

# **Techniques in Molecular Genetics**

**Preparing Publication  
Quality Information**

---

**H.E. Schellhorn**

## Day 7

- Finish Rotation
- Inoculate E. coli/pTaq
- Isolation of Taq (Tao)
- Preparing a Publication quality graph/Figure
- Quiz 1
- Add IPTG for O/N incubation

# Preparing a Publication quality graph/Figure

- The goal of any work should be dissemination of important new information.
- In designing experiments and presentation of data we must keep this in mind.
- Data should always be in high quality form...

## Loss of Data quality...

This can occur when a high quality image is saved in “lossy” form. For example, a RAW, TIFF, or JPG image is save in a GIF format or low resolution Jpg.

# Types of Image formats

1. **Raw** – common uncompressed camera format. Large size, lots of metadata
2. **Gif** -CompuServe's Graphics Interchange Format (small images, proprietary format)
3. **EPS** - Encapsulated PostScript (self contained Postscript image often preferred by publishers))
4. **JPG** - a lossy image format used to display photographic images (variable compression, non-proprietary))
5. **PNG** - Portable Network Graphic (alternative to jpg)
6. **BMP** - Microsoft Windows Bitmap formatted image (large files, not much value in science application)
7. **TIF** - Tagged Image File Format (many types, preferred by publishers)
8. **WMF** - Windows Meta File

# On Image Manipulation-

(American Society for Microbiology-Instructions to Authors)

*“Computer-generated images may be processed only minimally. Processing (e.g., changing contrast, brightness or color balance) is acceptable only if applied to all parts of the image, as well as to the controls, equally, and descriptions of all such adjustments and the tools used (both hardware and software) must be provided in the manuscript. Unprocessed data and files must be retained by the authors and be provided to the editor on request.”*

# Illustrations

*(American Society for Microbiology-Instructions to Authors)*

**File types and formats.** Illustrations may be continuous-tone images, line drawings, or composites. Color graphics may be submitted, but the cost of printing in color must be borne by the author.

At the modification stage, production quality digital figure files must be submitted. All graphics submitted with modified manuscripts must be bitmap, grayscale, or in the **RGB** (preferred) or **CMYK** color mode. Halftone images (those with various densities or shades) must be grayscale, not bitmap. JB accepts **TIFF** or **EPS** files but discourages PowerPoint for either black-and-white or color images. Note that all figures submitted in RGB or CMYK color will be processed as color and that you will incur color figure charges. If you submit a single Power-Point file containing multiple figures, it is important to ensure that each individual figure is saved in the color format (bitmap, grayscale, or RGB) in which you intend it to be published.

For instructions on creating acceptable EPS and TIFF files, refer to the Cadmus digital art website, <http://art.cadmus.com/da/index.jsp>. PowerPoint requires users to pay close attention to the fonts used in their images (see the section on fonts below). If instructions for fonts are not followed exactly, images prepared for publication are subject to missing characters, improperly converted characters, or shifting/obscuring of elements or text in the figure. For proper font use in PowerPoint images, refer to the Cadmus digital art website, [http://art.cadmuscom/da/instructions/ppt\\_disclaimer.jsp](http://art.cadmuscom/da/instructions/ppt_disclaimer.jsp).

# Illustrations

*(American Society for Microbiology-Instructions to Authors)*

**File types and formats.** Illustrations may be continuous-tone images, line drawings, or composites. Color graphics may be submitted, but the cost of printing in color must be borne by the author.

At the modification stage, production quality digital figure files must be submitted. All graphics submitted with modified manuscripts must be bitmap, grayscale, or in the **RGB** (preferred) or **CMYK** color mode. Halftone images (those with various densities or shades) must be grayscale, not bitmap. JB accepts **TIFF** or **EPS** files but discourages PowerPoint for either black-and-white or color images. Note that all figures submitted in RGB or CMYK color will be processed as color and that you will incur color figure charges. If you submit a single Power-Point file containing multiple figures, it is important to ensure that each individual figure is saved in the color format (bitmap, grayscale, or RGB) in which you intend it to be published.

For instructions on creating acceptable EPS and TIFF files, refer to the Cadmus digital art website, <http://art.cadmus.com/da/index.jsp>. PowerPoint requires users to pay close attention to the fonts used in their images (see the section on fonts below). If instructions for fonts are not followed exactly, images prepared for publication are subject to missing characters, improperly converted characters, or shifting/obscuring of elements or text in the figure. For proper font use in PowerPoint images, refer to the Cadmus digital art website, [http://art.cadmuscom/da/instructions/ppt\\_disclaimer.jsp](http://art.cadmuscom/da/instructions/ppt_disclaimer.jsp).

# Illustrations (cont'd)

*(American Society for Microbiology-Instructions to Authors)*

“For instructions on creating acceptable EPS and TIFF files, refer to the Cadmus digital art website, <http://artcadmus.com/da/index.jsp>. PowerPoint requires users to pay close attention to the fonts used in their images (see the section on fonts below). If instructions for fonts are not followed exactly, images prepared for publication are subject to missing characters, improperly converted characters, or shifting/obscuring of elements or text in the figure. For proper font use in PowerPoint images, refer to the Cadmus digital art website, [http://art.cadmus.com/da/instructions/ppt\\_disclaimer.jsp](http://art.cadmus.com/da/instructions/ppt_disclaimer.jsp).

## **Other important considerations**

- Minimum resolution (at least 600dpi)
- Size (should be journal column size)



# Making a Publication Quality Graph



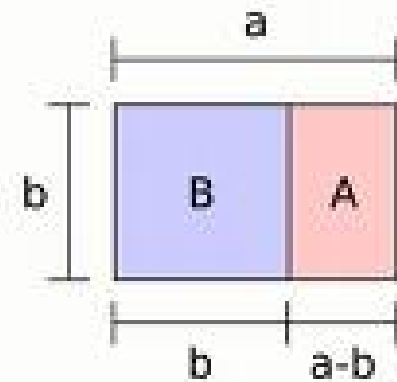


# Graphs as a form of art...

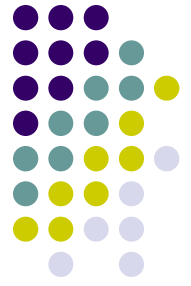
Graphs are essentially alternative representations of data and can be optimized for particular applications—aesthetics as well as accuracy are important.

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.



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



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



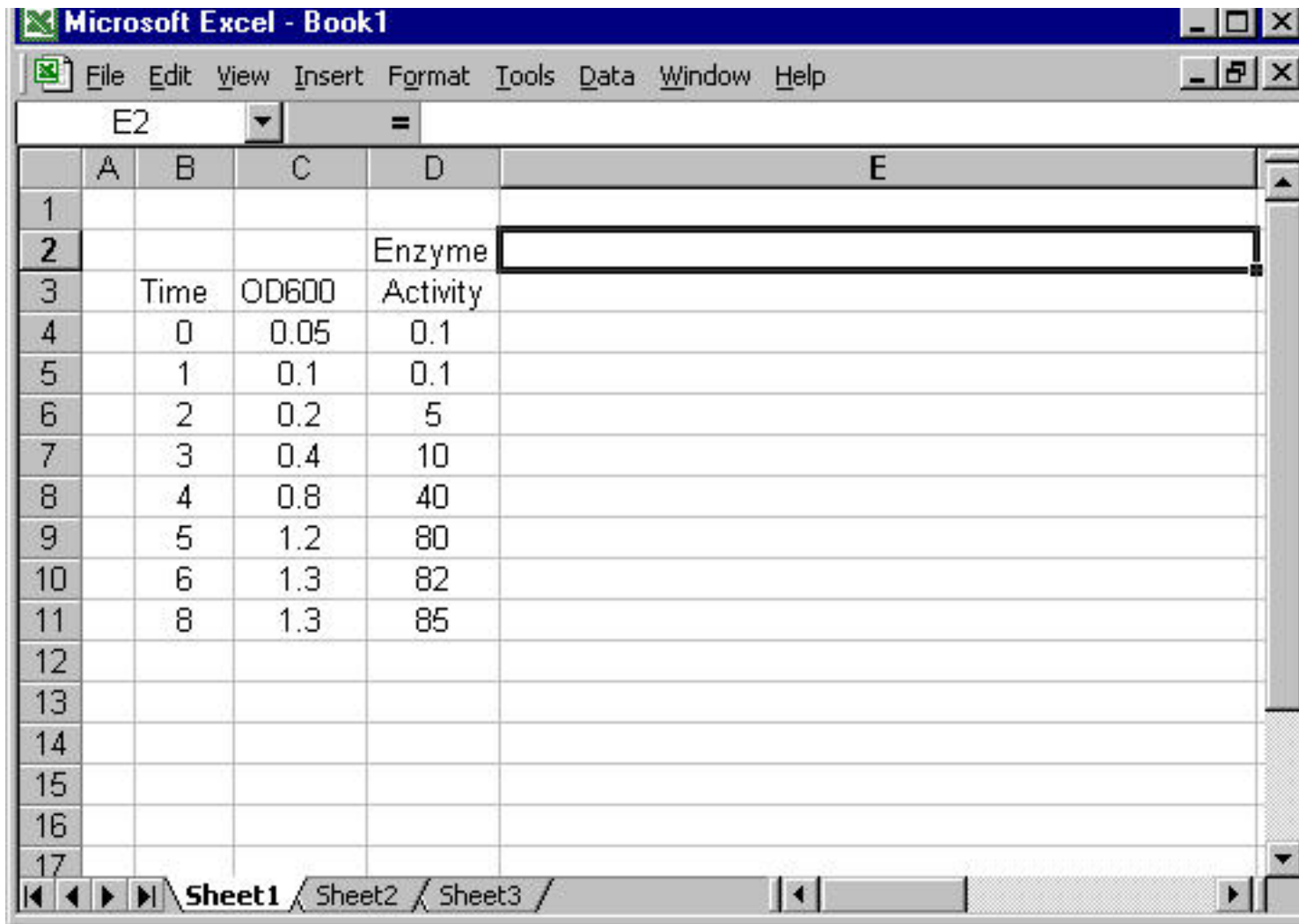
The following example illustrates some of the changes...

