Editorial and position papers

Early last summer *Protein Science* received a manuscript by Michael J. Behe and David W. Snoke entitled, "Simulating Evolution by Gene Duplication of Protein Features That Require Multiple Amino Acid Residues." The editors were aware that the authors of the paper are associated with the "Intelligent Design" movement, which challenges Darwinian evolutionary theory on the grounds that not enough time has elapsed since life arose on Earth to account for the complexity of living organisms and the molecules they contain without the intervention of an unnamed "designer." While these associations with an idea that clearly steps over the bounds of what can be determined by scientific means put us in an uncomfortable position, the editors, in the interest of fairness, sent the manuscript to reviewers in the usual way.

Two extensive reviews were obtained, which asked for changes to the manuscript. The authors addressed the concerns in the ways prescribed by the journal, and the paper was published in the October 2004 issue (Behe and Snoke 2004). Needless to say, it drew a great deal of attention from our usual audience and other scientists in evolutionary studies. The letters we received contained many points of disagreement with the Behe and Snoke article, some of which are summarized below. In addition, Professor Michael Lynch of Indiana University indicated to me that the article raised some issues that Dr. Lynch was considering and asked if we would be interested in a response to the Behe and Snoke article in the form of a research manuscript. At that point in the proceedings, it was not clear to me what the best approach would be, so I indicated to all parties that we would consider letters and responses, and I also indicated that we would welcome the study by Prof. Lynch as a submission to the journal. I indicated that Behe and Snoke would be invited to respond to anything we were considering for publication. All parties were informed that everything to be considered for publication in the journal, whether in letter or manuscript form, would have to go through careful scientific review and receive endorsement in order to be published.

Prof. Lynch's paper, "Simple Evolutionary Pathways to Complex Proteins," was received late last year and sent to reviewers. They returned reviews requesting a few changes that were subsequently addressed by Dr. Lynch. Drs. Behe and Snoke then sent a lengthy response to Dr.

Lynch's article entitled, "A Response to Michael Lynch." The essence of the response was that Behe and Snoke assume that intermediate mutations on the way to a new multi-residue feature are inevitably deleterious, while Lynch allows for neutrality or positive selection. Thus, the response reiterated the model and positions of the October 2004 paper.

The various letters and manuscripts were reviewed as a package by the editors and by outside experts. Some points made by the various commentators include:

- Substantial variation in the rate of mutation fixation occurs, both between lineages and between sites on a protein during evolution. This is a central concept of modern population genetics (Fitch and Markowitz 1970; Fitch 1971; Kimura 1983; Yang 1996; Whelan and Goldman 2004).
- Changes in one site are known to cause changes in the mutation and acceptance rate at other sites in a protein, generally called "compensatory" changes (Fitch and Markowitz 1970; Fitch 1971; Altschuh et al. 1987; Pollock et al. 1999).
- Recombination strongly accelerates the rate of joining of independent mutations at multiple sites and of grafting new domains with additional functions and sites of interaction to proteins to create new modes of action or regulation (de Souza et al. 1996; Teichmann et al. 1998; Thornton and DeSalle 2000; Vogel et al. 2005).
- Selection acts continuously, and cumulative effects, rather than a single strongly adaptive change, are the basis of evolution under a Darwinian model. Thus, intermediate states must also be assumed to be selected.

It was clear when all of the correspondence was analyzed by the editors and reviewers that no useful purpose would be served by opening this topic up to "Letters," since there was no real dialog, just statements of position. Prof. Lynch's approach of testing the problem raised by Drs. Behe and Snoke within the modern framework of evolutionary biology represents the desirable scientific approach (Lynch 2005, this issue; Behe and Snoke 2005, this issue). As Bruce Alberts wrote in a Letter to the Editor of the *New York Times* (Feb. 12, 2005): "In evolution, as in all areas of science, our knowledge is incomplete. But the entire success of the scientific enterprise has depended on an insistence that

Article and publication are at <http://www.proteinscience.org/cgi/doi/10.1110/ps.051654305>.

these gaps be filled by natural explanations, logically derived from confirmable evidence.”

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