２０２５年度名古屋大学大学院生命農学研究科博士前期課程入学試験
Entrance Examination for Master's Course, Graduate School of Bioagricultural Sciences

受験専門科目名 Subject chosen	細胞生物学 Cell Biology	この科目について(For this subject) (3)枚のうち(1)枚目 Total pages Page number

【問題 1】細胞周期について、以下の問に答えよ。

問1. グラフは増殖中にある１つの細胞の核内のDNA量の経時変化を模式的に示すもので、(b)は(a)のおよそ２倍のDNA量を示す。

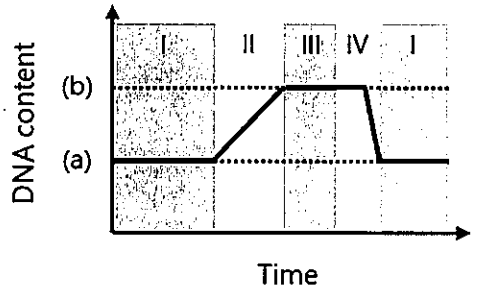
(1) (b)のDNA量をもつ細胞はどのような状態にあると考えられるか、次の中から適切な用語を選んで、60字以内で答えよ。
[転写、複製、G1期、G2期、M期、S期]

(2) 細胞周期のS期の細胞は グラフ中の(I)～(IV) のどの段階に相当するか、理由を含めて説明せよ。

(3) この細胞に化学物質Xを与えると、(a)のDNA量をもつ細胞の割合が著しく増加した。化学物質Xは細胞にどのように作用したか、理由を含めて説明せよ。

問2. 細胞がM期に入るときに作用する代表的なタンパク質の名称を2つ挙げ、その機能をそれぞれ100字以内で述べよ。

問3. 細胞周期におけるAPC/Cの役割を、APC/Cが作用するタンパク質を含めて、200字以内で説明せよ。(APC/C: Anaphase Promoting Complex or Cyclosome)



【Question 1】
Answer the following questions on the cell cycle.

Q1. The graph shows a schematic change in DNA content in the nucleus of a proliferating cell over time. (b) shows approximately twice the amount of DNA as (a).

(1) What state is a cell with DNA content in (b) considered to be in? Explain within 30 words using the appropriate terms from the following.
[transcription, replication, G1 phase, G2 phase, M phase, S phase]

(2) Which phase corresponds to the S phase of the cell cycle? Select one from phases (I) to (IV) in the graph and explain why.

(3) When these cells were exposed to chemical X, the proportion of cells with DNA content in (a) increased significantly. How did the chemical X affect these cells? Explain why.

Q2. Answer the names of two typical proteins that act when cells enter the M phase and describe their functions within 50 words, respectively.

Q3. Explain within 100 words the role of APC/C (Anaphase Promoting Complex or Cyclosome) in the cell cycle, including the substrate protein(s) of APC/C.

[注意事項] 各問題につき一枚の解答用紙（裏面使用も可）を使用せよ。
[Notes] Use one answer sheet for each question (the back side can also be used).

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【問題2】細胞の生存と死に関連する以下の問に答えよ。

問1. プログラム細胞死に関連する(1)～(3)の用語を、[ ] 内の語句を全て用いて、100～200 字程度で説明せよ。（同じ語句を複数回用いてよい）

(1) カスパーゼ　[プロカスパーゼ、タンパク質切断、核膜、核ラミン、タンパク質分解カスケード]

(2) Bcl2　[シトクロム c、ミトコンドリア、アポトソーム]

(3) Fas　[Fasリガンド、細胞死誘導シグナル伝達複合体（DISC）、キラー細胞]

問2. 動物細胞は、様々な細胞外シグナルを感知し、応答する。(1)～(3)の細胞外シグナル因子が引き起こす細胞応答を、[ ] 内の適切な用語を用いて簡潔に述べよ。(同じ用語を重複して複数回用いてよい)

[受容体、細胞周期、細胞サイズ、細胞死、細胞内シグナル伝達]

(1) 生存因子
(2) 分裂促進因子
(3) 増殖因子（成長因子ともいう）

【Question 2】Answer the following questions related to cell survival and death.

Q1. Explain the terms in (1) to (3) related to programmed cell death in 50 to 100 words, using all the words in [ ]. (The same word may be used more than once.)

(1) caspases [procaspase, proteolytic cleavage, nuclear envelope, nuclear lamin, proteolytic cascade]

(2) Bcl2 [cytochrome c, mitochondria, apoptosome]

(3) Fas [Fas ligand, DISC (death-inducing signaling complex), killer lymphocytes]

Q2. Animal cells sense and respond to a variety of extracellular signals. Describe briefly the cellular responses excited by the following extracellular signaling molecules in (1) to (3), using the appropriate words in [ ]. (The same word may be used more than once.)

[receptor, cell cycle, cell size, cell death, intracellular signaling]

(1) survival factors
(2) mitogens
(3) growth factors

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【問題3】小胞輸送に関する以下の記述を読み、問に答えよ。

[redacted]

問1. 小胞輸送における次の(1)～(3)のプロセスを、[ ]内から適切な用語を選択し、それぞれ200字以内で説明せよ。

(1) 輸送小胞の標的膜へのテザリング（係留）
(2) 輸送小胞の標的膜への接着
(3) 輸送小胞と標的膜の融合

[テザリングタンパク質、t-SNARE、v-SNARE、Rabタンパク質、脂質二重層、相補的]
（同じ語句を複数回用いてよい）

【Question 3】Read the following description of vesicular transport and answer the questions.

"After a transport vesicle buds from a membrane, it is actively transported to its destination by motor proteins that move along cytoskeletal fibers. When the transport vesicle has reached its target, it must recognize and dock with its specific membrane. Once docked, the vesicle can fuse with the target membrane and release its cargo proteins."

(Adapted with some modifications from Essential Cell Biology, 5th edition.)

Q1. Explain the following processes (1) to (3) in the vesicular transport within 100 words each, by selecting the appropriate terms from [ ].

(1) Tethering of the transport vesicle by the target membrane.
(2) Docking of the transport vesicle with the target membrane.
(3) Fusion of the transport vesicle with the target membrane.

[tethering protein, t-SNARE, v-SNARE, Rab protein, lipid bilayer, complementary]
(The same word may be used more than once.)

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