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The genome solver project: facilitating undergraduate research projects in bioinformatics

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Abstract

The Human Microbiome Project is revolutionizing our understanding of the microorganisms that coexist in and on the human body, and the relationship between the microbiome and human health. The sequence information from thousands of bacteria and bacteriophagesis available in public repositories. This vast data set represents an opportunity for undergraduates to engage in authentic bioinformatics research.

We have developed the Genome Solver online community (www.genomesolver.org) for faculty and students to share curriculum and research. As an illustration of the work that can be done, we show one project in which students found evidence for gene transfer between *Chlamydia (Chlamydophila) pneumoniae*isolates and *Chlamydia* phages. We found that two phage genes are found in a *C. pneumoniae* isolate which infects koalas, but only one of these, encoding a putative replication initiation protein (PRIP), is found in the isolates that infect humans. We further show by phylogenetic analyses that the PRIP proteins from the phages cluster together while the PRIP proteins from bacteria cluster together. These results are consistent with the hypothesis that phage genes were transferred into a *C. pneumoniae* ancestor that gave rise to the koala-infecting strain as well as the human-infecting strains, while the immediate ancestor of the human strains lost the second phage gene and retains only the PRIP gene. These observations suggest that the bacterial PRIP gene is retained because it serves an important, though unknown function. We are extending these results to examine transfer of PRIP genes between other phage and their bacterial hosts.

Biography

Anne Rosenwald completed a Ph.D. in Biochemistry from the Johns Hopkins University School of Public Health in 1989. Following post-doctoral fellowships at the Carnegie Institution of Washington and the National Cancer Institute at NIH, she joined the chemistry faculty at Dickenson College. Subsequently, she joined the biology faculty at Georgetown University in 1997. She is a 2011 winner of the Dean's Teaching Award at Georgetown and is a 2012 Bioscience Education Network Scholar. Funding for both her research on membrane traffic in yeast and the Genome Solver Project comes from the National Science Foundation.