

# Calculating Descriptive Statistics and Making Graphs in Excel 2016

1. Open a Microsoft Office Excel spreadsheet.
2. Arrange your data such that each treatment is in a single column, as shown below:

|    | A | B                  | C                       | D                       | F | G | H | I | J | K | L | M | N |
|----|---|--------------------|-------------------------|-------------------------|---|---|---|---|---|---|---|---|---|
| 1  |   | water              | Glucose production (mm) | Protein production (mm) |   |   |   |   |   |   |   |   |   |
| 2  |   | 0                  | 33                      | 1                       |   |   |   |   |   |   |   |   |   |
| 3  |   | 1                  | 48                      | 0                       |   |   |   |   |   |   |   |   |   |
| 4  |   | 1                  | 87                      | 2                       |   |   |   |   |   |   |   |   |   |
| 5  |   | 2                  | 77                      | 4                       |   |   |   |   |   |   |   |   |   |
| 6  |   | 2                  | 54                      | 2                       |   |   |   |   |   |   |   |   |   |
| 7  |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 8  |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 9  |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 10 |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 11 |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 12 |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 13 |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |
| 14 |   | Control            | Glucose                 | Protein                 |   |   |   |   |   |   |   |   |   |
| 15 |   | mean               |                         |                         |   |   |   |   |   |   |   |   |   |
| 16 |   | standard deviation |                         |                         |   |   |   |   |   |   |   |   |   |
| 17 |   | 1/2 SD             |                         |                         |   |   |   |   |   |   |   |   |   |
| 18 |   |                    |                         |                         |   |   |   |   |   |   |   |   |   |

We will use Excel to calculate the Mean and Standard Deviation of CO<sub>2</sub> production for the Control, Glucose and Protein groups.

3. Place your cursor in the cell for the Control Mean as shown above.
4. Type “=average(“ in this cell.
5. Highlight cells B2 – B5 and then type “)”. See below:

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6. Press “Enter”. The mean value should enter the cell.

**Next, we will use a shortcut to calculate the mean for the two treatment groups.**

- Put your cursor in the lower right corner of the Control Mean cell. The cursor should turn into a “+” symbol.
- Left click in the lower right corner and drag across the cells for the Glucose and Protein Mean. See below:

| File Home Insert Page Layout Formulas Data Review View |                    |                    |                         |                             |   |
|--------------------------------------------------------|--------------------|--------------------|-------------------------|-----------------------------|---|
| Normal                                                 |                    | Page Break Preview | Page Layout             | Custom Views                |   |
| Workbook Views                                         |                    | Ruler Formula Bar  |                         | Zoom 100% Zoom to Selection |   |
| B15                                                    |                    | =AVERAGE(B2:B6)    |                         |                             |   |
|                                                        | A                  | B                  | C                       | D                           | F |
| 1                                                      |                    | water              | Glucose production (mm) | Protein production (mm)     |   |
| 2                                                      |                    | 0                  | 33                      | 1                           |   |
| 3                                                      |                    | 1                  | 48                      | 0                           |   |
| 4                                                      |                    | 1                  | 87                      | 2                           |   |
| 5                                                      |                    | 2                  | 77                      | 4                           |   |
| 6                                                      |                    | 2                  | 54                      | 2                           |   |
| 7                                                      |                    |                    |                         |                             |   |
| 8                                                      |                    |                    |                         |                             |   |
| 9                                                      |                    |                    |                         |                             |   |
| 10                                                     |                    |                    |                         |                             |   |
| 11                                                     |                    |                    |                         |                             |   |
| 12                                                     |                    |                    |                         |                             |   |
| 13                                                     |                    |                    |                         |                             |   |
| 14                                                     |                    | Control            | Glucose                 | Protein                     |   |
| 15                                                     | mean               | 1.2                | 59.8                    | 1.8                         |   |
| 16                                                     | standard deviation |                    |                         |                             |   |
| 17                                                     | 1/2 SD             |                    |                         |                             |   |
| 18                                                     |                    |                    |                         |                             |   |

Next, you will use an equation to calculate the Standard Deviation for each group.

