Texas Tech University. Applied Mathematics Seminar.

Resolving the closure problem in evolutionary theory

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ABSTRACT. Most formal evolutionary theory is based on the Price equation, which gives the change in mean phenotype in a population as a function of the covariance between phenotype and fitness. Because it requires the current mean and variance in phenotype to calculate only the mean after selection, the Price equation can not be iterated forward in time without the addition of extra simplifying assumptions. Change in the variance and other moments can be found through subsequent application of the equation to powers of the phenotype, but this means that there is no general closed set of equations that can be iterated indefinitely. I will discuss how to circumvent this closure problem by constructing a theory that follows the entire frequency distribution of phenotypes, not just the mean, across generations. Because evolution is an inherently stochastic process, we actually need to calculate the probability distribution of frequency distributions. I show how to do this using a combination of characteristic and moment generating functions.