Human Biology

Volume 65 | Issue 3 Article 1

1993

Obituary

Human Biology Editors

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Keywords
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Obituary: Allan C. Wilson, 1935–1991

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Dr. Allan C. Wilson, Professor of Biochemistry and Molecular Biology at the University of California, Berkeley, died in Seattle on Sunday, July 21, 1991, at the age of 56. He died while undergoing a bone marrow transplant for leukemia at the Fred Hutchinson Memorial Cancer Institute; the illness had been diagnosed in late November 1990.

Allan felt that the brain was much more important than environmental change in driving morphological evolution of species with learning capabilities. He hypothesized that humans had become uncoupled from the demographic and environmental catastrophes that limit the expansion of new species because of the evolution of language. He trained more than 200 graduate students and postdoctoral fellows in molecular evolution in his laboratory. He was a Fellow of the Royal Society, received two Guggenheim awards, numerous science prizes, and a MacArthur Foundation "genius" award, and was a member of the American Academy of Arts and Sciences.

Allan's principal interest in evolution came from his observation that rates of morphological change and rates of mutation seemed to be uncoupled in many lineages. He was widely knowledgeable about the diversity and behavior of birds, fishes, primates, rodents, bacteria, bats, amphibians, ruminants, and insects. How did behavior drive evolution? What was the true phylogenetic picture that related species to each other, and when did these behavioral changes occur? He was interested in real examples. He had a way of encouraging students to work on projects likely to pay off with the application of new technologies and a phenomenal memory for who had stored what samples in what freezer.

Allan thought that evolutionary biologists needed a more objective way of measuring rates of change because they were often misled by convergence resulting from natural selection. He also thought that they needed a clear phylogenetic perspective for the group under study, because hypothesis testing would be impossible if family relationships among taxa were not known. The fossil record might be incomplete, but that should not stop biologists in the modern world from reconstructing evolutionary history. Allan believed that, to really study evolutionary change, it was best to concentrate on genes and proteins of living animals in a

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Human Biology, June 1993, v. 65, no. 3, pp. 343–358.

simple system and to make the fewest number of assumptions about how DNA mutated over time. What mattered to him was data, and the name or fame of the laboratory producing the data was always secondary.

Allan's contributions to evolutionary biology include (1) the primate molecular clock, which shows that humans and African apes shared a common ancestor as short as 5–7 million years ago in contrast to the 25-million-year divergence once favored by paleoanthropologists; (2) the Lucky Mother hypothesis to account for mtDNA divergence in modern people from an African ancestor who lived about 200,000 years ago; (3) the demonstration that convergence resulting from natural selection can occur at the molecular level in proteins, as evidenced in the same structure and function of a stomach enzyme (lysozyme) in cows and leaf-eating monkeys; (4) the discovery that the immense adaptive radiation of Hawaiian flies in the genus *Drosophila* must have taken place before the current Hawaiian islands were formed, leading to the hypothesis that insects island-hopped down the now submerged seamounts and atolls of the Hawaiian chain as new islands were formed; (5) the demonstration that the survival of DNA in ancient species is common and that it can be sequenced and compared to modern relatives; and (6) a universal framework for measuring rates of morphological evolution in animals and the observation that morphology appears to change faster in species that utilize observational learning in their social behavior (birds and primates). This last discovery formed the core of Allan's interest in big brains and language and the contribution these factors made to increasing the rate of morphological evolution in humans.

Allan wanted to have a statistically robust universal yardstick for measuring morphological change because he was struck by how subjective the opinions of anatomists were when describing evolutionary change within and between taxa. Allan was particularly put off by primate anatomists who attempted to dazzle their audiences with detail but neglected to deal with real issues of biology, notably, low sample sizes, no real understanding of sexual dimorphism, and the unknown link between genes and anatomical structures. Allan thought that the primate anatomists hid behind jargon and constantly attempted to put readers off by speaking in code about particular fossils by number instead of clearly identified terms. Allan spent part of a sabbatical in Kenya in the early 1970s, where he was finally able to see some of the fossil evidence for human evolution firsthand as a result of the help of Alan Walker, now at Johns Hopkins University.

This experience helped solidify Allan's perception that behavior must have been changing fast in human evolutionary history, and his interest in the reorganization of the brain as a response to the demands of language grew. He thought that all modern people shared similar language characteristics because they shared a recent, common origin. He also

believed that, until there was a real understanding of modern human genetic diversity and its origins, linguists would not be able to make much headway in the problem of when modern languages arose and where. Until he went to Seattle for further treatment, Allan was looking forward to future discussions with Derek Bickerton and others about the links between the expansion of modern humans about 100,000 years ago and the spread of particular language groups.

Allan thought that words had power beyond their obvious communication potential. He knew that words could hurt, and that they could also heal. His first years as a professor at Berkeley had embroiled him in some bitter debates, and he understood the necessity of funding long shots if they were likely to yield new evidence. When our Lucky Mother hypothesis was subjected to scathing ridicule after its first publication in 1987, Allan reminded me how sure the anthropological establishment had been that he was wrong too in 1967. Although it seemed impossible to get funding for research and I was almost ready to quit, he encouraged me to keep trying. I am now glad that he had faith in me, and this story could be repeated by a large number of his former students. He used his last years as a MacArthur fellow, when he was released from formal teaching duties, to travel extensively so that he could discuss, explore, and attempt to bridge gaps between biologists and social scientists. His overriding concern was the nature of the evidence that could be gathered, the potential bias in gathering it, the scientist(s) involved, and who would use the data for what eventual purpose. One of Allan's last acts was to coauthor a plea for the incorporation of diverse aboriginal human populations in a study of the human genome.

I knew Allan as an intense, gentle, humble, and humorous individual who packed 28 hours of activity into a 24-hour day. As a teacher, he stressed rigor and elegance in presentation of data. His norm for a good slide was one with less than 10 words on it, all less than 3 syllables long. Allan was a math wiz, but he appreciated that concepts were worth talking about too, because you never knew who was likely to have an important insight into a problem. He disliked pretension of any kind, political expediency, and departmental games. Berkeley was not always a comfortable place for him in this regard.

Most students began their stay with him by thinking that he talked too simply about evolution and left his lab understanding how important it is to talk and think clearly about this complicated subject. He promoted the interests of his students with vigilance and was constantly pressing conference organizers to include women and minorities on their speakers' lists. Gender and race were irrelevant to him, and it was no accident that at one time his laboratory had almost all the women students enrolled in the Department of Biochemistry at Berkeley.

As a friend, Allan enjoyed discussions about science with good food and fine wine, Mozart, single malts, sheep jokes, and simple technology. He and Leona, his wife of 32 years, often hosted memorable parties for hungry students and visiting dignitaries. He would promote these by saying, "Come to dinner. You'll learn what it's like to talk to someone who really thinks like a bat [monkey, camel, mouse, etc.]." His family in California—including Leona, his daughter Ruth, and his son David—often tolerated intrusions into their family life by needy visiting biologists. Allan was a proud citizen of New Zealand and grew up on a cattle ranch. His family there include his mother, Eunice, sister Coleen, and brother Gary. We students were often told to visit New Zealand before it became trendy and to see the one cattle farm in a land of 10 million sheep. Those of us who had the pleasure of working with Allan will always remember his warm smile, and his ready questions, "So, what are you doing lately? Can you stay a minute? I've got a new idea I need to talk over with you."

