Clemson University Biology Merit Exam
30 March 2001

The theme of this exam is that eminently respectable bird, the wild turkey.

1. The turkey belongs to the Kingdom

a) Plantae. b) Mammalia. c) Animalia. d) Zoologia.

2. The turkey also belongs to the Phylum ... and the Class

a) Chordata ... Aves. b) Vertebrata ... Galliformes.
c) Vertebrata ... Eutheria. d) Vertebrata ... Chordata.

3. An encyclopedia gives the Latin name of the turkey as *Meleagris gallopavo*. However, a hunting guide gets more exact, telling its readers about the differences between the Eastern turkey (*Meleagris gallopavo silvestris*) and the Florida turkey (*Meleagris gallopavo osceola*). For these two birds, the name ... is an example of a

a) *Meleagris gallopavo* ... genus. b) *silvestris* ... species.
c) *osceola* ... subfamily. d) *gallopavo* ... specific epithet.

4. Without any further information than the names, we would conclude that Eastern turkeys and Florida turkeys

a) belong to different genera. b) probably cannot interbreed.
c) are subspecies of the same species. d) <u>All</u> of these.

5. The earliest fossil record of *Meleagris gallopavo* comes from the southwestern US, about 50,000 years ago. If you could go back to that time, you would see

a) the earliest seed plants. b) the extinction of the dinosaurs.
c) a great diversity of mammals. d) the great Coal Age forests.

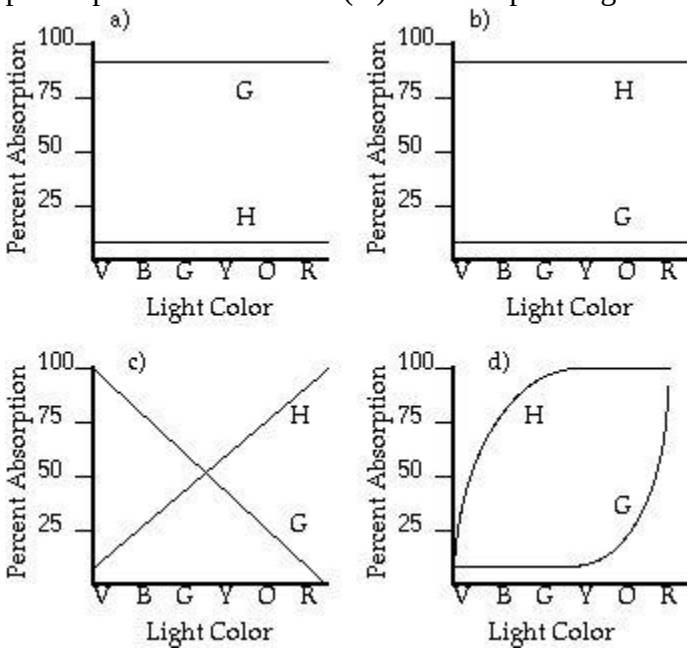
6. Male turkeys are called gobblers and females are called hens. The weight record for an Eastern gobbler is 27.5 pounds. This is about ... <u>grams</u>.

a) 60 b) 700 c) 770 d) 12500

7. The first thing we notice about a turkey is its feathers. Feathers are mostly made of a protein called keratin. A protein is a macromolecule that is composed of

a) carbohydrates linked by disulfide bonds.
b) a polymer of amino acids.
c) linked six-sided rings.
d) a polymer of purines and pyrimidines.