## **Growth dependent gene expression in Minimal Media..**

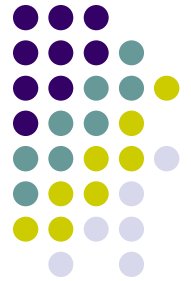
- In this example we will plot two data (Enzyme activity, OD600) against time using two y scales.
- Although Excel is used in this example, similar results can be obtained using other spreadsheet programs...

## Adding data to spreadsheet...

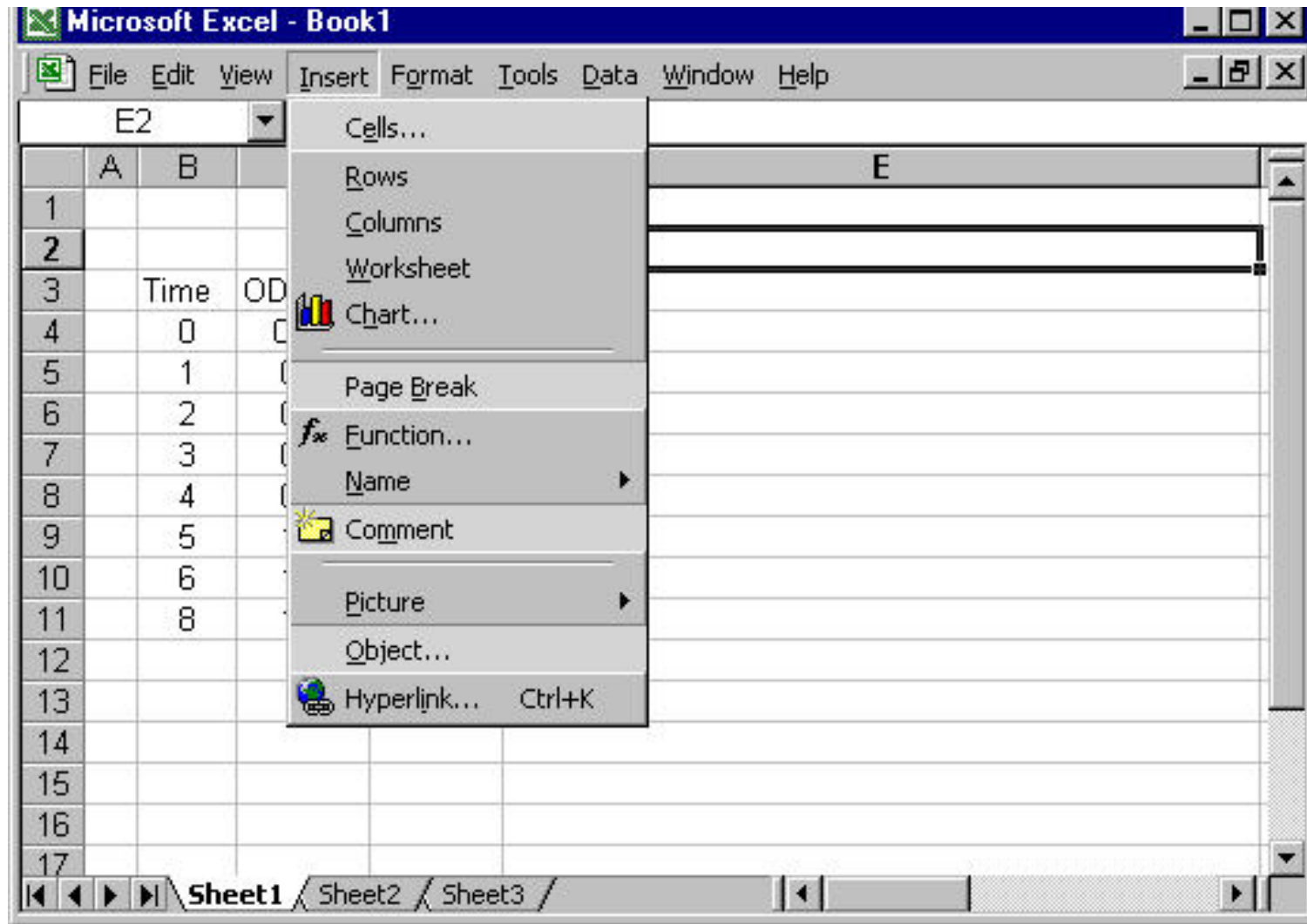
- *Type the data into columns as indicated...*



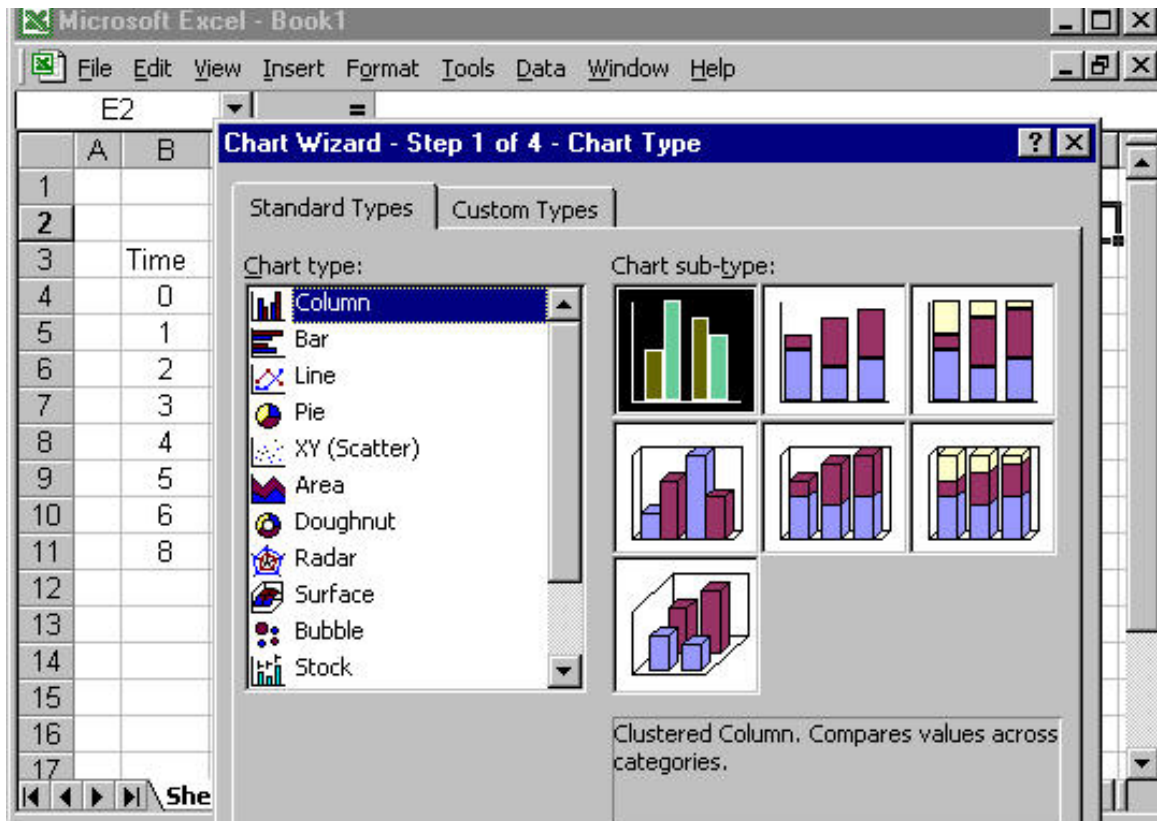
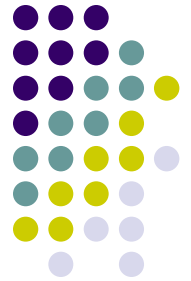
	A	B	C	D	E
1					
2				Enzyme	
3		Time	OD600	Activity	
4		0	0.05	0.1	
5		1	0.1	0.1	
6		2	0.2	5	
7		3	0.4	10	
8		4	0.8	40	
9		5	1.2	80	
10		6	1.3	82	
11		8	1.3	85	
12					
13					
14					
15					
16					
17					



