《生物》試題評析

曾正老師試題評析

一、命題分佈比重：

範疇	題數	題目
細胞學	3 題	第 33、57、64 題
酵素學	0 題	
生物能量學	1 題	第 35 題
細胞遺傳學	2 題	第 55、63 題
古典遺傳學	6 題	第 10、43、54、62、70、74 題
分子生物學	12 題	第 7～9、32、36、42、45、46、50～53 題
分類學	4 題	第 39、44、69、75 題
植物生理學	5 題	第 27、28、29、34、40 題
動物生理學	30 題	第 1～6、11、16～26、30、38、41、48、49、56、59 題 第 60、66～68、71 題
演化及行爲學	4 題	第 15、31、61、65 題
生態學	8 題	第 12～14、37、47、58、72、73 題

二、試題評析：

1.此份試卷是命題者好心，出了很多簡單試題給同學，但亦有若干具程度的考題，可分出極高、高、中等的考生！

2.命題與以往有些不同

①動物生理學一口氣出了 30 題(居榜首)，而分子生物學及演化生態緊追在後(各 12 題)

②超過命題教本(Campbell)內容僅有少許，但本班同學仍可(用思考解題)輕鬆作答。

3.考前謠傳「把所有教本都唸過才可考好」完全破功，甚至有些非本班考生唸了一堆「亂七八糟」的生化、分生補充，完全白費功夫且浪費時間；相對的，本班同學輕鬆應考，觀念強固，牢不可破，不必亂背即能獲得高分。

4.本班學員程度高者，可獲得 85 分以上，中等程度亦可達 70 分以上。

三、釋疑：

1.第 52 題：

(A)增加染色質濃縮應可給分，DNA 被甲基化，methyl-CpG-binding proteins 結合至甲基化區域(CpG islands)，再召喚其它蛋白質到該區抑制轉錄(包括 Histone deacetylase 將組蛋白的乙醯基移除而形成 heterochromatin (即染色質濃縮)

【參考：Biology by Brooker (2011, 2/E) P.278 (偉明書局代理) 】

2.第 69 題：

(A)某些輻射對稱動物 (radiata)當然有包括刺胞動物，它含有二種體型：polyp (無性世代,2n)，medusa(有性世代,2n)，交替產生對方，很類似植物的世代交替：孢子體世代(2n)，配子體世代(1n)交替產生對方，而題意並無涉及與植物作比較，是

否可將(A)視爲另類的世代交替而給分。

【參考：Campbell Biology (2011, 9/E) P.673 圖 33.8 說明 (偉明書局代理) 】

四、試題詳解：

題號	試題說明
1	人類的腦部佔最多比例的神經元爲中間神經元。(詳見動物生理學：神經系統神經元簡介)
2	題目出現精子歷經，故不可選去極化(卵)應選擇穿孔體反應，精子頭部穿孔體釋出水解酶消化膠狀層，使穿孔體突起延伸並穿透膠狀層。(詳見動物生理學：生殖系統受精過程)
3	激素須與激素接受器結合方能引發訊息轉導的步驟。(詳見動物生理學：內分泌的訊息轉導)
4	屬於局部調節劑有 NO 及前列腺 F (題目)而僅有 NO 活化 guanylyl cyclase 使平滑肌鬆弛。(詳見動物生理學：內分泌的訊息轉導)
5	胸腺是 T 細胞分化成熟的地點，一旦被藥物摧毀則 T 細胞的分化及成熟會受損。(詳見動物生理學：免疫系統 T 細胞分化路徑)
6	肺及腸道上皮雖分屬不同的上皮，但共有點是交換界面須大以增加吸收效率。(詳見動物生理學：生理概論，動物結構與功能)
7	蛋白組學便是研究蛋白組的學問，而基因歷經 RNA 產生蛋白質的組成，故換言之：研究基因組所編碼的動物完整蛋白組的學問。(詳見生物學基本介紹：生命特徵)
8	連鎖輿圖是遺傳標誌間的重組頻率，但物理輿圖是遺傳標誌間物理距離(鹼基對表示)。(詳見遺傳工程：人類基因組計劃)
9	細菌的轉化便是菌體吸收外來 DNA 的過程。(詳見分類學：細菌遺傳學)
10	對雄性的性連鎖性狀而言，X 染色體含有此受影響的基因，便會表現出來，故屬於半合子性(hemizygous)。(詳見古典遺傳學之遺傳疾病)
11	旁分泌通訊屬於局部調節劑的通訊，製造細胞與標的細胞距離很近。(詳見動物生理學：內分泌系統)
12	除了(D)是生物多樣性危機的結果之外，其餘都是引發生物多樣性的原因。(詳見生態學：保育生物學)
13	族群密度依賴的調節因子有競爭資源，捕食，毒性廢物及內在因子等。(詳見生態學：族群大小的調節)
14	海洋浮游區的特性(1)開闊廣大藍色水域(2)風驅動的洋流持續混合(3)水清故延伸至深層(4)氧氣濃度高，但養分低(5)覆蓋約 70%的地表(詳見生態學：水域生物相)
15	鮭魚返回出生的溪流地產卵肇因於嗅覺印痕。(詳見動物行爲學：印痕)
16	骨骼肌中，Ca^{2+}結合至肌鈣蛋白的 TnC 引起旋轉肌球素側移，於是粗肌絲頭部與細肌絲結合而發生〝力擊〞引發收縮。(詳見動物生理學：肌肉系統之骨骼肌收縮機制)
17	短期記憶中，訊息短暫的結合在海馬區而被激發。(詳見動物生理學：神經系統之記憶機制)

