

Model of horizontal gene transfer, and another power law mystery

Lawrence S. Schulman

Clarkson University, 8 Clarkson Ave, Potsdam, USA

Bacteria develop resistance to antibiotics either because of mutation (including the existing presence of a mutant, resistant strain in the population) or through a process known as horizontal gene transfer (HGT). There is a model of evolution and ecology known as the Tangled Nature model (TNM) that reproduces many natural features of both evolution and ecology and allows mutation. It is due to H. J. Jensen and collaborators. I have extended the model to describe the promiscuous process of HGT in which bacteria simply incorporate entire chunks of genome either from other bacteria or from the environment. I plan to review the TNM, the extensions for HGT and some results.

As far as I know there are no known – yet – clinical applications.

There is also a mysterious power law that shows up. The modified TNM was allowed to run and statistics gathered in which genomes survived under the rules for TNM, namely the demand for compatibility during a long metastable period. It was found that the resulting genome distribution varied widely, so widely that it gave indications that it did not have a second moment, i.e., it was Levy distributed.

Two questions immediately come to mind: Does this occur in nature or is it only a property of the TNM? and why does it occur in the first place?