## Insert a chart into the spreadsheet...



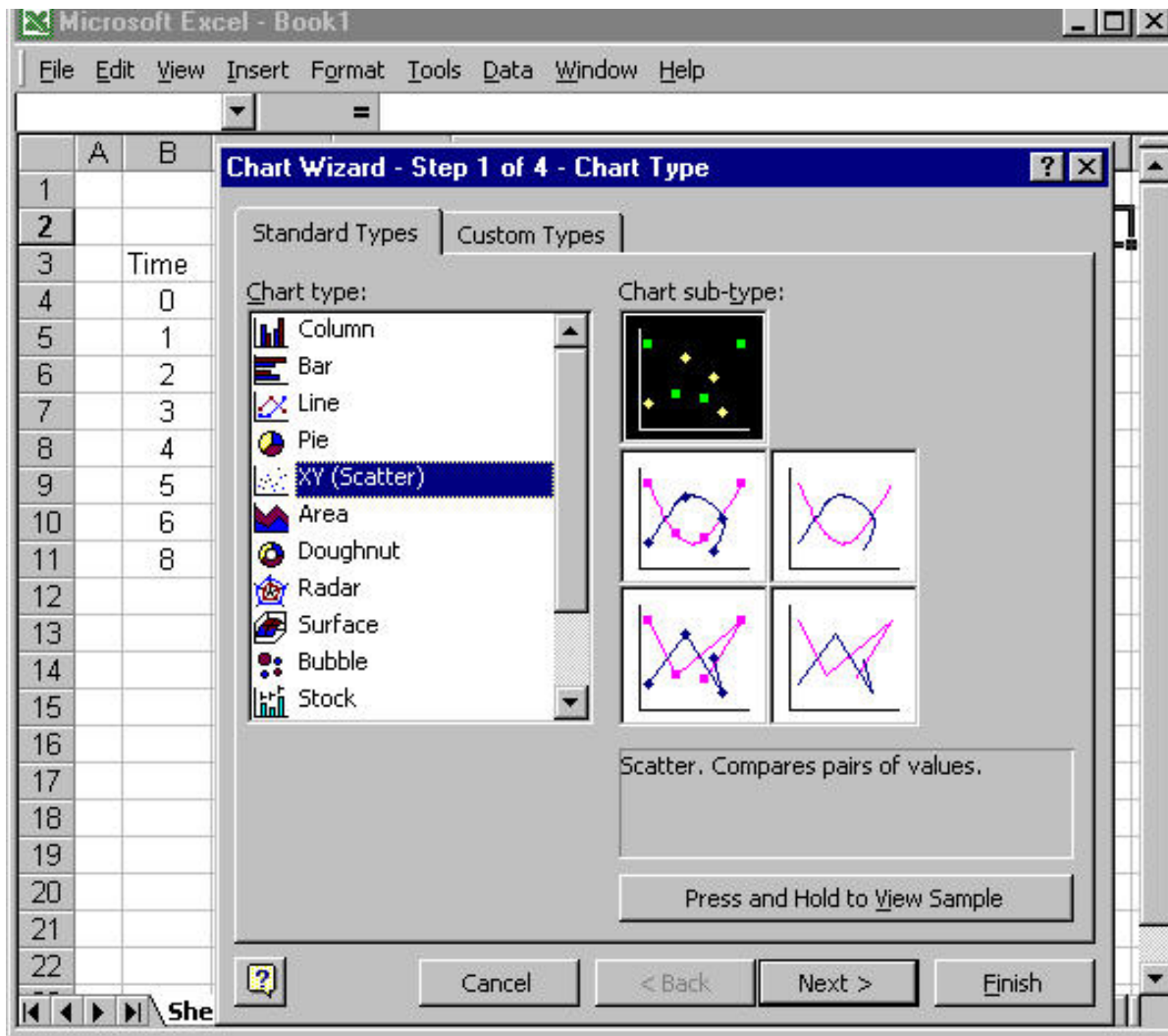
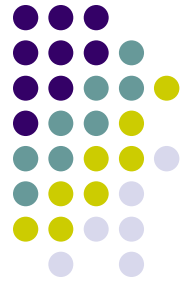
## *Pick the appropriate chart type*



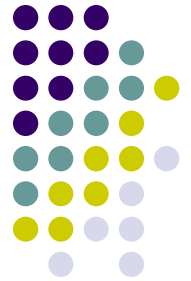
Inserting a chart into the spreadsheet...

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”

*So in this case, we will choose an “XY” graph..*







## *Insert the graph into the spreadsheet...*

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E
1					
2				Enzyme	
3		Time	OD600	Activity	
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					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

The Chart Wizard dialog box is open, showing the following options:

- Place chart:  As new sheet: Chart1
- As object in: Sheet1

Buttons: Cancel, < Back, Next >, Finish

## Choose the data series to be plotted...



Chart Wizard - Step 2 of 4 - Chart Source Data

Data Range Series

Enzyme

Data range:

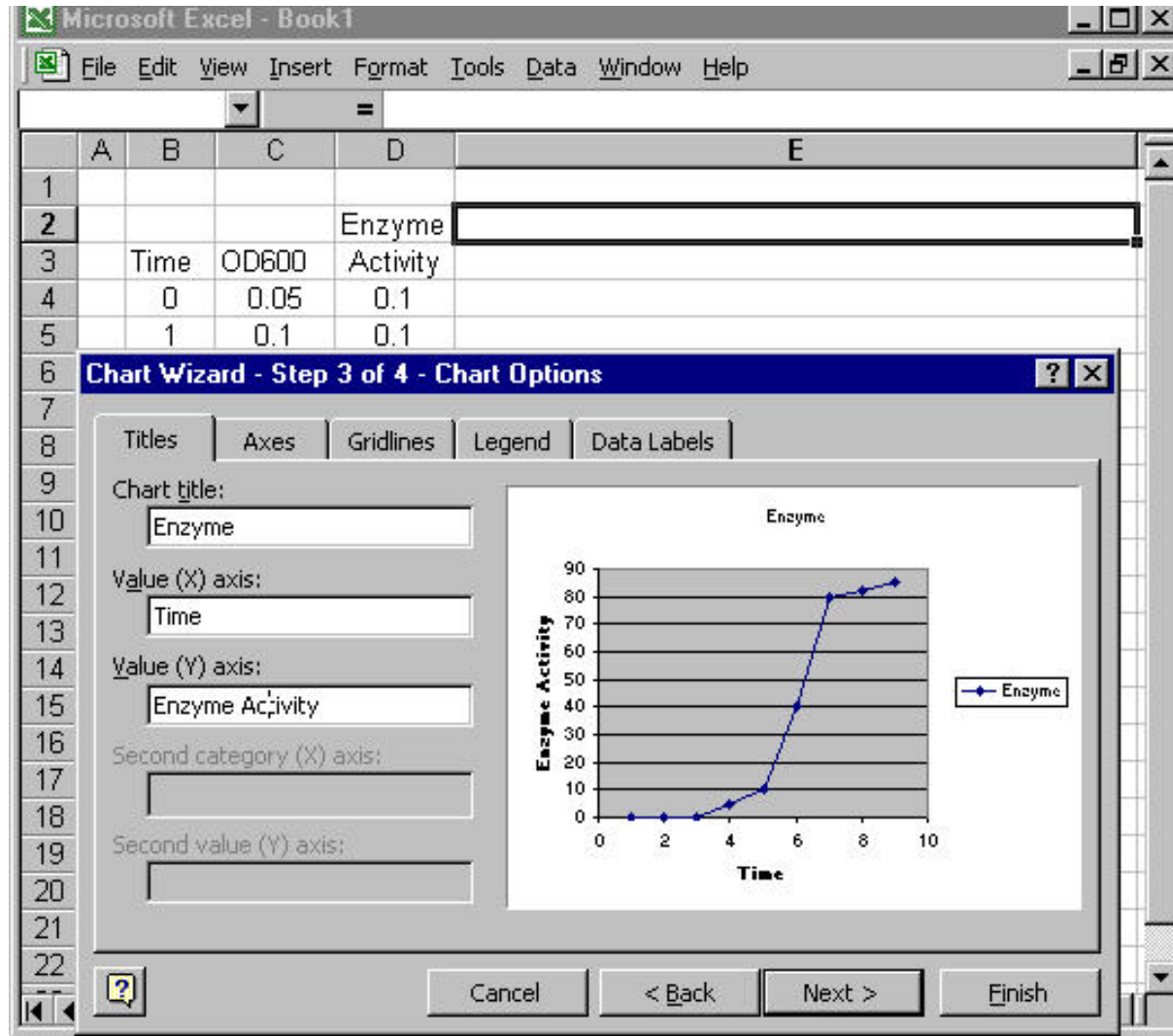
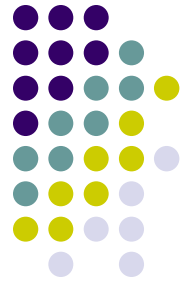
Series in:

- Rows
- Columns

Time	Enzyme
0	0
1	0
2	0
3	2
4	5
5	10
6	40
7	80
8	82
9	85

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

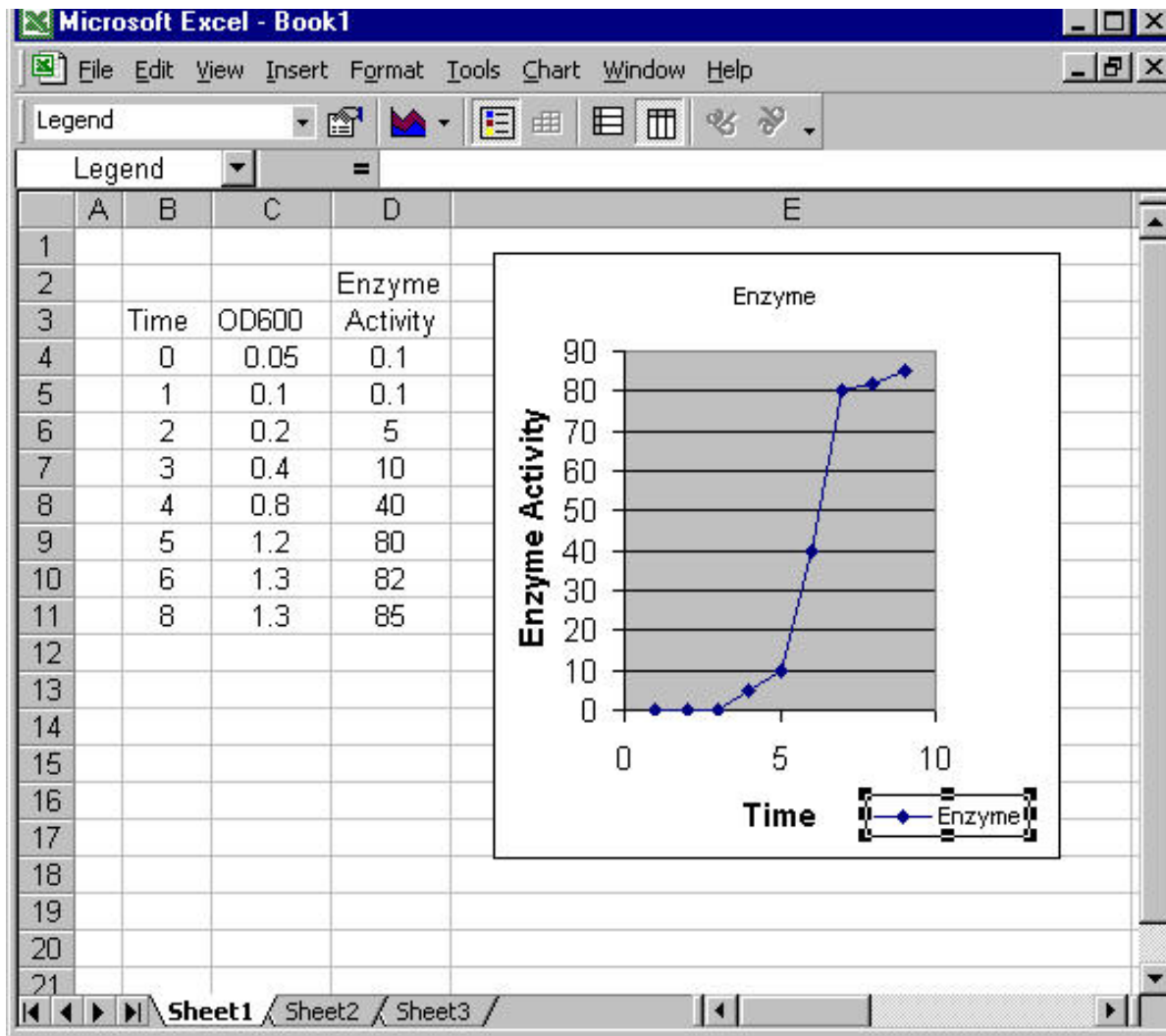
## Add labels to the graph...



Use meaningful labels with units, if appropriate.



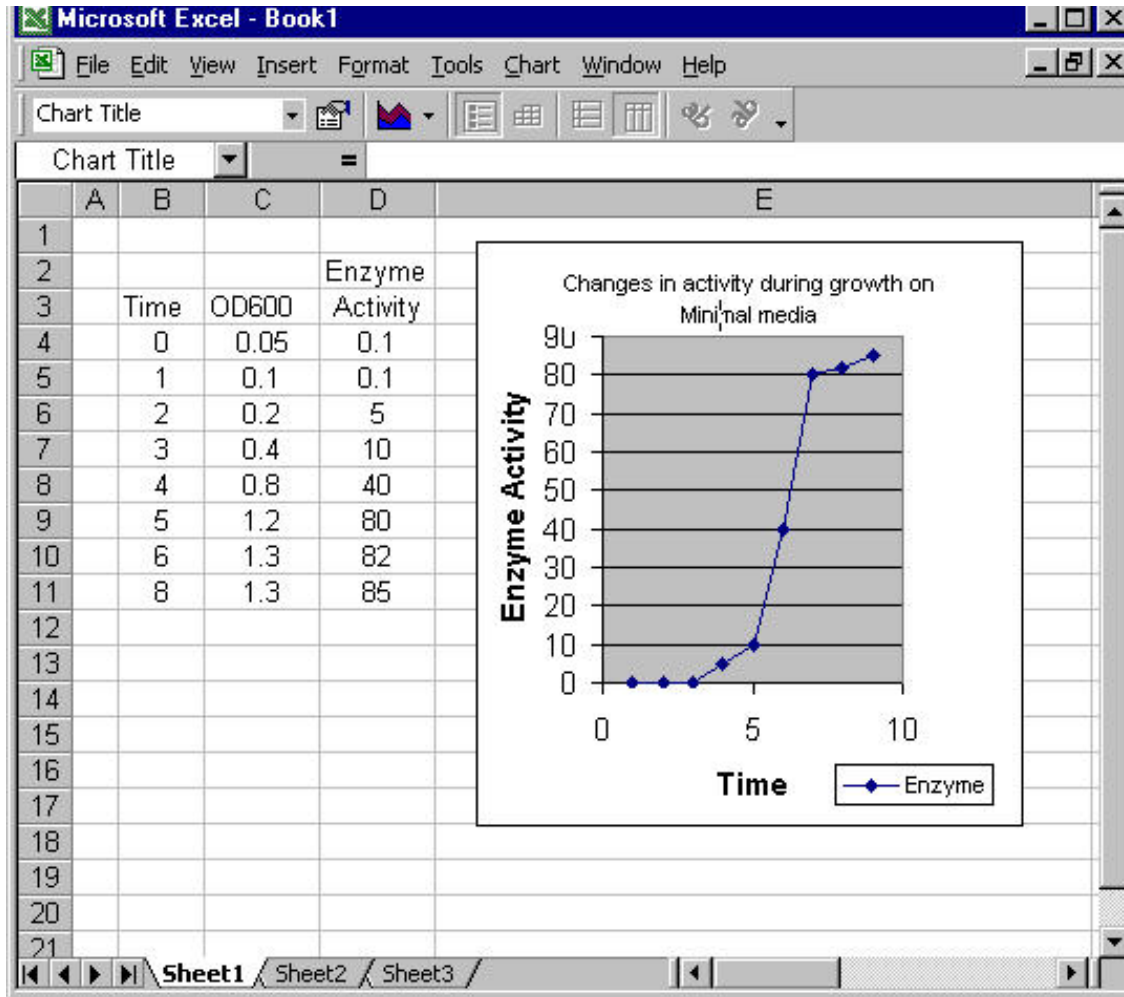
## Add a meaningful title...