題號	試題說明
18	血腦障壁(BBB)是星形膠細胞誘導而形成的，是種緻密接合可控制中樞神經元細胞外環境。(詳見動物生理學：神經系統膠細胞種類)
19	抑制性突觸後電位(IPSP)是因膜對 K^+或 Cl^-通透性增加所致。(詳見動物生理學：神經系統梯級電位)
20	胚胎發育過程爲：卵裂→囊胚形成→原腸胚形成→器官形成(詳見動物生理學：發育生物學之胚胎發育)
21	卵巢排卵後，殘餘的濾泡組織生長形成黃體，分泌額外的雌二醇以及黃體酮。(詳見動物生理學：生殖系統雌性生殖周期)
22	抗利尿激素及催產素由下視丘合成而貯存至腦下腺後葉。(詳見動物生理學：內分泌系統激素總論)
23	摧毀被病毒感染的體細胞，甚至是腫瘤細胞是細胞毒性型 T 細胞(Tc cell)的功能。(詳見動物生理學：免疫系統 T 細胞種類)
24	波爾效應指的 pH 下降(透過 CO_2與水的結合)導致氧-解離曲線右移的現象。(詳見動物生理學：呼吸系統 氧解離曲線判圖)
25	低血糖會導致胰臟分泌血糖升高素透過動用貯存的肝糖使血糖回升。(詳見動物生理學：內分泌系統 血糖調節)
26	標準代謝率(SMR)是用於外溫動物，而基礎代謝率(BMR)是用於內溫動物，二者共同處是在休息及禁食狀態下測定。(詳見動物生理學：消化系統 代謝率測定)
27	引發植物系統獲得性阻抗(SAR)是水楊酸 (Salicylic acid)，會誘導 PR 蛋白產生以及對病原體攻擊的抗性。(詳見植物生理學：植物的防禦)
28	植物透過不需受精或授粉以產生種子的方式稱爲無融合生殖，胚珠中的二套細胞產生胚。 (詳見植物生理學：植物的生殖)
29	小孢子形成的有害突變使得小孢子無法形成，自然連帶影響小配子體(雄配子體)形成，而雄配子體便是花粉粒。(詳見植物生理學：植物的生殖)
30	體內受精普遍發生在陸棲動物(爬蟲類及哺乳類)，但有些水生動物亦會進行。(詳見動物生理學：生殖系統 體內受精)
31	異源同型是指起源獨立的同功結構。(詳見演化論)
32	端粒酶的功能是催化真核生物端粒的延長，以重建其原始長度且補充每次 DNA 複製所造成的縮短，另外端粒酶是以 RNA 作爲延長端粒 DNA 的模版。 (詳見分子生物學：真核 DNA 複製的問題)
33	柴杉醇破壞微管的形成，故影響有絲分裂紡錘絲的形成。(詳見細胞學：細胞骨架補充)
35	光合作用中 P680 失去電子變成 $P680^+$，其空洞是由 H_2O 中的電子來填補，H_2O裂解伴隨產生 H^+及氧原子，氧原子與另一氧原子結合形成 O_2。(詳見生物能量學：光合作用的光反應)
36	生物資訊的定義爲運用多肽的胺基酸序列以預測蛋白質三度空間結構的技術。(詳見生物簡介及遺傳工程的補充)
37	群落生態學的定義爲影響群落結構及組建的物種之間交互作用的學科。(詳見生態學：群落生態系)

題號	試題說明
38	節肢動物的外骨骼成分爲幾丁質，含有液體作爲基質的僞骨稱爲流體靜液壓骨骼。(詳見分類學：無脊椎動物)
39	有些子囊菌及擔子菌無有性生殖稱爲不完全菌。(詳見分類學：真菌簡介)
40	水果噴灑乙烯會延遲成熟的時間。(詳見植物生理學：植物激素乙烯論述)
41	章魚(軟體動物頭足類)以及節肢動物含有血藍素運送氧氣。(詳見分類學：無脊椎動物)
42	肺炎鏈球菌 S 株含莢膜有致病性。(詳見分子生物學：DNA 發現的歷史)
43	在單性雜種雜交中 1：2：1，代表不完全顯性或 F2 之基因型比例。(詳見古典遺傳學：孟氏遺傳的修飾)
44	Hfr →F^-的接合生殖，若 F^-受體未獲得 F 因子，仍爲 F^-(詳見分類學：細菌遺傳學)
45	乳糖操縱子中，lac I 的產物爲壓制物，無異乳糖存在下會結合至操作子(operator)阻止結構基因的轉錄。(詳見分子生物學：原核生物基因表現調節)
46	各種載體的插入量：plasmid (0.01-10kb)、phage λ (10-20kb)、Ti plasmid (200kb)、Cosmid (35-50kb)、YAC(500-3000kb)(詳見遺傳工程學：載體的選擇)
47	中台灣山區的物種因 2000 年地震而去森林化，而如今森林重現達到頂極群落，此過程稱爲次級消長。(詳見生態學：消長種類)
48	比目魚及兩生類的變態是由甲狀腺素及泌乳素調控。(詳見動物生理學：內分泌系統)
49	開花植物的配子體階段產生配體(透過有絲分裂達成)。(詳見分類學及植物生理學：被子植物生活史)
50	真核生物的 mRNA 是由核質中的 RNAP Ⅱ 所合成。(詳見分子生物學：轉錄過程)
51	噬菌體的基因表現調控類似其宿主(細菌)，故只能選擇與細菌基因表現調節類似的機制—操縱子 (operon)。(詳見分子生物學：原核生物基因表現調節)
52	哺乳類 DNA 胞嘧啶核苷酸被甲基化使其基因不表現。(詳見分子生物學：真核生物基因表現調節)
53	剪接體摧化 intron 切除的催化組成是 RNA 而非蛋白質組成。(詳見分子生物學：轉錄後加工)
54	豌豆花色雜種雜交，得到子代 (F_1)爲親代之一的表型稱爲顯性。(詳見古典遺傳學：單性雜種雜交)
55	干擾紡錘絲形成，則後期無法進行，故有絲分裂停於中期。(詳見細胞遺傳學：有絲分裂)
56	睪丸酮屬於類固醇激素，其接受器位於細胞質液中，一旦與激素結合形成複合體便進入核中開啓基因表現。(詳見動物生理學：內分泌系統 訊息轉導)
57	Tay-Sachs 症肇因於溶酶體缺乏 hexosaminidases A 而使得脂質累積導致患者心智停滯、失明及肌肉衰弱等症狀。(詳見古典遺傳學：遺傳疾病)
58	Batesian 擬態是指無害的物種模擬對捕食者有毒或其它方面有害的物種，例如無毒蛇模擬毒蛇。(詳見生態學：群落生態學擬態)

