies at the interface between biology and computer science, and is focused on developing the computational methods needed to analyze and extract useful biological information from the sequences of DNA.
 - (d) the systematic inactivation of each gene in the genome by homologous recombination.
8. Polytene chromosomes
 - (a) are *Drosophila* chromosomes present in hundreds of copies and aligned in parallel.
 - (b) are a pair of homologous *Drosophila* chromosomes aligned side by side.
 - (c) are visible by light microscopy due to their highly condensed nature.
 - (d) can be stained to yield bands that correspond to 200 kilobases of sequence.
9. Partial digestion of chromatin with micrococcal nuclease was found to yield DNA fragments approximately 200 base pairs long. What accounts for this phenomenon?
 - (a) The low pH environment of the nucleus renders the nuclease able to cut only in 200-base-pair increments.
 - (b) The nuclease cleaves at specific DNA sequences that occur every 200 base pairs in the genome.
 - (c) This is a random phenomenon, and its significance is unknown.
 - (d) This result suggests that the binding of proteins to DNA in chromatin protects regions of DNA from nuclease digestion.

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科目：分子生物學【生科系碩士班甲組選考、乙組選考】

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10. The wobble hypothesis predicts that codons coding for the same amino acid _____.
 - (a) may differ at the first position
 - (b) may differ at the second position
 - (c) may differ at the third position
 - (d) may differ at the first two positions
 - (e) may differ at all three positions
11. A nonsense suppressor mutation is a mutation _____.
 - a) that alters the reading frame
 - b) that changes the amino acid sequence of the gene product
 - c) that creates a termination codon
 - d) in a tRNA gene that allows it to recognize a termination codon
 - e) that allows a ribosome to bypass termination codons
12. Transposons, or jumping genes, are DNA elements that move within the genome. In which organismic groups are transposons found?
 - a) bacteria
 - b) eukaryotes
 - c) mammals
 - d) ancient bacteria
 - e) all organismic groups
13. An aminoacyl tRNA synthase^{Valine} is mutated so that it now attaches the amino acid glycine to the tRNA^{Valine} instead of valine. What will happen at translation?
 - a) There will be glycines at all valine positions and valines at all glycine positions.
 - b) There will be valines at all glycine positions and glycines at all valine positions.
 - c) There will be valines at all glycine positions and at all valine positions.
 - d) There will be glycines at all glycine positions and at all valine positions.
 - e) There will be no translation.
14. During bacterial translation initiation, the mRNA _____.
 - a) binds to the large subunit
 - b) is oriented so that the AUG start codon is in the A site
 - c) only binds f-Met tRNA after the entire ribosome has been assembled
 - d) is oriented by its Shine-Delgarno sequence through base-pairing with an rRNA
 - e) requires ATP hydrolysis for binding to the ribosomal subunit
15. A major difference between the *E. coli lac* and *ara* operons is that _____.
 - a) the substrate of the enzyme coded by *ara* is not the inducer
 - b) the *ara* regulator protein interacts with two regions of the operon
 - c) *ara* does not have a CAP-binding site
 - d) *ara* is expressed constitutively
 - e) *ara* does not have an operator site
16. A protein causes the acetylation of histones. What affect do you think this will have on a gene in that region?
 - a) It will cause a decrease in expression.
 - b) It will cause an increase in expression.
 - c) It will cause the methylation of that DNA.
 - d) It will permit DNA replication only, but will silence the gene.
 - e) It will only change the chromatin structure, with no effect on gene expression.

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：分子生物學【生科系碩士班甲組選考、乙組選考】

題號：4033

共 4 頁 第 4 頁

17. The advantage of RNAi over other functional genomic techniques is that _____.
a) RNAi does not affect any gene but the targeted one
b) other techniques cannot target single genes
c) other techniques cannot make specific mutagenic changes
d) RNAi introduces no mutations to the organism
e) All of the above
18. A mutation in one gene that counteracts the effects of a mutation in another gene is known as a _____.
a) temperature-sensitive mutation b) recessive mutation c) conditional mutation
d) suppressor mutation e) nonsense mutation.
19. Which of the following clusters of terms applies when addressing *enhancers* or *silencers* as elements associated with eukaryotic genetic regulation?
a) *cis*-acting, fixed position, fixed orientation
b) *trans*-acting, fixed position, fixed orientation
c) *cis*-acting, variable orientation, variable position
d) *cis*-acting, variable position, fixed orientation
e) *trans*- and *cis*-acting, variable position
20. Under strictly controlled conditions, a probe can be used that will hybridize only with its complementary sequence and not with other sequences that may vary by as little as one nucleotide. What are such probes called?
a) generation-specific probes b) short, variable repeats c) VNTRs
d) microsatellites e) allele-specific oligonucleotides (ASOs)

四、問答題 (30 points)

