

GraphPad

By Hayden Gemeinhardt

1. What is GraphPad?

GraphPad Prism is a statistics tool designed for scientists to easily create graphs to represent their data without wasting an excessive amount of time learning and configuring other programs. It provides a combination of methods for biostatistics, curve fitting, and graphing all in one and is used by 750,000 scientists worldwide.

The focus of the software is to provide an ease of use targeted at users who are either not familiar with other programs like RStudio or do not want to spend a lot of time making graphs.

2. Advantages

The greatest benefit of GraphPad is the ease of use. One can simply select the format used by the data (such as errors, multiple lines, or ANOVA), paste the data into the spreadsheet, and follow the guidance and suggestions provided by GraphPad.

Other programs like R, SAS, and SPSS have steep learning curves. While they might be able to provide more cohesive or effective plots, it takes considerably more effort to do so.

A similar comparison in computer science is with C++ and Python. Although C++ has a major advantage in performance over Python, Python is the leading language for data analysis and machine learning due to its easy-to-read code and simple syntax that makes it perfect for beginners, non-coding experts, or simply those who do not want to spend the extra time for the extra performance.

Another popular way to make graphs is through Microsoft Excel, but Excel is far from a plotting tool. Compared to GraphPad Prism, it lacks automatic error bars on XY graphs, error bars on bar graphs, nonparametric statistics, normality testing, survival analysis, box-and-whiskers plots, and many more features. It is also much more difficult to customize and format graphs in general on Excel, and very difficult to perform nonlinear regression.

3. Disadvantages

First off, GraphPad costs money, as opposed to the free programming language and software environment of R, and it is not available on Linux. These two barriers prevent a wide range of people from being able to utilize the software.

Data handling and manipulation can be clunky in GraphPad and better suited for a program like Excel, which also has a quick, albeit lackluster, graph option. Due to this, many users may

prefer to stick to a single all-in-one program and choose Excel with more of a concern on handling data than making graphs.

On top of that, while R is harder to learn, it can provide much more sophistication and customizability than GraphPad. It can create a wider scope of statistical evaluation and utilize a variety of packages, such as ggplot, dplyr, and many more. Going back to the C++ and Python comparison, Python is extremely popular due to the abundance of packages that saves the user enormous amounts of time from creating their own functions, as is reflected in R.

4. Example

This example will demonstrate how to plot an IC50 curve for drug assay, following [this tutorial](#).

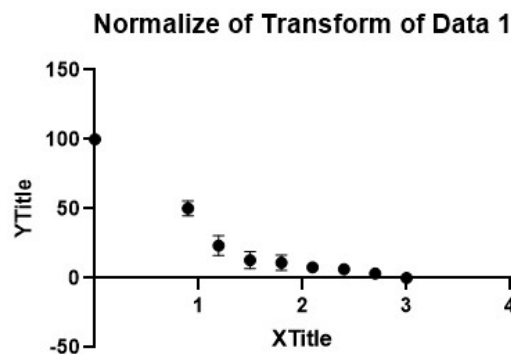
Starting off, these are the values used (which can easily be copied and pasted into GraphPad).

The X values are the concentrations and the y values are the absorbance values. Concentration 0 is the control.

Table format: XY		X	Group A		
		X Title	Data Set-A		
		X	A:Y1	A:Y2	A:Y3
1	Title	1000.00	31640	30572	31993
2	Title	500.00	32668	31385	33596
3	Title	250.00	33492	33243	34267
4	Title	125.00	33961	33148	35360
5	Title	62.50	35011	33457	37383
6	Title	31.30	36245	33655	37942
7	Title	15.60	37289	39350	42322
8	Title	7.88	50882	49256	47070
9	Title	0.00	66585	66585	66585

Now, the values need to be transformed. First, the X values can be transformed using Prism's analyze tool. The new X values are set to $\text{Log}(X)$ of the original X values. Next, the Y values will need to be normalized on a percentage scale. The top Y values will be 0% and the lower Y values will be 100%. Both of these steps can be accomplished in only a few clicks using GraphPad's user interface.

