AP Bio FRQ Fridays

2019 #8
Membrane Transport & Tonicity

FRQ Friday #7

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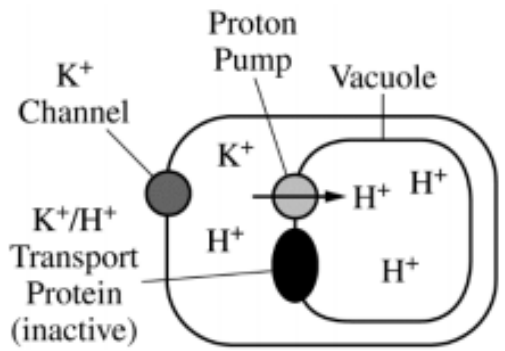
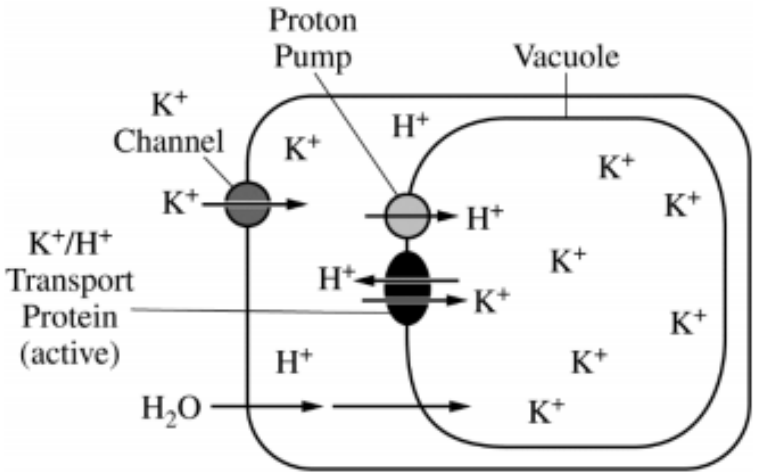
The petal color of the Mexican morning glory (*Ipomoea tricolor*) changes from red to blue, and the petal cells swell during flower opening. The pigment heavenly blue anthocyanin is found in the vacuole of petal cells. Petal color is determined by the pH of the vacuole. A model of a morning glory petal cell before and after flower opening is shown in Table 1.

TABLE 1. CHANGES IN MORNING GLORY PETAL CELLS DURING FLOWER OPENING

	BUD	OPEN FLOWER
		
Vacuole pH	6.6	7.7
Flower Color	Red	Blue
Cell Volume	Small	Large

FRQ Friday #7

2019 #8

(a) **Identify** the cellular component in the model that is responsible for the increase in the pH of the vacuole during flower opening AND **describe** the component's role in changing the pH of the vacuole.

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	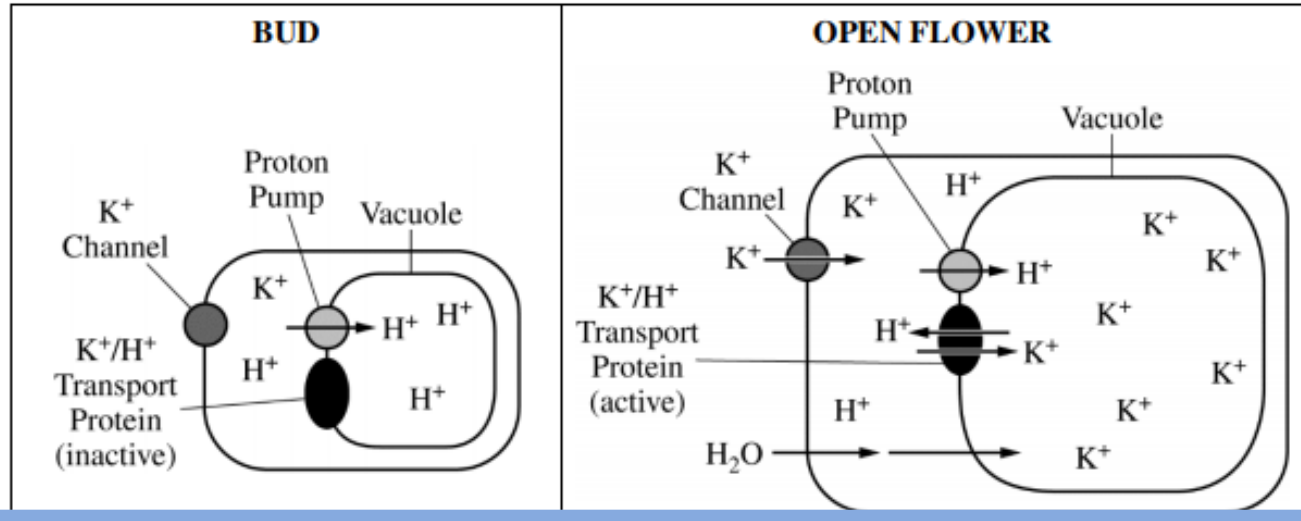	
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Identification (1 point)

