

Physiology in evolution

Dr. William F. Martin, better known to many by his nickname "Bill", has made significant contributions to our understanding of the role of physiology in evolution. His focus has been on clarifying the main contours of early evolution, in particular two of the most important evolutionary transitions: endosymbiosis in the origin of eukaryotes and geochemistry in the origin of life. His approach to understanding these transitions has been from the perspective of physiology. The origin of eukaryotes is generally regarded as one of the hardest problems in all of biology. Bill's contribution was to integrate comparative physiology of eukaryotic anaerobes into the century-old foundations of endosymbiotic theory. His formulation of endosymbiotic theory, the hydrogen hypothesis, accounted for the origin of hydrogen producing fermentations in anaerobic mitochondria. In doing so, it predicted the presence of mitochondria in the eukaryotic common ancestor, which is now textbook knowledge in the field. It furthermore posited that the host lineage for the origin of mitochondria should be a hydrogen dependent archaeon, a proposal that is now being borne out by recent metagenomic studies reporting new archaeal lineages that are more closely related to the host that acquired the mitochondrion at eukaryotic origin. His proposal for the origin of life is also based in comparative physiology. By recognizing the similarities between spontaneous geochemical reactions at hydrothermal vents and the biochemistry of hydrogen dependent anaerobic autotrophs (acetogens and methanogens) his work has significantly improved our understanding of early evolution by narrowing the gaps between the chemical reactions involving rocks, water, and carbon on the early Earth and the chemical reactions at the heart of carbon and energy metabolism in the most primitive prokaryotic lineages. His work on physiology in evolution has led to very successful collaborations between his team and Croatian laboratories on the role of physiology in evolution, collaborations that can be, and should be, intensified in the future. The present initiative would serve to recognize further strengthen those collaborations recognize his work on physiology in evolution.