

Chapter 2: Data Presentation

TXCL7565/PHSC7565

What This Lecture Covers

- ▶ Numeric tables
- ▶ Bar charts
- ▶ Graphics for distribution of values
 - ▶ Histograms
 - ▶ Box-and-whisker plots
 - ▶ Scatter plots
- ▶ Key tips for preparing a graphic for research dissemination

A Picture is Worth 1000 Words

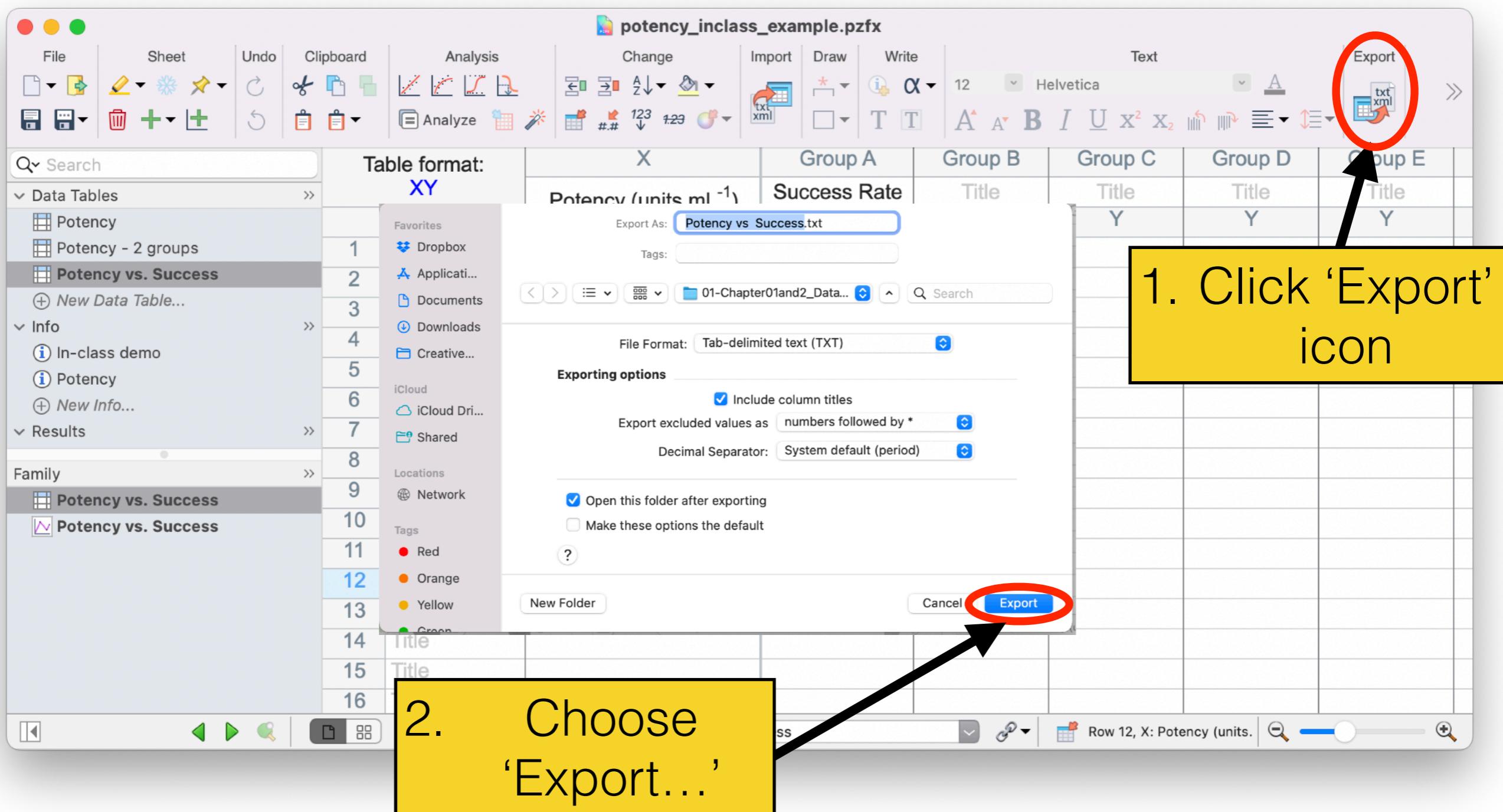
- Statistical analyses allow complex data to be summarized objectively and clearly into one or two numbers
- A pictorial representation will often alert you to important aspects of the data that can be missed if we relied solely on one or two dry, numerical statistics

Numeric tables

Numeric Tables

- **Pros:**
 - ✓ Full details of the original data are available for re-analysis
 - ✓ When variables are qualitative, a graphic may not be possible or appropriate
- **Cons:**
 - ✓ Lack immediacy
 - ✓ In general, individuals can only process 6-10 data points

Export data table from GraphPad



Numeric tables for research dissemination

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Journal of Controlled Release

journal homepage: www.elsevier.com/locate/jconrel



Delivery of a model lipophilic membrane cargo to bone marrow via cell-derived microparticles

Chunyan Yang^{a,b,1}, Fangfang Chen^{a,b,*1}, Ping Ren^b, Laren Lofchy^b, Chun Wan^c, Jingshi Si^c, Guankui Wang^b, Hanmant Gaikwad^b, Jessica Ponder^d, Craig T. Jordan^d, Robert Scheinman^d, Dmitri Simberg^{b,*}

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Table 1

Characterization of DiD+ BM subpopulations: The values were obtained after subtracting percentages in control group (non-injected mice). HPC1 and HPC2 are hematopoietic progenitor cells at different stages of differentiation. MPP is multipotent progenitor population. The gating strategy is shown in Supplemental data.