題號	試題說明
59	涉及寄生蟲感染的抗體爲 IgE，而細胞毒性型 T 細胞通常攻擊被病毒感染的體細胞。(詳見動物生理學：免疫系統抗體種類)
60	內溫性一般是指藉自體的代謝產生的熱來暖化，此熱通常維持一段相當穩定的體溫(高於外界環境的溫度)。(詳見動物生理學：生物溫學)
61	$a = 0.3 = q \Rightarrow q^2 = (0.3)^2 = 0.09 = 9\%$(詳見演化論；哈一溫定律)
62	按此推算應爲 X X X 雌性，通常爲健康且無不尋常的物理特徵，稍爲的學習低下，但仍有生育力。(詳見古典遺傳學：性染色體不分離)
63	配子是單套而非雙套，且雌性唯有在精子進入之後，才完成第二次減數分裂。(詳見細胞遺傳學及動物生理學生殖系統)
64	解除藥物的毒素是發生在肝臟的平滑型內質網(SER)。(詳見細胞學：平滑型內質網的功能)
65	每個 branch point 代表由一共同祖先分歧的二個譜系，每個子代稱爲 taxon，而僅有單系群 taxon 等於一個〝clade〞，而 (C)則應該爲 homologies。(詳見演化論：演化關係的推導)
66	血友病是缺少凝血因子，血塊主要是由 fibrin 組成，成熟紅血球是不具細胞核，白血球的功能才是抗病原體。(詳見動物生理學：循環系統 血球功能)
67	乳糜微粒首先是由上皮細胞運至中央乳糜管，胺肽酶存在小腸，果糖的吸收是異化擴散。(詳見動物生理學：消化系統 脂質吸收)
68	ionotropic receptor 不涉及第二信使，動作電位不同於梯級電位，化學突觸運用神經傳遞物質來溝通。(詳見動物生理學：神經系統、突觸的溝通)
69	刺胞動物爲散漫式神經網無神經節，馬陸及蜈蚣個別被稱爲千足蟲及百足蟲並非真正指其足的數目，蠍子爲胎生，無蛹的階段。(詳見分類學：無脊椎動物)
70	重組頻率 $= 0.025 = 2.5\%$ $= 2.5$ cM (詳見古典遺傳學：連鎖及互換)
71	抵抗濃度梯度是需耗能，離子無法自由通過脂質雙層，尿液塩濃度高於血液。(詳見動物生理學：排泄系統、滲透調節)
72	此爲均勻分散，植物種藉分泌毒素使鄰近的植物無法生長稱爲異種抑制。(詳見生態學：族群的特徵)
73	生態系多樣性指的是生態系中結構及功能的多樣性，而物種多樣性是指群落中物種的數目及相對豐富性。(詳見生態學：保育生物學)
74	按題意：$1/4 \times 1/4 \times 1/2 \times 1/4 \times 1/2 = (1/4)^3 \times (1/2 \times 1/2) = (1/4)^4$ (詳見古典遺傳學：遺傳學計算)
75	裸子植物花粉粒轉移，通常而非全部是風媒，花是由四輪變態葉(孢子葉)組成。(詳見分類學及植物生理學：裸子植物及被子植物)

楊老師試題評析

一、今年題目與去年相比，顯得非常容易。許多是出自題庫。
二、沒有超出範圍的題目，全部都是純生物的題目。
三、遺傳考 8 題，分生 13 題，共佔 29%，(去年 22%、前年 18%、大前年 24%)
四、生理考 25 題，佔 32%，(去年 13%、前年 42%、大前年 21%)
五、分類、演化考約 11%（去年 27%、前年 12%、大前年 12%）
六、植物學，佔 8%（去年 3%、前年 8%、大前年 6%）
七、生態學，佔 12%（去年 14%、前年 6%、大前年 22%）
八、還是老話：
①不要好高騖遠，講義心智繪圖讀熟，會該會的就可以得高分。
②準備方向不要偏，書不在讀的多，考試是考有沒有讀熟。很偏的題目，就算花再多的時間也不容易掌握，反而捨本逐末。

