AP Biology
1999 Sample Student Responses

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This classification scheme would place four of the existing kingdoms into one broader category, the animilia, plantae, protista, and fungi would all be in domain Eukanya. This suggests that these four kingdoms share a universal common evolutionary trait - the use of eukaryotic cells. The other kingdom monera would be split into Domain Bacteria and Domain Archaea suggesting that there is a greater evolutionary difference between eubacteria and archaebacteria than previously acknowledged in the classification system. Also this classification scheme includes a universal ancestor which reinforces the idea that life on earth evolved from a single origin whereas in the previous system there was no universal ancestor or evolutionary origin.

On a molecular level it makes sense to separate eubacteria from archaebacteria. Archaebacteria tend to survive in a greater variety of conditions than the eubacteria. For example, salophiles are archaebacteria that live in extremely salty environments where other bacteria cannot survive. However eubacteria tend to be more closely related on a molecular level using oxygen and water more frequently than some archaebacteria that live in sulfur-rich and other harsh areas. Also archaebacteria are structurally less complex than eubacteria and are generally smaller in size. Physiologically, protists, fungi, plantae, and animilia share eukaryotic cells in common, a great evolutionary step. These cells have organelles, chromosomes with histone proteins, and a nucleus. They allow for higher organization and multicellular organisms to function through specialization. Genetically these organisms are different as well as they have much longer genetic codes in general than bacteria as well as a great deal of common genetic material - DNA bound by histone proteins rather than the ring in bacteria.

The universal ancestor was prokaryotic meaning it had no organelles or nucleus and was fairly small. It was also unicellular as it was not developed enough to support multicellular specialization and function. It had a cell membrane just like its descendants that separated intracellular and extracellular material by a phospholipid bilayer. It was a heterotroph meaning it gained food

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from outside sources such as ~~[illegible]~~ organic molecules. It did not therefore produce its own food or carry out photosynthesis.

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The organization of living things concludes that all organisms ~~[illegible]~~ evolved from the same ancestor. In other words, all Eukaryotic cells had a similar ancestor with all prokaryotic and bacterial cells. Also, this scheme concludes that archaebacteria are more closely related to eukaryotes than to eubacteria. This scheme says that most ~~[illegible]~~ organisms, all of the eukaryotes, are closely related. Within the 5 kingdom system, the organisms were split into 5 different categories which were not closely related.

Much evidence was used to develop this scheme. First, physiologically, the original split of the universal ancestor occured because eubacteria did not need oxygen but the other organisms did. Eubacteria could live in extreme environments. Next, structurally the 3 domains are different. The Eukaryotes all ~~[illegible]~~ have ~~[illegible]~~ many organelles and a membrane-bound nucleus. Both the Domain Bacteria and Domain Archaea are comprised of prokaryotic cells. These cells ~~[illegible]~~ lack a true membrane and only have one circular strand of DNA. ~~[illegible]~~ On a ~~[illegible]~~ Molecular level, most of the organisms in the Domain Eukarya are larger/multi-cellular. Eubacteria and archaebacteria are generally single-celled organisms.

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The universal ancestor must have contained DNA. This DNA was made of the bases A, T, G, and C. This DNA carried the hereditary information onto the offspring. The Universal ancestor had to have the ability to reproduce. Either sexually or asexually, the ancestor must have had the ability to pass on genetic information to offspring. Also, it must have had the ability to slightly change in order for all of the other organisms to evolve, the ancestor must of had the ability to mutate and then pass these changes on. The ancestor must of contained a simple type of nucleus, where the DNA is stored. It was not membrane bound. Also, it must have contained ribosomes. Ribosomes are responsible for protein synthesis and are found in both prokaryotic and eukaryotic cells.

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This classification schema presents different conclusions by showing Eubacteria, Archaebacteria and Eukaryotes all came from a universal ancestor. These conclusions are different because it was once thought bacteria, prokaryotes, were the single ancestor. The schema shows that Eubacteria and Archaebacteria are not part of the same kingdom as once presented. It shows the divided separately and Archaebacteria are more closely related to Eukaryotes. It also shows that Eukaryotes didn't evolve from bacteria, as it was once thought.

One type of evidence is structural. The Archaebacteria and Eubacteria contain different protein coats. Another type of evidence is physiological. Archaebacteria live in more extreme climates than Eubacteria, such as volcanic or acidic environments. This is very different from how Eubacteria live. Often more Archaebacteria tend to be chemotrophic, getting energy from molecules, than are Eubacteria.

Characteristics of the universal ancestor is it would be single celled, heterotrophic, live in extreme conditions and