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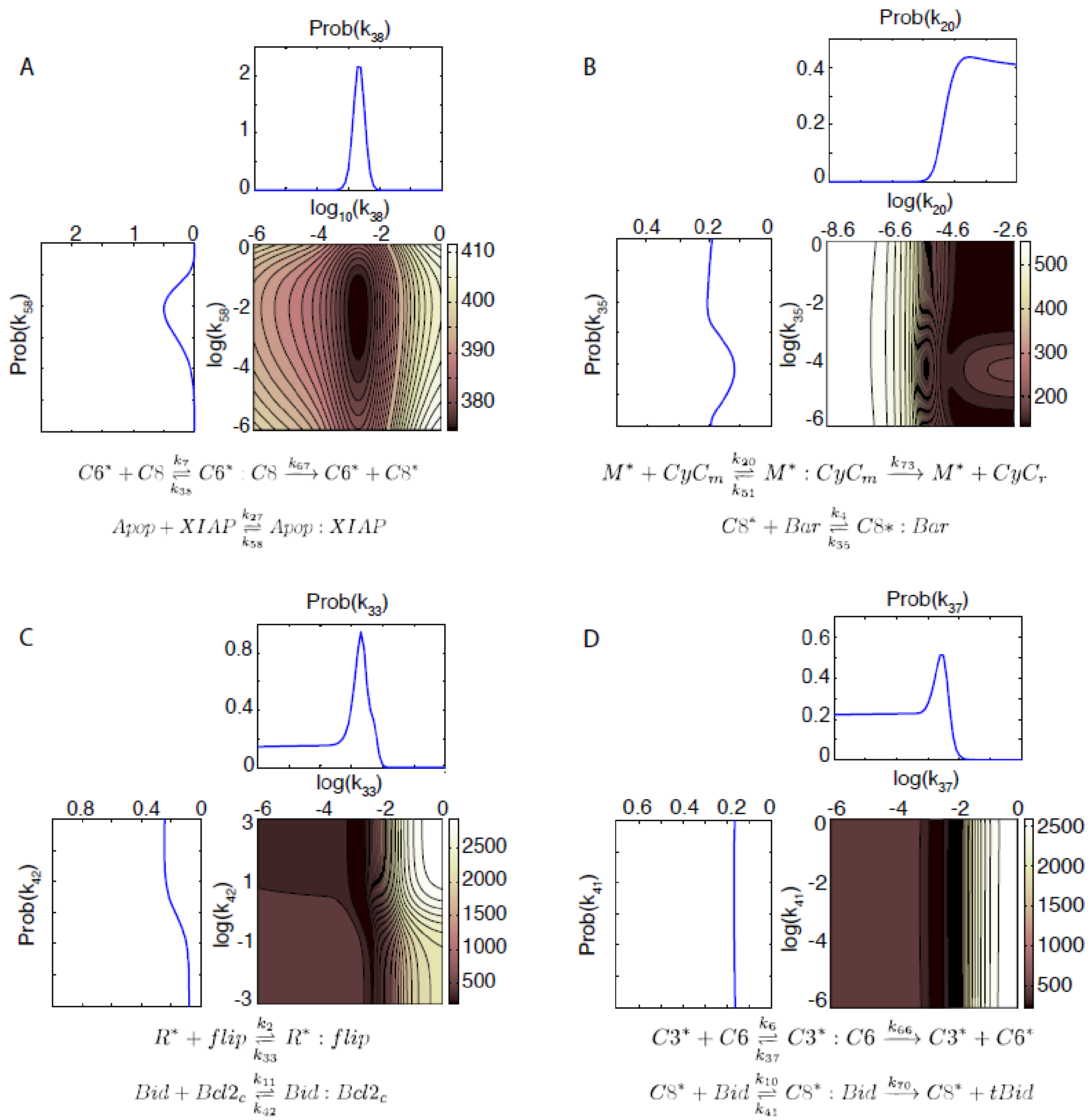
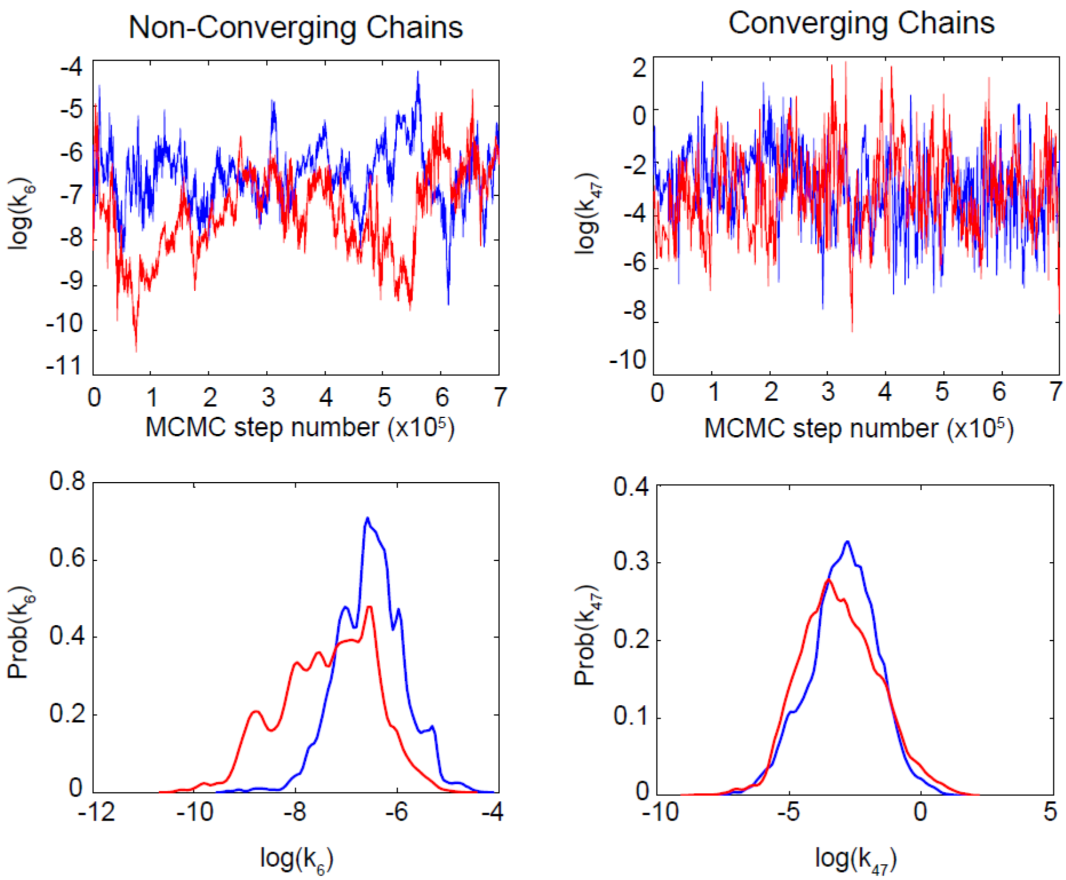
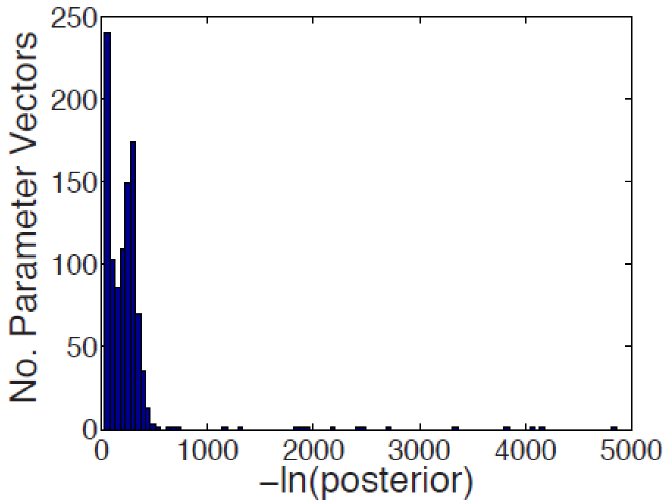