Population	Murine marker	Jurkat-DiD	Liposome-DiD
Phagocytes	CD11b +	7.00%	8.10%
Non-phagocytes	CD11b-	2.90%	2.20%
HPC1	CD150- CD48 +	1.00%	1.70%
HPC2	CD150 + CD48 +	11.60%	8.80%
MPP	CD150- CD48-	0.70%	0.10%
Eosinophils	Siglec F +	18.00%	10.80%
T cells	CD3 +	6.60%	0.40%
B cells	CD19 +	3.40%	5.30%
Neutrophils	Ly6G +	2.10%	0.30%
Monocytes	CD11b + Ly6C high	17.40%	20.90%

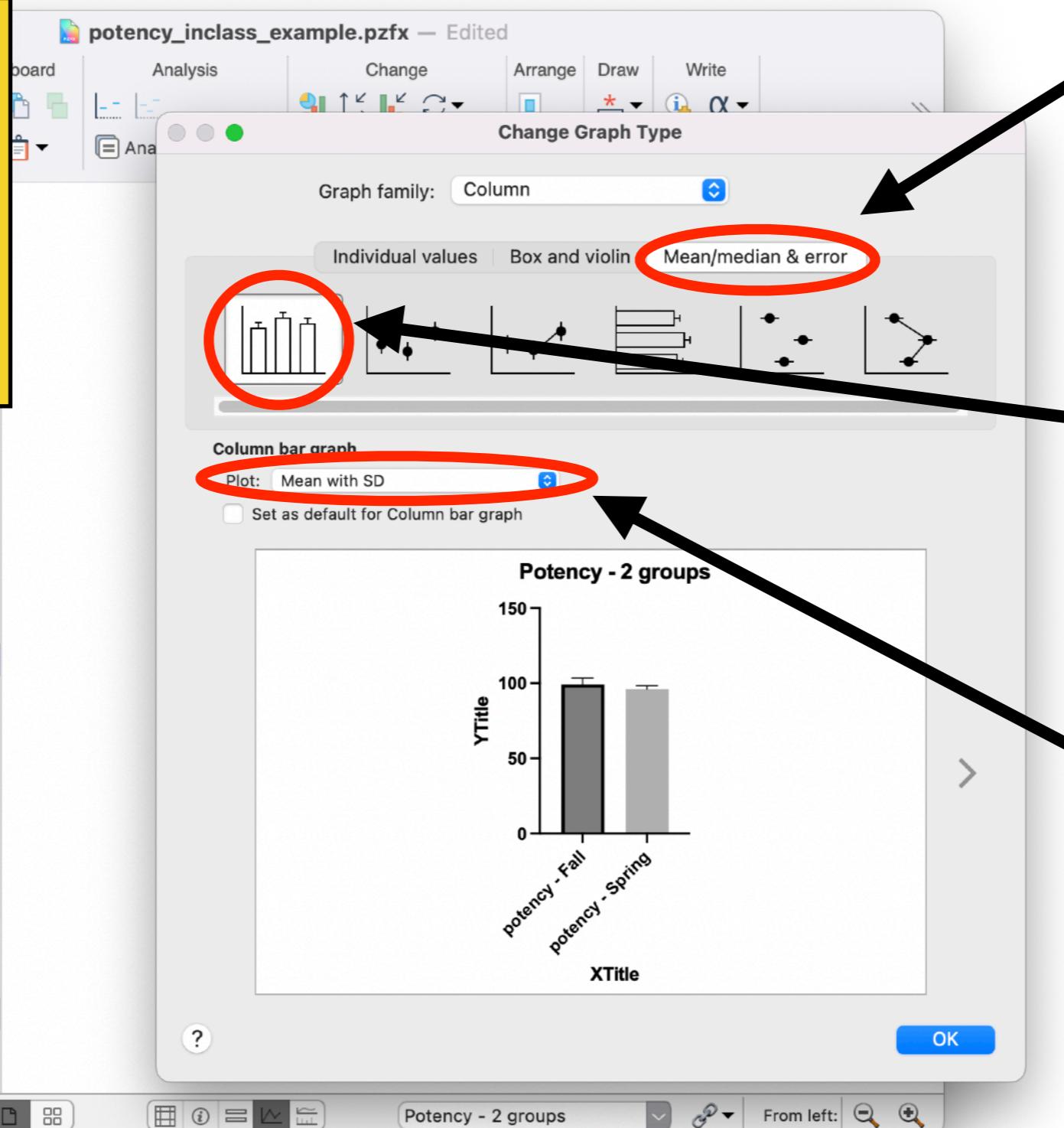
Bar charts

Bar Charts

- One of the most commonly used charts (for better or for worse)
- Can plot interval, ordinal, or nominal data
- Often used to display a statistical summary of an interval variable