Received 21 October 1991; revision received 11 September 1992.

Publications by A.C. Wilson (1966–1992)

Gleason, F.H., R.A. Nolan, A.C. Wilson, and R. Emerson. 1966. D(−)-lactate dehydrogenase in lower fungi. *Science* 152:1272–1273.

Kitto, G.B., and A.C. Wilson. 1966. Evolution of malate dehydrogenase in birds. *Science* 153:1408–1410.

Rose, R.G., and A.C. Wilson. 1966. Peafowl lactate dehydrogenase: Problem of isoenzyme identification. *Science* 153:1411–1413.

Sarich, V.M., and A.C. Wilson. 1966. Quantitative immunochemistry and the evolution of primate albumins: Micro-complement fixation. *Science* 154:1563–1566.

Arnheim, N., Jr., and A.C. Wilson. 1967. Quantitative immunological comparison of bird lysozymes. *J. Biol. Chem.* 242:3951–3956.

Arnheim, N., Jr., G.T. Cocks, and A.C. Wilson. 1967. Molecular size of hagfish muscle lactate dehydrogenase. *Science* 157:568–569.

Sarich, V.M., and A.C. Wilson. 1967. Immunological time scale for hominid evolution. *Science* 158:1200–1203.

Sarich, V.M., and A.C. Wilson. 1967. Rates of albumin evolution in primates. *Proc. Natl. Acad. Sci. USA* 58:142–148.

Wilson, A.C., G.B. Kitto, and N.O. Kaplan. 1967. Enzymatic identification of fish products. *Science* 157:82–83.

Bailey, G.S., and A.C. Wilson. 1968. Homologies between isoenzymes of fishes and those of higher vertebrates: Evidence for multiple H_4 lactate dehydrogenases in trout. *J. Biol. Chem.* 243:5843–5853.

Wilson, A.C., and N. Arnheim. 1968. A small molecule in hagfish tissues, possibly related to the cardiac agent, eptatretin. *Comp. Biochem. Physiol.* 25:359–362.

Arnheim, N., E.M. Prager, and A.C. Wilson. 1969. Immunological prediction of sequence differences among proteins: Chemical comparison of chicken, quail, and pheasant lysozymes. *J. Biol. Chem.* 244:2085–2094.

Bailey, G.S., G.T. Cocks, and A.C. Wilson. 1969. Gene duplication in fishes: Malate dehydrogenases of salmon and trout. *Biochem. Biophys. Res. Commun.* 34:605–612.

Cocks, G.T., and A.C. Wilson. 1969. Immunological detection of single amino acid substitutions in alkaline phosphatase. *Science* 164:188–189.

Nakanishi, M., A.C. Wilson, R.A. Nolan, G.C. Gorman, and G.S. Bailey. 1969. Phenoxyethanol: Protein preservative for taxonomists. *Science* 163:681–683.

Wilson, A.C., and V.M. Sarich. 1969. A molecular time scale for human evolution. *Proc. Natl. Acad. Sci. USA* 63:1088–1093.

Bailey, G.S., A.C. Wilson, J.E. Halver, and C.L. Johnson. 1970. Multiple forms of supernatant malate dehydrogenase in salmonid fishes: Biochemical, immunological, and genetic studies. *J. Biol. Chem.* 245:5927–5940.

Stanier, R.Y., D. Wachter, C. Gasser, and A.C. Wilson. 1970. Comparative immunological studies of two *Pseudomonas* enzymes. *J. Bacteriol.* 102:351–362.

Gorman, G.C., A.C. Wilson, and M. Nakanishi. 1971. A biochemical approach towards the study of reptilian phylogeny: Evolution of serum albumin and lactic dehydrogenase. *Syst. Zool.* 20:167–185.

Karig, L.M., and A.C. Wilson. 1971. Genetic variation in supernatant malate dehydrogenase of birds and reptiles. *Biochem. Genet.* 5:211–221.

Prager, E.M., and A.C. Wilson. 1971. The dependence of immunological cross-reactivity upon sequence resemblance among lysozymes. I. Micro-complement fixation studies. *J. Biol. Chem.* 246:5978–5989.

Prager, E.M., and A.C. Wilson. 1971. The dependence of immunological cross-reactivity upon sequence resemblance among lysozymes. II. Comparison of precipitin and micro-complement fixation results. *J. Biol. Chem.* 246:7010–7017.

Prager, E.M., and A.C. Wilson. 1971. Multiple lysozymes of duck egg white. *J. Biol. Chem.* 246:523–530.

Sensabaugh, G.F., Jr., A.C. Wilson, and P.L. Kirk. 1971. Protein stability in preserved biological remains. I. Survival of biologically active proteins in an 8-year-old sample of dried blood. *Int. J. Biochem.* 2:545–557.

Sensabaugh, G.F., Jr., A.C. Wilson, and P.L. Kirk. 1971. Protein stability in preserved biological remains. II. Modification and aggregation of proteins in an 8-year-old sample of dried blood. *Int. J. Biochem.* 2:558–568.

Wallace, D.G., L.R. Maxson, and A.C. Wilson. 1971. Albumin evolution in frogs: A test of the evolutionary clock hypothesis. *Proc. Natl. Acad. Sci. USA* 68:3127–3129.

Clark, M.-C., D. Goodman, and A.C. Wilson. 1972. The biochemical approach to mutation monitoring in man. In *Planning an Epidemiological Study of Pollution Effects,* L. LeCam, J. Neyman, and E.L. Scott, eds. Sixth Berkeley Symposium on Mathematical Statistics and Probability. Berkeley, CA: University of California Press, 393–399.

Cocks, G.T., and A.C. Wilson. 1972. Enzyme evolution in the *Enterobacteriaceae*. *J. Bacteriol.* 110:793–802.

Prager, E.M., and A.C. Wilson. 1972. Comparison of multiple duck lysozymes. *Biochem. Genet.* 7:269–272.

Prager, E.M., N. Arnheim, G.A. Mross, and A.C. Wilson. 1972. Amino acid sequence studies on bobwhite quail egg white lysozyme. *J. Biol. Chem.* 247:2905–2916.

Steffen, D.L., G.T. Cocks, and A.C. Wilson. 1972. Micro-complement fixation in *Klebsiella* classification. *J. Bacteriol.* 110:803–808.

Wallace, D.G., and A.C. Wilson. 1972. Comparison of frog albumins with those of other vertebrates. *J. Molec. Evol.* 2:72–86.

Hanke, N., E.M. Prager, and A.C. Wilson. 1973. Quantitative immunological and electrophoretic comparison of primate lysozymes. *J. Biol. Chem.* 248:2824–2828.

Sarich, V.M., and A.C. Wilson. 1973. Generation time and genomic evolution in primates. *Science* 179:1144–1147.

