Explain the hormonal cascade of reproductive physiology in birds.

An example of an A answer:

“The hormonal cascade in birds is ultimately cued by photoperiod (day length) in temperate zones, and seasonal precipitation or vegetative greenness in tropical ones. These cues signal the onset of a period of reasonably abundant and reliable resources, which is reflected in the seasonal growth/shrinkage/recrudescence of gonads in most bird species. The ultimate cue stimulates the hypothalamus of the brain to release gonadotropin-releasing hormone (GNRH), which then acts on the pituitary, causing it to release three gonadotropins, called follicle-stimulating hormone (FSH), luteinizing hormone (LH), and prolactin. These act on the gonads. FSH stimulates maturation of the gonads in both sexes and sperm production in males. LH stimulates ovulation by females and sex hormone (estrogen, testosterone) production in both sexes. Prolactin induces brooding behavior and brood patch development, and serves as a negative feedback to the pituitary to halt production of LH and FSH. Decreased photoperiod (or precipitation or greenness) has the same negative feedback effect, bringing the breeding season to a close for most species. In a few species (e.g. Feral Pigeon), there is continuous breeding, meaning that there is no seasonal start or halt.”

This answer is factually correct, detailed, well-organized, and thorough. It uses the appropriate terminology (jargon, if you will) and provides discrete examples. This answer is clearly head and shoulders above the others (below).

An example of a B answer:

“Seasonal breeding in birds is triggered by daylength or possibly rainfall (tropics), which trigger the hypothalamus to release gonadotropin-releasing hormone, which acts on the pituitary, causing it to release follicle-stimulating hormone, luteinizing hormone, and prolactin. FSH triggers sperm production and causes gonad maturation, LH causes ovulation and estrogen and testosterone production, and prolactin controls breeding behaviors as well as serves as a negative feedback, halting the process.”

This answer, although correct in what it says, is sparse, not providing much explanatory detail. It clearly does not merit the same grade as does the A answer.

Examples of C answers:

“Hypothalamus → gonadotropin-releasing hormone → pituitary → gonadotropins → gonads. The gonadotropins are follicle-stimulating hormone, luteinizing hormone, and prolactin. FSH stimulates gonad maturation and sperm production. LH stimulates ovulation and sex hormone production. High prolactin or shorter day length serve as negative feedback to the pituitary.”

This answer is a flimsy, minimalist one that lacks convincing detail that the student has mastered the subject.
“Day length is sensed by the hypothalamus, which releases GNRH, which acts on the pituitary. The pituitary then releases the gonadotropins LH, FSH, and prolactin, which act on the gonads directly. FSH causes gonad maturation, LH causes ovulation and hormone production, and prolactin controls behaviors as well as serves as a negative feedback of the cascade.”

Although what is said is correct, there is little supporting evidence of mastery of the subject. The use of “GNRH,” “FSH,” and “LH” without spelling out what the abbreviations mean is indicative of the student’s desire to make a hasty rather than a thorough answer.

An example of a D answer:

“Photoperiod is sensed by the hypothalamus, which releases 3 gonadotropins that act on the gonads. FSH stimulates gonad maturation. LH induces ovulation. Prolactin causes brood patch development and serves as a negative feedback.”

An error in the pathway (where’s the pituitary?) indicates that the student is confused in his/her thinking. Although the descriptions of the 3 gonadotropin functions are correct, this is only part of the answer. Lack of spelling out what the abbreviations means, lack of details, and lack of placing the cascade in context mean that only a minimal amount of credit is to be received.

Examples of F answers:

“The hormones produced by the gonads of a bird dictate the plumage and secondary sex characteristics. There is an increase in these hormones as a precursor to breeding, which causes breeding plumages to be displayed and for females to ovulate. In males and females that display secondary sex organs such as combs, these are a result of an increase in the levels of testosterone.”

This “answer” does not in fact answer the question.

“During the breeding season, there is a hormonal cascade in both males and females. Triggers in the brain start the process, which start the production of gonadotropins, which stimulate the gonads and prepare the bird for reproduction. The first hormone creates sperm for males, and ovaries become active for females. This leads to the releasing of the luteining hormone, which produces estrogen and testosterone. The pituitary gland serves as a two-way brake system to stop the hormonal cascade.”

This answer is confused, filled with inaccuracies, and misses many crucial details. Inclusion of certain terms (e.g. gonadotropins, pituitary, luteining hormone) are indicative that the student is grasping for straws and is trying to include as many buzzwords as possible in hopes that the correct answer may be found somewhere therein. It is clear that this student does not demonstrate any degree of mastery of the material.