楊老師講義命中事實

題號	回數	頁數	題號	回數	頁數
1	總複習	P83	39	總複習	P153
2	總複習	P47→ 第 2→1→2 分支	40	總複習	P178
3	總複習	P99	41	總複習	P62→ 第 3 分支
4	總複習	P86	42	總複習	P24→ 第 1 分支
5	總複習	P69	43	總複習	P21→ 第 1 分支
6	總複習	P72	44	總複習	P31→ 第 2→1 分支
7	總複習	P41→ 第 4→2 分支	45	總複習	P31→ 第 3→1 分支
8	總複習	P40→ 第 2→2 分支	46	總複習	P39→ 第 4→2 分支
9	總複習	P31→ 第 2→1 分支	47	總複習	P124
10	總複習	P23→ 第 1→2→2 分支	48	總複習	P25→ 第 2→2 分支
11	總複習	P98	49	總複習	P167
12	總複習	P132～133	50	總複習	P26→ 第 2→2→2 分支
13	總複習	P25→ 第 2→2 分支	51	總複習	P31→ 第 3→1 分支
14	總複習	P117	52	總複習	P36→ 第 1 分支
15	總複習	P112	53	總複習	P27→ 第 1→3 分支
16	總複習	P82→ 第 2→1 分支	54	總複習	P21→ 第 2 分支
17	總複習	P1→ 第 1→2→1 分支	55	總複習	P17→ 第 2→2 分支
18	總複習	P83	56	總複習	P106
19	總複習	P85	57	總複習	P8→ 第 4→1→2 分支
20	總複習	P46	58	總複習	P127
21	總複習	P108	59	總複習	P67→ 第 4→3 分支
22	總複習	P102	60	總複習	P79→ 第 2→1 分支

題號	回數	頁數	題號	回數	頁數
23	總複習	P69	61	總複習	P136
24	總複習	P73→ 第 3 分支	62	總複習	P23→ 第 1→2→2 分支
25	總複習	P103	63	總複習	P136
26	總複習	P52→ 第 3 分支	64	總複習	P8→ 第 2→2→2 分支
27	總複習	P180	65	總複習	P141
28	總複習	P174	66	總複習	P65→ 第 5 分支
29	總複習	P175	67	總複習	P58
30	總複習	P105	68	總複習	P83
31	總複習	P135	69	總複習	P158
32	第 5 回	P25→ 第 2→2 分支	70	總複習	P22→ 第 2→4 分支
33	總複習	P17→ 第 2→2 分支	71	總複習	P78
34	總複習	P176	72	總複習	P126
35	總複習	P16→ 第 2 分支	73	總複習	P132
36	總複習	P41→ 第 5 分支	74	總複習	P20→ 第 2→7 分支
37	總複習	P124	75	總複習	P166～167
38	總複習	P82→ 第 1→3 分支			

《生物》

I.【單選題】1-50 題，每題 1 分，共計 50 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。

(C) 1.Most of the neurons in the human brain are _____.
(A) sensory neurons (B) motor neurons (C) interneurons
(D) auditory neurons (E) olfactory neurons

(E) 2.Contact of a sperm with signal molecules in the coat of an egg causes the sperm to undergo _____.
(A) mitosis (B) depolarization (C) apoptosis
(D) vitellogenesis (E) the acrosomal reaction

(B) 3.Only certain cells in the body are target cells for the steroid hormone aldosterone. Which of the following is the best explanation for why these are the only cells that respond to this hormone?
(A) Only target cells are exposed to aldosterone.
(B) Only target cells contain receptors for aldosterone.
(C) Aldosterone is unable to enter nontarget cells.
(D) Nontarget cells destroy aldosterone before it can produce its effect.
(E) Nontarget cells convert aldosterone to a hormone to which they do respond.

(A) 4. Which of the following is a local regulator responsible for activating an enzyme that relaxes smooth muscle cells?
(A) nitric oxide (B) prostaglandin F (C) epinephrine (D) A and B (E) A, B, and C

(D) 5. If a newborn were accidentally given a drug that destroyed the thymus, what would most likely happen?
(A) His cells would lack class I MHC molecules on their surface.
(B) His humoral immunity would be missing.
(C) Genetic rearrangement of antigen receptors would not occur.
(D) His T cells would not mature and differentiate appropriately.
(E) His B cells would be reduced in number and antibodies would not form.

(B) 6. A specialized function shared by the many cells lining the lungs and the lumen of the gut is _____.
(A) decreased oxygen demand due to the lack of oxygen in foods
(B) increased exchange surface provided by their membranes
(C) greater numbers of cell organelles contained within their cytoplasm
(D) greater protection due to increased cellular mass
(E) lowered basal metabolic rate due to cooperation between cells

(B) 7. What is proteomics?
(A) the linkage of each gene to a particular protein
(B) the study of the full protein set encoded by a genome
(C) the totality of the functional possibilities of a single protein
(D) the study of how amino acids are ordered in a protein
(E) the study of how a single gene activates many proteins

(A) 8. What is the difference between a linkage map and a physical map?
(A) For a linkage map, markers are spaced by recombination frequency, whereas for a

physical map they are spaced by numbers of base pairs (bp).
(B) For a physical map, the ATCG order and sequence must be achieved, but not for the linkage map.
(C) For a linkage map, it is shown how each gene is linked to every other gene.
(D) For a physical map, the distances must be calculable in units such as nanometers.
(E) There is no difference between the two except in the type of pictorial representation.