Wallace, D.G., M.-C. King, and A.C. Wilson. 1973. Albumin differences among ranid frogs: Taxonomic and phylogenetic implications. *Syst. Zool.* 22:1–13.

Champion, A.B., E.M. Prager, D. Wachter, and A.C. Wilson. 1974. Micro-complement fixation. In *Biochemical and Immunological Taxonomy of Animals*, C.A. Wright, ed. London: Academic Press, 397–416.

Corbin, K.W., C.G. Sibley, A. Ferguson, A.C. Wilson, A.H. Brush, and J.E. Ahlquist. 1974. Genetic polymorphism in New Guinea starlings of the genus *Aplonis*. *Condor* 76:307–318.

Fainaru, M., A.C. Wilson, and R. Arnon. 1974. Correlation of structural differences in several bird lysozymes and their loop region with immunological cross-reactivity. *J. Molec. Biol.* 84:635–642.

Maxson, L.R., and A.C. Wilson. 1974. Convergent morphological evolution detected by studying proteins of tree frogs in the *Hyla eximia* species group. *Science* 185:66–68.

Maxson, L.R., and A.C. Wilson. 1974. Lactate dehydrogenases of the treefrog *Hyla regilla*: Subunit homologies and genetic variation. *Copeia* 1974(4):833–838.

Prager, E.M., A.C. Wilson, and N. Arnheim. 1974. Widespread distribution of lysozyme *g* in egg white of birds. *J. Biol. Chem.* 249:7295–7297.

Prager, E.M., M. Fainaru, A.C. Wilson, and R. Arnon. 1974. Molecular basis of the antigenic difference between two closely related lysozymes of known sequence: Effect of internal substitutions. *Immunochemistry* 11:153–156.

Prager, E.M., A.H. Brush, R.A. Nolan, M. Nakanishi, and A.C. Wilson. 1974. Slow evolution of transferrin and albumin in birds according to micro-complement fixation analysis. *J. Molec. Evol.* 3:243–262.

Sharon, N., Y. Eshdat, I. Maoz, Y. Bernstein, E.M. Prager, and A.C. Wilson. 1974. Comparative studies of the active site region of lysozymes from eleven different sources. *Isr. J. Chem.* 12:591–603.

Wilson, A.C., and E.M. Prager. 1974. Antigenic comparison of animal lysozymes. In *Lysozyme*, E.F. Osserman, R.E. Canfield, and S. Beychok, eds. New York: Academic Press, 127–141.

Wilson, A.C., L.R. Maxson, and V.M. Sarich. 1974. Two types of molecular evolution: Evidence from studies of interspecific hybridization. *Proc. Natl. Acad. Sci. USA* 71:2843–2847.

Wilson, A.C., V.M. Sarich, and L.R. Maxson. 1974. The importance of gene rearrangement in evolution: Evidence from studies of rates of chromosomal, protein, and anatomical evolution. *Proc. Natl. Acad. Sci. USA* 71:3028–3030.

Champion, A.B., K.L. Soderberg, A.C. Wilson, and R.P. Ambler. 1975. Immunological comparison of azurins of known amino acid sequence: Dependence of cross-reactivity upon sequence resemblance. *J. Molec. Evol.* 5:291–305.

King, M.-C., and A.C. Wilson. 1975. Evolution at two levels in humans and chimpanzees. *Science* 188:107–116.

King, M.-C., and A.C. Wilson. 1975. Our close cousin, the chimpanzee. *New Scientist* 67:16–18.

Maxson, L.R., and A.C. Wilson. 1975. Albumin evolution and organismal evolution in tree frogs (Hylidae). *Syst. Zool.* 24:1–15.

Maxson, L.R., V.M. Sarich, and A.C. Wilson. 1975. Continental drift and the use of albumin as an evolutionary clock. *Nature* 255:397–400.

Nolan, R.A., A.H. Brush, N. Arnheim, and A.C. Wilson. 1975. An inconsistency between protein resemblance and taxonomic resemblance: Immunological comparison of diverse proteins from gallinaceous birds. *Condor* 77:154–159.

Prager, E.M., and A.C. Wilson. 1975. Slow evolutionary loss of the potential for interspecific hybridization in birds: A manifestation of slow regulatory evolution. *Proc. Natl. Acad. Sci. USA* 72:200–204.

Wilson, A.C. 1975. Evolutionary importance of gene regulation. *Stadler Genet. Symp.* 7:117–134.

Wilson, A.C., G.L. Bush, S.M. Case, and M.-C. King. 1975. Social structuring of mammalian populations and the rate of chromosomal evolution. *Proc. Natl. Acad. Sci. USA* 72:5061–5065.

Bailey, G.S., H. Tsuyuki, and A.C. Wilson. 1976. The number of genes for lactate dehydrogenase in salmonid fishes. *J. Fish. Res. Bd. Canada* 33:760–767.

Ho, C.Y.-K., E.M. Prager, A.C. Wilson, D.T. Osuga, and R.E. Feeney. 1976. Penguin evolution: Protein comparisons demonstrate phylogenetic relationship to flying aquatic birds. *J. Molec. Evol.* 8:271–282.

Jollès, J., F. Schoentgen, P. Jollès, E.M. Prager, and A.C. Wilson. 1976. Amino acid sequence and immunological properties of chachalaca egg white lysozyme. *J. Molec. Evol.* 8:59–78.

Levin, D.A., and A.C. Wilson. 1976. Rates of evolution in seed plants: Net increase in diversity of chromosome numbers and species numbers through time. *Proc. Natl. Acad. Sci. USA* 73:2086–2090.

Prager, E.M., and A.C. Wilson. 1976. Congruency of phylogenies derived from different proteins: A molecular analysis of the phylogenetic position of cracid birds. *J. Molec. Evol.* 9:45–57.

Prager, E.M., D.P. Fowler, and A.C. Wilson. 1976. Rates of evolution in conifers (Pinaceae). *Evolution* 30:637–649.

Prager, E.M., A.C. Wilson, D.T. Osuga, and R.E. Feeney. 1976. Evolution of flightless land birds on southern continents: Transferrin comparison shows monophyletic origin of ratites. *J. Molec. Evol.* 8:283–294.

Wilson, A.C. 1976. Gene regulation in evolution. In *Molecular Evolution*, F.J. Ayala, ed. Sunderland, MA: Sinauer Associates, 225–234.

Bisbee, C.A., M.A. Baker, A.C. Wilson, I. Hadji-Azimi, and M. Fischberg. 1977. Albumin phylogeny for clawed frogs (*Xenopus*). *Science* 195:785–787.

Bush, G.L., S.M. Case, A.C. Wilson, and J.L. Patton. 1977. Rapid speciation and chromosomal evolution in mammals. *Proc. Natl. Acad. Sci. USA* 74:3942–3946.

Carlson, S.S., G.A. Mross, A.C. Wilson, R.T. Mead, L.D. Wolin, S.F. Bowers, N.T. Foley, A.O. Muijsers, and E. Margoliash. 1977. Primary structure of mouse, rat, and guinea pig cytochrome *c*. *Biochemistry* 16:1437–1442.