9. Left click in the cell for the Control Standard Deviation.

10. Type “=stdev(“ in the cell.

11. Highlight cells B2 – B6 and type a “)” See below:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |               |                         |                         |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------------------|-------------------------|---|
| <div> <div> <div>Normal</div> <div>Page Break Preview</div> <div>Page Layout</div> <div>Custom Views</div> </div> <div> <div> <input checked="" type="checkbox"/> Ruler           <input checked="" type="checkbox"/> Formula Bar         </div> <div> <input checked="" type="checkbox"/> Gridlines           <input checked="" type="checkbox"/> Headings         </div> <div>Show</div> </div> <div> <div> <div>Zoom</div> <div>100%</div> <div>Zoom to Selection</div> </div> <div>Zoom</div> </div> </div> |                    |               |                         |                         |   |
| <div> <div>B16</div> <div>✕ ✓ <i>fx</i></div> <div>=STDEV(B2:B6)</div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |               |                         |                         |   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | A                  | B             | C                       | D                       | F |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | water         | Glucose production (mm) | Protein production (mm) |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | 0             | 33                      | 1                       |   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | 1             | 48                      | 0                       |   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | 1             | 87                      | 2                       |   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | 2             | 77                      | 4                       |   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    | 2             | 54                      | 2                       |   |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |               |                         |                         |   |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |               |                         |                         |   |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |               |                         |                         |   |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |               |                         |                         |   |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |               |                         |                         |   |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |               |                         |                         |   |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |               |                         |                         |   |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    | Control       | Glucose                 | Protein                 |   |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | mean               | 1.2           | 59.8                    | 1.8                     |   |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | standard deviation | =STDEV(B2:B6) |                         |                         |   |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1/2 SD             |               |                         |                         |   |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |               |                         |                         |   |

12. Press “Enter” and the Standard Deviation for the Control should enter the cell.

13. Calculate the Standard Deviation of the Glucose and Protein groups using the highlight and drag method you used for the Mean values.

**Next, you will calculate the ½ standard deviation for each group.**

14. Click in the Control ½ Standard Deviation cell.

15. Type “=0.5 \*B11 or whatever cell is your standard deviation cell” in the cell.

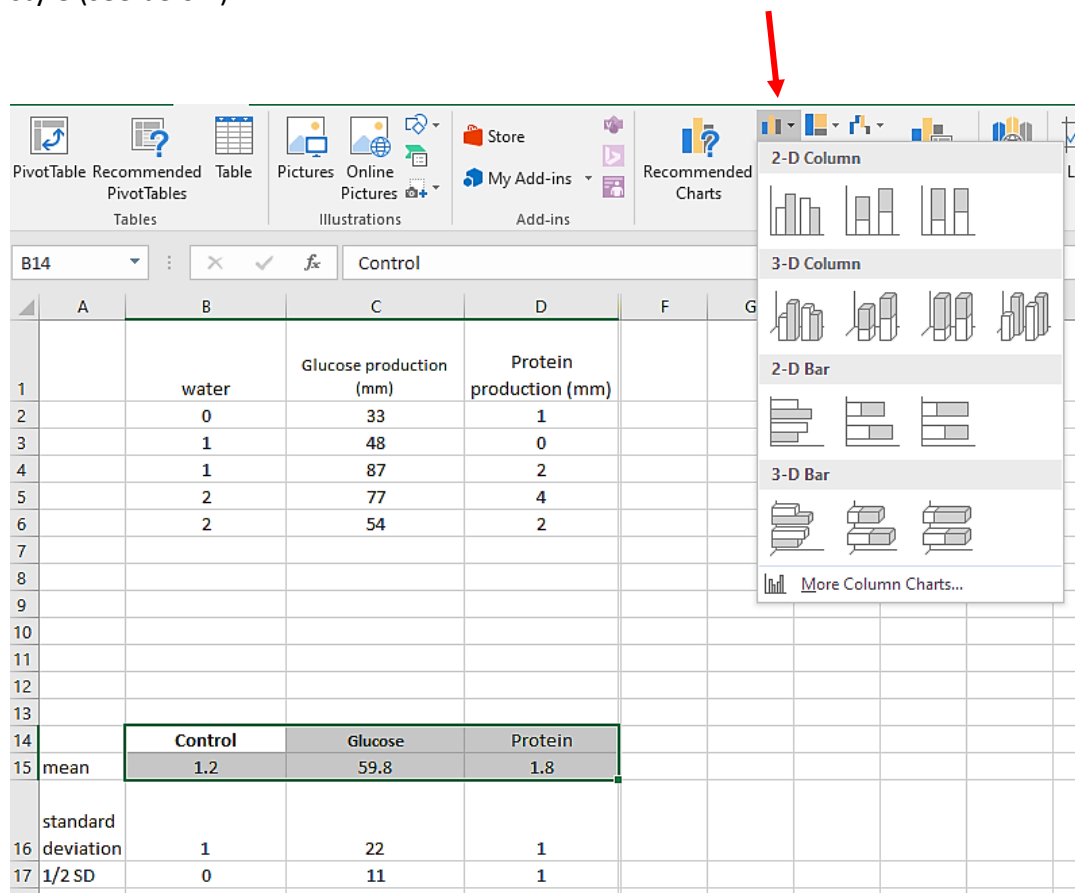
16. Then press enter.