- (K^+ / H^+) transport protein

Description (1 point)

- It moves H^+ out of the vacuole.

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- (K^+ / H^+) transport protein

Description (1 point)

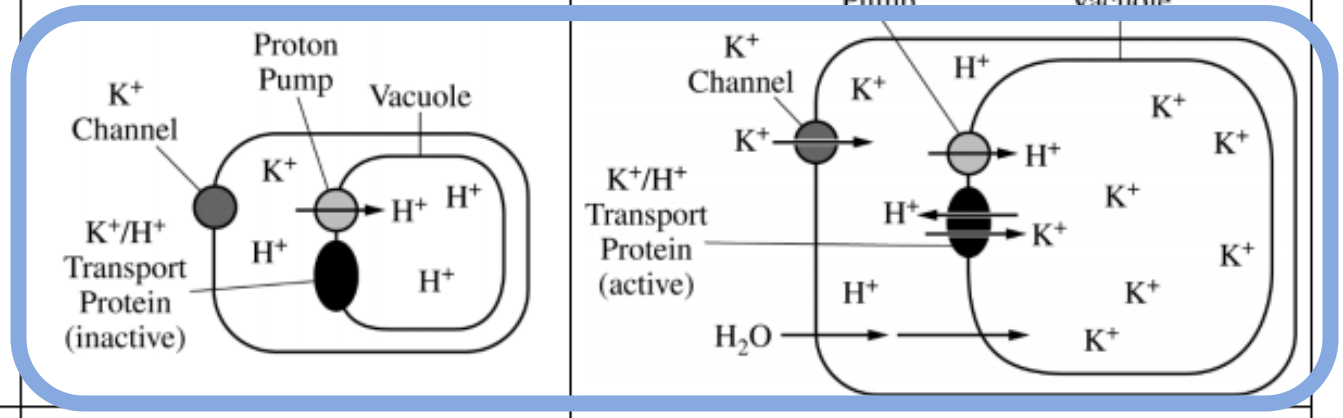
- It moves H^+ out of the vacuole.

The pH of the vacuole is increased by the K^+/H^+ transport protein. It changes the pH by removing the H^+ ions brought in by the proton pump, thus decreasing H^+, which equals increasing pH. It acts as an antiporter of K^+ and H^+.

FRQ Friday #7

2019 #8

(b) A researcher claims that the activation of the K^+ / H^+ transport protein causes the vacuole to swell with water. **Provide reasoning** to support the researcher's claim.



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- The concentration of solute (K^+) is increasing inside the vacuole.
- The solute (K^+) is moving into the vacuole, making it hypertonic/hyperosmotic/lowering water potential.

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The movement of K^+ into the vacuole is also accompanied by the (osmosis) diffusion of water, since moving K^+ into the vacuole by the pump. decreases water potential, water moves in with the K^+ to balance out the changes in water potential to reach equilibrium, causing it to swell with water.