Increasingly, studies of biological problems are attracting contributions by theoretical physicists. One major area where this is occurring is that of protein folding. The physico-chemical processes of misfolding and aggregation are amenable to theoretical modeling without requiring extensive knowledge of biological processes. This is true particularly for the amyloid diseases, in which misfolding and aggregation of specific proteins are the key component of disease onset. Included in this classification are Alzheimer’s, Mad Cow, Parkinson’s, Huntington’s, and type II diabetes diseases. Prion diseases, such as Mad Cow disease, are especially fascinating since there is considerable evidence that they involve only proteins in the infection and can occur sporadically, genetically, or via transmission. In this colloquium, Dr. Orr will begin by presenting a review of our understanding of the fundamental concepts of biology and protein folding. She will then survey the key aspects of prion diseases, which have been attracting contributions by theoretical physicists and present results from work on molecular modeling of the misfolded structures of the prion protein as an example of how physicists can apply our knowledge of statistical mechanics to biological systems.

Dr. Orr is a recent doctoral graduate in theoretical condensed matter physics from UC Davis where she did dissertation work on the dynamics of protein folding and stability (specifically with prions). She is also a Cal Poly Physics alum, where she graduated in 2004 after serving for three years as SPS president. Dr. Orr currently lives in Mountain View, CA with her husband and is teaching undergraduate physics at Foothill College while she finishes up some final research and completes a few publications.