White, T.J., G.A. Mross, E.F. Osserman, and A.C. Wilson. 1977. Primary structure of rat lysozyme. *Biochemistry* 16:1430–1436.

Wilson, A.C., S.S. Carlson, and T.J. White. 1977. Biochemical evolution. *Annu. Rev. Biochem.* 46:573–639.

Wilson, A.C., T.J. White, S.S. Carlson, and L.M. Cherry. 1977. Molecular evolution and cytogenetic evolution. In *Molecular Human Cytogenetics*, R.S. Sparkes, D.E. Comings, and C.F. Fox, eds. New York: Academic Press, 375–393.

Carlson, S.S., A.C. Wilson, and R.D. Maxson. 1978. Do albumin clocks run on time? *Science* 200:1183–1185.

Cherry, L.M., S.M. Case, and A.C. Wilson. 1978. Frog perspective on the morphological difference between humans and chimpanzees. *Science* 200:209–211.

Prager, E.M., and A.C. Wilson. 1978. Construction of phylogenetic trees for proteins and nucleic acids: Empirical evaluation of alternative matrix methods. *J. Molec. Evol.* 11:129–142.

Prager, E.M., G.W. Welling, and A.C. Wilson. 1978. Comparison of various immunological methods for distinguishing among mammalian pancreatic ribonucleases of known amino acid sequence. *J. Molec. Evol.* 10:293–307.

Prager, E.M., A.C. Wilson, J.-P. Périn, and P. Jollès. 1978. Further studies of an anomalous cross-reaction involving worm and vertebrate lysozymes. *Immunochemistry* 15:577–583.

White, T.J., and A.C. Wilson. 1978. Molecular anthropology. *Evolution* 32:693–694.

White, T.J., I.M. Ibrahimi, and A.C. Wilson. 1978. Evolutionary substitutions and the antigenic structure of globular proteins. *Nature* 274:92–94.

Brown, W.M., M. George, Jr., and A.C. Wilson. 1979. Rapid evolution of animal mitochondrial DNA. *Proc. Natl. Acad. Sci. USA* 76:1967–1971.

Cherry, L.M., S.M. Case, J.G. Kunkel, and A.C. Wilson. 1979. Comparison of frogs, humans, and chimpanzees. *Science* 204:435.

Ibrahimi, I.M., E.M. Prager, T.J. White, and A.C. Wilson. 1979. Amino acid sequence of California quail lysozyme: Effect of evolutionary substitutions on the antigenic structure of lysozyme. *Biochemistry* 18:2736–2744.

Jollès, J., I.M. Ibrahimi, E.M. Prager, F. Schoentgen, P. Jollès, and A.C. Wilson. 1979. Amino acid sequence of pheasant lysozyme: Evolutionary change affecting processing of prelysozyme. *Biochemistry* 18:2744–2752.

Maxson, L.E.R., and A.C. Wilson. 1979. Rates of molecular and chromosomal evolution in salamanders. *Evolution* 33:734–740.

Champion, A.B., E.L. Barrett, N.J. Palleroni, K.L. Soderberg, R. Kunisawa, R. Contopoulou, A.C. Wilson, and M. Doudoroff. 1980. Evolution in *Pseudomonas fluorescens*. *J. Gen. Microbiol.* 120:485–511.

Ibrahimi, I.M., J. Eder, E.M. Prager, A.C. Wilson, and R. Arnon. 1980. The effect of a single amino acid substitution on the antigenic specificity of the loop region of lysozyme. *Molec. Immunol.* 17:37–46.

Kunkel, J.G., L.M. Cherry, S.M. Case, and A.C. Wilson. 1980. *M*-statistics and morphometric divergence. *Science* 208:1060–1061.

Martin, S.L., E.A. Zimmer, Y.W. Kan, and A.C. Wilson. 1980. Silent δ-globin gene in Old World monkeys. *Proc. Natl. Acad. Sci. USA* 77:3563–3566.

Prager, E.M., and A.C. Wilson. 1980. Phylogenetic relationships and rates of evolution in birds. *Proc. Int. Ornithol. Congr.* 17:1209–1214.

Prager, E.M., A.C. Wilson, J.M. Lowenstein, and V.M. Sarich. 1980. Mammoth albumin. *Science* 209:287–289.

Zimmer, E.A., S.L. Martin, S.M. Beverley, Y.W. Kan, and A.C. Wilson. 1980. Rapid duplication and loss of genes coding for the α chains of hemoglobin. *Proc. Natl. Acad. Sci. USA* 77:2158–2162.

Ferris, S.D., A.C. Wilson, and W.M. Brown. 1981. Evolutionary tree for apes and humans based on cleavage maps of mitochondrial DNA. *Proc. Natl. Acad. Sci. USA* 78:2432–2436.

Ferris, S.D., W.M. Brown, W.S. Davidson, and A.C. Wilson. 1981. Extensive polymorphism in the mitochondrial DNA of apes. *Proc. Natl. Acad. Sci. USA* 78:6319–6323.

Martin, S.L., E.A. Zimmer, W.S. Davidson, A.C. Wilson, and Y.W. Kan. 1981. The untranslated regions of β-globin mRNA evolve at a functional rate in higher primates. *Cell* 25:737–741.

Prager, E.M., D.A. Taylor, V.M. Sarich, and A.C. Wilson. 1981. Protein survival in mammoth muscle and evidence for leaching. In *Magadan Baby Mammoth*, N.K. Vereshchagin and V.M. Mikhelson, eds. Leningrad: Nauka, 178–190.

Beverley, S.M., and A.C. Wilson. 1982. Molecular evolution in *Drosophila* and higher Diptera. I. Micro-complement fixation studies of a larval hemolymph protein. *J. Molec. Evol.* 18:251–264.

Brown, W.M., E.M. Prager, A. Wang, and A.C. Wilson. 1982. Mitochondrial DNA sequences of primates: Tempo and mode of evolution. *J. Molec. Evol.* 18:225–239.

Cann, R.L., and A.C. Wilson. 1982. Models of human evolution. *Science* 217:303–304.

Cann, R.L., W.M. Brown, and A.C. Wilson. 1982. Evolution of human mitochondrial DNA: A preliminary report. In *Human Genetics: Part A, The Unfolding Genome*, B. Bonné-Tamir, T. Cohen, and R.M. Goodman, eds. New York: Alan R. Liss, 157–165.

Cherry, L.M., S.M. Case, J.G. Kunkel, J.S. Wyles, and A.C. Wilson. 1982. Body shape metrics and organismal evolution. *Evolution* 36:914–933.

Ferris, S.D., R.D. Sage, and A.C. Wilson. 1982. Evidence from mtDNA sequences that common laboratory strains of inbred mice are descended from a single female. *Nature* 295:163–165.

Smith-Gill, S.J., A.C. Wilson, M. Potter, E.M., Prager, R.J. Feldmann, and C.R. Mainhart. 1982. Mapping the antigenic epitope for a monoclonal antibody against lysozyme. *J. Immunol.* 128:314–322.

Cann, R.L., and A.C. Wilson. 1983. Length mutations in human mitochondrial DNA. *Genetics* 104:699–711.

