Evolution 213 — Spring 1998 — KEY to Final Exam — Page 1 of 8

Notes:

1. Use Scantron form to mark your answers for questions 1-50.
2. This is a closed-book, closed-note test.
3. Make sure you write your name on the Scantron form and all test pages (or at least pages 7 & 8).
4. Turn in the Scantron form and only pages 7 & 8 of your test.
5. For those giving permission to post, grades will be posted inside 3-120 & also outside Dr. Bryant's office by 8 AM Wed, 17 June 1998.
6. The blanks in front of each multiple-choice question are for you to mark your answers before transferring them to the scantron sheet, if you wish. If you use these blanks, you may then compare your answers to the key after the exam is over. Key will be posted on Bryant's web site by 8 AM Wed, 17 June 1998.
7. Mark the **one best** answer to each multiple-choice question on your Scantron.

__b__1. [Ch. 19] Which of the following periods is the most recent in time: a. Carboniferous b. Tertiary c. Triassic d. Permian e. Ordovician

__b__2. [Ch. 1] Darwin's main contribution was: a. the origination of the idea that evolution has occurred b. the proposal of and supporting evidence for a mechanism for evolution c. journals of his trip around the world d. the proposal of and supporting evidence for the idea that fossils represented ancient creatures long since extinct e. the origination of the idea that the earth was very old

__d___3. [lecture] *Homo habilis* lived about how many years ago? a. 15 million b. 5 million c. 3.5 million d. 1.8 million e. 50,000

__b__4. [Ch. 2] For a simple Mendelian trait, if a homozygote mates to a heterozygote, and half of their offspring look like each parent, the homozygote was: a. a dominant homozygote b. a recessive homozygote c. a pleiotropic crossed-over homozygote d. a pleiotropic plesiomorphic homozygote e. red

[end of material covered by Test 1]

__b_5. [Ch. 10] Gene families may originate by gene duplication by: a. normal crossing over b. unequal crossing over c. plesiosynapsis d. mitosis e. translocational concerted mutation

__c_6. [Ch. 4] If, for many generations, both individuals who are shorter and those who are taller than average in a population survive and reproduce better than individuals near or at average, and height is heritable, we would have: a. stabilizing selection for height in this population b. directional selection for height in this population c. disruptive selection for height in this population d. selection for a trivial stable equilibrium in this population e. heterosis

__e_7. [Ch. 5] Which of the following is one of the forces which can cause evolutionary genetic change: a. segregation b. independent assortment c. crossing over d. mitosis e. migration

__a_8. [Ch. 11.8] Sexual selection in most species works by: a. male competition and female choice b. male choice and female competition c. male and female competition d. male and female choice e. the preference of females for handicapped males

[end of material covered by Test 2]

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__b___9. [Ch. 14.1] Which of the following principles of biological classification represents evolutionary classification, specifically taking ancestor-descendant relationships into account? a. phenetic b. phylogenetic (there are only two main principles, so no c, d, or e choices for this question)

__a___10. [Ch. 14.2] The classification of organisms by similarity of appearance constitutes: a. phenetics b. cladistics c. evolutionary taxonomy d. divergence e. phenetic phylogenetics

__a___11. [Ch. 14.5] Since only one real phylogenetic tree exists for living organisms, which of the following is unambiguous in theory (if not always in practice)? a. cladism b. pheneticism c. phyletic gradualism d. punctuated equilibrium e. evolutionary classification/taxonomy

__e___12. [Ch. 14.6] Which of the following avoids some of the extraordinary properties of cladism (such as putting humans in the lungfish clade), but suffers from some of the ambiguity of phenetics, even though it excludes convergence but doesn't exclude differential divergence? a. phylomeiotics b. pheneticism c. phyletic gradualism d. punctuated equilibrium e. evolutionary classification/taxonomy

__a___13. [Ch. 14.7] Probably because competition is stronger between more similar forms, and evolution proceeds in small stages, and variation is undirected, living things show a particular pattern of evolutionary relationships. This pattern is: a. diverging and tree-like b. converging and diamond-shaped c. linear d. circular e. log-linear

__c__ 14. [Ch. 15.1] Field identification of species is usually accomplished by: a. cladistic analysis b. phenetic analysis c. a few reliable external characteristics d. using the biological species concept e. determining which individuals fit into which niches