Create a Bar Chart in GraphPad

1. Click data table name under the **Graphs** folder



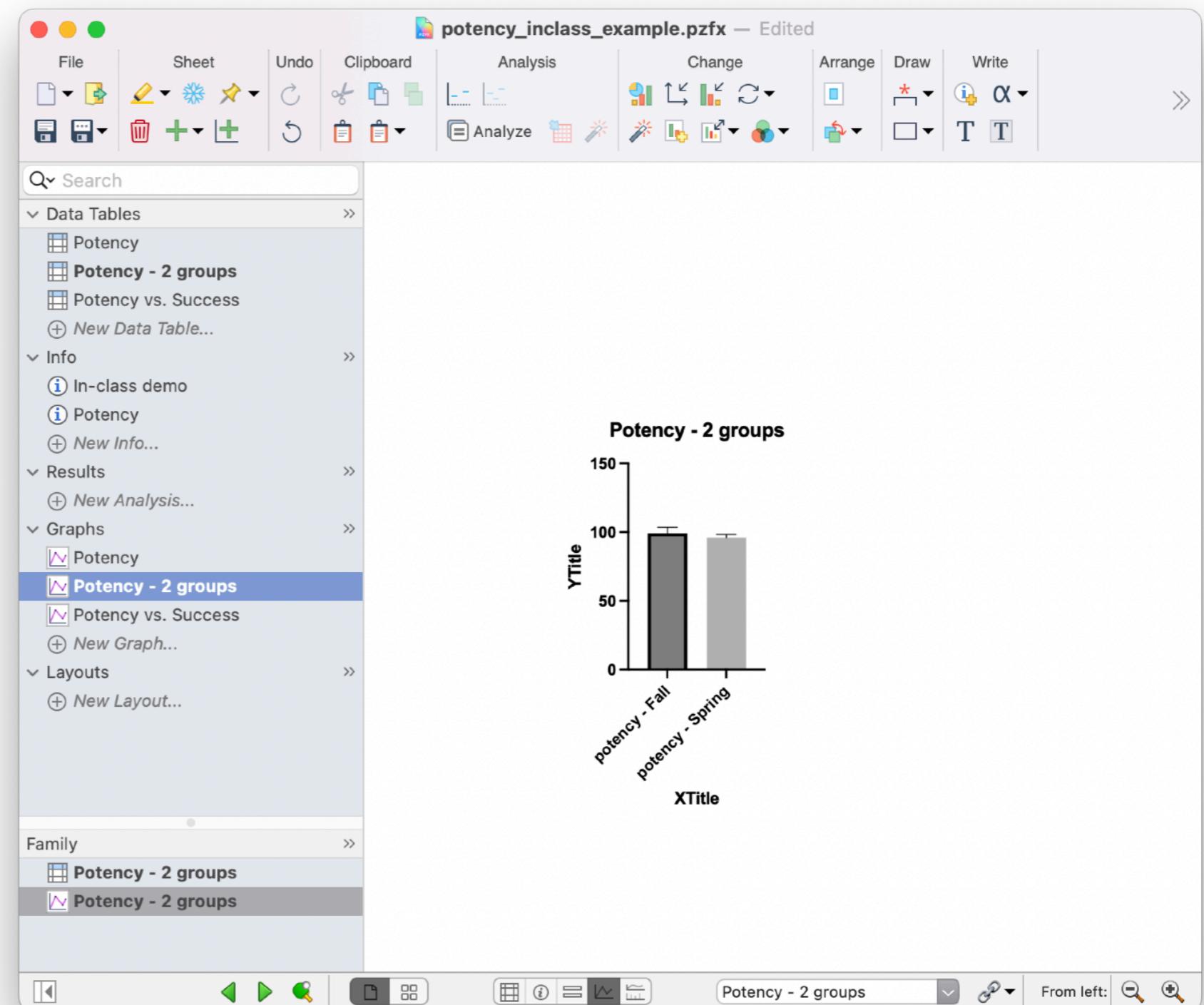
2. Select 'Mean/median & error' from the first row of choices