Ferris, S.D., U. Ritte, K. Fischer Lindahl, E.M. Prager, and A.C. Wilson. 1983. Unusual type of mitochondrial DNA in mice lacking a maternally transmitted antigen. *Nucleic Acids Res.* 11:2917–2926.

Ferris, S.D., R.D. Sage, E.M. Prager, U. Ritte, and A.C. Wilson. 1983. Mitochondrial DNA evolution in mice. *Genetics* 105:681–721.

Ferris, S.D., R.D. Sage, C.-M. Huang, J.T. Nielsen, U. Ritte, and A.C. Wilson. 1983. Flow of mitochondrial DNA across a species boundary. *Proc. Natl. Acad. Sci. USA* 80:2290–2294.

Martin, S.L., K.A. Vincent, and A.C. Wilson. 1983. Rise and fall of the delta globin gene. *J. Molec. Biol.* 164:513–528.

Sawada, I., M.P. Beal, C.-K.J. Shen, B. Chapman, A.C. Wilson, and C. Schmid. 1983. Intergenic DNA sequences flanking the pseudo alpha globin genes of human and chimpanzee. *Nucleic Acids Res.* 11:8087–8101.

Wyles, J.S., J.G. Kunkel, and A.C. Wilson. 1983. Birds, behavior, and anatomical evolution. *Proc. Natl. Acad. Sci. USA* 80:4394–4397.

Benjamin, D.C., J.A. Berzofsky, I.J. East, F.R.N. Gurd, C. Hannum, S.J. Leach, E. Margoliash, J.G. Michael, A. Miller, E.M. Prager, M. Reichlin, E.E. Sercarz, S.J. Smith-Gill, P.E. Todd, and A.C. Wilson. 1984. The antigenic structure of proteins: A reappraisal. *Annu. Rev. Immunol.* 2:67–101.

Beverley, S.M., and A.C. Wilson. 1984. Molecular evolution in *Drosophila* and the higher Diptera. II. A time scale for fly evolution. *J. Molec. Evol.* 21:1–13.

Cann, R.L., W.M. Brown, and A.C. Wilson. 1984. Polymorphic sites and the mechanism of evolution in human mitochondrial DNA. *Genetics* 106:479–499.

Dobson, D.E., E.M. Prager, and A.C. Wilson. 1984. Stomach lysozymes of ruminants. I. Distribution and catalytic properties. *J. Biol. Chem.* 259:11607–11616.

Ferris, S.D., R.D. Sage, and A.C. Wilson. 1984. DNA variation and evolution. *Nature* 309:285–286.

Higuchi, R., B. Bowman, M. Freiberger, O.A. Ryder, and A.C. Wilson. 1984. DNA sequences from the Quagga, an extinct member of the horse family. *Nature* 312:282–284.

Hornbeck, P.V., and A.C. Wilson. 1984. Local effects of amino acid substitutions on the active site region of lysozyme: A comparison of physical and immunological results. *Biochemistry* 23:998–1002.

Jollès, P., F. Schoentgen, J. Jollès, D.E. Dobson, E.M. Prager, and A.C. Wilson. 1984. Stomach lysozymes of ruminants. II. Amino acid sequence of cow lysozyme 2 and immunological comparisons with other lysozymes. *J. Biol. Chem.* 259:11617–11625.

Larson, A., E.M. Prager, and A.C. Wilson. 1984. Chromosomal evolution, speciation and morphological change in vertebrates: The role of social behaviour. *Chromosomes Today* 8:215–228.

Sage, R.D., P.V. Loiselle, P. Basasibwaki, and A.C. Wilson. 1984. Molecular versus morphological change among cichlid fishes of Lake Victoria. In *Evolution of Fish Species Flocks*, A.A. Echelle and I. Kornfield, eds. Orono, ME: University of Maine Press, 185–201.

Wilson, A.C., J.G. Kunkel, and J.S. Wyles. 1984. Morphological distance: An encounter between two perspectives in evolutionary biology. *Evolution* 38:1156–1159.

Beverley, S.M., and A.C. Wilson. 1985. Ancient origin for Hawaiian Drosophilinae inferred from protein comparisons. *Proc. Natl. Acad. Sci. USA* 82:4753–4757.

Gyllensten, U., D. Wharton, and A.C. Wilson. 1985. Maternal inheritance of mitochondrial DNA during backcrossing of two species of mice. *J. Hered.* 76:321–324.

Gyllensten, U., R.F. Leary, F.W. Allendorf, and A.C. Wilson. 1985. Introgression between two cutthroat trout subspecies with substantial karyotypic, nuclear, and mitochondrial genomic divergence. *Genetics* 111:905–915.

Sawada, I., C. Willard, C.-K.J. Shen, B. Chapman, A.C. Wilson, and C.W. Schmid. 1985. Evolution of *Alu* family repeats since the divergence of human and chimpanzee. *J. Molec. Evol.* 22:316–322.

Willard, C., E. Wong, J.F. Hess, C.-K.J. Shen, B. Chapman, A.C. Wilson, and C.W. Schmid. 1985. Comparison of human and chimpanzee $\zeta 1$ globin genes. *J. Molec. Evol.* 22:309–315.

Wilson, A.C. 1985. The molecular basis of evolution. *Sci. Am.* 253(4):164–173.

Wilson, A.C., R.L. Cann, S.M. Carr, M. George, U.B. Gyllensten, K.M. Helm-Bychowski, R.G. Higuchi, S.R. Palumbi, E.M. Prager, R.D. Sage, and M. Stoneking. 1985. Mitochondrial DNA and two perspectives on evolutionary genetics. *Biol. J. Linn. Soc.* 26:375–400.

Chapman, B.S., K.A. Vincent, and A.C. Wilson. 1986. Persistence or rapid generation of DNA length polymorphism at the zeta-globin locus of humans. *Genetics* 112:79–92.

Helm-Bychowski, K.M., and A.C. Wilson. 1986. Rates of nuclear DNA evolution in pheasant-like birds: Evidence from restriction maps. *Proc. Natl. Acad. Sci. USA* 83:688–692.

Sage, R.D., J.B. Whitney III, and A.C. Wilson. 1986. Genetic analysis of a hybrid zone between domesticus and musculus mice (*Mus musculus* complex): Hemoglobin polymorphisms. *Curr. Topics Microbiol. Immunol.* 127:75–85.

Sage, R.D., D. Heyneman, K.-C. Lim, and A.C. Wilson. 1986. Wormy mice in a hybrid zone. *Nature* 324:60–63.

Stoneking, M., K. Bhatia, and A.C. Wilson. 1986. Mitochondrial DNA variation in Eastern Highlanders of Papua New Guinea. In *Genetic Variation and Its Maintenance*, D.F. Roberts and G.F. De Stefano, eds. Cambridge: Cambridge University Press, 87–100.

Stoneking, M., K. Bhatia, and A.C. Wilson. 1986. Rate of sequence divergence estimated from restriction maps of mitochondrial DNAs from Papua New Guinea. *Cold Spring Harbor Symp. Quant. Biol.* 51:433–439.