		X	A		
		X	A:1	A:2	A:3
1		3.000	0.677	-2.358	1.681
2		2.699	3.599	-0.047	6.237
3		2.398	5.941	5.234	8.144
4		2.097	7.274	4.964	11.251
5		1.796	10.259	5.842	17.000
6		1.496	13.766	6.405	18.589
7		1.193	16.733	22.591	31.038
8		0.897	55.368	50.747	44.533
9		0.000	100.000	100.000	100.000



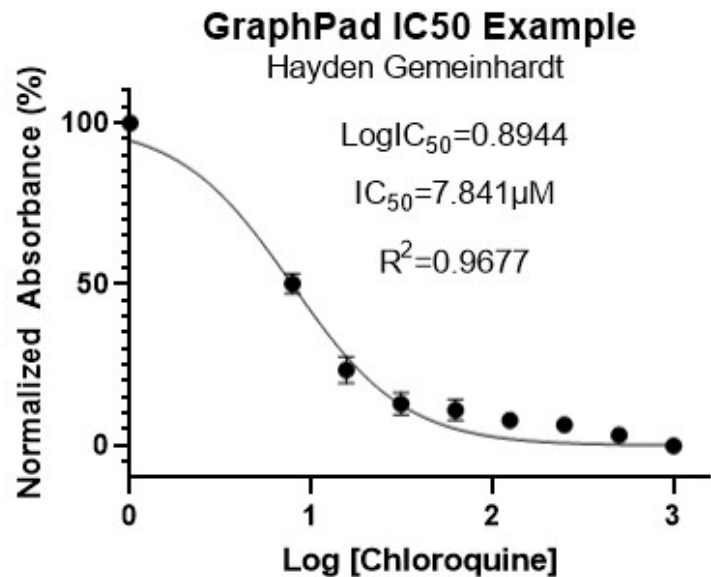
Further cleaning up the table requires a short few steps:

- Naming the Y axis and the X axis and removing the title
- Setting Error bars to represent standard error of the mean
- Refitting the X axis to 0->3.2 and Y axis to -10->110

Then to fit a sigmoid curve, again use the analyze tool and select “Nonlinear regression”.

Representing values obtained from the analysis on the graph (which GraphPad will automatically update if the data is changed) can then be inserted using text boxes.

Nonlin fit Table of results		A
1	log(inhibitor) vs. normalized response -- Variable slope	
2	Best-fit values	
3	LogIC ₅₀	0.8944
4	HillSlope	-1.394
5	IC ₅₀	7.841
6	95% CI (profile likelihood)	
7	LogIC ₅₀	0.8237 to 0.9570
8	HillSlope	-1.798 to -1.126
9	IC ₅₀	6.664 to 9.057
10	Goodness of Fit	
11	Degrees of Freedom	25
12	R squared	0.9677
13	Sum of Squares	817.9
14	Sy.x	5.720
15		
16	Number of points	
17	# of X values	27
18	# Y values analyzed	27



The analysis took roughly fifteen minutes for a beginner to learn how to set up. To create further plots and analyses, one simply can copy and paste data on top the old data to replace it, and everything will automatically update.

5. Personal Remarks

As a sophomore in computer science, I would definitely love to use this software in any situation requiring plots or analysis. In the future, I will learn how to code in R, but for the mean time this more than satisfies my needs. The only issue, going back to the disadvantages, is the cost barrier. I cannot afford to pay for the program on my own. I performed the example and learned how to use the software with the free trial, though that only lasts thirty days.

Given that I will more than likely learn how to use R in the future, it also may not be worth my time to learn how to use GraphPad when I can instead spend the time learning R. Especially with the costs, I cannot see a situation in which I would use GraphPad without the university paying for it.

Still, if I were given a project to do today without an ample amount of time to spend learning R and had some way to pay for it, GraphPad would be my choice.