

**Meeting:** 1003, Atlanta, Georgia, MAA CP S1, MAA Session on Meeting the Challenge: Relationship Between Mathematics and Biology in the 21st Century

1003-S1-245      **Scott R Herriott\*** ([herriott@mum.edu](mailto:herriott@mum.edu)), 1000 N. 4th St. Box 1070, Fairfield, IA 52557. *An Unrestricted Model for Dating Genetic Separation.*

For thirty-five years, mathematicians have been helping molecular biologists develop increasingly sophisticated models that account for changes in a DNA string over time. The most well-known application of this work has been to date the separation of the genetic lineages of modern man and the Neanderthal (no, we're not descended from Neanderthals), but there have been many others. The analytic models used, however, made restrictive assumptions about the pattern of mutation among the four base molecules in the DNA string. Using only elementary probability and some matrix algebra, this paper models DNA mutation as a Markov process and derives a general equation for the probability that a DNA base pair will remain unchanged  $T$  years after genetic separation, assuming a constant mutation rate across the locations on the DNA string. The model generalizes also to the case where the mutation rate is heterogeneous but follows a gamma distribution. The paper concludes with comments and a case study on the difficulties created for biologists when they lack an understanding of the mathematical models they are using. (Received September 02, 2004)