Weisman, L.S., B.M. Krummel, and A.C. Wilson. 1986. Evolutionary shift in the site of cleavage of prelysozyme. *J. Biol. Chem.* 261:2309–2313.

Whittam, T.S., A.G. Clark, M. Stoneking, R.L. Cann, and A.C. Wilson. 1986. Allelic variation in human mitochondrial genes based on patterns of restriction site polymorphism. *Proc. Natl. Acad. Sci. USA* 83:9611–9615.

Cann, R.L., M. Stoneking, and A.C. Wilson. 1987. Disputed African origin of human populations. *Nature* 329:111–112.

Cann, R.L., M. Stoneking, and A.C. Wilson. 1987. Mitochondrial DNA and human evolution. *Nature* 325:31–36.

Cantatore, P., M.N. Gadaleta, M. Roberti, C. Saccone, and A.C. Wilson. 1987. Duplication and remoulding of tRNA genes during the evolutionary rearrangement of mitochondrial genomes. *Nature* 329:853–855.

Carr, S.M., A.J. Brothers, and A.C. Wilson. 1987. Evolutionary inferences from restriction maps of mitochondrial DNA from nine taxa of *Xenopus* frogs. *Evolution* 41:176–188.

DeSalle, R., T. Freedman, E.M. Prager, and A.C. Wilson. 1987. Tempo and mode of sequence evolution in mitochondrial DNA of Hawaiian *Drosophila*. *J. Molec. Evol.* 26:157–164.

Gyllensten, U., and A.C. Wilson. 1987. Interspecific mitochondrial DNA transfer and the colonization of Scandinavia by mice. *Genet. Res.* 49:25–29.

Gyllensten, U., and A.C. Wilson. 1987. Mitochondrial DNA of salmonids: Inter- and intraspecific variability detected with restriction enzymes. In *Population Genetics and Fishery Management*, N. Ryman and F. Utter, eds. Seattle, WA: University of Washington Press, 301–317.

Hammer, M.F., and A.C. Wilson. 1987. Regulatory and structural genes for lysozymes of mice. *Genetics* 115:521–533.

Hammer, M.F., J.W. Schilling, E.M. Prager, and A.C. Wilson. 1987. Recruitment of lysozyme as a major enzyme in the mouse gut: Duplication, divergence, and regulatory evolution. *J. Molec. Evol.* 24:272–279.

Higuchi, R.G., L.A. Wrischnik, E. Oakes, M. George, B. Tong, and A.C. Wilson. 1987. Mitochondrial DNA of the extinct quagga: Relatedness and extent of postmortem change. *J. Molec. Evol.* 25:283–287.

Ochman, H., and A.C. Wilson. 1987. Evolutionary history of enteric bacteria. In *Escherichia coli and Salmonella typhimurium: Cellular and Molecular Biology*, F.C. Neidhardt, J.L. Ingraham, K.B. Low, B. Magasanik, M. Schaechter, and H.E. Umbarger, eds. Washington, DC: American Society Microbiology, 1649–1654.

Ochman, H., and A.C. Wilson. 1987. Evolution in bacteria: Evidence for a universal substitution rate in cellular genomes. *J. Molec. Evol.* 26:74–86.

Shields, G.F., and A.C. Wilson. 1987. Calibration of mitochondrial DNA evolution in geese. *J. Molec. Evol.* 24:212–217.

Shields, G.F., and A.C. Wilson. 1987. Subspecies of the Canada goose (*Branta canadensis*) have distinct mitochondrial DNAs. *Evolution* 41:662–666.

Spicer, S.S., S.L. Erlandsen, A.C. Wilson, M.F. Hammer, R.A. Hennigar, and B.A. Schulte. 1987. Genetic differences in the histochemically defined structure of oligosaccharides in mice. *J. Histochem. Cytochem.* 35:1231–1244.

Stewart, C.-B., J.W. Schilling, and A.C. Wilson. 1987. Adaptive evolution in the stomach lysozymes of foregut fermenters. *Nature* 330:401–404.

Stewart, C.-B., and A.C. Wilson. 1987. Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters. *Cold Spring Harbor Symp. Quant. Biol.* 52:891–899.

Wilson, A.C., H. Ochman, and E.M. Prager. 1987. Molecular time scale for evolution. *Trends Genet.* 3:241–247.

Wilson, A.C., M. Stoneking, R.L. Cann, E.M. Prager, S.D. Ferris, L.A. Wrischnik, and R.G. Higuchi. 1987. Mitochondrial clans and the age of our common mother. In *Human Genetics: Proceedings of the 7th International Congress, Berlin 1986*, F. Vogel and K. Sperling, eds. Berlin: Springer-Verlag, 158–164.

Wrischnik, L.A., R.G. Higuchi, M. Stoneking, H.A. Erlich, N. Arnheim, and A.C. Wilson. 1987. Length mutations in human mitochondrial DNA: Direct sequencing of enzymatically amplified DNA. *Nucleic Acids Res.* 15:529–542.

Helm-Bychowski, K.M., and A.C. Wilson. 1988. Temporal calibration of nuclear DNA evolution in phasianoid birds: Evidence from restriction maps. *Acta Int. Ornithol. Cong.* 19:1896–1904.

Pääbo, S., and A.C. Wilson. 1988. Polymerase chain reaction reveals cloning artefacts. *Nature* 334:387–388.

Pääbo, S., J.A. Gifford, and A.C. Wilson. 1988. Mitochondrial DNA sequences from a 7000-year old brain. *Nucleic Acids Res.* 16:9775–9787.

Prager, E.M., and A.C. Wilson. 1988. Ancient origin of lactalbumin from lysozyme: Analysis of DNA and amino acid sequences. *J. Molec. Evol.* 27:326–335.

Stewart, C.-B., J.W. Schilling, and A.C. Wilson. 1988. Convergent evolution of lysozyme sequences? *Nature* 332:788.

Vigilant, L., M. Stoneking, and A.C. Wilson. 1988. Conformational mutation in human mtDNA detected by direct sequencing of enzymatically amplified DNA. *Nucleic Acids Res.* 16:5945–5955.

Wilson, A.C. 1988. More on the *Molecular Biology of the Gene. Immunogenetics* 28:68–69.

Wilson, A.C. 1988. Time scale for bird evolution. *Acta. Int. Ornithol. Cong.* 19:1912–1917.

Cortopassi, G.A., and A.C. Wilson. 1989. Electrophoretic survey of mouse lysozymes with an improved way of detecting lysozyme activity in gels. In *The Immune Response to Structurally Defined Proteins: The Lysozyme Model*, S.J. Smith-Gill and E.E. Sercarz, eds. Schenectady, NY: Adenine Press, 87–96.

Gyllensten, U.B., S. Jakobsson, H. Temrin, and A.C. Wilson. 1989. Nucleotide sequence and genomic organization of bird minisatellites. *Nucleic Acids Res.* 17:2203–2214.

Irwin, D.M., and A.C. Wilson. 1989. Multiple cDNA sequences and the evolution of bovine stomach lysozyme. *J. Biol. Chem.* 264:11387–11393.