17. Click and drag cell to calculate the ½ Standard Deviation for the Glucose and Protein treatments.

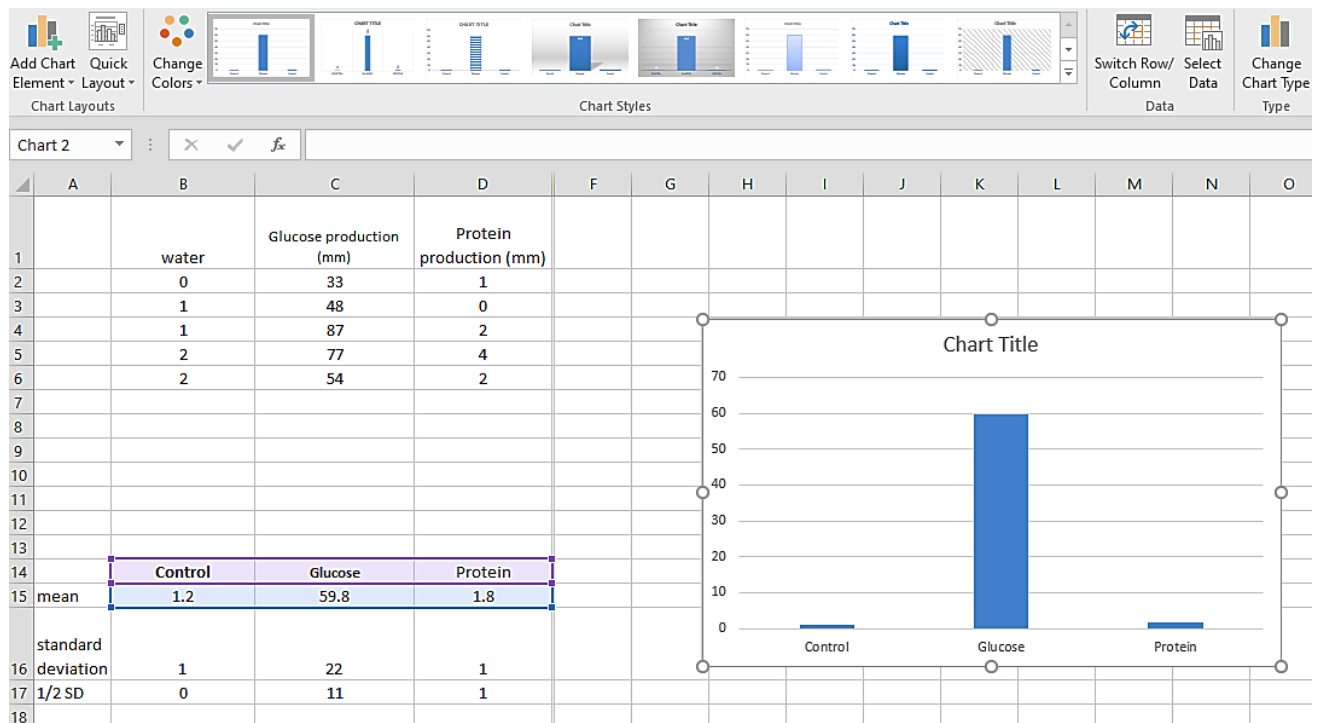
(You calculated the  $\frac{1}{2}$  standard deviation value by hand in lab to test for statistical significance between your groups. Make sure your hand-calculated value matches the value calculated in Excel. If the  $\frac{1}{2}$  standard deviation values differ, recalculate these values by hand to determine if you made an error in your hand calculation. Do not assume that the Excel value is correct and your hand calculation is wrong).

Now that we have your data in the spreadsheet, we will construct a bar graph.