3. 'Column bar graph' is the first option

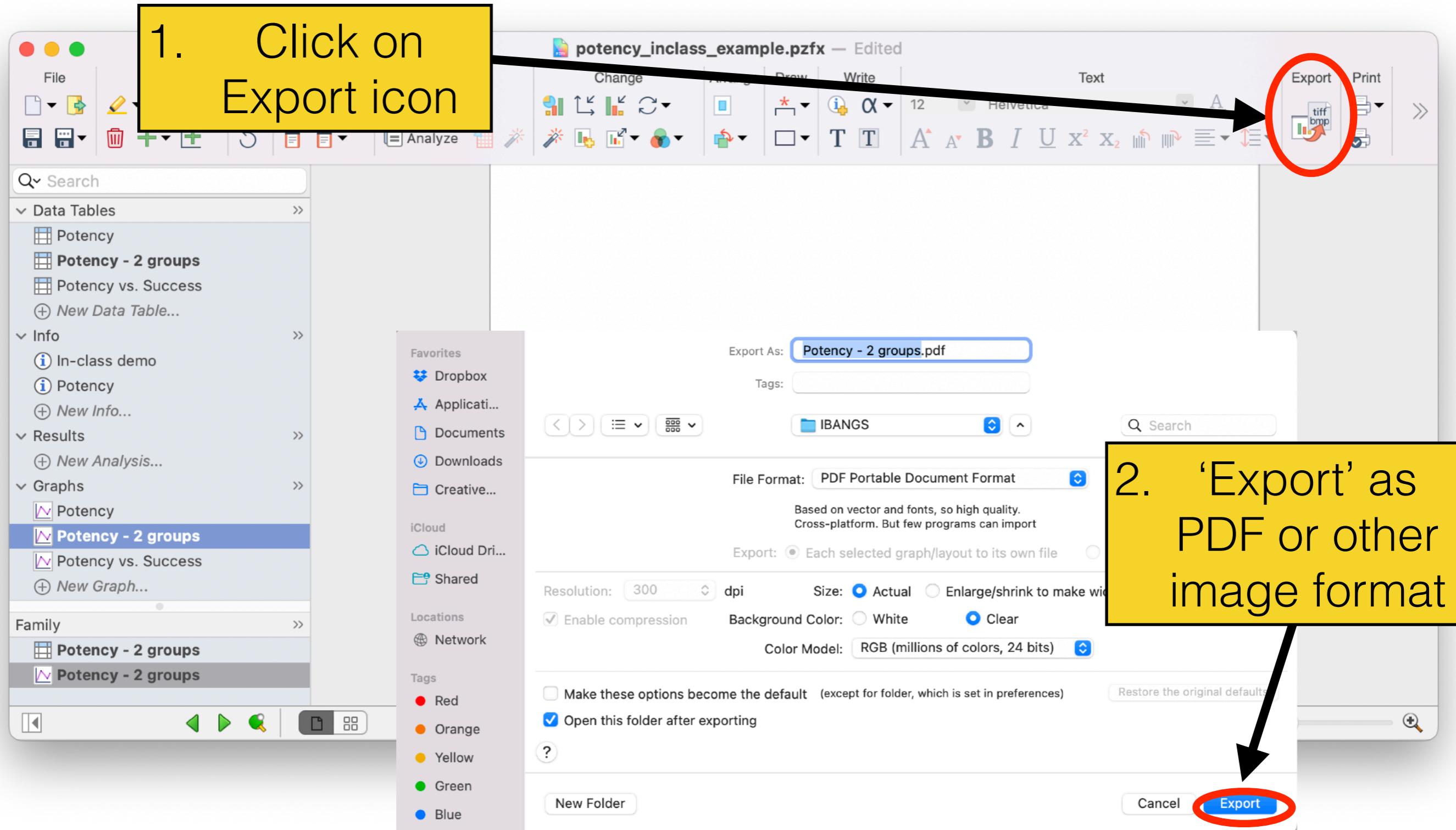
4. Select the summary statistic that you want to plot

Graph Details

- Click on different elements of the graphic to edit
- You can change many details including:
 - Axis titles
 - Title
 - Bar patterns and colors
 - Fonts



Export Graphic



Bar chart for research dissemination

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DOI: 10.1111/ctr.14037



Clinical TRANSPLANTATION

The Journal of Clinical and Translational Research

WILEY

ORIGINAL ARTICLE

National survey of physicians' perspectives on pharmacogenetic testing in solid organ transplantation

Kimberly M. Deininger¹ | Shirley M. Tsunoda² | Jan D. Hirsch³ | Heather Anderson¹ | Yee Ming Lee¹ | Colleen K. McIlvennan^{4,5} | Robert L. Page II¹ | Jacinda N. Tran² | Christina L. Aquilante¹

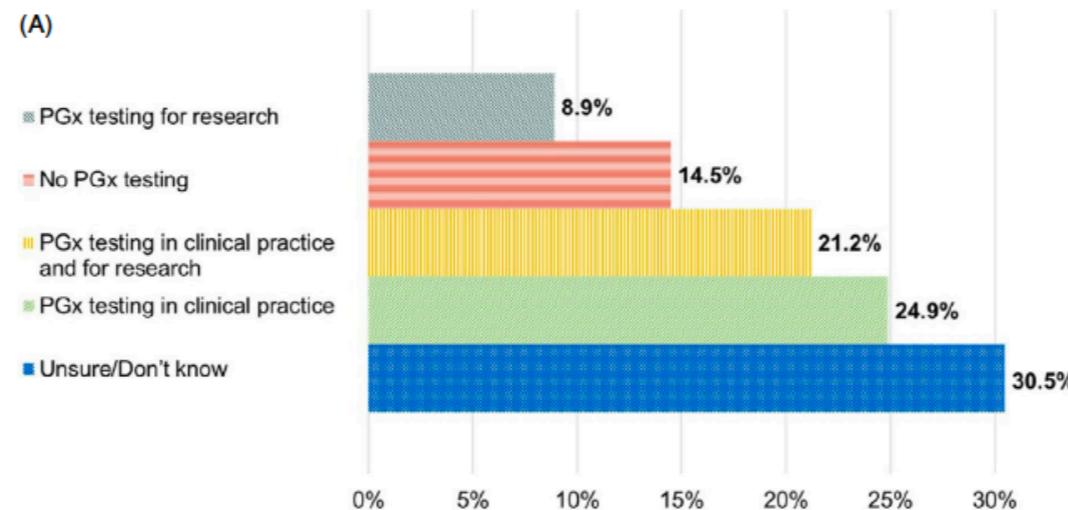
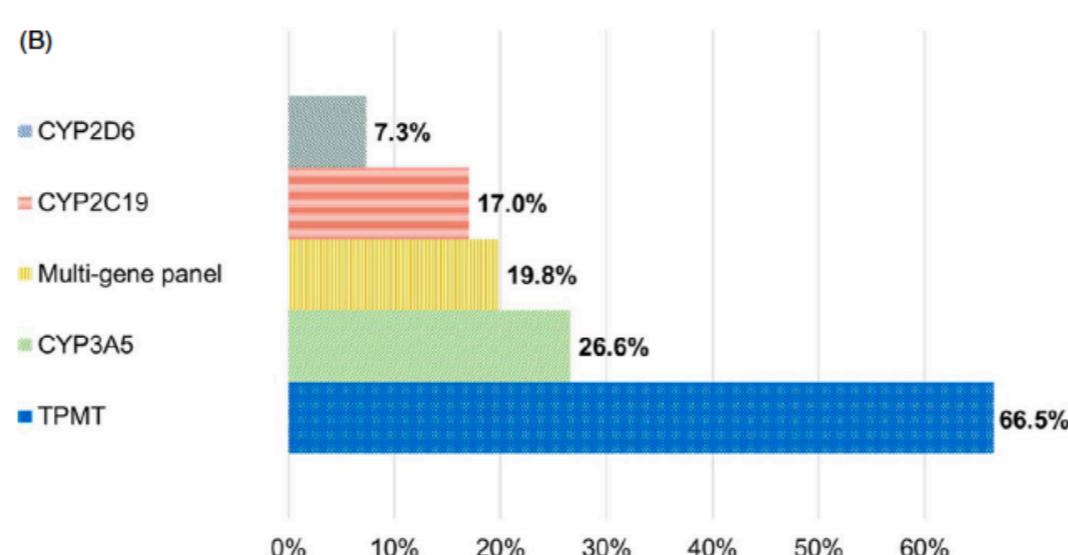