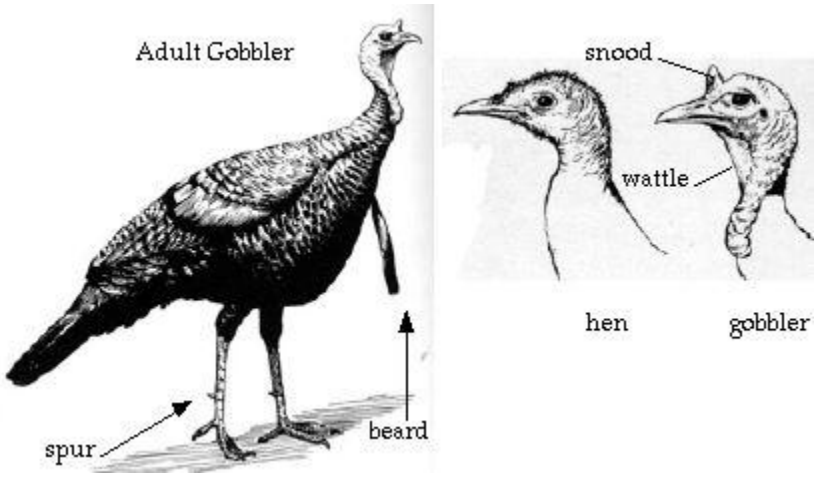
8. Turkey feathers get their colors from pigments. The tips of the breast feathers are white in hens and black in gobblers, accounting for the gobbler's darker appearance. In the graphs below, the letters V, B, G, Y, O, and R stand for violet, blue, green, yellow, orange, and red. The graph that shows the correct absorption spectra for both hen (H) feather tips and gobbler (G) feather tips is



9. The head of a gobbler turns bright red when the bird is excited and the skin of the head is full of blood, but the head skin fades to pale blue if the bird is frightened and blood drains out of it. The red color is probably due to

a) fucoxanthin. b) hemocyanin. c) carotenoids. d) hemoglobin.

10. Aside from having different feather and head colors, gobblers are distinguished from hens by having wattles under their chins, a "snood," or wormlike appendage attached to the upper edge of the beak, a "beard" or tassle of feathers emerging from the front of the chest, and spurs on the backs of the legs.



These male features would collectively be called

a) gonads. b) secondary sexual characteristics.
c) primary sexual organs. d) accessory sexual organs.

11. Normal gobblers have the male plumage described above. If a young gobbler is castrated (has his testes removed), he still grows the usual male plumage. If a young hen has her ovaries removed, she also grows male plumage. These observations are most consistent with the hypothesis that development of male plumage

a) will not happen without male hormones.
b) will not happen without female hormones.
c) is inhibited by the presence of female hormones.
d) is independent of hormones.

12. "Broodiness," or the tendency of the female to show maternal behavior, is dependent on the hormone prolactin. In humans, prolactin comes from the ... and functions principally in

a) anterior pituitary ... ejection of milk from the breasts.
b) thyroid ... regulation of metabolic rate.
c) posterior pituitary ... contractions of the uterus during labor.
d) adrenal cortex ... coping with stress.

13. Turkeys have amazingly acute eyesight and good ability to discriminate between colors during the day, but they have poor vision at night. We would suspect that their eyes have more or better ... than

a) rods ... cones. b) cones ... rods.

14. The fact that a turkey can see a very high-resolution, detailed image of the world is the best evidence that its

a) ciliary body is nearly transparent.
b) ciliary body has a high amount of light-absorbing pigment.
c) pupil is extremely active and able to admit large amount of light.
d) cornea and lens can focus a sharp image on the retina.

15. Turkeys (especially larger ones) prefer to escape from predators by running on the ground. They can run this way for long distances. However, if frightened, a turkey will suddenly launch into flight, rising at a 60° angle, but flying only for a short distance. This effort is very exhausting, and a turkey that is flushed four times will probably be unable to fly. We would expect that turkey leg muscles operate mainly by ... respiration, and turkey wing muscles operate mainly by ... respiration.

a) aerobic ... anaerobic b) anaerobic ... aerobic
c) aerobic ... aerobic d) anaerobic ... anaerobic

16. If a turkey muscle cell is undergoing anaerobic respiration, we know that the cell is ... pyruvic acid to

a) oxidizing ... citric acid. b) reducing ... lactic acid.
c) reducing ... succinic acid. d) oxidzing ... lactic acid.

17. Both gobblers and hens tend to put on weight as fall approaches. The fat they accumulate is mainly made of

a) steroids. b) disaccharides. c) triglycerides. d) purines.

18. If a a group of turkeys is forced to go without food, gobblers will starve in about 11 days, but hens will last about 15 days. This is probably due to the fact that gobblers have ... than hens.

a) larger fat reserves b) more efficient digestive enzymes
c) more red blood cells d) a higher metabolic rate

19. Eastern turkeys eat all kinds of vegetation and insects, but one of the major food items in their diets (about 1/3) is acorns. An acorn is a(n) ... that develops from a(n)

a) fruit ... ovary. b) male gametophyte ... microspore.
c) ovule ... anther. d) megaspore ... microspore.