18. Highlight the group titles and mean values (as shown below). In the top toolbar, click on 'Insert', then 'Charts', then click on "Column or Bar Chart". select the first 2-D column style (see below).



19. After selecting the 2-D column style, an Excel graph should pop-up on the screen. The graph should look like the one shown below:



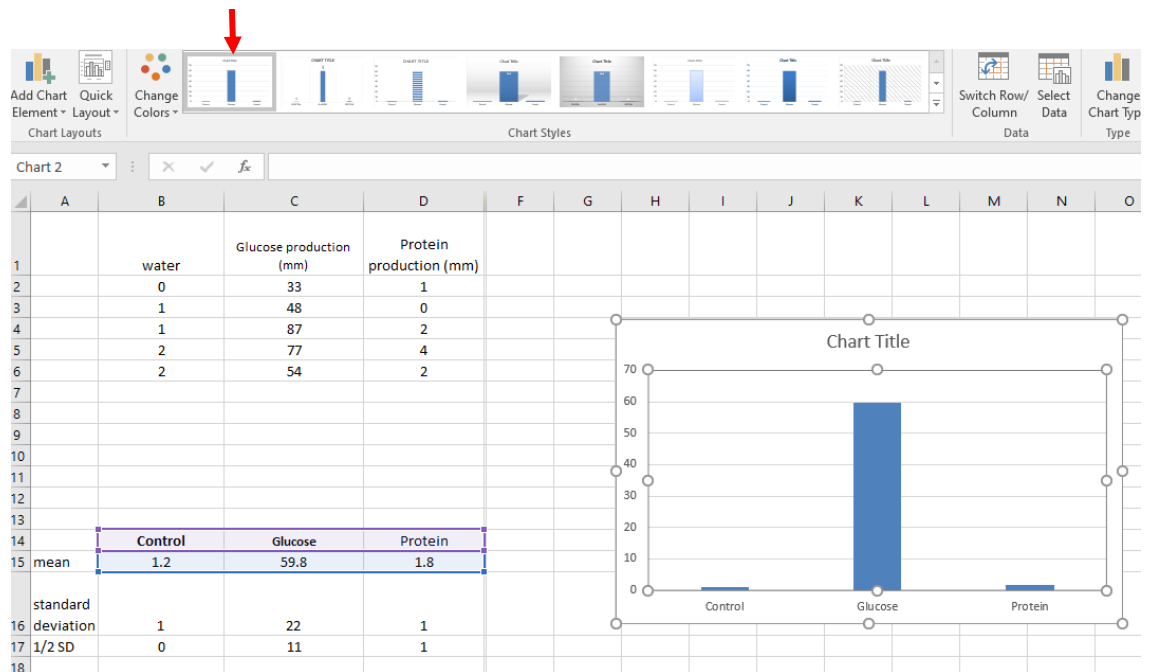
**Next, you will create axis labels for your graph**

20. Left click anywhere on the graph.

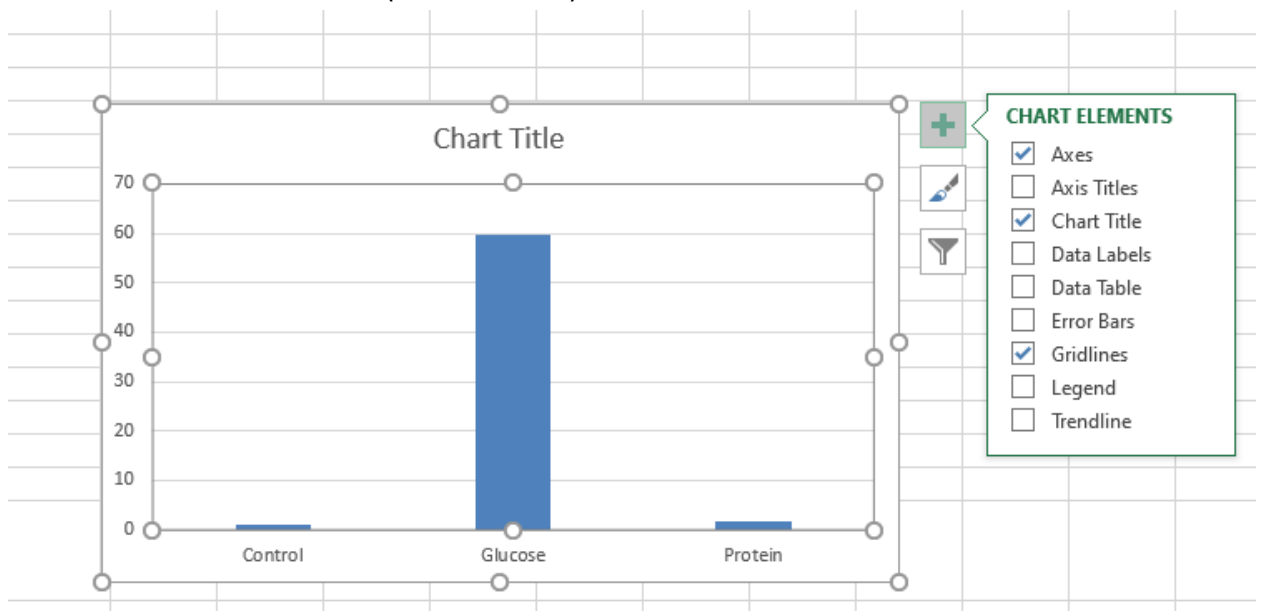
21. Click on 'Design' in the middle of the top toolbar.

