

1. Recently in the news, it was announced that two patients died in Calgary when they had their blood dialysed against KCl instead of NaCl.

Why is KCl lethal when our cells are normally full of K^+ ions?

If somebody murders their rich aunt by intravenous injection of KCl, why is this difficult for the coroner to detect?

2. Your lab has discovered a protein that allows Ca^{2+} to cross membranes. What experiments might you plan to try to determine the following:

- a) is it active or passive transport?
- b) is it an electrogenic transporter?
- c) is it a transporter or an ion selective channel?

Can you explain the difference between an ion pump, an ion uniporter and an ion channel? If a uniporter moves an ion from low to high concentration, is this necessarily active transport?

3. If protein kinase B inactivates glycogen synthase kinase, and glycogen synthase kinase inactivates glycogen synthase, what happens to glycogen synthase when insulin binds to its receptor?

4. Which do you think is more dangerous to an organism?

A mutation of Ras that prevents GTP hydrolysis
A mutation of Ras that speeds up GTP hydrolysis
A mutation of Ras that prevents GTP from binding

5. How do cholera toxin and pertussis toxin increase activity of adenylate cyclase? Why are the symptoms of cholera and pertussis (whooping cough) different if the biochemical effect is the same?
6. Why do voltage gated ion channels in the nervous system use different mechanisms for opening and closing the channel?

Why do nerve impulses travel in one direction?

7. What would happen to the normal cellular membrane potential of -60 mV inwards if K^+ channels opened unexpectedly? Does this explain why there are many toxins that act on Na^+ channels but none known that act on K^+ channels?
8. Caffeine inhibits the phosphodiesterase that breaks down cyclic AMP.

Can you explain how caffeine can induce a "high" energy state? How can consuming coffee and a donut induce the hypoglycemic state sometimes called caffeine "crash"?