

Making a Publication Quality Graph



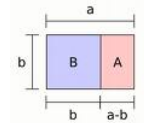
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Graphs as a form of art...

Graphs are essentially alternative representations of data and can be optimized for particular applications—aesthetics as well as accuracy are important.

Vertical graphs can be used to show changes in magnitude of response for relatively small numbers of sample point while horizontal graphs are better suited for large numbers of sample points. The golden rectangle (look it up...) is regarded as a good starting point for graph proportions.



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Here are some other works based on golden rectangle proportions...



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The purpose of this tutorial is to show how data can be plotted as a “publication quality” figure. Most spreadsheet programs can produce very good results but the default settings (graph type, symbol type etc.) must be changed. The default settings are really designed for business graphics and are thus not applicable for representing scientific data

The following example illustrates some of the changes...

Growth dependent gene expression in Minimal Media..

- In this example we will plot two data (Enzyme activity, OD600) against time using two y scales.
- Although Excel is used in this example, similar results can be obtained using other spreadsheet programs...

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Adding data to spreadsheet...

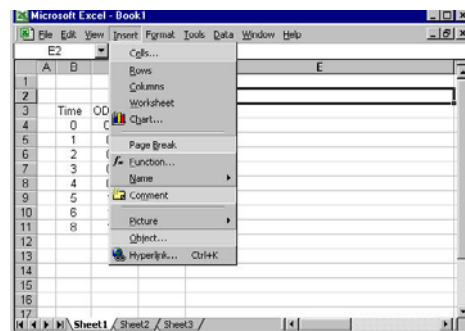
- Type the data into columns as indicated...

	A	B	C	D	E
1					
2					
3	Time	OD600	Enzyme		
4	0	0.05	0.1		
5	1	0.1	0.1		
6	2	0.2	5		
7	3	0.4	10		
8	4	0.8	40		
9	5	1.2	80		
10	6	1.3	82		
11	8	1.3	85		
12					
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15					
16					
17					

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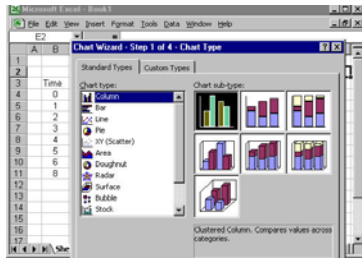
Insert a chart into the spreadsheet...



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Pick the appropriate chart type

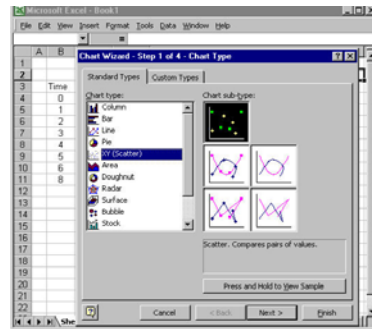


Inserting a chart into the spreadsheet... there many types of graph available but you should choose "XY" for most purposes. "Line" graphs, are not appropriate for plotting quantitative Y variables against quantitative X variables"

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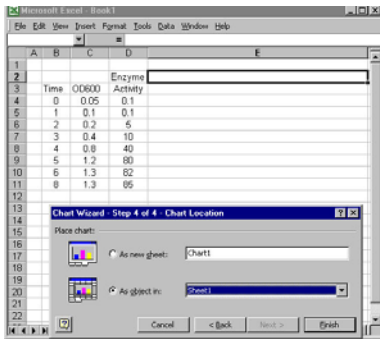
So in this case, we will choose an "XY" graph..



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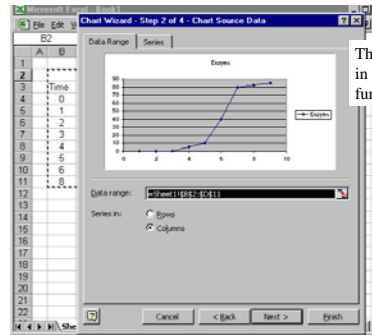
Insert the graph into the spreadsheet...



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Choose the data series to be plotted...

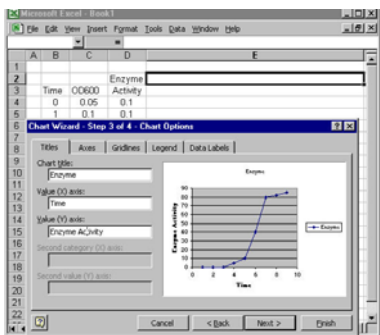


This will look a bit different in different programs but the fundamental step is similar...

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Add labels to the graph...

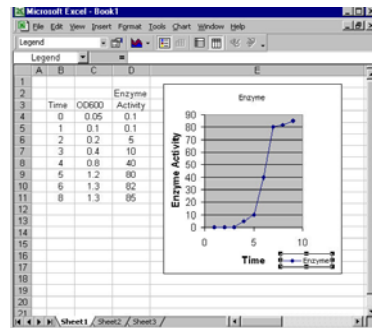


Use meaningful labels with units, if appropriate.

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Add a meaningful title...

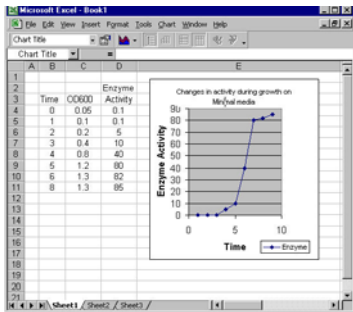


In this case, "Enzyme", the default title is not a very good title.