22. Go to 'Chart Styles' and select the first chart design (unless one of the other layouts seems more appropriate for your data). See below:

23.



24. Click on the graph. Some icons should show to the right of the graph. Click on the + icon which is chart elements (Shown below).



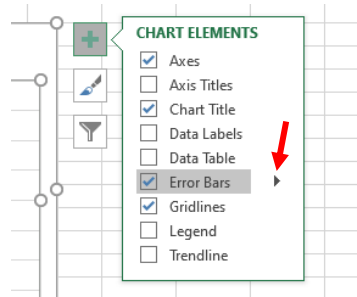
25. Check "Axes, Axis titles, Error Bars and Gridlines. **Uncheck** Chart Title.

26. You will be able to go back and write your Axis labels.

Make sure that the axis labels are short, yet descriptive. Specify any units of measurement in metric units. Adjust font size as deemed appropriate. We will add a caption to the graph later.

Next, you will add both upper and lower  $\frac{1}{2}$  standard deviation bars to each column in the bar graph.

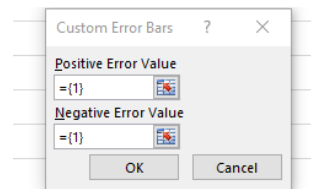
27. In the Chart Elements, click on the Error Bars and you will see a small arrow to the side. Click on the small arrow.



28. After you click on the arrow, you will get a menu of choices, pick the “More Options” and click on that choice.

29. You should then see the **Format Error Bars** choices. Go down to the **Error Amount** options and click on “Custom”. Next click on the “Specify Value” box.

30. A ‘Custom Error Bars’ box should appear.



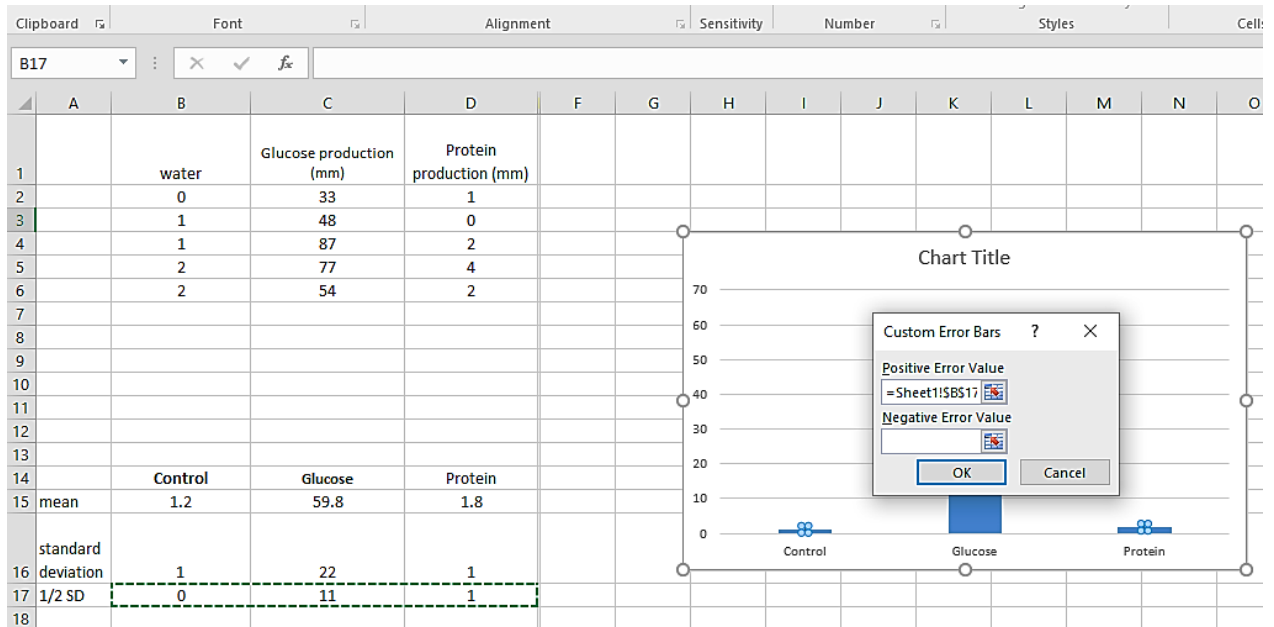
Next, you will add both positive  $\frac{1}{2}$  standard deviation and negative  $\frac{1}{2}$  standard deviation values.