20. When a young oak tree grows out of the acorn, the first part to emerge is the embryonic root or ...; its growth is fueled by food stored in the

a) epicarp ... hypocarp. b) radicle ... coyledons.
c) epicotyle ... hypocotyl. d) epicotyl ... scutellum.

21. The food reserves in the acorn are mostly a macromolecule composed of monomers with the formula

a) $C_3H_3PO_4$. b) $CO(NH_2)_2$. c) $C_6H_{12}O_6$. d) $C_{12}H_{22}O_{11}$.

22. An oak seedling emerging from an acorn will bend towards the light. This is caused when ... accumulates on the ... side of the seedling.

a) sucrose ... dark b) cytokinin ... lighted
c) calcium ... lighted d) auxin ... dark

23. As the oak seedling grows, sugars are made in its leaves when photosynthesis

a) reduces CO_2 with electrons obtained from the splitting of water.
b) oxidizes $NADP^+$ in the light reactions and reduces it in the dark reactions.
c) splits glucose into 2 phosphoglyceraldehydes and then oxidizes them to pyruvic acid.
d) All of these steps are necessary.

24. Acorns are very hard food, and turkeys have no teeth. However, a bird can devour foods like acorns without chewing because of the action of its

a) omasum. b) omentum. c) crop. d) gizzard.

25. Especially when acorns are lacking in the winter and spring, Eastern turkeys eat large amounts of grass leaves. We would have no trouble deciding that grass is a ... because

a) dicot ... its leaves contain chlorophylls a, b and c in equal amounts.
b) monocot ... it has straplike leaves with parallel leaf veins.
c) dicot ... its endosperm is haploid.
d) monocot ... it has vascular cambium in its stems.

26. Most of the photosynthesis of grass leaves takes place in the leaf's

a) epidermis. b) cambium. c) mesophyll. d) cortex.

27. Once sugar is made in the grass leaf, how does it get to other parts of the plant?

a) It moves by diffusion through plasmodesmata.
b) Higher water potential in the phloem than in the xylem causes a sucrose solution to invade the xylem and move to plant parts with lower water potential than the xylem has.
c) Parenchyma cells convert it into starch and move it from cell to cell in glycogenolysis vesicles.
d) It is actively transported into the tops of the sieve tubes, and osmotic water intake creates a pressure buildup that powers a mass flow through the sieve tubes.

28. In some situations, turkeys can eat large amounts of ferns and club mosses. These two plants

a) have vascular tissue.
b) have gametophytes that are entirely contained within the sporophyte.
c) are members of the Division Sphenophyta.
d) <u>All</u> of these.

29. Turkeys eat many kinds of berries. One turkey was found with over 2,500 <u>poison ivy</u> berries in its gut! Such a diet would be dangerous for a human because so many humans are allergic to poison ivy. Many human allergy symptoms can be accounted for by the fact that

a) helper T cells cannot secrete interleukin-2 unless they have been primed with their antigen.
b) mast cells release histamine, which increases the permeability of capillaries.
c) macrophages secrete excessive amount of antibodies when their receptors are "capped" by a very high antigen concentration.
d) complement punches holes in cell membranes when it is activated by interferon.

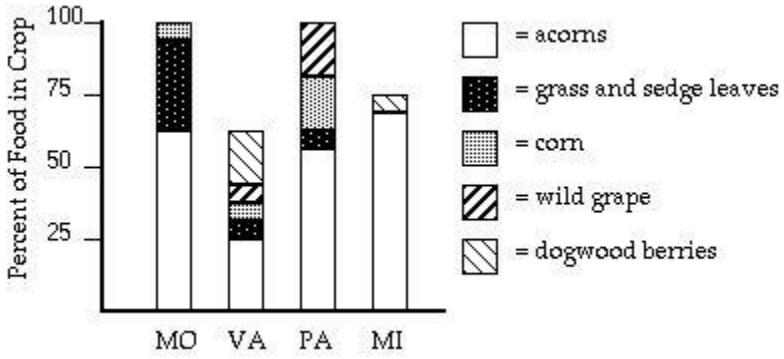
30. Many kinds of berries are acid. This means that their tissue has a ... ion concentration ... than 1×10^{-7} M.

a) hydrogen ... lower b) hydroxyl ... higher
c) hydrogen ... higher d) hydronium ... lower

31. As a minor part of their diet, turkeys also eat insects (especially grasshoppers). An insect would make a "crunchy" meal because of its ... consisting mostly of

a) tergites ... cellulose. b) malpighian tubules ... glycogen.
c) crop ... peptidoglycan. d) exoskeleton ... chitin.