(E) 9. What does transformation involve in bacteria?
(A) the creation of a strand of DNA from an RNA molecule
(B) the creation of a strand of RNA from a DNA molecule
(C) the infection of cells by a phage DNA molecule
(D) the type of semiconservative replication shown by DNA
(E) assimilation of external DNA into a cell

(A) 10. Males are more often affected by sex-linked traits than females because _____.
(A) males are hemizygous for the X chromosome
(B) male hormones such as testosterone often alter the effects of mutations on the X chromosome
(C) female hormones such as estrogen often compensate for the effects of mutations on the X chromosome
(D) X chromosomes in males generally have more mutations than X chromosomes in females
(E) mutations on the Y chromosome often worsen the effects of X-linked mutations

(A) 11. Paracrine signaling _____.
(A) involves secreting cells acting on nearby target cells by discharging a local regulator into the extracellular fluid
(B) requires nerve cells to release a neurotransmitter into the synapse
(C) occurs only in paracrine yeast cells
(D) has been found in plants but not animals
(E) involves mating factors attaching to target cells and causing production of new paracrine cells

(D) 12. Which of the following provides the best evidence of a biodiversity crisis?
(A) the incursion of a non-native species. (B) increasing pollution levels.
(C) decrease in regional productivity. (D) high rate of extinction.
(E) climate change.

(B) 13. Which of the following is most likely to contribute to density-dependent regulation of populations?
(A) the removal of toxic waste by decomposers (B) intraspecific competition for nutrients
(C) earthquakes (D) floods (E) fires

(D) 14. Which of the following statements about the ocean pelagic biome is true?
(A) The ocean is a vast, deep storehouse that always provides sustenance; it is the next "frontier" for feeding humanity.
(B) Because it is so immense, the pelagic ocean biome is globally uniform.
(C) Globally, more photosynthesis occurs in the ocean neritic biome than in the pelagic biome.
(D) Pelagic ocean photosynthetic activity is disproportionately low in relation to the size of the biome.
(E) The most abundant animals are vertebrate fishes.

(C) 15. A salmon returns to its home stream to spawn. What term best applies to this behavior?
(A) sign stimulus (B) cognition (C) imprinting

(D) classical conditioning (E) operant conditioning

(E) 16. Skeletal muscle contraction begins when calcium ions bind to _____.
(A) energized cross-bridges (B) myosin (C) actin
(D) tropomyosin (E) troponin

(D) 17. Short-term memory information processing usually causes changes in the _____.
(A) brainstem (B) medulla (C) hypothalamus (D) hippocampus (E) cranial nerves

(A) 18. The blood-brain barrier _____.
(A) is formed by tight junctions
(B) is formed by oligodendrocytes
(C) tightly regulates the intracellular environment of the CNS
(D) uses chemical signals to communicate with the spinal cord
(E) provides support to the brain tissue

(A) 19. An inhibitory postsynaptic potential (IPSP) occurs in a membrane made more permeable to _____.
(A) potassium ions (B) sodium ions (C) calcium ions
(D) ATP (E) all neurotransmitter molecules

(C) 20. From earliest to latest, the overall sequence of early development proceeds in which of the following sequences?
(A) gastrulation → organogenesis → cleavage
(B) ovulation → gastrulation → fertilization
(C) cleavage → gastrulation → organogenesis
(D) gastrulation → blastulation → neurulation
(E) preformation → morphogenesis → neurulation

(B) 21. In humans, the follicular cells that remain behind in the ovary following ovulation become _____.
(A) the ovarian endometrium that is shed at the time of the menses
(B) a steroid-hormone synthesizing structure called the corpus luteum
(C) the thickened portion of the uterine wall
(D) swept into the fallopian tube
(E) the placenta, which secretes cervical mucus

(A) 22. Oxytocin and antidiuretic hormone are synthesized in the _____.
(A) hypothalamus (B) adenohypophysis (C) anterior pituitary
(D) adrenal cortex (E) posterior pituitary

(A) 23. The cell-mediated immunity that destroys virally infected cells involves _____.
(A) cytotoxic T cells (B) natural killer cells (C) helper T cells
(D) macrophages (E) B cells

(E) 24. The Bohr shift on the oxygen-hemoglobin dissociation curve is produced by changes in _____.
(A) the partial pressure of oxygen (B) the partial pressure of carbon monoxide
(C) hemoglobin concentration (D) temperature (E) pH

(B) 25. Hypoglycemia, or low levels of glucose in the blood of a healthy human, is “corrected” by a(n) _____.
(A) increase in the secretion of insulin
(B) increase in the secretion of glucagon
(C) increase in the secretion of both insulin and glucagon
(D) decrease in the secretion of both insulin and glucagon
(E) increase in the secretion of thyroid hormones

(E) 26. Standard metabolic rate (SMR) and basal metabolic rate (BMR) are _____.
(A) used differently: SMR is measured during exercise, whereas BMR is measured at rest
(B) used to compare metabolic rate between hibernating and nonhibernating states
(C) both measured across a wide range of temperatures for a given species
(D) both standard measurements of fat metabolism in mammals
(E) both measured in animals in a resting and fasting state