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

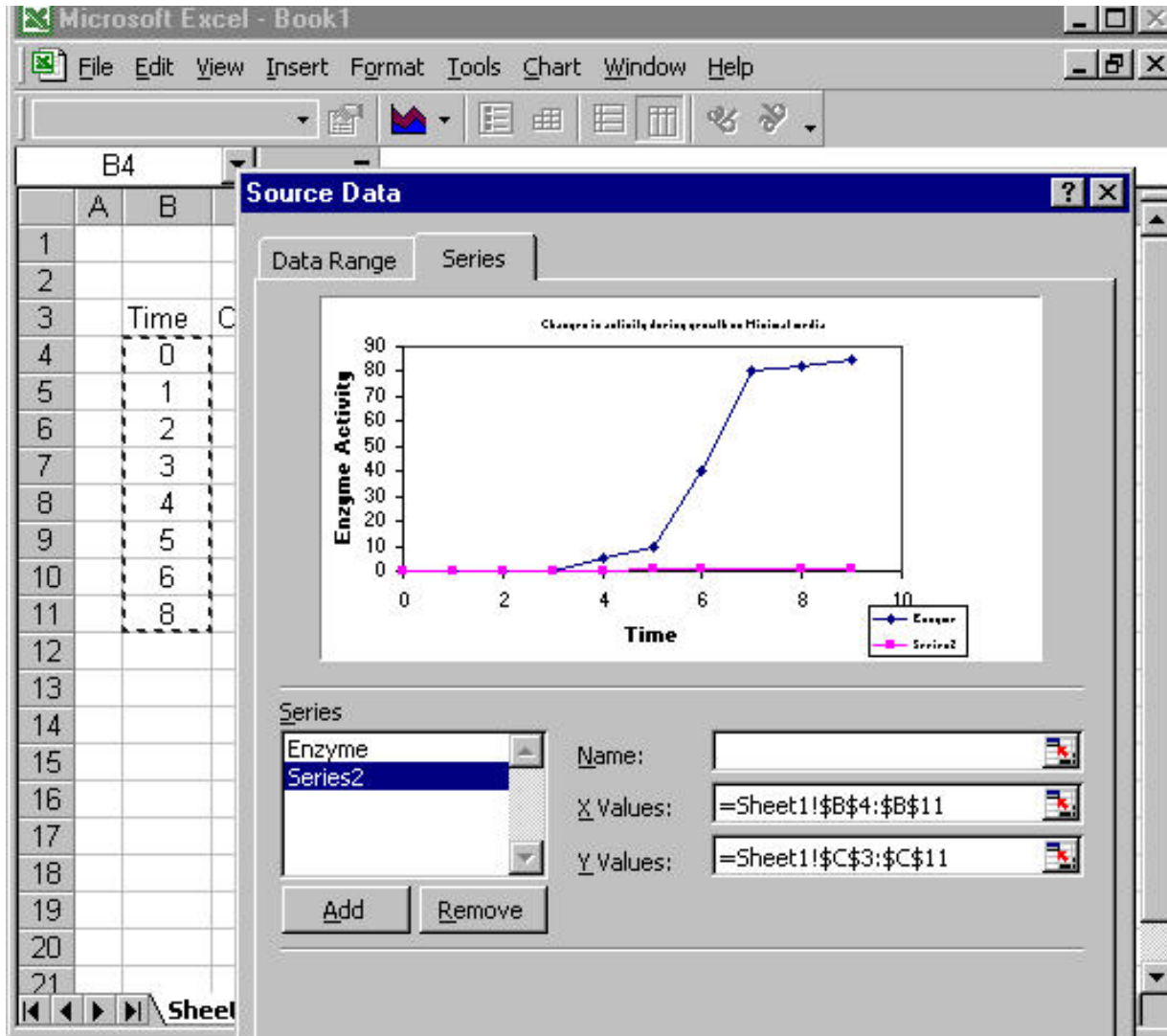


## Graph title



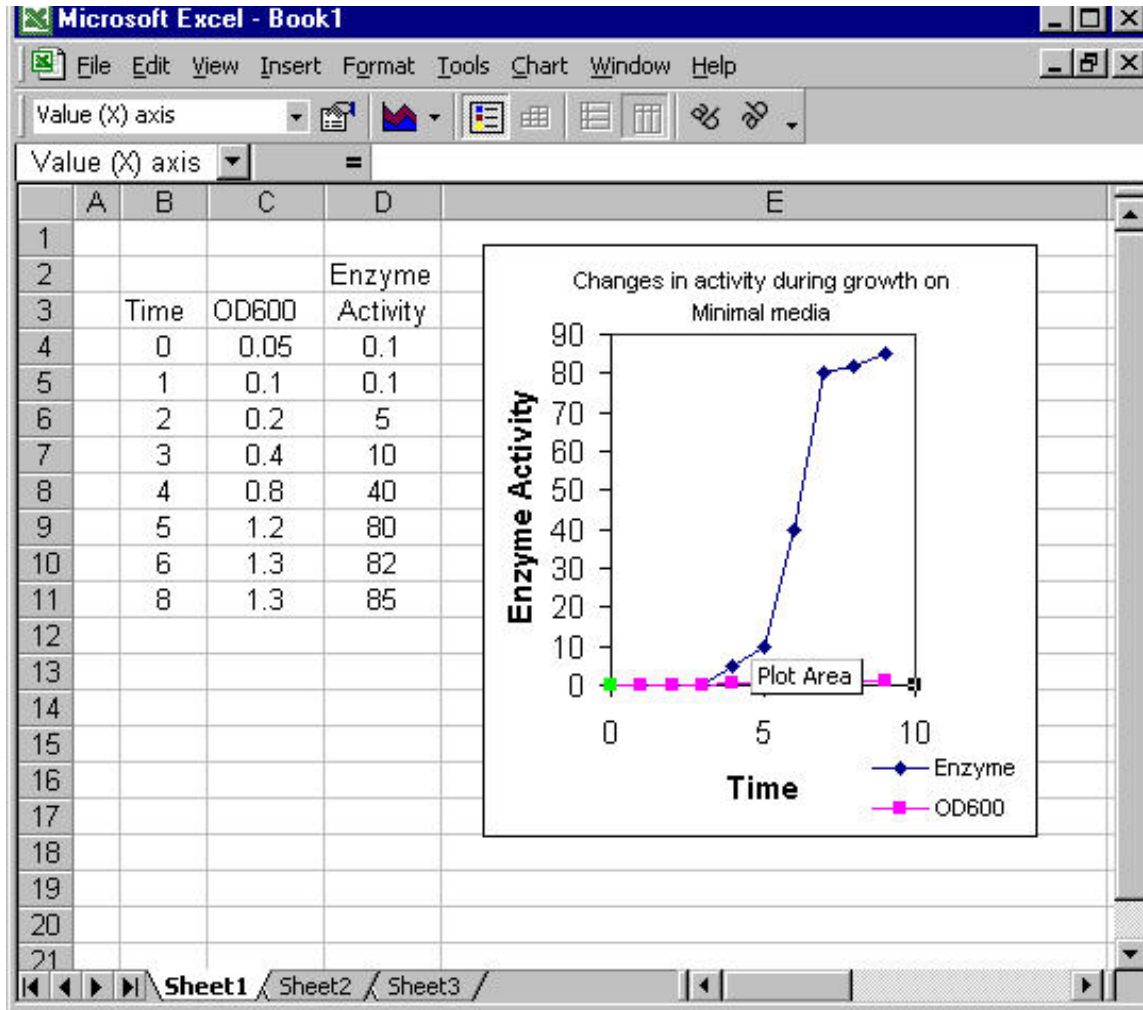
Here I have chosen a title that reflects the data that is plotted...