32. A review article on turkey diets had the following graph on the composition of winter turkey diets in four states. The crop is a large sac in which a bird stores its most recently-eaten food, and crop contents are a convenient source of diet information for wildlife biologists.



What is the best explanation for the fact that the bars for the Virginia and Michigan turkeys did not reach 100%?

a) They were going hungry and their crops were not full.
b) The rest of the food in their crops was not one of the five foods shown on the graph.
c) They are smaller than the Missouri and Pennsylvania birds, and their crops are not as big.
d) They eat so many acorns that there is no room for anything else.

33. In Missouri, grass and sedge leaves made up about ... of the crop food.

a) 90% b) 60% c) 35% d) Can't be determined.

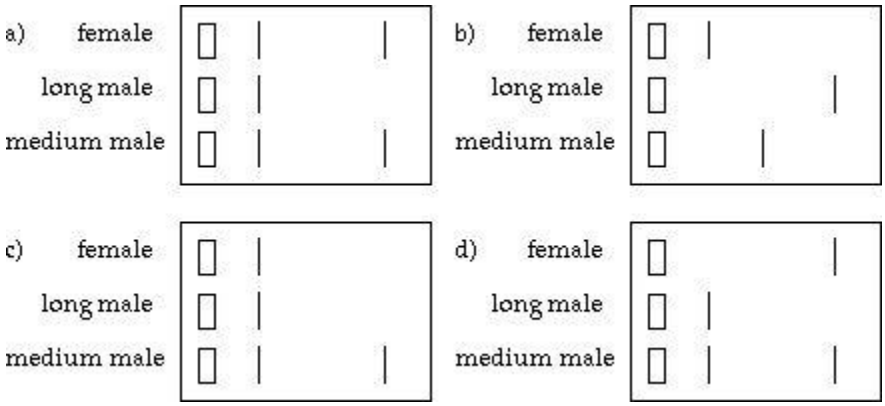
34. In turkeys, as in many birds, the male has two Z sex chromosomes and the female has a Z chromosome and a W chromosome. This means that the ... determines the sex of the offspring.

a) female b) male

35. You may remember that the snood is the fleshy cylinder that protrudes from a gobbler's upper bill. Normal hens do not have snoods, no matter what alleles they carry. Say that snood length is a Z-linked trait in turkeys, and that SS = long, Ss = medium, and ss = short. A male with a long snood mates with a certain female and produces male offspring that <u>all</u> have medium-length snoods. If this same female mated with a male with a medium-length snood, the snood length of the male offspring will be

a) all medium. b) 50% long and 50% medium
c) all short d) 50% short and 50% medium.

36. Say that we isolate the DNA of the female and the two males above. Then we cut out the alleles for snood length and run them on an electrophoretic gel. Assume that no DNA from the W chromosome was included. Which pattern below would you expect? The small boxes represent the wells.



37. A part of the long snood allele has the DNA sequence CTAGTC. The <u>mRNA</u> transcribed from this allele has the sequence

a) GAUCAG. b) CUACUG. c) CUGAUC. d) GATCAG.

38. The color of the breast feathers can be many shades, from light brown to very dark brown. If two turkeys with an intermediate shade of brown mate, they produce mostly offspring with a series of intermediate shades, but some offspring that are either very light or very dark as well. Both males and females seem to have equal influence in determining the feather colors of the offspring. It sounds as if the color of the ends of turkey breast feathers are controlled by

a) complete dominance at one locus. b) several autosomal loci.
c) a sex-linked locus. d) extrachromosomal inheritance.

39. Game managers are usually very interested in determining the <u>ages</u> of animals caught in the wild. Knowing the age distribution of wild turkeys would be most useful for determining

a) age at peak fertility. b) population size.
c) mortality rate. d) sex ratio.

40. Given all the dietary data in the questions above, the role of wild turkeys in the ecosystem is mainly as

a) primary producers. b) primary consumers.
c) secondary consumers. d) decomposers.