__a__ 15. [Ch. 15.2] A set of organisms sufficiently similar to one another is one way of stating which of the following species concepts? a. phenetic b. ecological c. recognition d. cladistic e. none of the preceding

__e__ 16. [Ch. 15.3] A set of interbreeding forms with isolating mechanisms preventing breeding with other such groups is one way of stating which of the following species concepts? a. phenetic b. ecological c. recognition d. cladistic e. none of the preceding

__b__ 17. [Ch. 15.5] A set of organisms adapted to a particular niche is one way of stating which of the following species concepts? a. phenetic b. ecological c. recognition d. cladistic e. none of the preceding

__d__ 18. [Ch. 15.7] The members of a evolutionary lineage between two branch points is one way of stating which of the following species concepts? a. phenetic b. ecological c. recognition d. cladistic e. none of the preceding

__a__ 19. [Ch. 16.2] If new species evolve from geographically isolated subpopulations, which type of speciation has happened? a. allopatric b. parapatric c. orthopatric d. sympatric e. none of the preceding

__a__ 20. [Ch. 16.3] In terrestrial vertebrates, at least, the majority of species evolve by which of the following types of speciation? a. allopatric b. parapatric c. orthopatric d. sympatric e. none of the preceding

__a__ 21. [Ch. 16.8] Many new plant species have evolved quickly by which of the following processes? a. hybridization followed by polyploidy b. inversion heterozygosity c. stabilizing selection d. polyploidy followed by hybridization e. character displacement

__e__ 22. [Ch 16.9] The enhancement of reproductive isolation by natural selection is called: a. character displacement b. allopolyploidy c. clinal interbreeding d. postzygotic isolation e. reinforcement

__c__ 23. [Ch. 16.12] New species, at least in fruit flies, but also more generally, take about how long to evolve? a. ten thousand years b. 100 thousand years c. a million years d. 10 million years e. 100 million years

__e___24. [Ch. 18.3] Nearctic, Neotropical, Palearctic, Ethiopian, Oriental and Australian are: a. names given to the continents by biogeographers b. the six main floral regions of the world c. names given to the maximum extent of the ice ages on each continent d. places in the world where there is a high index of similarity among the species e. the six main faunal regions of the world

__e___25. [Ch. 18.4] The distributions of species are influenced by ecological tolerances and which of the following: a. area cladograms b. the six faunal regions of the world c. congruent biogeographic patterns d. recolonization e. historical accidents

__b___26. [Ch. 18.5] The splitting of a species range by a geographic/geological event is called: a. an area cladogram b. vicariance c. a congruent biogeographic pattern d. recolonization e. an historical accident

__a___27. [Ch. 18.8] If the taxonomic cladogram matches the geological history of an area, this is evidence that which of the following occurred? a. vicariance b. dispersal c. natural selection d. mutation e. none of the preceding

__b___28. [Ch. 18.9] The end result of the formation of the Isthmus of Panama about 3 Ma was that: a. the South American mammals essentially took over North America b. the North American mammals essentially took over South America c. there was an equal exchange — both continents now have large proportions of mammals from the other d. essentially no mammals went from one continent to the other e. none of the preceding

__a___29. [Ch 20.2] Rates of evolution measured during artificial selection experiments in the laboratory compare how with rates of evolution measured from fossils? a. lab rates are higher than fossil rates b. lab rates are about the same as fossil rates c. lab rates are slower than fossil rates d. it totally depends on the group of organisms — in some the lab is faster, some the same, and some the lab is slower e. for prokaryotes, lab and fossil are about the same, but for eukaryotes, fossil evolution is faster

__e___30. [Ch 20.5] The pattern of evolution whereby most change in concentrated in temporally short speciation events, with little change between speciation events, is called: a. phyletic equilibrium b. punctuated gradualism c. cladistics d. phyletic gradualism e. punctuated equilibrium

__b___31. [Ch. 20.7] Is it yet clear that punctuated equilibrium is the way evolution works in the vast majority of cases? a. yes b. no

__b___32. [Ch. 20.10] Is it yet clear whether the same set of evolutionary rates and processes operate at all taxonomic level or whether there are characteristic mechanisms and rates at the different levels? a. yes b. no (no c, d, or e answers for this question)

__d___33. [Ch. 20.11] Dividing a character change into states, and studying the rate of change between states is a technique used for studying what kind of evolutionary change? a. small changes in gene frequencies b. small morphological changes, such as the size of teeth in horses c. changes in chromosome size and shape d. large morphological changes, such as limbs into wings in bats e. none of the preceding

