Skill building pack: Communication

Describing cause-and-effect relationships

Cause-and-effect (因果關係) is a relationship between two or more events. The 'cause' is the reason **why** something happened. The 'effect' is the description of **what** happened because of the cause. To describe the cause-and-effect relationship, the following words are often used:

Words for 'cause'	Words for 'effect'
because	so
since	therefore
as	thus
due to	hence
as a result of	as a result
because of	this causes

Note: 'Since/As' should not be followed by 'so/therefore/thus'.

Examples of cause-and-effect relationships in biology:

1 When some plant cells are put in distilled water, the cells gain water by osmosis (*effect*) ***because*** the water potential of distilled water is higher than that of the cells (*cause*). ➲ Ch 3

2 The blood pressure in arteries is high (*effect*) ***due to*** the pumping action of the heart (*cause*). ➲ Ch 8

3 High temperatures cause a change in the shape of the active site of enzyme molecules (*cause*). ***Therefore***, the activity of enzymes decreases at high temperatures (*effect*). ➲ Ch 4

4 When light intensity increases, stomata in the leaves open wider. The cross-sectional area for the diffusion of water vapour increases (*cause*). ***As a result***, water vapour diffuses out of the leaves more rapidly through the stomata (*effect*). ➲ Ch 10

Sometimes, we wrongly assume that two things have a cause-and-effect relationship when they happen together. For example:

High usage of smartphones ***causes*** short sight. ✗

Although there is a ***positive correlation*** between the time spent daily on smartphones and the risk of developing short sight, the two things do NOT have a cause-and-effect relationship. Remember that correlation does not imply causation (refer to the worksheet *Identifying correlations between two variables* for details.)

Practice

Determine whether the two things in each of the following questions have a cause-and-effect relationship. If there is a relationship, write a paragraph to link the two things together.

1
- Active transport requires energy coming from respiration of cells.
- Active transport occurs in living cells only.

Since active transport requires energy coming from respiration of cells, it occurs in living cells only. (or other correct answers)

2
- The chance of having a boy or a girl for each birth is the same.
- Sperms containing an X chromosome and sperms containing a Y chromosome are produced in equal proportions, and fertilization is a random process.

Sperms containing an X chromosome and sperms containing a Y chromosome are produced in equal proportions, and fertilization is a random process. Therefore, the chance of having a boy or a girl for each birth is the same. (or other correct answers)

3
- Colour blindness is an inherited eye defect.
- There is no cure for colour blindness.

The two things do not have a cause-and-effect relationship.

4
- Binary fission involves mitotic cell division only.
- Binary fission gives rise to offspring with genetic make-up identical to that of the parent.

Binary fission gives rise to offspring with genetic make-up identical to that of the parent because only mitotic cell division is involved in binary fission. (or other correct answers)

技巧提升教材：傳意

描述因果關係

「**因果關係**」是事件與事件之間的一種關係。顧名思義，「因果關係」中的「因」是事件發生的**原因**，而「果」是該原因導致的**結果**。在描述因果關係時，我們通常會使用以下字詞：

描述「原因」	描述「結果」
因為 由於 原因是 理由是	所以 因此 結果 於是 以致

生物學上有因果關係的例子：

1 當植物細胞被放入蒸餾水時，細胞會藉滲透吸收水份（結果），原因是蒸餾水的水勢比植物細胞的水勢高（原因）。

➲ 第 3 章

2 因為動脈內的血液直接受心的泵壓（原因），所以動脈內的血壓很高（結果）。

➲ 第 8 章

3 由於高温會使酶分子活性部位的形狀改變（原因），因此高温時酶活性下降（結果）。

➲ 第 4 章

4 光強度愈高，植物葉上的氣孔張得更大，這使水汽擴散的橫切面面積增加（原因），結果加快水汽從葉內氣室通過氣孔擴散到大氣中（結果）。

➲ 第 10 章

有時，我們會誤把兩項同時發生的事件以因果關係連繫起來，例如：

長時間使用智能手機會**引致**近視。✗

雖然每天使用智能手機的時間與患上近視的風險有**正相關** (positive correlation) 的關係，但兩者並沒有因果關係。留意「相關 (correlation)」並不代表兩項事件之間有因果關係（詳情可參閱工作紙「辨識兩個變量之間的關係」）。

練　習

閱讀下列各題中的兩項事件，然後決定兩者有沒有因果關係。如果有，撰寫一段文字，把兩項事件連繫起來。

1

- 主動轉運需要能量來推動，而能量來自細胞的呼吸作用。
- 主動轉運只會在活細胞進行。

由於主動轉運需要能量來推動，而能量來自細胞的呼吸作用，因此主動轉運只會在活細胞進行。（或其他正確答案）

2

- 每次生育誕下男嬰或女嬰的機會是均等的。
- 載有 X 染色體和載有 Y 染色體的精子產生的比例相等，而且受精是隨機過程。

因為載有 X 染色體和載有 Y 染色體的精子產生的比例相等，而且受精是隨機過程，所以每次生育誕下男嬰或女嬰的機會是均等的。（或其他正確答案）

3

- 色盲是遺傳性的眼睛毛病。
- 色盲無法醫治。

兩項事件沒有因果關係。

4

- 二分裂只涉及有絲細胞分裂。
- 二分裂產生的後代與親本在遺傳上完全相同。

由於二分裂只涉及有絲細胞分裂，所以二分裂產生的後代與親本在遺傳上完全相同。（或其他正確答案）