ROBUSTNESS AND ACCURACIES OF RELAXED CLOCK METHODS IN ESTIMATING DIVERGENCE TIMES AND THEIR CREDIBILITY INTERVALS. F. U. Battistuzzi[1], A. Filipski[1], S. B. Hedges[2], and S. Kumar [1,3], [1]Center for Evolutionary Functional Genomics, The Biodesign Institute, Arizona State University, Tempe, AZ 85287-5301, fabia.battistuzzi@asu.edu, [2]Department of Biology, The Pennsylvania State University, University Park, PA 16802, [3]School of Life Sciences, Arizona State University, Tempe, AZ 85287-5301

The rapid expansion of sequence data and the development of statistical approaches that embrace varying evolutionary rates among lineages have encouraged many more investigators to use molecular data to time species divergences. However, a systematic evaluation of the relative accuracies and robustness of relaxed clock methods in estimating divergence times, and their credibility intervals (CrI), remains to be conducted. Here, we report results of our computer simulation investigations on the efficiency of two frequently-used relaxed-clock methods that allow evolutionary lineage rates to vary in a phylogeny randomly (e.g., BEAST software), or correlated in ancestral and descendant branches (e.g., MultiDivTime software). We applied these methods for analyzing sequence datasets simulated using naturally derived parameters (evolutionary rates, sequence lengths, and base substitution patterns), and assumed that clock-calibrations are known without error. We find that relaxed clock times are, on average, close to the true times as long as the assumed model of lineage rate changes matches the actual model. The 95% CrIs contain the true time for ≥ 95% of the simulated datasets. However, the use of incorrect lineage rate model reduces this frequency to 83%, which shows that relaxed clock times and CrIs are not generally robust. Because the lineage rate model is rarely known *a priori*, and is difficult to detect empirically, we suggest building composite CrIs based on the credibility intervals from both MultiDivTime and BEAST analysis. These composite CrIs are found to contain the true time for ≥ 97% datasets. Our analyses also verify the usefulness of the common practice of interpreting the congruence of times inferred from different methods as a reflection of the accuracy of time estimates. Overall, our results show that simple strategies can be used to enhance our ability to estimate times and their credibility intervals when using the relaxed-clock methods.