__e__ 34. [Ch. 21.1] The evolution of mammals from reptiles is an example of what kind of evolution? a. radiative b. non-adaptive c. competitive d. ecological e. adaptive

__e___35. [Ch 21.2] The neo-Darwinian theory of the origin of higher taxa suggests that higher taxa evolve by which process: a. large, sudden changes b. vicariance c. macromutation d. polyploidy e. many small adaptive changes

__c__36. [Ch 21.4] If terminal addition is the only type of evolution in a lineage, the organism will develop by "climbing up the family tree". This is called: a. heterochrony b. paedomorphosis c. recapitulation d. neotony e. hypermorphosis

__e__37. [Ch. 21.5] The relative timing and rate of different developmental processes can shift. This is known as: a. heterostasis b. heterosis c. heteromorphosis d. heterology e. heterochrony

__c__38. [Ch. 21.10] Changes in the relative sizes of two organs are studied by: a. multivariate regression diagrams b. factor analysis plots c. allometric graphs d. submetric diagrams e. D'Arcy Thompson diagrams

__e__39. [Ch. 22.2] When insects evolve detoxification or avoidance mechanisms in response to plants' development of insecticides, we usually have the process of: a. recapitulation b. reinforcement c. concerted evolution d. coevolution e. sequential evolution

___c___40. [Ch. 22.4] If parasites have limited dispersal powers, what is the likely pattern of speciation in such parasites and their hosts? a. first the parasites speciate, then the hosts b. first the hosts speciate, then the parasites c. they will speciate virtually simultaneously d. when the hosts speciate, they evolve resistance to the parasites, and the parasites must find another host e. none of the preceding

__d___41. [Ch. 22.5] The evolution of larger brains in mammal prey and mammal predators over time has produced an escalation of brain size in both groups, though predators maintain their brain size advantage over their prey. Such escalatory coevolution is often termed: a. the Red Queen hypothesis b. punctuated equilibrium c. sequential coevolution d. an evolutionary arms race e. transient escalatory modal equievolution (TEME)

__d___42. [Ch. 22.6] The extinction rates of species are: a. positively correlated with how long a species has been in existence b. negatively correlated with how long a species has been in existence c. negatively correlated with how long a species has been in existence for species in existence generally for 10,000 years or less, and positively correlated with how long a species has been in existence for species in existence generally over 10,000 years d. uncorrelated with how long a species has been in existence e. positively correlated with how long a species has been in existence for species in existence generally for 10,000 years or less, and negatively correlated with how long a species has been in existence for species in existence generally over 10,000 years

__a___43. [Ch. 22.7] Survivorship curves for species over time are log-linear. This implies that: a. the probability of a species going extinct is constant over time, and doesn't depend on how long the species has already been in existence; that is, species don't "grow old" b. the probability of a species going extinct increases with the time the species has already been in existence; that is, species become "senile" c. the probability of a species going extinct decreases over time; that is, species find the "fountain of youth" as they age d. the probability of a species going extinct first increases, then is constant, then decreases; there is a lot of "infant death", then a constant "middle

probability of a species going extinct has two phases, a low phase just after speciation, and a high phase generally occurring after about a half million years have passed (at least for macroorganisms)

__c__ 44. [Ch. 23.1] The ecological causes of a particular species extinction are best studied in: a. species which went extinct at least 50 Ma, since the fossil record will have had time to settle down by now b. species which went extinct over 250 Ma, since it is hard to study the ecology of more recently extinct species c. modern species, since ecology is easier to study when you can actually work in the current environment d. either fossil or modern species, it really doesn't matter, but it's easier if you work with rare bacteria e. none of the preceding

__b__ 45. [Ch. 23.2] The taxonomic subdivision of a continuous lineage is called: a. extinction b. pseudoextinction c. punctuated equilibrium d. anomalous extinction e. more than one of the preceding

___e__46. [Ch. 23.4] If natural selection favors one form of a character in one species, and another form of the character in a different species, and if the different forms of the character cause species to have differing speciation or extinction rates, then a trend may operate to favor the kind of species with the higher speciation or lower extinction rates. This is called: a. punctuated equilibrium b. pseudoextinction c. coevolution d. macroevolution e. species selection