FIGURE 2 Availability and use of PGx testing among transplant physicians. A, Availability of PGx testing at participants' institution ($n = 73$). B, Distribution of PGx tests used in the transplant clinic in the past 12 mo ($n = 31$). CYP, cytochrome P450; PGx, pharmacogenetic; TPMT, thiopurine-S-methyltransferase



Graphics for
distribution of values

Graphics for Distribution of Values

- Used for interval data
- **Histogram**
 - ‘Bins’ continuous values and counts the number of observations within a bin
 - Provides details about the shape of the distribution
- **Box-and-whisker plots**
 - Shows the quantiles of the data along with outlier values
 - Good for large number of values
- **Scatter plots (single variable)**
 - Plots every observation
 - Good for small number of values

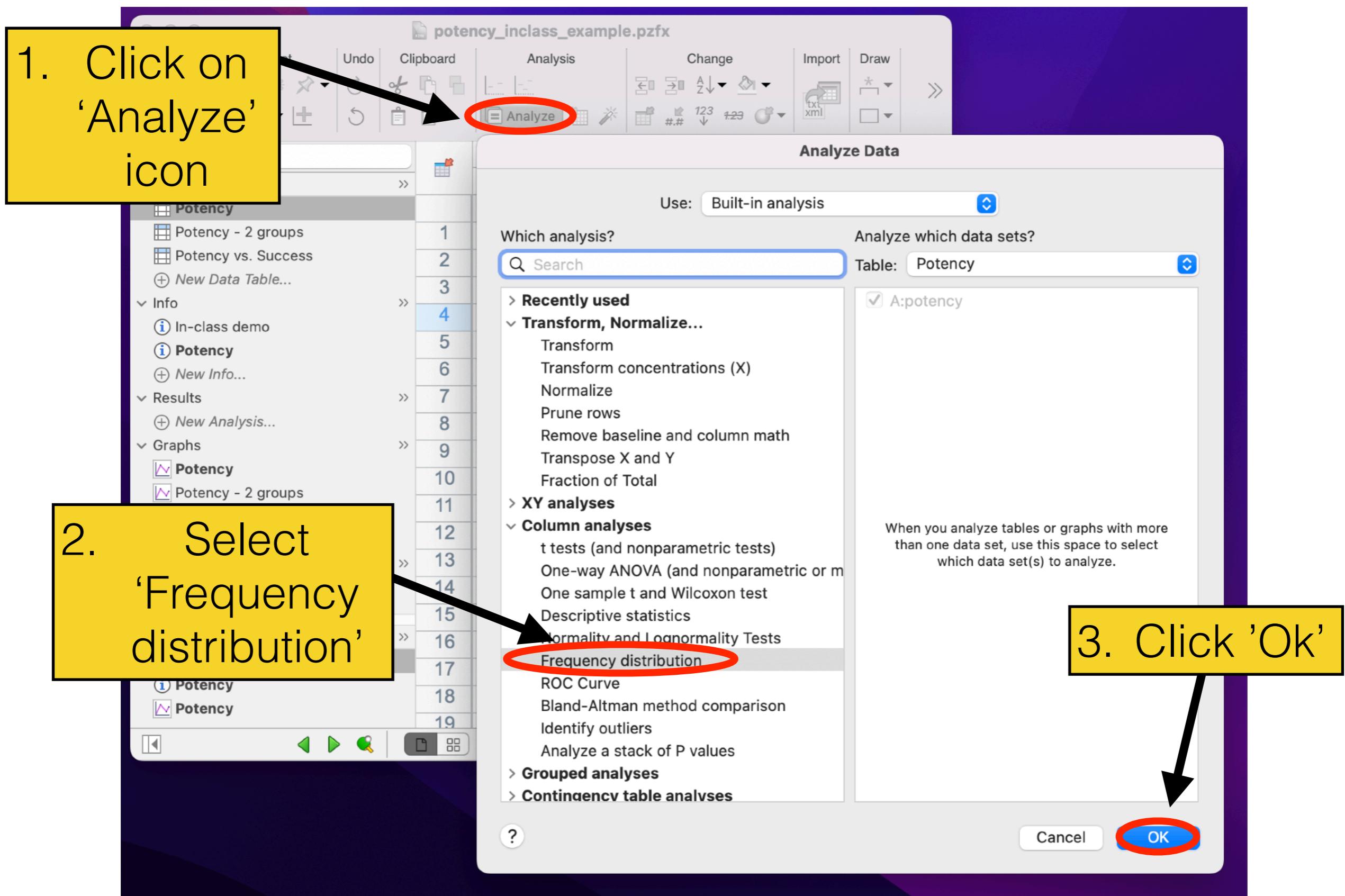
Histogram

Graphics for distribution of values

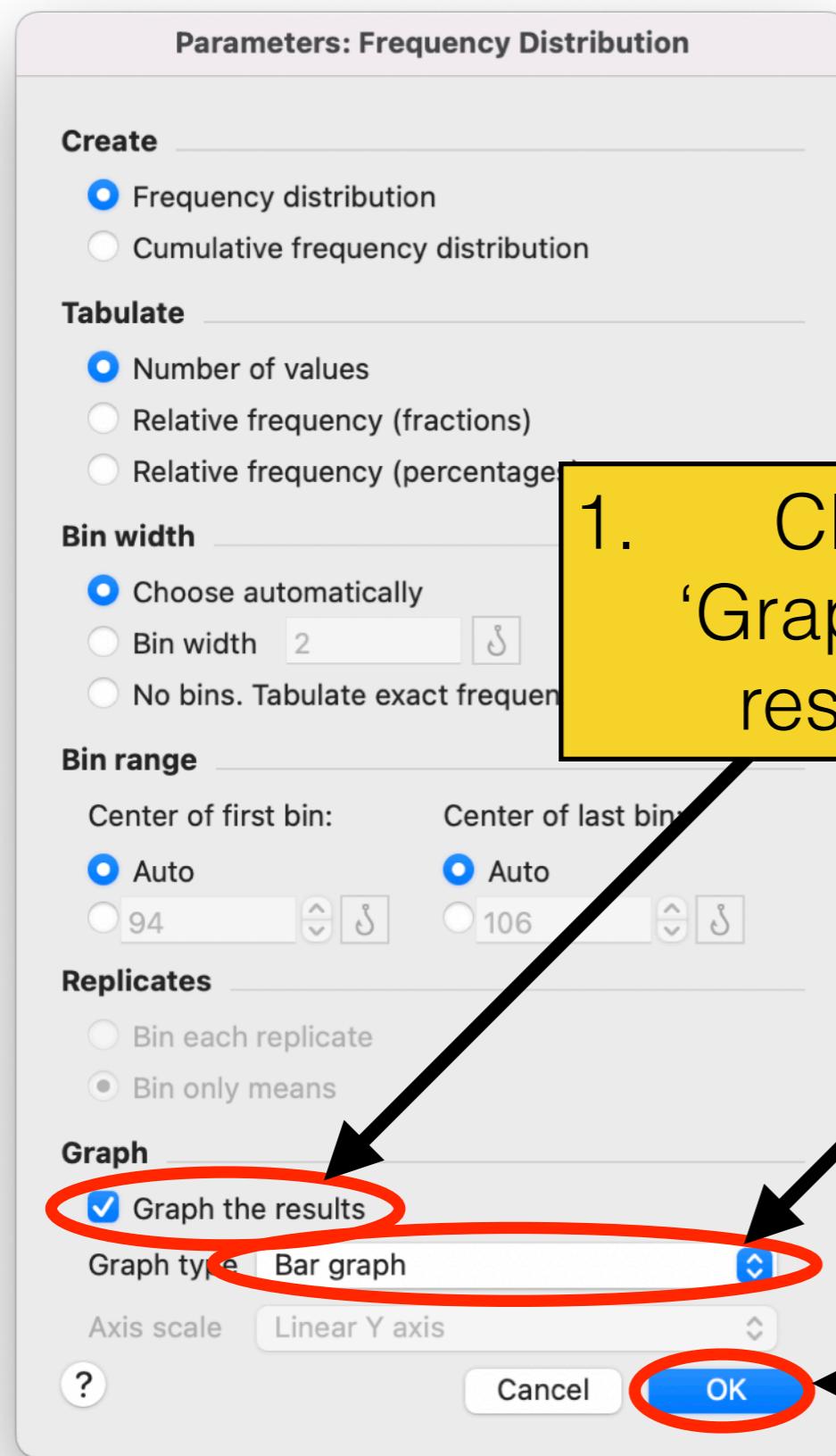
Histogram in GraphPad

1. Choose the Data Table that you would like to graph
2. Click ‘Analyze’ in the *Analysis* box
3. Choose ‘Frequency Distribution’ under **Column analyses** in the *Which Analysis?* box
4. Click ‘Ok’
5. Click ‘Graph the results’ in the **Graph** section
6. Click ‘Ok’
7. Open the new graph in the Graphs folder
8. Double click on the graph to get the ‘Format Graph’ box
9. Graph Settings —> Spacing —> Between adjacent data
—> 0%