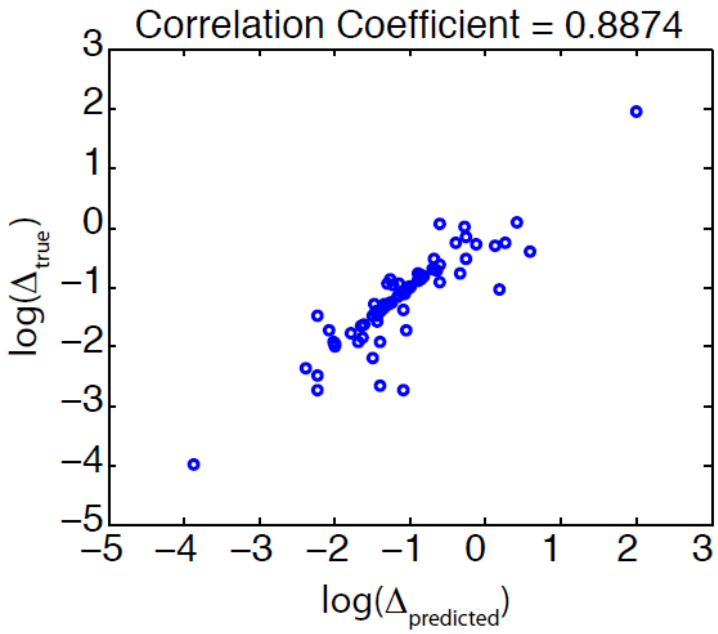
Supplementary Figure 1. A selection of 2D slices of the -ln(posterior) landscape for pairs of parameters with marginal posteriors. (A) A landscape of k_{38} vs k_{58} shows a minimum (corresponding to a maximum in the posterior) with both parameters described by approximately Gaussian distributions. (B) A landscape of k_{20} vs k_{35} shows two minima separated by a hump. The marginal of one parameter is bounded on only one side and the other parameter is largely non-identifiable. (C) A landscape of k_{33} vs k_{42} shows a canyon-like topography; the non-identifiable region runs mostly along the k_{42} axis. Marginal distributions show how the individual parameters are bounded on one side and unbounded on the other. (D) A landscape k_{37} vs k_{41} exhibits nonidentifiability in one parameter (k_{41}) and the other (k_{37}) has a minimum near the central region but plausible values also three orders of magnitude lower.