__c___47. [Ch. 23.8] The K-T meteorite impact crater near Chicxulub, Yucatan is now thought to be the (main) cause of the end-cretaceous mass extinction. The first evidence for this meteoric theory of mass extinction came from: a. the finding of the crater b. the dating of the crater c. the finding of large amounts of iridium at the K-T boundary d. the 26 million year cycle of Oort cloud disturbances e. none of the preceding

__d___48. [Ch. 23.9] If a mass extinction is sudden, synchronous, and global, this combination of characteristics most supports which of the following causes of the mass extinction: a. sudden volcanic activity b. rise in sea level c. climatic cooling d. meteoric impact e. changes in habitat caused by continental drift

__a__ 49. [Dawkins video] According to Richard Dawkins, the condition(s) for natural selection to take place boil down to: a. heredity b. variation c. competition d. variation and competition e. none of the preceding

__a__ 50. [Cronin video] According to Helena Cronin, which of the following is the unit of selection (which means that level of biological organization at which selection most operates)? a. the gene b. the organ c. the organism d. the population e. the species

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End of multiple-choice section of exam

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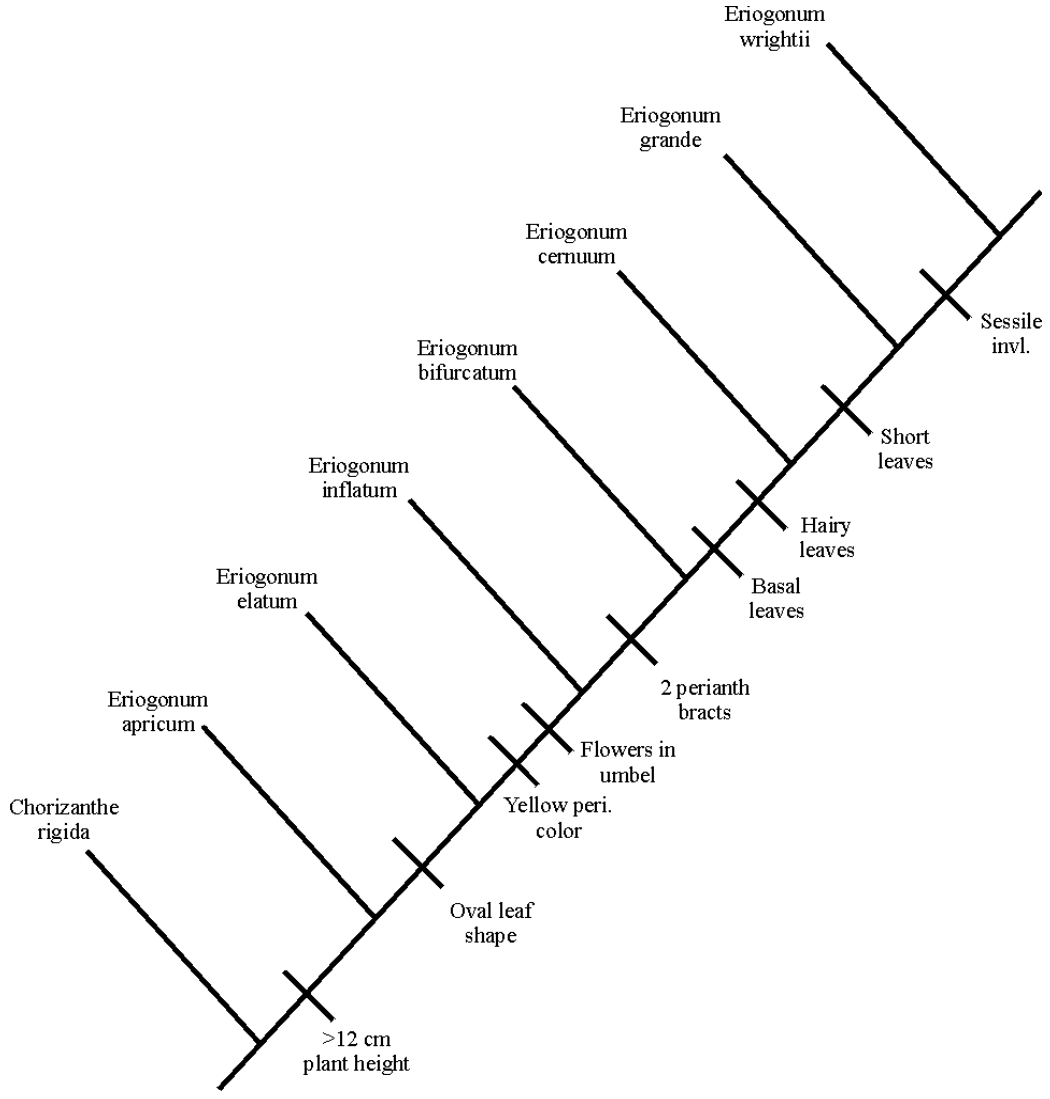
51. (25 points) *Eriogonum* genus shown below, using *Chorizanthe rigida* as the outgroup. Between each branch of your cladogram, write in the new trait (such as yellow color, hairy leaves or whatever) that evolved.

