

Prism 3. GraphPad Software, 5755 Oberlin Drive, #110, San Diego, CA 92121. www.graphpad.com. See Web Site for Pricing Information.

Prism 3 is a comprehensive software for data analysis that combines nonlinear regression, basic statistics, and scientific graphing in a single integrated package. Version 3 is available for both Macintosh and Windows platforms. The minimum requirements are Mac OS 8.1 or later, 16 MB of RAM and 12 MB of disk space; or Win 95, Win 98, Win ME, NT4, Win 2000, or XP, and 5 MB disk space. A 733 MHz G4 Mac with 256 MB RAM running Mac OS 9.2.2 was used for this evaluation, although the Windows version appears virtually identical.

The package is simple to install and has a very intuitive interface. Compared to other statistical and graphing packages I have used, Prism is very easy to learn. For new users, this software provides Assistants for common analyses that create the initial data table and superimpose a help screen for guidance. Each file, or project, is composed of one or more data tables with associated tables of results, graphs, layouts, and pages for notes. These components are organized logically and greatly simplify the use of the software. The key to this simplicity is the flexible formatting of the data tables and the automated analyses that Prism allows. For example, if the data set consists of triplicate data points for three different treatment groups, the software automatically computes the errors for each set and produces a graph with the data points and error bars. Nonlinear regression (curve-fitting) and other statistical analyses are readily performed using either the extensive built-in set of equations or user-defined equations. Once the analysis is chosen, Prism automatically produces a new table of results and graphs the results of the analysis. Prism makes it very easy to chain analyses together, and if the original data table is edited or changed, the software automatically updates the entire chain of analysis. Data entry is straightforward, because direct entry into a formatted table, cutting and pasting from another table, or importing from an Excel or other spreadsheet is allowed. The import function is quite flexible, allowing the user to choose which data to import and how to arrange the data in Prism. Each data table can handle up to 52 data sets, and each data set can contain up to 16 replicate values. There are several features that help the user to automate routine analyses. Analysis and graphing steps can be saved in templates and methods files to be used in new projects. Prism can also use scripts to automate importing, analyzing, and graphing a large series of experiments.

There are several built-in curve-fitting functions, including linear and nonlinear regression; fit spline/LOWESS; simulated theoretical curve; smooth, differentiate, or integrate a curve; survival curve; and area under curve. Built-in statistical analyses include frequency distribution (histogram), row means/totals,

column statistics, T-tests and nonparametric test, one- and two-way ANOVA, survival curve, contingency tables, and correlation. Prism can fit data to two equations and compare the fits with an F-test. Built-in data manipulations include transforms, normalize, prune rows, remove baseline, and transpose X and Y . However, the program cannot perform transforms that combine columns of data (other than baseline correction).

The curve-fitting function appears to be quite robust. Prism uses the Marquardt method for performing nonlinear regression with up to 14 variables and allows the user to modify a number of parameters, including how initial values are chosen, weighting method, calculation options, and output options. Data can be fit to several built-in equations including one- and two-site binding, sigmoidal dose-response, one- and two-site competition, one- and two-phase exponential decay or association, exponential growth, power series, polynomial equations up to fourth order, sine wave, Gaussian distribution, and enzyme kinetics. The program does not calculate multiple regression and, thus, cannot fit models with two or more independent variables, nor can it handle differential equations. User-defined equations can also be applied, and the equation editor is very easy to use.

Prism has a limited number of automatic graph types, but they include all of the most common and useful scientific graphs: XY, semilog, histogram, four quadrant, quality control, before and after plot, survival curve, mass spectrum, and column and bar graphs. The program automatically chooses one of these types on the basis of the format of the data or results table. It is quite easy to change graph types, however. Although many other types of charts, such as polar, pie, or 3-D charts that are found in competing graphing packages, cannot be generated, the graphs are easily customized (fonts, legends, axes, symbols, colors, etc.), and Prism has a nice layout function that allows the user to arrange multiple graphs, tables, and text on a single page. The layout can be enhanced with text or drawing objects, including images imported as TIFF, PCX, BMP, GIF, or WMF files. Graphs and tables generated by the program can be pasted into other programs, such as Microsoft Word or PowerPoint, or exported in PICT, BMP, PNG, and TIFF formats at various resolutions.

Prism was clearly designed for the biological sciences (enzyme kinetics, binding studies, etc.), but should be suitable for most curve-fitting or statistical analyses in any area of chemistry. One of the strongest features of this program is that it does not require a great deal of statistical sophistication to use. The software comes with a well-written user manual and a very useful handbook (*Analyzing Data with GraphPad Prism*, by H. Motulsky, president of GraphPad) that explains the theory behind the various statistical analyses and how to interpret the results generated by them. In addition, the GraphPad Web site has a tutorial and examples of nearly all of the analyses that Prism can handle. While working in the program, clear

explanations and interpretations of the various statistical analyses are just a click away. Together, these resources provide a nice introduction to the practical uses and limitations of statistical analysis of two-dimensional data. All in all, Prism 3 is a very well-designed package for scientific graphing and statistical analysis. Although it does not have all the bells and whistles of

other graphing programs, Prism shines when it comes to guiding the user through its powerful curve-fitting and statistical analyses.

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