31. Click in the ‘Positive Error Value’ box.

32. Delete the “={1}” value in the box.



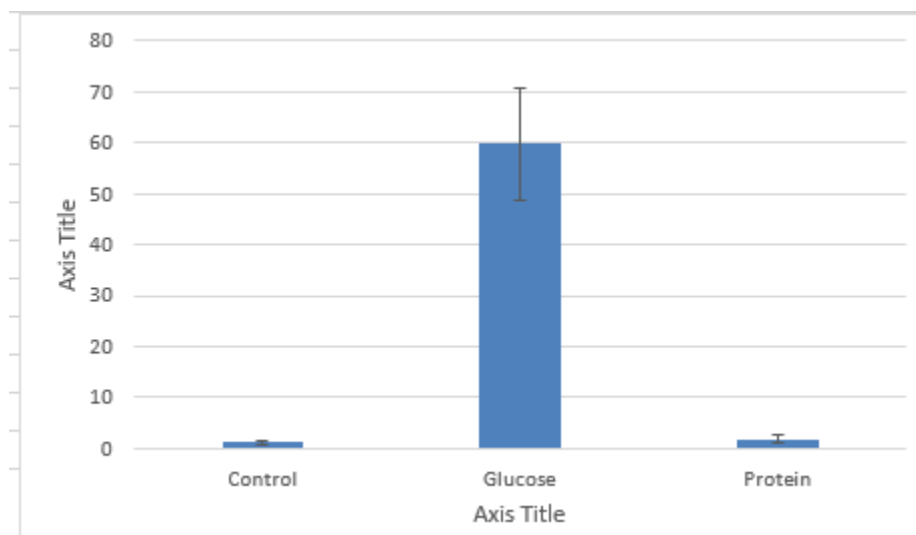
33. Highlight the  $\frac{1}{2}$  standard deviation values for the control, glucose and protein treatments. This should enter the  $\frac{1}{2}$  standard deviation values into the 'positive error value' box. See below:



34. Repeat steps 30-32 for the 'lower error values' box.

35. Click 'OK'.

Your graph should now look something like the one shown below (I have purposefully left out the titles):



The error bars should correspond to the  $\pm \frac{1}{2}$  Standard Deviation (SD) for the mean of each group for the data collected for your lab class. Based on the statistical rule used in lab, the three groups are *significantly* different if the  $\pm \frac{1}{2}$  SD error bars of the groups do not overlap. If the  $\pm \frac{1}{2}$  SD error bars overlap, then the three groups are not significantly different from one another. See page 5 & 6 of the lab book for more information on statistics.

You can modify the font size of axis labels and units for the axes by clicking on them and then go back to the home tab and change the font and the size of the font.

36. After you have completed your graph, right click on the graph and select 'copy.'
37. Paste the graph into a Word document for your lab report. Remember to place your name, course and lab section in the upper left-hand corner of the lab report document.
38. Below the graph, create a short, yet descriptive **caption** for your graph. Make sure that the title, axis labels, and all other components of the graph follow the guidelines outlined in the lab report guide. The lab report guide is located on 101 lab Blackboard page.