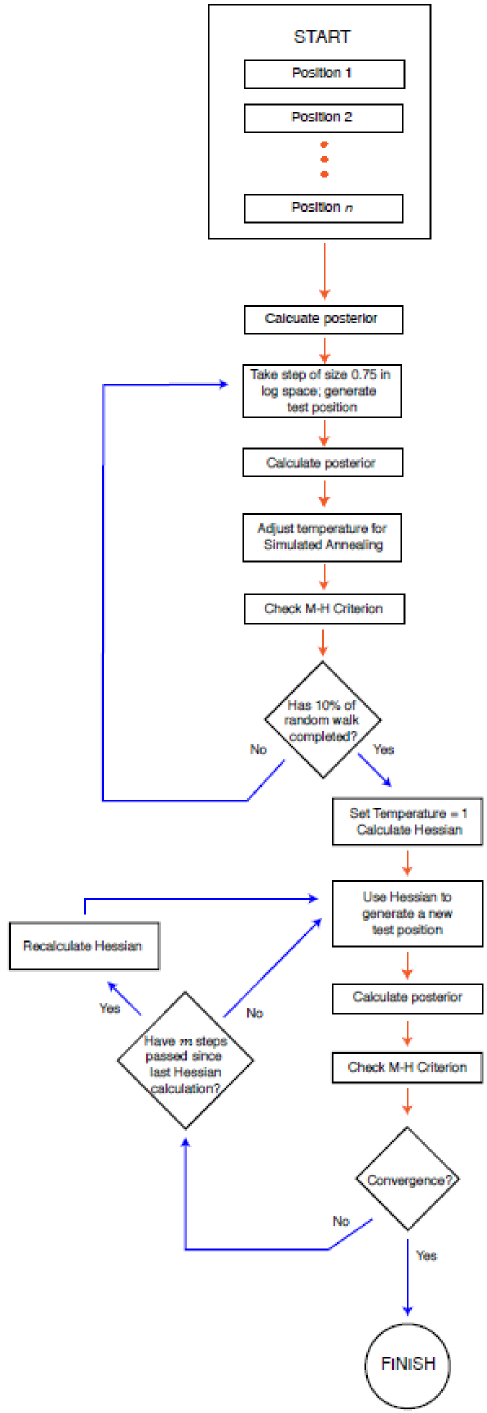
Supplementary Figure 2. Time-series of two chains that converge for parameter k_1 (top right) and two chains that do not converge for parameter k_2 (top left). Marginal distributions for convergent chains are much more similar (bottom right) than those for non-convergent chains (bottom left).



Supplementary Figure 3. –ln(posterior) values for trajectories generated from independent sampling of 10 most insensitive parameters: 5 for which the means of the marginal posterior deviated the least from the prior (ascertained by a t-test), and 5 for which the variance deviated the least (ascertained by a chi-squared variance test).



Supplementary Figure 4. Approximating parameter space using the Hessian, which is obtained from a second-order Taylor Series expansion, is justified by a high correlation coefficient value of 0.8874 between the true value of the posterior landscape, Δ_{true}, and the Hessian-based prediction $\Delta_{predicted}$.



Supplementary Figure 5. A flowchart illustrating the algorithm described in this manuscript. The letter *n* denotes the number of independent, parallel chains that each start at random positions in parameter space. For the first 10% of the MCMC random walk, simulated annealing is performed and the steps sizes are 0.75 in log space. After the completion of the first 10% of the random walk, an MCMC walk is applied, guided by a local Hessian. The algorithm ends once the *n* chains reach convergence according to the Gelman-Rubin criterion.