Histogram in GraphPad



Histogram in GraphPad



1. Click
‘Graph the
results’

2. Select ‘Bar
graph’ from
drop down
menu

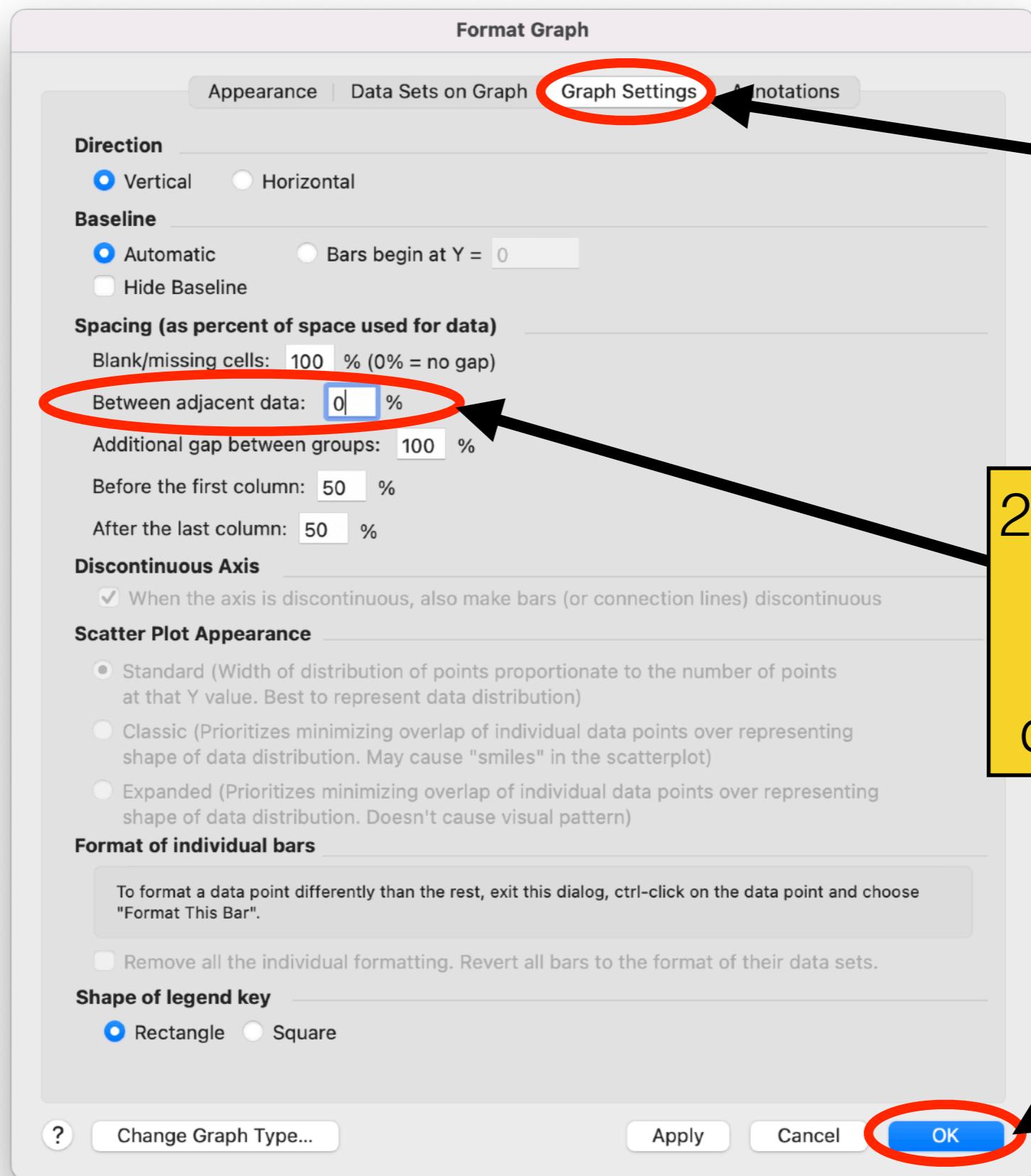
3. Click ‘OK’

Histogram in GraphPad

The screenshot shows the GraphPad software interface with the following elements:

- Top Bar:** Includes File, Sheet, Undo, Clipboard, Analysis, Change, Arrange, Draw, and other standard menu items.
- Search Bar:** A search field labeled "Search".
- Data Tables:** A list of data tables including "Potency", "Potency - 2 groups", "Potency vs. Success", "New Data Table...", "In-class demo", "Histogram of Potency", "New Analysis...", "Graphs", "Potency", "Potency - 2 groups", "Potency vs. Success", and "Histogram of Potency".
- Graph Area:** A histogram titled "Frequency distribution" showing the number of values versus bin center. The x-axis is labeled "Bin Center" with values 94, 96, 98, 100, 102, 104, 106. The y-axis is labeled "Number of values" with values 0.0, 0.5, 1.0, 1.5, 2.0, 2.5. The histogram bars are black. A legend indicates "# values".
- Annotations:**
 - A yellow box on the left contains the text: "1. Select the Histogram graphic in the **Graphs** folder". An arrow points from this text to the "Histogram of Potency" item in the Data Tables list.
 - A yellow box on the right contains the text: "2. Double click on the graph to get *Format Graph* to open". An arrow points from this text to the histogram area.

