Most students successfully described at least one difference between a reflex arc and a typical stimulus-response pathway. However, many students incorrectly claimed that without a reflex, organisms will not respond to any stimulus. Students often confused neural pathways with signal transduction pathways or with hormone signaling, and some students described neuron function (resting potentials, action potentials, etc.) rather than answering the question. While students were able to provide adequate descriptions, many students failed to provide adequate reasoning connecting the reflex with the ability of the organism to avoid a threat.

1. Many essays did not demonstrate familiarity with the pancreatic hormones involved in the counterregulatory homoostatic mechanisms underlying glucose levels in the blood. Less commonly, the effects of insulin and glucagon were reversed. Numerous essays omitted the identity of specific target cells, and some revealed confusion about the distinctions molecules and cells. In some cases there appeared to be a blending of hormone–receptor interactions with enzyme–substrate interactions, neurotransmitter actions, or immune cell activation. The overall distinctions between the actions of steroid hormones and the actions of protein hormones were described poorly in many essays and were reversed in a few cases.

1. In Step 1, students confused the receptor with a channel protein or an enzyme’s active site. They described the hormone/ligand going through the receptor as in facilitated diffusion rather than initiating signaling. In Step 2, students described a single, signal protein changing shape, often several times, in order to morph into a shape that would fit through the nuclear membrane. Some students erroneously described an enzyme passing through the cell membrane and then changing its shape and activity as it made its way to the nucleus. In Step 3, students were not specific as to the regulation of the target gene. They restated the question prompt by saying gene expression was regulated, but did not indicate the direction (stimulated or repressed.) Some indicated the DNA was mutated/altered/changed by the molecule that entered the nucleus. Students stated DNA was replicated or translated rather than transcribed. Many stated the original hormone entered the nucleus, after having been modified.

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