Species	Leaves basal?	Peri. color?	Leaf Shape?	Leaf Length?	Plant height?	Flrs. in umbel?	Perianth bracts?	Lvs. hairy?	Invl. sessile?
Eriogonum wrightii	yes	yellow	oval	short	>12 cm	yes	2	yes	yes
Eriogonum apricum	no	brown	round	long	>12 cm	no	3	no	no
Eriogonum cernuum	yes	yellow	oval	long	>12 cm	yes	2	yes	no
Eriogonum bifurcatum	no	yellow	oval	long	>12 cm	yes	2	no	no
Eriogonum inflatum	no	yellow	oval	long	>12 cm	yes	3	no	no
Eriogonum elatum	no	brown	oval	long	>12 cm	no	3	no	no
Eriogonum grande	yes	yellow	oval	short	>12 cm	yes	2	yes	no
Chorizanthe rigida	no	brown	round	long	<10 cm	no	3	no	no



52. (25 points) What is evolution? Write between 300 and 500 words, as legibly as possible. Use the back of this page if necessary. PLEASE WRITE LEGIBLY!! (Yes, I know it is difficult, you've seen me try.)

Evolution is genetic change in a lineage, which is a group of organisms and their ancestors and/or descendants through time. The study of evolution includes the study of evidence for evolution, population genetics, adaptation and natural selection, classification, and the rates and modes of evolutionary change. The evidence for evolution includes the fossil record, which shows ever more dissimilar fossils as rocks get older; laboratory experiments which can produce new species; artificial selection experiments which produce new kinds (dogs, cats, pigeons, and flowers, for instance); evolution on a small scale in nature (such as the peppered moth and insects evolving resistance to insecticides); the imperfectness of adaptation; and homologous similarities among organisms.

Population genetics is the branch of genetics which studies the ways in which genetic changes may occur in lineages. Such changes have been seen in extensive laboratory experiments, and the mathematical theory is well-developed. Five major forces can cause evolutionary genetic change: selection, migration, mutation, non-random mating and genetic drift. Of these, selection, which is a difference in reproduction among individuals, is the most generally important. Selection is also the only force that can produce an adaptation, which is a feature of an organism that allows it to reproduce better than if it lacked the feature.

Organisms may be classified in many ways, but the cladistic method is the most generally used today. This method involves classification by shared derived traits, and defines a species as the organisms in a lineage between branching points of that lineage. Other methods of classification define species differently.

Fossils are traces of past life. Single-celled organisms arose at least 3.8 billion years ago, and large multi-cellular organisms arose in quantity 600 million years ago. Since then, there has been a general increase in the size and complexity of organisms on the planet. Evolution may proceed gradually with unnoticeable gradations from species to species (phyletic gradualism), or species may remain practically unchanged until a new species arises in a geologically short period of time (punctuated equilibrium). It is currently unresolved whether either phyletic gradualism or punctuated equilibrium is the case for most of evolutionary change. As far as the evidence goes, changes which result in new kingdoms, phyla or other large groupings are no different in kind than those which result in new species — macroevolution is brought about by the same processes as microevolution.

Species may go extinct due to competition, shifts in climate or other factors, and the majority of species that have lived on the planet are extinct. However, species do not "age"; that is, they appear to have a constant probability of extinction which does not increase with the length of time the species has existed. On occasion, many species go extinct simultaneously, which is called a mass extinction. The best studied of these, between the Mesozoic and Cenozoic, was caused by a meteorite that fell on the Yucatan Peninsula in Mexico, 65 million years ago. Probably most mass extinctions had other causes.