## Add the growth data (OD600)...



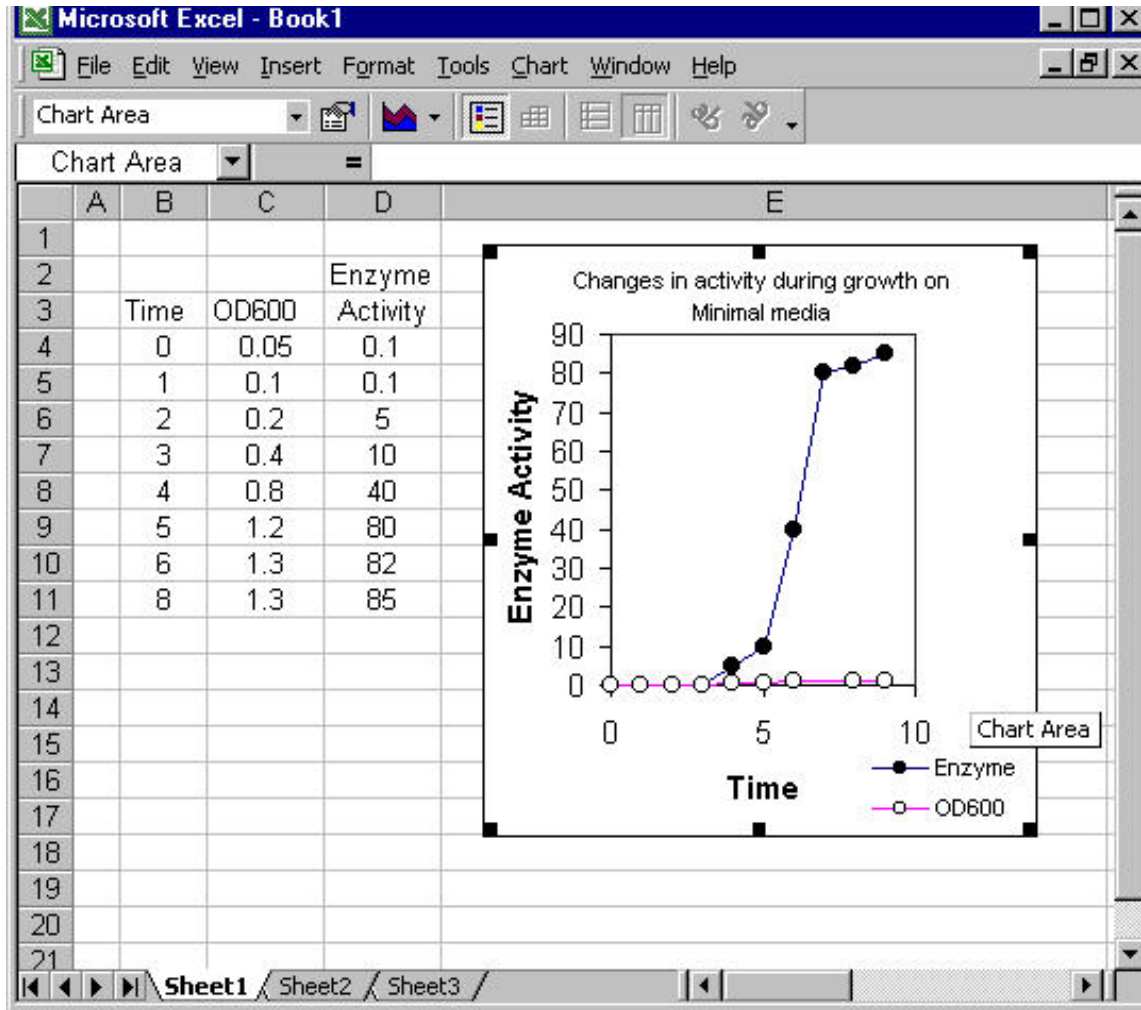
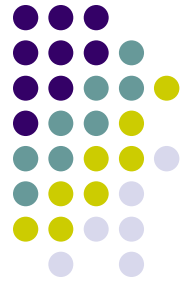
Add the data to the graph...

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



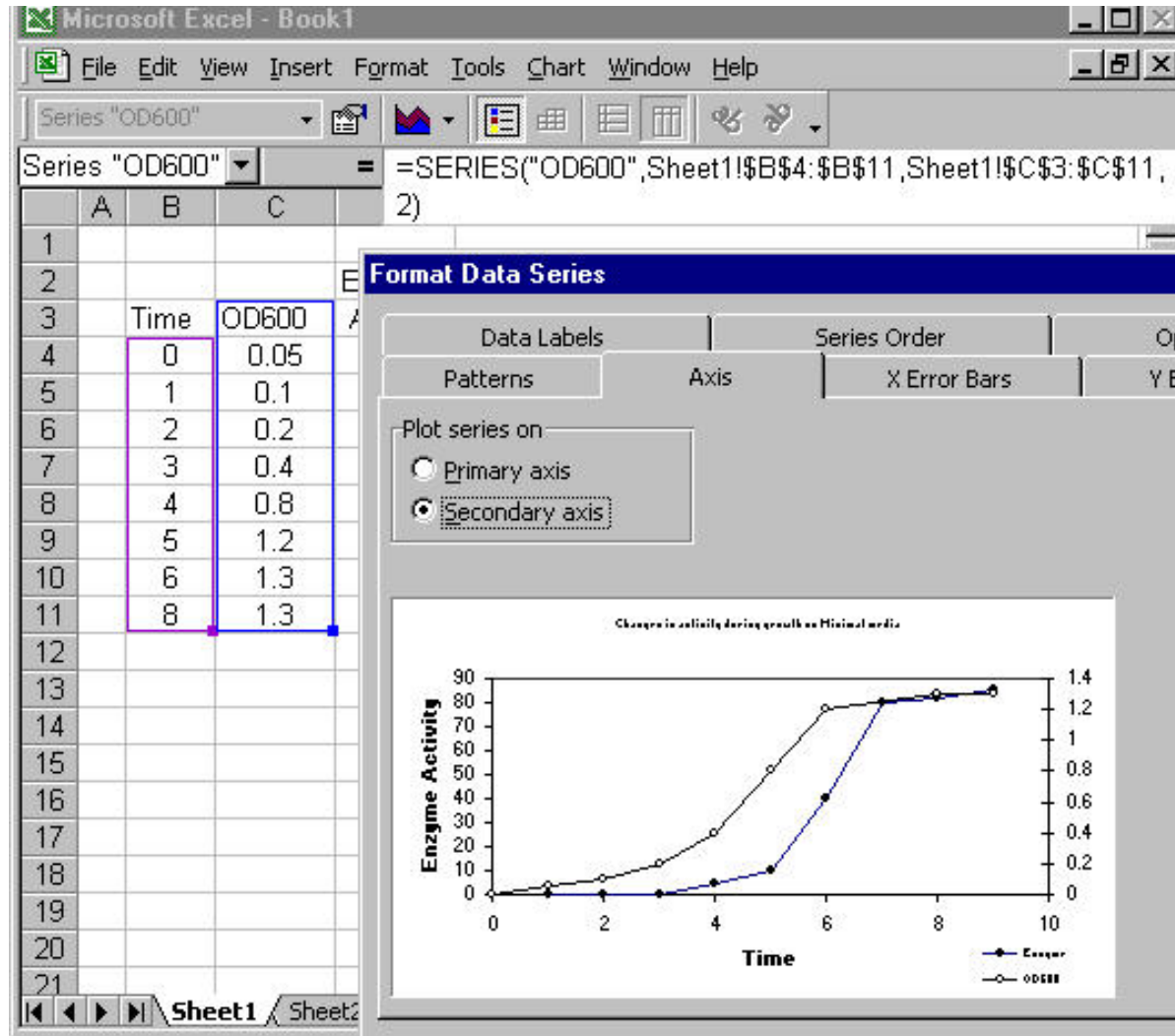
The default colors and symbols used in both Excel and Quattro Pro are not suitable for scientific publication and must be modified. Use open and filled circles and squares...

