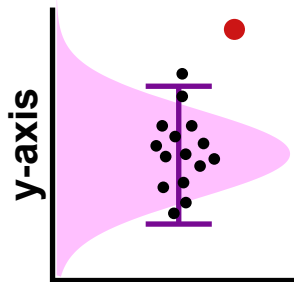# *Understanding Error Bars in Experimental Science*

Standard Deviation(SD) (Descriptive)
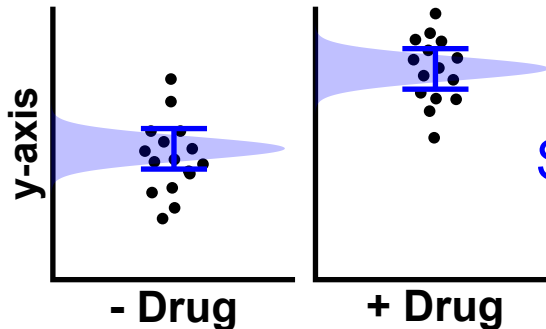**Q's w/n a population:** *Is this "normal"?*

$$SD = \sqrt{\frac{\sum (y - \bar{y})^2}{(n-1)}}$$

Standard Error(SE) (Inferential)
Q's between populations: *Are they "different"?*

- Drug   **+ Drug**

$$SE = \frac{SD}{\sqrt{n}}$$

Standard Error (SE) vs 95% Confidence Interval (CI) vs p-value

n = 3 (4×SE = CI)

4SE gap: *p = 1%*

2SE gap: *p = 5%*

50% overlap: *p = 1%*

(100% overlap: *p = 5%*)

n > 9 (2×SE = CI)

2SE gap: *p = 1%*

0% overlap: *p < 1%*

(1SE gap: *p = 5%*)   (50% overlap: *p = 5%*)