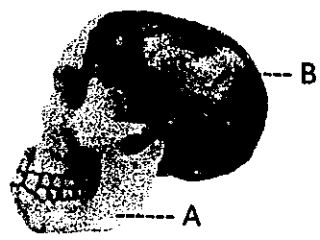
※ 注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

壹、 閱讀測驗 (40%)

I. Piltdown Man

from **The Library and Archives collection of** Natural History Museum (London)

In 1912 Charles Dawson, an amateur archaeologist claimed to have discovered the 'missing link' between ape and man. He had found part of a human-like skull in Pleistocene gravel beds near Piltdown village in Sussex, England. Dawson wrote to Arthur Smith Woodward, Keeper of Geology at the Natural History Museum at the time, about his find. Dawson and Smith Woodward started working together, making further discoveries in the area. They found a set of teeth, a jawbone, more skull fragments and primitive tools, which they suggested belonged to the same individual. Smith Woodward made a reconstruction of the skull fragments, and ***the archaeologists*** hypothesized that the find indicated evidence of a human ancestor living 500,000 years ago. They announced their discovery at a Geological Society meeting in 1912. For the most part, their story was accepted in good faith. However, in 1949 new dating technology arrived that changed scientific opinion on the age of ***the remains*** Using fluorine tests, Dr Kenneth Oakley, a geologist at the Natural History Museum, discovered that the Piltdown remains were only 50,000 years old. This eliminated the possibility of the Piltdown Man being the missing link between humans and apes as at this point in time humans had already developed into their *Homo sapiens* form. Following this, biological anthropologist Dr Joseph Weiner and human anatomist Wilfrid Le Gros Clark, both from Oxford University, worked with Dr Oakley to further test the age of the Piltdown findings. Their results showed that the skull and jaw fragments actually came from two different species, a human and an ape, probably an orangutan. Scratches on the surfaces of the teeth, visible under the microscope, revealed that the teeth had been filed down to make them look human. They also discovered that most of the finds from the Piltdown site had been artificially stained to match the local gravels.



Piltdown Man cranium and mandible as reconstructed by Dr Arthur Smith Woodward

1. 文中的 ***the archaeologists*** 指的是哪些人？ (4 %)
2. 文中的 ***the remains*** 指的物品主要有哪些？ (6 %)
3. 你認為"Piltdown Man"事件是惡意造假，或是因當代研究工具、技術不足所產生的誤判？為什麼？ (10%)
4. 文末所附照片中，A 與 B 部分是來自甚麼物種？(4 %)

II. Gliotransmission from astrocytes to neurons

Modified from Narges Bazargani & David Attwell (Nature Neuroscience, 2015)

The discovery that glutamate evokes a calcium concentration rise in astrocytes, which can propagate along astrocyte processes and even between glial cells raised the possibility that glial Ca^{2+} waves might constitute an extraneuronal signaling system in the brain. The subsequent demonstration that rises in intracellular Ca^{2+}