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

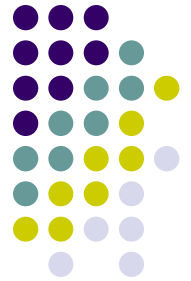




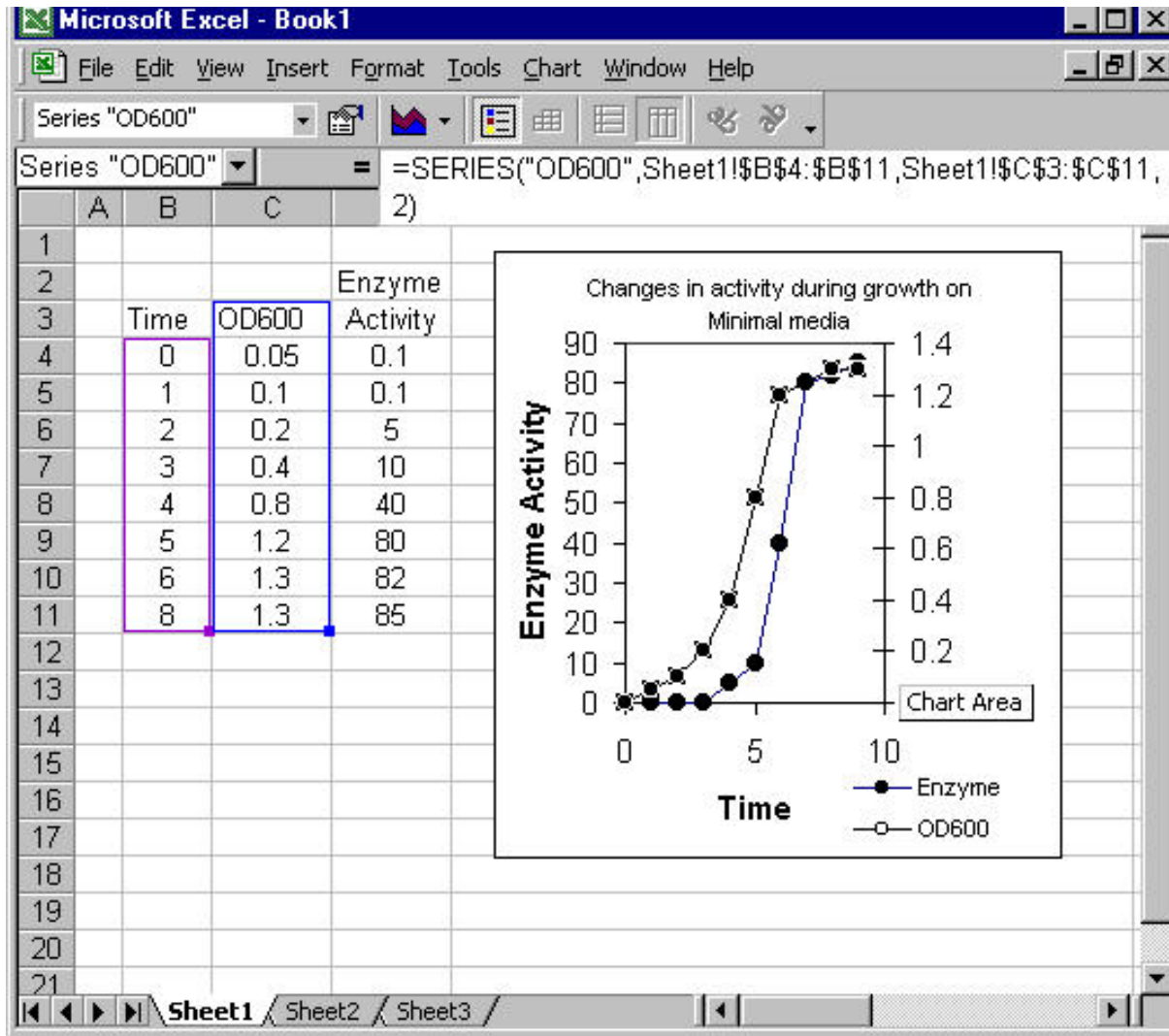
*The growth data in this case must be plotted on a secondary y scale...*



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

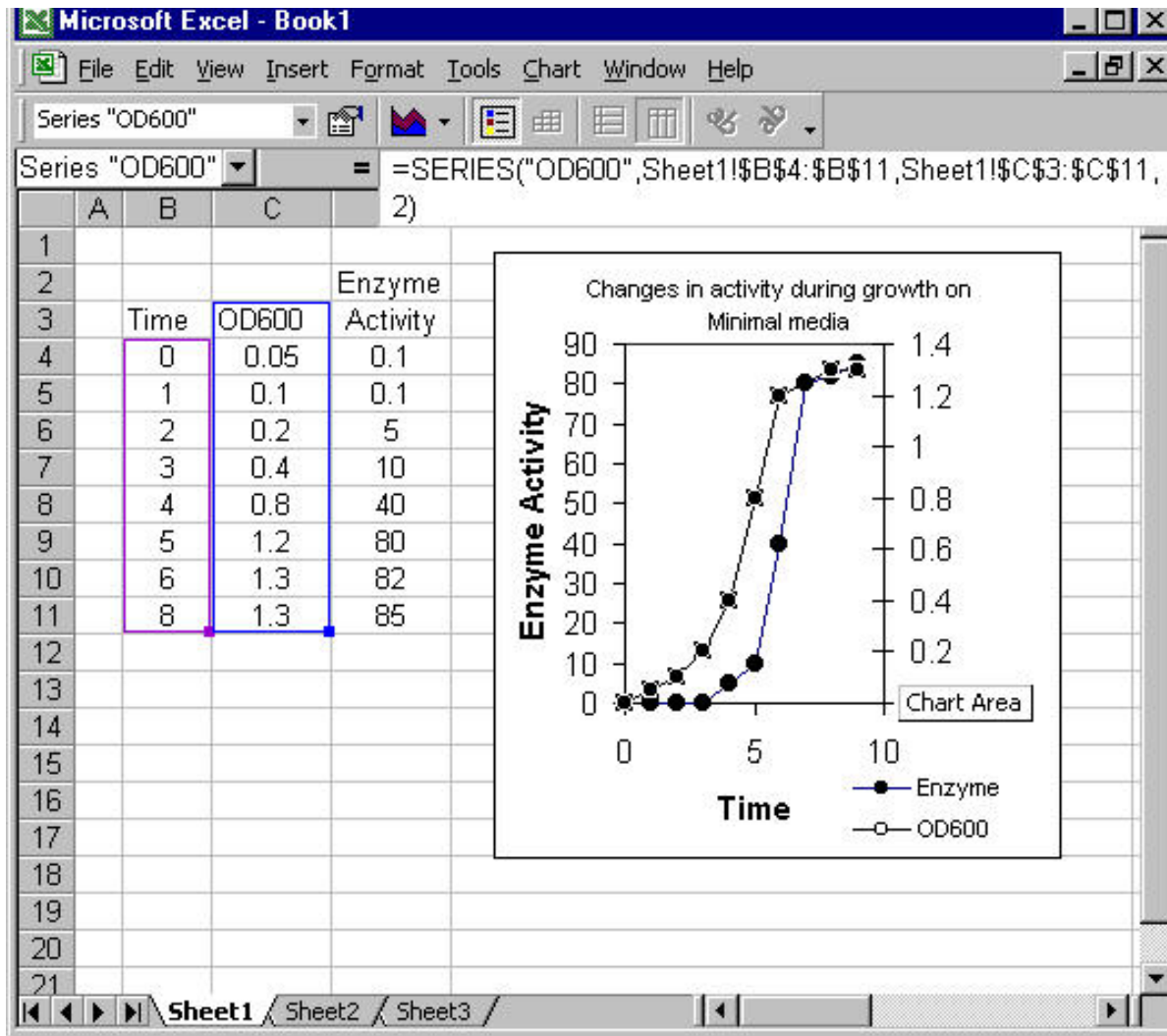


***Several elements of this basic graph must still be changed...***





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



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

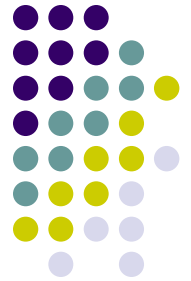


The screenshot shows Microsoft Excel with a data table and the 'Format Axis' dialog box open. The data table is as follows:

	A	B	C	D	E
1					
2				Enzyme	
3		Time	OD600	Activity	
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					
13					
14					
15					
16					
17					
18					
19					
20					
21					

The 'Format Axis' dialog box is open, showing the 'Patterns' tab. The 'Lines' section has 'Automatic' selected. The 'Major tick mark type' section has 'Crossed' selected. The 'Minor tick mark type' section has 'None' selected. The 'Tick mark labels' section has 'Next to axis' selected. The 'OK' button is visible at the bottom right of the dialog box.