(C) 27. The transduction pathway that activates systemic acquired resistance in plants is initially signaled by _____.
(A) antisense RNA (B) Pfr phytochrome (C) salicylic acid
(D) abscisic acid (E) red, but not far-red, light

(A) 28. The asexual production of seeds from a diploid cell, allow hybrid plants to pass on their desirable genomes intact to their offspring is called _____.
(A) apomixis (B) dioecious (C) etiolation (D) phyllotaxy (E) statoliths

(D) 29. A flowering plant with a deleterious mutation in microsporogenesis would most likely _____.
(A) fail to produce sepals (B) fail to produce petals
(C) fail to produce anthers (D) fail to produce pollen
(E) fail to produce ovules

(D) 30. In which vertebrates is fertilization exclusively internal?
(A) chondrichthyans, osteichthyans, and mammals
(B) amphibians, mammals, and reptiles
(C) chondrichthyans, osteichthyans, and reptiles
(D) reptiles and mammals
(E) reptiles and amphibians

(A) 31. The term *homoplasy* is most applicable to which of the following features?
(A) the legless condition found in various lineages of extant lizards
(B) the five-digit condition of human hands and bat wings
(C) the β hemoglobin genes of mice and of humans
(D) the fur that covers Australian moles and North American moles
(E) the bones of bat forelimbs and the bones of bird forelimbs

(C) 32. Telomerase is an enzyme can solve the problem of replication at the ends of linear chromosomes. How does it work?
(A) Repetitive sections of DNA can range from a single nucleotide to hundreds of nucleotides. Three nucleotides of smaller is a microsatellite.
(B) It adds 5' cap and 3' polyA on chromosome that resists degradation by nucleases.
(C) It works like regular DNA polymerase (3'-5') except does not need DNA template strand to direct synthesis. Uses intrinsic RNA strand to synthesize GGGTTA sequence.
(D) It causes specific double-strand DNA breaks and rejoins the blunt ends on both strands.
(E) It adds numerous methylated GC pairs which resist hydrolysis and maintain chromosome integrity.

(E) 33. Taxol is an anticancer drug extracted from the bark of the Pacific yew tree. It disrupts microtubule formation by binding to microtubules and accelerating their assembly from tubulin. Taxol must affect _____.
(A) the formation of the chromatid assembly (B) the anaphase of the cell cycle
(C) the formation of the centrioles (D) the S phase of the cell cycle
(E) the formation of the mitotic spindle

(E) 34. Which of the following statements about plant hormones differing from hormones in animals is correct?
(A) Plant hormones are synthesized from two or more different molecules.

(B) Animal hormones are primarily for mating and embryonic development.
(C) Plant hormones interact primarily with intracellular receptors.
(D) Animal hormones are found in much greater concentration.
(E) Plant hormones may travel in air or through vascular systems.

(B) 35. Which of the following statements about photosynthesis is correct?
(A) The splitting of water yields molecular carbon dioxide as a by-product.
(B) The electron vacancies in $P680^+$ are filled by electrons derived from water.
(C) The ATP required for the Calvin cycle comes from reactions initiated in photosystem I.
(D) Photosystem I passes electrons to the thylakoid membrane electron transport chain.
(E) Cyclic electron flow also supplements the supply of ATP and NADPH.

(C) 36. Which of the following techniques uses the amino acid sequences of polypeptides to predict a protein's three-dimensional structure?
(A) X-ray crystallography (B) two-dimensional electrophoresis
(C) bioinformatics (D) gas chromatography mass spectrometry
(E) NMR spectroscopy

(E) 37. Which one is the correct description of community ecology?
(A) Testing both biotic and abiotic factors.
(B) The study of interactions between organisms and their environment.
(C) All members of a species in same habitat.
(D) The study of how behavior contributes to the differential survival and reproduction of organisms.
(E) Patterns of species change and succession.

(C) 38. In muscular-skeletal systems, which one is the correct description?
(A) Arthropod exoskeletons are composed primarily of calcium carbonate.
(B) A skeleton that relies on muscular force exerted against water is termed an endoskeleton.
(C) Skeletal muscles are striated, voluntary, and have unbranched fibers.
(D) Each skeletal muscle cell constitutes a single motor unit.
(E) The thick filament is composed almost entirely of actin molecules.

(D) 39. In fungi, which one is the correct description?
(A) Wildlife benefit from endophytes because the endophytes cause more luxuriant plant growth.
(B) All materials passing from one hyphal cell to another must diffuse across the septal wall.
(C) Lichens are monophyletic.
(D) Many kinds of ascomycetes and basidiomycetes have lost the ability to reproduce sexually.
(E) Conidia are sexual spores produced by mushrooms.

