

“... the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications.”

— Charles Darwin, *On the Origin of Species* (1859)



This depiction of the Tree of Life, embodying a smattering of the contributions of genomics to advancing our understanding of evolutionary concepts since Charles Darwin's seminal publications, celebrates the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of *On the Origin of Species*. Advances in comparative genomics are represented by a multi-species alignment of the glucose-6-phosphate dehydrogenase gene (green ground cover), which displays recent signatures of positive selection associated with resistance to malaria. Khaki, grass-like peaks in this UCSC Genome Browser representation show conserved genomic regions across species, to highlight regions of functional constraint. Other examples of adaptive evolution determined by genetic and genomic

analyses are illustrated by the sequence alignment around one of the single nucleotide polymorphisms (orange) associated with lactase persistence in Europeans and the graphic depiction of the evolutionary history of maize domestication from teosinte to modern corn. Mammals (shadows) represent the DNA sequencing efforts that are underway to inform on both human genome structure and function and to reconstruct phylogenetic relationships among these species. Comparative analysis of expression patterns of various growth factors has shed light on the molecular underpinnings of beak morphology in Darwin's finches, the classic example of species diversification by natural selection and adaptive evolution of complex traits. Population and molecular genetic analyses in cichlid fish exemplify the importance of natural selection in speciation. The Star of Bethlehem orchid reminds us of Darwin's prescience; Darwin predicted a pollinator with a proboscis long enough to reach the bottom of the orchid's nectar tube, and 21 years after his death the hawk moth (*Xanthopan morgani praedicta*) was observed. (Poster concept by Joshua Akey [University of Washington]. Design and illustration by Caroline Bodson [Singapore].)