Irwin, D.M., A. Sidow, R.T. White, and A.C. Wilson. 1989. Multiple genes for ruminant lysozymes. In *The Immune Response to Structurally Defined Proteins: The Lysozyme Model*, S.J. Smith-Gill and E.E. Sercarz, eds. Schenectady, NY: Adenine Press, 73–85.

Jollès, J., P. Jollès, B.H. Bowman, E.M. Prager, C.-B. Stewart, and A.C. Wilson. 1989. Episodic evolution in the stomach lysozymes of ruminants. *J. Molec. Evol.* 28:528–535.

Kirsch, J.F., B.A. Malcolm, M.J. Corey, L. Zhang, and A.C. Wilson. 1989. Mechanistic and evolutionary studies on genetically engineered chicken lysozyme. In *The Immune Response to Structurally Defined Proteins: The Lysozyme Model*, S.J. Smith-Gill and E.E. Sercarz, eds. Schenectady, NY: Adenine Press, 59–63.

Kocher, T.D., W.K. Thomas, A. Meyer, S.V. Edwards, S. Pääbo, F.X. Villablanca, and A.C. Wilson. 1989. Dynamics of mitochondrial DNA evolution in animals: Amplification and sequencing with conserved primers. *Proc. Natl. Acad. Sci. USA* 86:6196–6200.

Larson, A., and A.C. Wilson. 1989. Patterns of ribosomal RNA evolution in salamanders. *Molec. Biol. Evol.* 6:131–154.

Lavoie, T.B., L.N.W. Kam-Morgan, A.B. Hartman, C.P. Mallett, S. Sheriff, D.A. Saroff, C.R. Mainhart, P.A. Hamel, J.F. Kirsch, A.C. Wilson, and S.J. Smith-Gill. 1989. Structure-function relationships in high affinity antibodies to lysozyme. In *The Immune Response to Structurally Defined Proteins: The Lysozyme Model*, S.J. Smith-Gill and E.E. Sercarz, eds. Schenectady, NY: Adenine Press, 151–168.

Pääbo, S., R.G. Higuchi, and A.C. Wilson. 1989. Ancient DNA and the polymerase chain reaction: The emerging field of molecular archaeology. *J. Biol. Chem.* 264:9709–9712.

Stoneking, M., and A.C. Wilson. 1989. Mitochondrial DNA. In *The Colonization of the Pacific: A Genetic Trail*, A.V.S. Hill and S.W. Serjeantson, eds. Oxford: Clarendon Press, 215–245.

Thomas, W.K., J. Maa, and A.C. Wilson. 1989. Shifting constraints on tRNA genes during mitochondrial DNA evolution in animals. *New Biol.* 1:93–100.

Thomas, R.H., W. Schaffner, A.C. Wilson, and S. Pääbo. 1989. DNA phylogeny of the extinct marsupial wolf. *Nature* 340:465–467.

Vigilant, L., R. Pennington, H. Harpending, T.D. Kocher, and A.C. Wilson. 1989. Mitochondrial DNA sequences in single hairs from a southern African population. *Proc. Natl. Acad. Sci. USA* 86:9350–9354.

Vincent, K.A., and A.C. Wilson. 1989. Evolution and transcription of Old World monkey globin genes. *J. Molec. Biol.* 207:465–480.

Wilson, A.C., E.A. Zimmer, E.M. Prager, and T.D. Kocher. 1989. Restriction mapping in the molecular systematics of mammals: A retrospective salute. In *The Hierarchy of Life: Molecules and Morphology in Phylogenetic Analysis*, B. Fernholm, K. Bremer, and H. Jörnvall, eds. Amsterdam: Elsevier Science, 407–419.

Cortopassi, G.A., and A.C. Wilson. 1990. Recent origin of the P lysozyme gene in mice. *Nucleic Acids Res.* 18:1911.

Edwards, S.V., and A.C. Wilson. 1990. Phylogenetically informative length polymorphism and sequence variability in mitochondrial DNA of Australian songbirds (*Pomatostomus*). *Genetics* 126:695–711.

Irwin, D.M., and A.C. Wilson. 1990. Concerted evolution of ruminant stomach lysozymes: Characterization of lysozyme cDNA clones from sheep and deer. *J. Biol. Chem.* 265:4944–4952.

Jollès, J., E.M. Prager, E.S. Alnemri, P. Jollès, I.M. Ibrahimi, and A.C. Wilson. 1990. Amino acid sequences of stomach and nonstomach lysozymes of ruminants. *J. Molec. Evol.* 30:370–382.

Lavoie, T.B., L.N.W. Kam-Morgan, C.P. Mallett, J.W. Schilling, E.M. Prager, A.C. Wilson, and S.J. Smith-Gill. 1990. Analysis of antibody-protein interactions utilizing site-directed mutagenesis and a new evolutionary variant of lysozyme. In *Use of X-Ray Crystallography in the Design of Antiviral Agents*, G.W. Laver and G. Air, eds. New York: Academic Press, 213–232.

Malcolm, B.A., K.P. Wilson, B.W. Matthews, J.F. Kirsch, and A.C. Wilson. 1990. Ancestral lysozymes reconstructed, neutrality tested, and thermostability linked to hydrocarbon packing. *Nature* 345:86–89.

Meyer, A., and A.C. Wilson. 1990. Origin of tetrapods inferred from their mitochondrial DNA affiliation to lungfish. *J. Molec. Evol.* 31:359–364.

Meyer, A., T.D. Kocher, P. Basasibwaki, and A.C. Wilson. 1990. Monophyletic origin of Lake Victoria cichlid fishes suggested by mitochondrial DNA sequences. *Nature* 347:550–553.

Pääbo, S., D.M. Irwin, and A.C. Wilson. 1990. DNA damage promotes jumping between templates during enzymatic amplification. *J. Biol. Chem.* 265:4718–4721.

Palumbi, S.R., and A.C. Wilson. 1990. Mitochondrial DNA diversity in the sea urchins *Strongylocentrotus purpuratus* and *S. droebachiensis*. *Evolution* 44:403–415.

Sage, R.D., E.M. Prager, H. Tichy, and A.C. Wilson. 1990. Mitochondrial DNA variation in house mice, *Mus domesticus* (Rutty). *Biol. J. Linn. Soc.* 41:105–123.

Sidow, A., and A.C. Wilson. 1990. Compositional statistics: An improvement of evolutionary parsimony and its application to deep branches in the tree of life. *J. Molec. Evol.* 31:51–68.

Simon, C., S. Pääbo, T.D. Kocher, and A.C. Wilson. 1990. Evolution of mitochondrial ribosomal RNA in insects as shown by the polymerase chain reaction. In *Molecular Evolution: UCLA Symposia on Molecular and Cellular Biology*, M. Clegg and S. Clark, eds. New York: Alan R. Liss, n.s., v. 122, 235–244.

Stoneking, M., L.B. Jorde, K. Bhatia, and A.C. Wilson. 1990. Geographic variation in human mitochondrial DNA from Papua New Guinea. *Genetics* 124:717–733.

