

An Outsider's View of the Genome

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Abstract. Genomics has transformed biology, including our understanding of evolution. Comparisons of the human genome to those of chimpanzees, rats, and other species have generated tremendous insights into the deep history of many evolutionary processes including gene duplication, neutral evolution, chromosome rearrangement, and changes in gene expression. These insights not only enrich our understanding of the history of life, but may also help guide research in medicine and conservation biology.

Yet genomics has not obliterated the deep tension between molecular and organismal biology that has existed for decades. In the 1960s, this tension was dramatically illustrated in the struggle between James Watson and E.O. Wilson over the direction of biological research at Harvard. Watson championed the reductionist methods of molecular biology, declaring, "There is only one science: physics. Everything else is social work." Wilson represented the social workers of biologists who studied organisms. Their fight led to the biology department splitting in two.

Forty years later, this tension remains strong in the postgenomic era. Based solely on the analysis of genomes, scientists today frequently make sweeping claims about various aspects of evolution, such as the origins of complexity and patterns of biogeography. Rarely do these scientists consult a paleontologist about what the fossil record has to say on these matters. If they did, they would discover a far more intricate reality than reflected in their genome-based generalizations. In my talk, I will discuss some case studies in the perils of genomic myopia. I will also discuss examples of how computational biologists can work fruitfully with paleontologists and other organismal biologists to draw more reliable conclusions about evolution.