(B) 40. In Taiwan, farmers harvest banana when the fruit is green. Then, it is shipped to other countries. Before marketing, with what kind of plant hormone is the fruit treated?
(A) Abscisic acid (B) Ethylene (C) Auxins (D) Gibberellins (E) Cytokinins

(A) 41. In octopus, what kind of respiratory pigment can be found?
(A) Hemocyanin (B) Hemoglobin (C) Hemophilia (D) Hemochromatosis (E) Ferritin

(B) 42. Why does the S-type strain of *Streptococcus pneumonia* cause pneumonia?
(A) Unable to defend the immune system (B) Surrounded by a polysaccharide capsule
(C) Able to grow and move (D) Inactivated by the immune system

(E) Unable to form colony

(C) 43. In monohybrid crosses, the phenotype ratio 1:2:1 indicates _____.
(A) linkage disequilibrium (B) pleiotropy (C) incomplete dominance
(D) three alleles for each trait (E) epistatic effect

(E) 44. In *E. coli* mating system, Hfr type could be a genetic donor and F^- could be a genetic recipient. After the mating between Hfr and F^- type cells, the F^- recipient _____.
(A) becomes Hfr (B) becomes H^+ (C) becomes F^- (D) gets episome (E) remains F^-

(E) 45. In the lactose operon of *E. coli*, which one is the description of the product of the *lacI* gene?
(A) Transcriptional activator protein (B) ß-Galactosidase
(C) Induces lac operon transcription (D) Binds to the RNA polymerase
(E) Binds to the operator

(D) 46. In DNA cloning experiments, which vectors can be keeping the largest DNA fragments?
(A) Plasmid (B) Bacteriophage lambda (C) Ti plasmid
(D) YACs (E) Cosmids

(A) 47. The mountain area of the Central Taiwan was deforested by the 921 earthquake in 2000 and has been recovered today. It is an example of _____.
(A) secondary succession (B) primary succession (C) climax succession
(D) arrival and speciation (E) seral accumulation

(A) 48. In human endocrine systems, which one is **NOT** correct description?
(A) Metamorphosis in flatfishes and in amphibians is controlled by growth hormone.
(B) Vitamin D is a hormone produced in part by exposure to sunlight.
(C) If blood sodium levels rise sharply above normal limits the heart will release more atrial natriuretic peptide.
(D) Insulin's effects on reducing blood glucose levels are counteracted by glucagon's actions, which increase blood glucose.
(E) It would be reasonable to assume that environmental cues such as photoperiod and temperature might regulate animal reproduction.

(D) 49. In flowering plant, which one of the following is true characteristic of the gametophyte stage?
(A) It is the obvious stage such as an oak tree. (B) Megasporangium
(C) Seed embryo (D) Gamete producing (E) Diploid

(C) 50. In eukaryotes there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?
(A) ligase (B) RNA polymerase I (C) RNA polymerase II
(D) RNA polymerase III (E) primase

Ⅱ.【單選題】51-75 題，每題 2 分，共計 50 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。

(C) 51.In many ways, the regulation of the genes of a particular group of viruses will be similar to the regulation of the host genes. Therefore, which of the following would you expect of the genes of the bacteriophage?
(A) regulation via acetylation of histones
(B) positive control mechanisms rather than negative
(C) control of more than one gene in an operon
(D) reliance on transcription activators

(E) utilization of eukaryotic polymerases

(E) 52. A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture. One of her colleagues suggested she try increased methylation of C nucleotides in a mammalian system. Which of the following results would she most likely see?
(A) increased chromatin condensation (B) decreased chromatin concentration
(C) abnormalities of mouse embryos (D) decreased binding of transcription factors
(E) inactivation of the selected genes

(C) 53. During splicing, which molecular component of the spliceosome catalyzes the excision reaction?
(A) protein (B) DNA (C) RNA (D) lipid (E) sugar

(C) 54. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates _____.
(A) the blending model of genetics (B) true-breeding (C) dominance
(D) a dihybrid cross (E) the mistakes made by Mendel

(D) 55. If cells in the process of dividing are subjected to colchicine, a drug that interferes with the functioning of the spindle apparatus, at which stage will mitosis be arrested?
(A) anaphase (B) prophase (C) telophase (D) metaphase (E) interphase

(B) 56. Testosterone functions inside a cell by _____.
(A) acting as a signal receptor that activates ion-channel proteins
(B) binding with a receptor protein that enters the nucleus and activates specific genes
(C) acting as a steroid signal receptor that activates ion-channel proteins
(D) becoming a second messenger that inhibits adenylyl cyclase
(E) coordinating a phosphorylation cascade that increases glycogen metabolism

(C) 57. Tay-Sachs disease is a human genetic abnormality that results in cells accumulating and becoming clogged with very large and complex lipids. Which cellular organelle must be involved in this condition?
(A) the endoplasmic reticulum (B) the Golgi apparatus (C) the lysosome
(D) mitochondria (E) membrane-bound ribosomes

(C) 58. Which of the following is an example of Batesian mimicry?
(A) an insect that resembles a twig
(B) a butterfly that resembles a leaf
(C) a nonvenomous snake that looks like a venomous snake
(D) a fawn with fur coloring that camouflages it in the forest environment
(E) a snapping turtle that uses its tongue to mimic a worm, thus attracting fish

(E) 59. A patient who has a parasitic worm infection and another patient responding to an allergen such as ragweed pollen have which of the following in common?
(A) an increase in cytotoxic T cell number
(B) suffering from anaphylactic shock
(C) risking development of an autoimmune disease
(D) suffering from a decreased level of innate immunity
(E) an increase in the levels of IgE

(B) 60. Endothermy is _____.
(A) a characteristic of most animals found in tropical zones
(B) a characteristic of animals that have a fairly constant body temperature
(C) a term equivalent to cold-blooded
(D) a characteristic of mammals but not of birds
(E) seen only in insects and in certain predatory fishes

(D) 61. In a Hardy-Weinberg population with two alleles, *A* and *a*, that are in equilibrium, the frequency of the allele *a* is 0.3. What is the percentage of the population that is homozygous for this allele?
(A) 0.09 (B) 0.49 (C) 0.9 (D) 9.0 (E) 49.0