## Change OD600 to exponential scale...



Microsoft Excel - Book1

File Edit View Insert Format Tools Chart Window Help

Secondary value (Y) axis

Secondary va... =

	A	B	C	D	E
1					
2				Enzyme	
3		Time	OD600	Activity	
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					
13					
14					
15					
16					
17					
18					
19					
20					
21					

**Format Axis**

Patterns Scale Font Number Alignment

Value (Y) axis scale

Auto

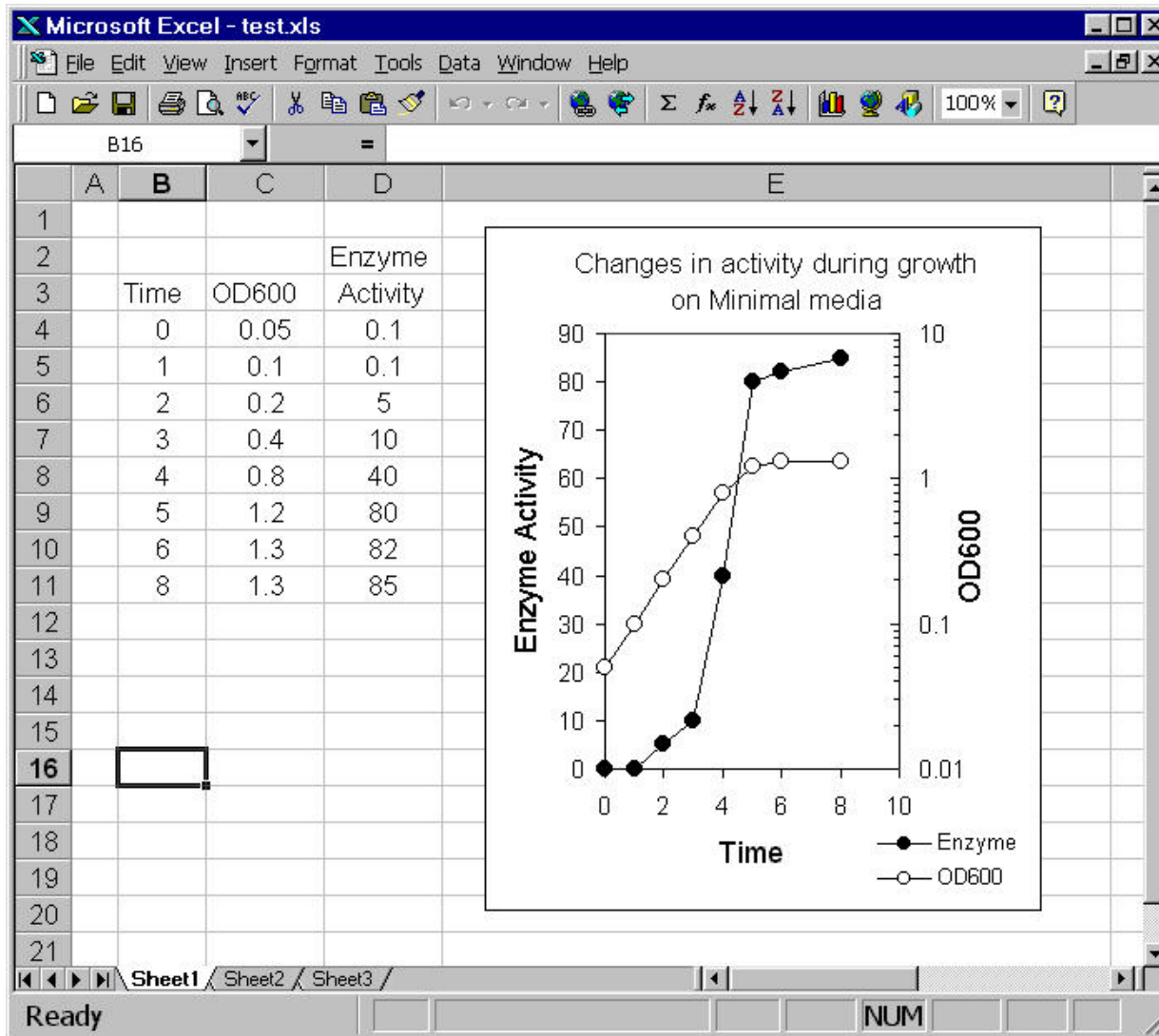
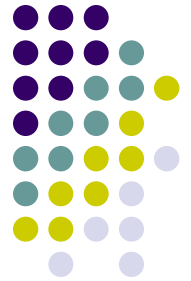
- Minimum: 0
- Maximum: 1.4
- Major unit: 0.2
- Minor unit: 0.04
- Value (X) axis
- Crosses at: 0

Display units: None  Show display units

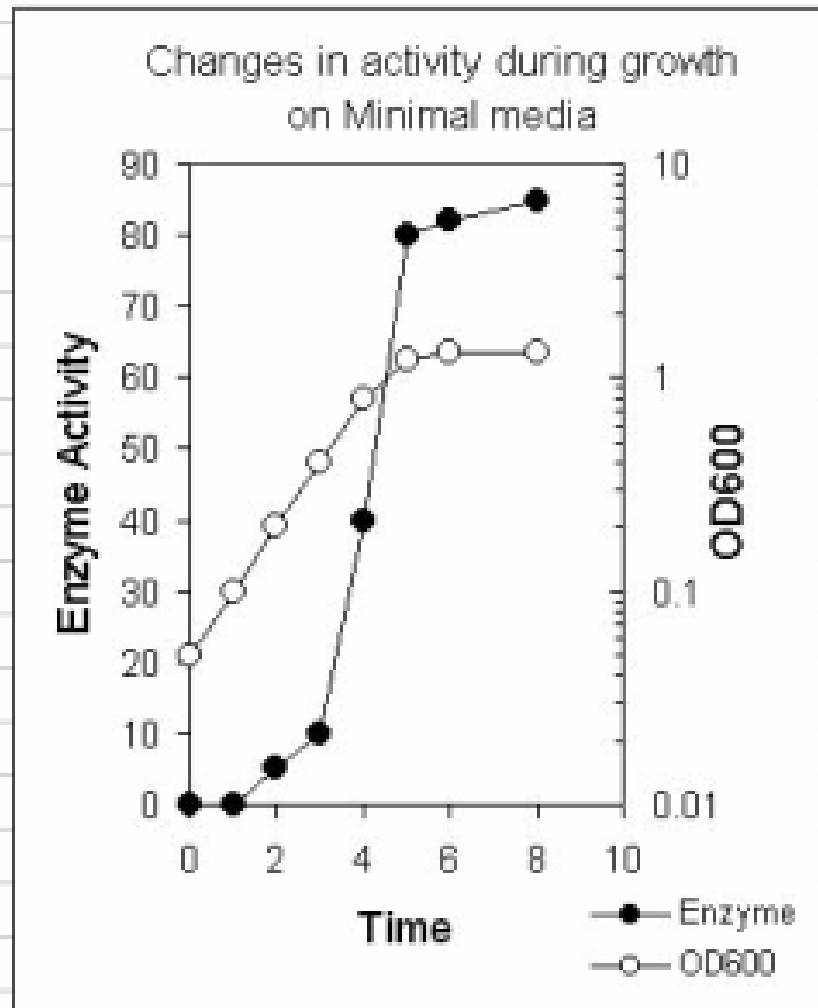
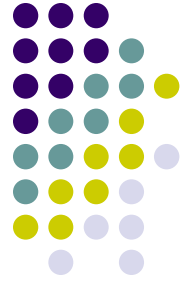
- Logarithmic scale**
- Values in reverse order
- Value (X) axis crosses at maximum value

OK

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

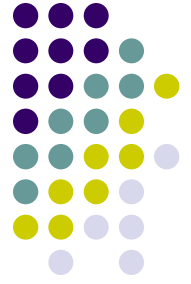


# *The final figure....*



(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.



## 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/jbitoa09.pdf> see page 12)
- Cell (<http://www.cell.com/authors#figures> )



# Assignment..

- Prepare a publication Quality Graph of your Acid Phosphatase data.
  - Plot Acid Phosphatase against sample type (WT, RpoS Mutant).
  - Use a chart graph.
  - Include standard errors bars (use “help” to find this if you haven’t done this before...)