Bayesian Statistics: The Foundation of Scientific Inference

There are two types of inferential statistics that are widely used: frequentist and Bayesian. Frequentist inference is an oversimplification, and it sometimes gives obviously wrong results. However, frequentist inference remains the dominant way that statistics is learned and applied to experimental data to make claims because it is somewhat easier to learn. We will begin with the unassailable basics which underlie both frequentist and Bayesian statistics. The basics common to both are known as "descriptive statistics." After covering descriptive statistics, we can spend some time on frequentist inference, including the derivation of the linear regression formulae. Then we will graduate to Bayesian statistics. We will need to develop and use some calculus to do statistics, but I will go slowly and assume you have never seen any calculus. We will rely on Young, ***Statistical Treatment of Experimental Data,*** for descriptive statistics and Donovan and Mickey, ***Bayesian Statistics for Beginners,*** for Bayesian statistics and an introduction to Monte Carlo methods**.** We will conclude with the first two chapters of Gilks, Richardson, and Spiegelhalter, ***Markov Chain Monte Carlo in Practice.*** These two chapters serve as a bridge from the illustrative but simple Monte Carlo applications in Chapters 13-16 of Donovan and Mickey to realistic and modern epidemiological applications.