(A) 62. By karyotype analysis, a woman is found to have 47 chromosomes, including one extra X chromosome. What kind of phenotype for her is expected?
(A) normal female (B) sterile female (C) enlarged genital structures
(D) albino (E) color blindness

(D) 63. Which one of following statements is **FALSE**?
(A) In a species that has a chromosome number of 2n = 16, each cell has eight homologous pairs.
(B) An error in either egg or sperm meiotic anaphase might result in a human zygote with 45 chromosomes.
(C) Single, haploid (*n*) sets of chromosomes in ovum and sperm unite during fertilization, forming a diploid (*2n*), single-celled zygote.
(D) At sexual maturity, ovaries and testes produce diploid gametes by meiosis.
(E) If a cell of a usually diploid species with 42 chromosomes per cell is triploid, this cell would be expected to have 63 chromosomes in 21 sets of 3.

(B) 64. Which of the following structures is primarily involved in the detoxification of many poisons and drugs in liver and therefore abundant in liver cells?
(A) Golgi apparatus (B) smooth ER (C) chemical
(D) rough ER (E) transport vesicles

(E) 65. In systematics and phylogeny, which one is the correct description?
(A) A phylogenetic tree is actually a theory that depicts the evolutionary relationships among species.
(B) A paraphyletic group contains groups of species with different common ancestors.
(C) Morphology is a term that refers to similarities among various species that occur because the species are derived from a common ancestor.
(D) Where a branching point in a phylogenetic tree is called a clade.
(E) A phylotenetic tree is then being used as a cladogram.

(C) 66. In animal circulatory systems, which one is the correct description?
(A) Hemophilia results from a deficiency in platelets.
(B) The meshwork that forms the fabric of a blood clot mostly consists of fibrinogen.
(C) Reduced levels of hemoglobin in the blood result in the condition of anemia.
(D) During cellular maturation, mammalian erythrocytes lose their plasma membrane.
(E) The primary function served by erythrocytes is defense against pathogens.

(A) 67. In animal digestion and absorption, which one is the correct description?
(A) The small intestine releases the hormone secretin in response to acid.
(B) Fats packaged in chylomicrons pass directly from epithelial cells to the bloodstream.
(C) In the stomach, proteins are cleaved into amino acids by aminopeptidases.
(D) All sugars are absorbed via secondary active transport.
(E) In omnivores, including humans, the cecum is an important organ for digestion of cellulose.

(B) 68. In the cells of the nervous system, which one is the correct description?
(A) Ionotropic receptors act by activating G proteins in target cells.
(B) Metabotropic receptors act by initiating changes in second messenger systems in target cells.
(C) Action potentials are typically also graded potentials.
(D) Electrical synapses transmit signals using neurotransmitters.
(E) Most of the cells in your brain are neurons.

(C) 69. Which one is the correct description of the invertebrates?
(A) The two body forms of some *Radiata* is an example of alternation of generations.

(B) The nervous system of a cnidarian consists of a central ganglion leading into a nerve net.
(C) Scorpions do not lay eggs but rather give birth to live young.
(D) All Platyhelminthes are parasitic.
(E) Millipedes have a thousand legs whereas centipedes have only a hundred legs.

(D) 70. Between two genes in same chromosome, recombination frequency is 0.025. What is the distance between two genes on the linkage map?
(A) 0.025 cM (B) 0.25 cM (C) 1.25 cM (D) 2.50 cM (E) 5.00 cM

(D) 71. Which one is the correct description of salt and water balance in animal?
(A) Sodium and potassium ions can easily diffuse through the lipid bilayer of plasma membranes.
(B) Sweat has a higher salt concentration than the blood does in humans.
(C) Animals that do not control internal water concentration also typically do not control the concentrations of ions like sodium and potassium.
(D) Transport of salts against their concentration gradients is energetically expensive.
(E) The filtrate that leaves the proximal convoluted tubule is much more concentrated than the blood in humans.

(B) 72. In species interaction, which one is the correct description of allelopathy?
(A) Amensalism
(B) The secretion of toxins into the environment by plant roots or leaves
(C) Commensalism
(D) Mutualism
(E) The movement of genes from one species to another

(E) 73. In biodiversity, which one is the correct description of ecosystem diversity?
(A) The amount of genetic variation that occurs within and between populations.
(B) Only the amount of genetic variation that occurs between species.
(C) Includes trophic diversity and process diversity.
(D) Defines the species diversity and morphology of an ecosystem.
(E) Refers to the structure and function within an ecosystem.

(D) 74. In the cross Aa Bb CC Dd Ee × Aa Bb Cc Dd EE, in which all genes undergo independent assortment, what proportion of offspring are expected to be homozygous dominant for all five genes?
(A) $(1/4)$ (B) $(1/4)^2$ (C) $(1/4)^3$ (D) $(1/4)^4$ (E) 0

(E) 75. In gymnosperms and angiosperms, which one is the correct description?
(A) All gymnosperms are wind-pollinated.
(B) The fossil record shows that angiosperms evolved directly from the Gnetophytes.
(C) Horizontal gene transfer is restricted to prokaryotes and protists.
(D) The fossil record shows that pollen cones of conifers have become increasingly complex through their evolutionary history.
(E) Stamens and carpals are, in fact, modified sporangia-bearing leaves.