Reply to “Comments on ‘Estimating Michaelis-Menten or Langmuir Isotherm Constants by Weighted Nonlinear Least Squares’”

In our paper, we analyzed a data set using three linearizations of the Michaelis-Menten equation and using a nonlinear least-squares method; all data points were weighted equally in all methods. None of the linearizations gave as good a fit as the nonlinear method (i.e., the residual sum of squares was not minimized). This is because the linearizations transform the data and, in effect, weight the points unequally. Dr. Barry correctly points out that, when a linearization method is used, the points ought to be weighted unequally to compensate for the unequal weighting introduced in the linearization. As he shows, when this compensation is made, the linearizations work almost as well as nonlinear least-squares fitting.

Although the need to compensate for the unequal weighting introduced in the linearization was recognized and a procedure for compensating demonstrated by Wilkinson (1961), it has not become standard practice (judging from presentations in textbooks) and is rarely done. However, we acknowledge that a “fair comparison” of curve-fitting methods should include compensatory weighting when appropriate.

There is also another reason to weight points unequally, even when the data have not been transformed. Unequal weighting is appropriate when the data points are known to be of unequal uncertainty (here all uncertainty is presumed to be in the dependent variable). Such unequal uncertainty may be inherent in the method of measurement, for example, or may be inferred from the observed reproducibility of replicate measurements. Such weighting should be applied in addition to any compensatory weighting necessitated by the use of a linearization.

Received 6 Nov. 1989.

Lawrence Berkeley Lab.
Earth Sciences Div.
1 Cyclotron Rd.
Bldg. 50-E.
Berkeley, CA 94720

Reference