1. What is the difference between telomerase in cancer cells and telomerase in normal somatic cells of an adult, and what is the significance of that difference? (5 points)
2. What does the term "replication licensing" refer to in the process of eukaryotic DNA replication? (5 points)
3. Describe briefly the maturation of eukaryotic mRNA transcript, i.e. what is the posttranscriptional processing of eukaryotic mRNA transcript. (5 points)
4. (a) List three major structural classifications of DNA-binding domains that are found in eukaryotic transcription factors. (3 points)
(b) Name three consensus sequences or modular DNA sequences that exist upstream from the coding regions of some eukaryotic genes. (3 points)
5. Assume that a plasmid (circular) is 3200 base pairs in length and has restriction sites at the following locations: 400, 700, 1400, 2600. Give the expected sizes of the restriction fragments following complete digestion. (4 points)
6. Nucleotide excision repair (NER) occurs through two distinct mechanisms; what are these, and how do they differ? (5 points)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

題號：4040

科目：植物分類學【生科系碩士班丙組選考】

共 1 頁 第 1 頁

答案須書寫於答案紙上

一、解釋名詞(每題 4 分，共 40 分)

1. aggregate fruit (4 分)
2. allopolyploidy (4 分)
3. cladistics (4 分)
4. founder effect (4 分)
5. apomixes (4 分)
6. biological species concept (4 分)
7. haplotype (4 分)
8. carpel (4 分)
9. disjunction (4 分)
10. endemic (4 分)

二、請列出台灣平地(及低海拔山區)可見之原生維管束植物 10 種的中文名稱、學名和診斷特徵(diagnostic characters)，並使用枝葉方面的特徵(僅使用葉子的特徵亦可)建構一個可將此 10 種植物區分出來的檢索表。(40 分)

三、請簡述分子生物技術在植物分類學上的應用。(20 分)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：生態學【生科系碩士班丙組】

題號：4032
共 1 頁 第 1 頁

I. 解釋名詞，共 20 分 (20%)

1. Eutrophication (5 分)
2. Ecological efficiency (5 分)
3. Acid deposition (5 分)
4. Fecundity (5 分)

II. 問答題，共 80 分 (80%)

5. Discuss and explain the distinctiveness of biodiversity in Taiwan. (20 分)
6. What are the short-term and long-term effects of carbon dioxide increasing in the atmosphere? (20 分)
7. Discuss major factors in deep that will affect interspecific competition of two species. (20 分)
8. Discuss and explain relationships of primary producers, consumers and decomposers related to food webs and ecosystems. (20 分)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：植物生理學【生科系碩士班乙組選考】

題號：4041
共 1 頁 第 1 頁

一、 Please answer the following questions (100 points)

1. Please explain the following terms: (30 points)

Abscission layer; bulk flow; casparian strip; circadian rhythm; climacteric fruit; vivipary; cytoplasmic male sterility; microRNA; thigmotropism; aerenchyma.

2. Plant root gravitropism is affected by the columella cells of root cap and is associated with auxin transport and distribution. Please explain the possible mechanism for root gravitropism. (10 points)
3. Triple response consists of inhibition and swelling of the hypocotyls, and exaggeration of the apical hook in *Arabidopsis*. Ethylene is the key regulator of triple response. Please explain how ethylene mediates triple response in germinating seedling. (10 points)
4. In deep-water rice, plant growth regulators including ethylene and GA have been implied in association with the promotion of stem elongation during flooding. Please provide the possible explanation for the flooding-mediated promotion of stem elongation in deep-water rice. (10 points)
5. Abscisic acid (ABA) and blue light are two key regulators associated with stomata closure and opening, respectively. Please explain how ABA and blue light affect stomata closure and opening. (10 points)
6. Please explain (a) what is photorespiration? and (b) why C_3 plant exhibits higher photorespiration compared to C_4 and CAM plants? (10 points)
7. Plant roots absorb mineral nutrients from soil. Factors including soil particle (size and charge), soil pH, soil mycorrhizal fungi and proton excretion from root system may affect soil mineral nutrient availability and absorption. Please explain how these factors affect soil mineral nutrient availability and absorption. (10 points)
8. Plants generally have to develop different defense mechanisms against biotic stress for survival. Systemin, jasmonic acid and proteinase inhibitor have been indicated to play important roles against herbivore damage in local and systemic leaves. Please explain how plants defense themselves against herbivore damage. (10 points)

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：微生物學【生科系碩士班乙組選考】

題號：4042
共 1 頁 第 1 頁

請勿在本試題紙上作答，答案請務必依題目順序書寫於答案卷上。

1. Compare and contrast the structure of prokaryotic 70S ribosome and eukaryotic 80S ribosome. (10%)
2. What would happen if you omit the mordant step in Gram staining. Explain why. (10%)
3. (1) What is a nosocomial infection? (5%) (2) Name the top 3 most common types of nosocomial infections. (5%)
4. What is wrong with this statement: "Prior to vaccination, the patient's skin was sterilized with 70% ethanol"? What would be more correct wording? (10%)
5. HIV attacks only specific types of human cells, such as certain white blood cells and nerve cells. Please explain why a virus can enter some types of cells but not others? (10%)
6. Compare and contrast "fermentation" and "anaerobic respiration". (15%)
7. (1) What is an Hfr cell? (8%) (2) What would happen after an Hfr cell conjugated with an F⁻ cell? (7%)
8. (1) Draw a brief figure to illustrate the nitrogen cycle. (8%) (2) Briefly explain the following terms: (a) ammonification (3%), (b) denitrification (3%), (c) nitrification (3%), and (d) nitrogen fixation (3%).