Thomas, R.H., S. Pääbo, and A.C. Wilson. 1990. Chance marsupial relationships. *Nature* 345:393–394.

Thomas, W.K., S. Pääbo, F.X. Villablanca, and A.C. Wilson. 1990. Spatial and temporal continuity of kangaroo rat populations shown by sequencing mitochondrial DNA from museum specimens. *J. Molec. Evol.* 31:101–112.

Wilson, A.C. 1990. Will sequencing the human genome revolutionize biology? *New Biol.* 2:585–586.

Cavalli-Sforza, L.L., A.C. Wilson, C.R. Cantor, R.M. Cook-Deegan, and M.-C. King. 1991. Call for a worldwide survey of human genetic diversity: A vanishing opportunity for the Human Genome Project. *Genomics* 11:490–491.

Cortopassi, G.A., and A.C. Wilson. 1991. Genetic analysis of a switch in cell specificity of P lysozyme expression in *molossinus* mice. *Genet. Res.* 58:111–114.

Di Rienzo, A., and A.C. Wilson. 1991. Branching pattern in the evolutionary tree for human mitochondrial DNA. *Proc. Natl. Acad. Sci. USA* 88:1597–1601.

Edwards, S.V., P. Arctander, and A.C. Wilson. 1991. Mitochondrial resolution of a deep branch in the genealogical tree for perching birds. *Proc. R. Soc. Lond.*, ser. B, 243:99–107.

Gyllensten, U., D. Wharton, A. Josefsson, and A.C. Wilson. 1991. Paternal inheritance of mitochondrial DNA in mice. *Nature* 352:255–257.

Irwin, D.M., T.D. Kocher, and A.C. Wilson. 1991. Evolution of the cytochrome *b* gene of mammals. *J. Molec. Evol.* 32:128–144.

Kocher, T.D., and A.C. Wilson. 1991. DNA amplification by the polymerase chain reaction. In *Essential Molecular Biology*, v. 2, *A Practical Approach*, T.A. Brown, ed. Oxford: IRL Press, 187–209.

Kocher, T.D., and A.C. Wilson. 1991. Sequence evolution of mitochondrial DNA in humans and chimpanzees: Control region and a protein-coding region. In *Evolution of Life: Fossils, Molecules, and Culture*, S. Osawa and T. Honjo, eds. Tokyo: Springer-Verlag, 391–413.

Meyer, A., and A.C. Wilson. 1991. Coelacanth's relationships. *Nature* 353:219.

Meyer, A., T.D. Kocher, and A.C. Wilson. 1991. African fishes. *Nature* 350:467–468.

Pääbo, S., and A.C. Wilson. 1991. Miocene DNA sequences: A dream come true? *Curr. Biol.* 1:45–46.

Pääbo, S., W.K. Thomas, K.M. Whitfield, Y. Kumazawa, and A.C. Wilson. 1991. Rearrangements of mitochondrial transfer RNA genes in marsupials. *J. Molec. Evol.* 33:426–430.

Quinn, T.W., G.F. Shields, and A.C. Wilson. 1991. Affinities of the Hawaiian goose based on two types of mitochondrial DNA data. *Auk* 108:585–593.

Sidow, A., and A.C. Wilson. 1991. Compositional statistics evaluated by computer simulations. In *Phylogenetic Analysis of DNA Sequences*, M.M. Miyamoto and J. Cracraft, eds. Oxford: Oxford University Press, 129–146.

Sidow, A., A.C. Wilson, and S. Pääbo. 1991. Bacterial DNA in *Clarkia* fossils. *Phil. Trans. R. Soc. Lond.*, ser. B, 333:429–433.

Swanson, K.W., D.M. Irwin, and A.C. Wilson. 1991. Stomach lysozyme gene of the langur monkey: Tests for convergence and positive selection. *J. Molec. Evol.* 33:418–425.

Thomas, W.K., and A.C. Wilson. 1991. Mode and tempo of molecular evolution in the nematode Caenorhabditis: Cytochrome oxidase II and calmodulin sequences. *Genetics* 128:269–279.

Tikochinski, Y., U. Ritte, S.R. Gross, E.M. Prager, and A.C. Wilson. 1991. mtDNA polymorphism in two communities of Jews. *Am. J. Hum. Genet.* 48:129–136.

Vigilant, L., M. Stoneking, H. Harpending, K. Hawkes, and A.C. Wilson. 1991. African populations and the evolution of human mitochondrial DNA. *Science* 253:1503–1507.

Wilson, A.C. 1991. From molecular evolution to body and brain evolution. In *Perspectives on Cellular Regulation: From Bacteria to Cancer*, M. Inouye, J. Campisi, D. Cunningham, and M. Riley, eds. New York: Wiley-Liss, 331–340.

Wilson, A.C., M. Stoneking, and R.L. Cann. 1991. Ancestral geographic states and the peril of parsimony. *Syst. Zool.* 40:363–365.

Cooper, A., C. Mourer-Chauviré, G.K. Chambers, A. von Haeseler, A.C. Wilson, and S. Pääbo. 1992. Independent origins of New Zealand moas and kiwis. *Proc. Natl. Acad. Sci. USA* 89:8741–8744.

Goloubinoff, P., S. Pääbo, and A.C. Wilson. 1992. Molecular characterization of ancient maize: Potentials and pitfalls. In *Corn and Culture in the Prehistoric World*, S. Johannessen and C.A. Hastorf, eds. Boulder, CO: Westview Press (in press).

Irwin, D.M., and A.C. Wilson. 1992. Limitations of molecular methods for establishing the phylogeny of mammals, with special reference to the position of elephants. In *Mammal Phylogeny*, F.S. Szalay, M.J. Novacek, and M.C. McKenna, eds. New York: Springer-Verlag (in press).

Irwin, D.M., E.M. Prager, and A.C. Wilson. 1992. Evolutionary genetics of ruminant lysozymes. *Animal Genet.* 23 (in press).

Shih, P., B.A. Malcolm, S. Rosenberg, J.F. Kirsch, and A.C. Wilson. 1992. Reconstruction and testing of ancestral proteins. *Meth. Enzymol.* (in press).

Stoneking, M., A.S.M. Sofro, and A.C. Wilson. 1992. Implications of a mitochondrial marker for the colonization of the Pacific. In *Human Evolution in the Pacific Region*, C.K. Ho, G. Krantz, and M. Stoneking, eds. Pullman, WA: Washington State University Press (in press).

Tucker, P.K., R.D. Sage, J.H. Warner, A.C. Wilson, and E.M. Eicher. 1992. Abrupt cline for sex chromosomes in a hybrid zone between two species of mice. *Evolution* 46:1146–1158.

Wilson, A.C., and R.L. Cann. 1992. The recent African genesis of humans. *Sci. Am.* 266(4):68–73.

Irwin, D.M., R.T. White, and A.C. Wilson. 1993. Characterization of the cow stomach lysozyme genes: Repetitive DNA and concerted evolution. *J. Molec. Evol.* (in press).

Prager, E.M., and A.C. Wilson. 1993. Information content of immunological distances. *Meth. Enzymol.* 224 (in press).