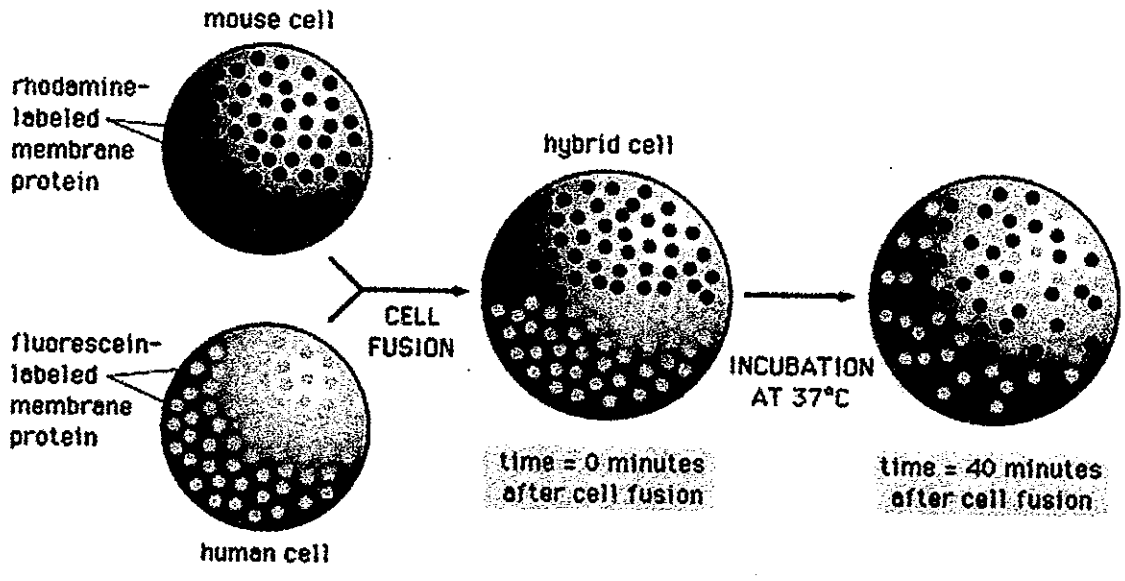
見背面

concentration ([Ca2+]i) in astrocytes in turn induce a $[Ca^{2+}]_i$ rise in adjacent neurons sparked a flurry of studies that generated the concept of gliotransmission from astrocytes to neurons. The release of gliotransmitters by astrocytes has been reported to generate a wide range of effects on neurons. Glutamate release evokes an inward membrane current in neurons, mediated by NMDA receptors, that regulates excitability and synchronizes action potential firing. Release of glutamate and GABA, and of ATP regulates synaptic vesicle release probability by activating presynaptic receptors. In addition to altering neuronal information processing, calcium-evoked release of messengers from astrocytes was suggested to regulate the energy supply to the brain in three important ways. First, increases of astrocyte $[Ca^{2+}]_i$ lead to the release of arachidonic acid-derived messengers that modify the contraction of vascular smooth muscle. This provides a mechanism by which the polarized morphology of astrocytes-with many processes around synapses, and endfeet apposed to blood vessels-could regulate cerebral blood flow and energy supply according to the activity of synapses, the main consumers of energy in the brain. Second, glutamate-evoked rises in astrocyte $[Ca^{2+}]_i$ trigger the insertion of more glucose transporters into the cell membrane, facilitating glucose uptake from the blood when synapses are active. Third, regulation of oxygen supply to the whole body may involve the acidification of brainstem astrocytes by CO_2, which leads to a $[Ca^{2+}]_i$ rise and ATP release that in turn increases breathing rate. All this work led to the idea that astrocytes constitute a network of cells that process information and regulate brain energy supply in parallel with neurons.

5.簡要描述上文主旨以及內容中與你過去所習有關 astrocyte 知識有何相同與相異之處? (4 %)
6. 文中所提 gliotransmitters 有哪些，又何者與腦區血液流量控制有關? (6 %)
7. 根據上文當神經細胞代謝上生需增加血氧供應時，如何透過 astrocyte 調節? (6 %)

貳、 英文科學短文 (30%)

下圖是 1970 年兩位美國科學家 Larry Frey 與 Michael Edidin 著名的細胞融合實驗概念示意圖。這項研究工作証實膜蛋白在細胞膜上能進行側邊移動，並且支持細胞膜結構的流體鑲嵌模型。請依圖中資訊用英文扼要闡述，該實驗的設計概念與結果為何能証實膜蛋白有側邊移動。



接次頁

參、 配合填空 (30 %)

將下列 a－o 的單字、專有名詞或片語依前後文意填入下面兩段科學短文中的 1-15 空格中 (30%)

a. accumulated	**b.** buffer	**c.** characteristic
d. combination	**e.** conform	**f.** consists of
g. guarantee	**h.** maintain	**i.** occurrence
j. optimal	**k.** self-regulate	**l.** strategies
m. sustainable	**n.** vaccination	**o.** variable

Grapevine diseases, especially viral infections, cause main crop losses. Methods have been developed to eliminate viruses and other microorganisms from plant material, but elimination of viruses from plant material does not ___1___ protection from future reinfection. Elimination of viral particles in plant material could create genetic drift, leading in turn to an increase in the ___2___ of pathogenic strains of viruses. A possible solution may be a ___3___ of virus elimination and plant propagation in tissue culture with *in vitro* ___4___. In this context, possible ___5___ to control viral infections include application of plant resistance inducers, cross protection and vaccination using siRNA, dsRNA and viral replicons during plant 'cleaning' and *in vitro* propagation. The experience and knowledge ___6___ in human immunization can help plant scientists to develop and employ new methods of protection, leading to more ___7___ and healthier crop production.

An important ___8___ of animals is the ability to ___9___ the extracellular environment in which their cells are bathed and function. The extracellular environment is a ___10___ between the intracellular environment and the external environment of an animal, which ___11___ an aquatic or terrestrial environment in exchange with the atmosphere. These external environments can be highly ___12___ with respect to their physical characteristics, which would affect the intracellular physiological processes necessary for animals to function. Therefore, some aspects of the intracellular environment of an animal are invariably kept different from their external environment. Consequently, an important role of homeostasis in animals is the regulation of aspects of the extracellular environment different from the external environment to provide an ___13___ internal environment in which the cells function. Homeostasis is an underlying principle of animal physiology, and physiological systems are the means by which homeostasis is maintained. Homeostatic processes ___14___ the internal environment, although not all animals regulate all physiological variables to the same extent. Animals may ___15___ with respect to some physiological variables, with the internal variable the same as for the external environment.

試題隨卷繳回