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Graph title

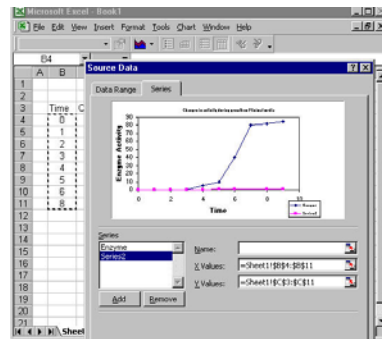


Here I have chosen a title that reflects the data that is plotted...

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Add the growth data (OD600)...

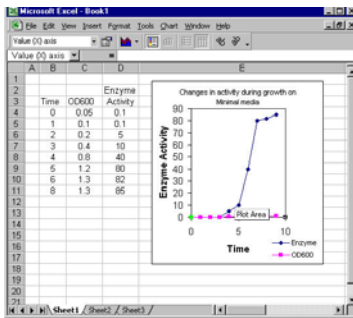


Add the data to the graph...

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Change the default symbols to ones that are more commonly used...

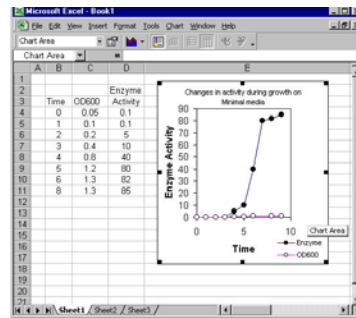


The default colors and symbols used in both Excel and Quattro Pro are not suitable for scientific publication and must be modified. Use open and filled circles and squares...

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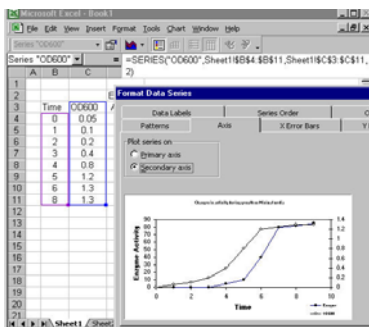
Compare these symbols to those used in the previous slide...



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The growth data in this case must be plotted on a secondary scale...

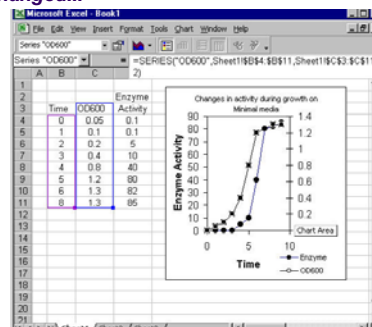


If there are two Y variables that must be scaled differently, you can make a secondary axis...

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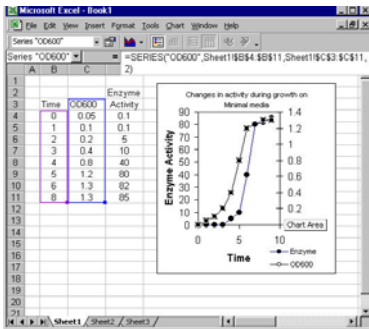
Several elements of this basic graph must still be changed...



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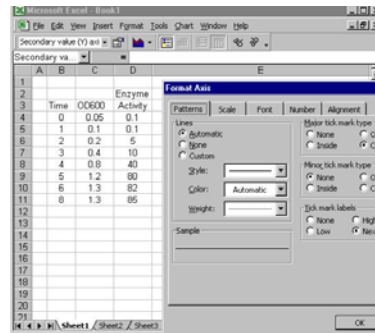
Since bacterial growth is exponential, it is best represented on a log scale....



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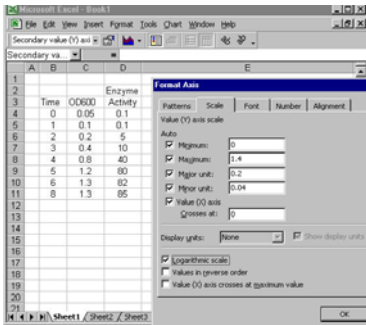
And the line weighting and tick marks must be modified....



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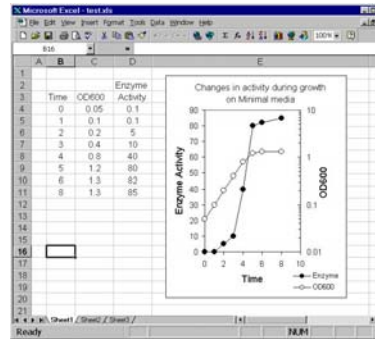
Change OD600 to exponential scale...



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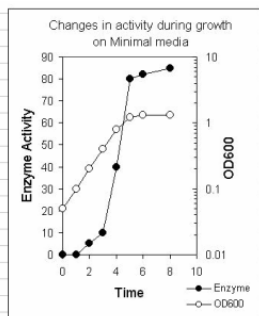
Note the change of scaling of elements in the final figure.



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The final figure....



(A bit fuzzy because it is a screen capture)
This graph might be further improved by adding minor ticks, increasing title font size and/or adding enzyme units.

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Other Resources...

- The Evil Tutor's Guide on how to not create graphs-sometimes it is helpful to see some bad examples (<http://www.eviltutor.com/>.)
- Journals have very specific guidelines on how to make graphs—it is a lot easier to read these beforehand than to redraw everything. Here are a couple of links that are a good guide.
- Journal of Bacteriology (<http://jb.asm.org/misc/ibitoa09.pdf> see page 12)
- Cell (<http://www.cell.com/authors#figures>)

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