Histogram in GraphPad

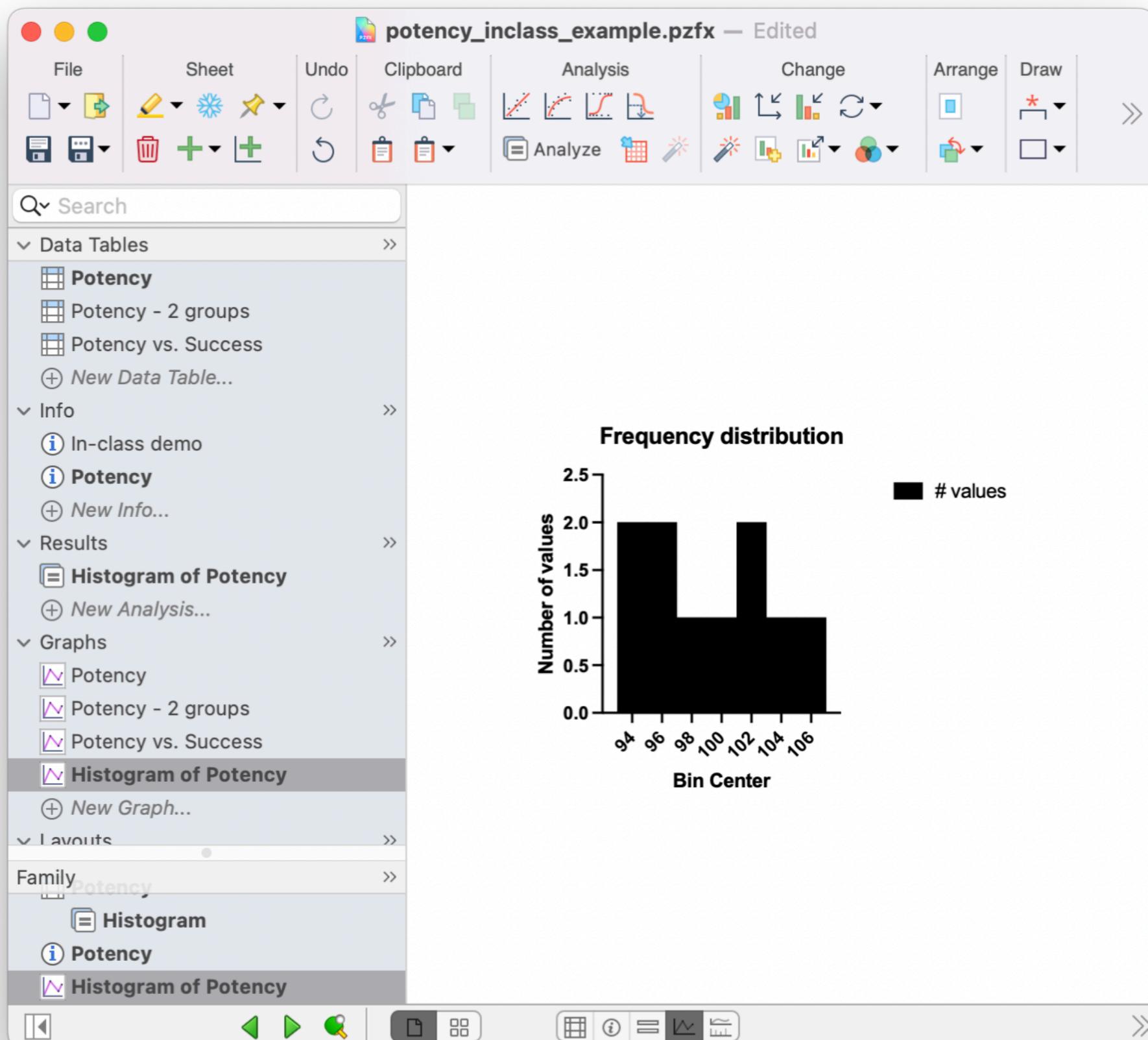


1. Select 'Graph Settings'

2. Set 'Between adjacent data' to 0%

3. Click OK

Histogram in GraphPad



Histogram for research dissemination

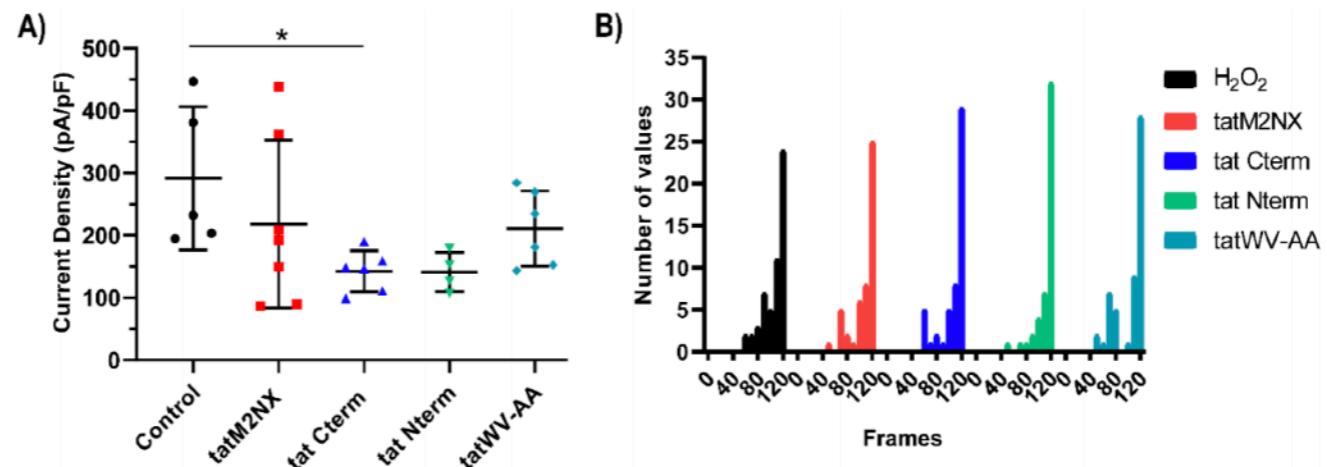
Research Article | Article

Characterization and optimization of the novel TRPM2 antagonist tatM2NX

I. Cruz-Torres, D.S. Backos, and P.S. Herson

Molecular Pharmacology November 26, 2019; mol.119.117549; DOI: <https://doi.org/10.1124/mol.119.117549>

Molecular Pharmacology Mol # 117549



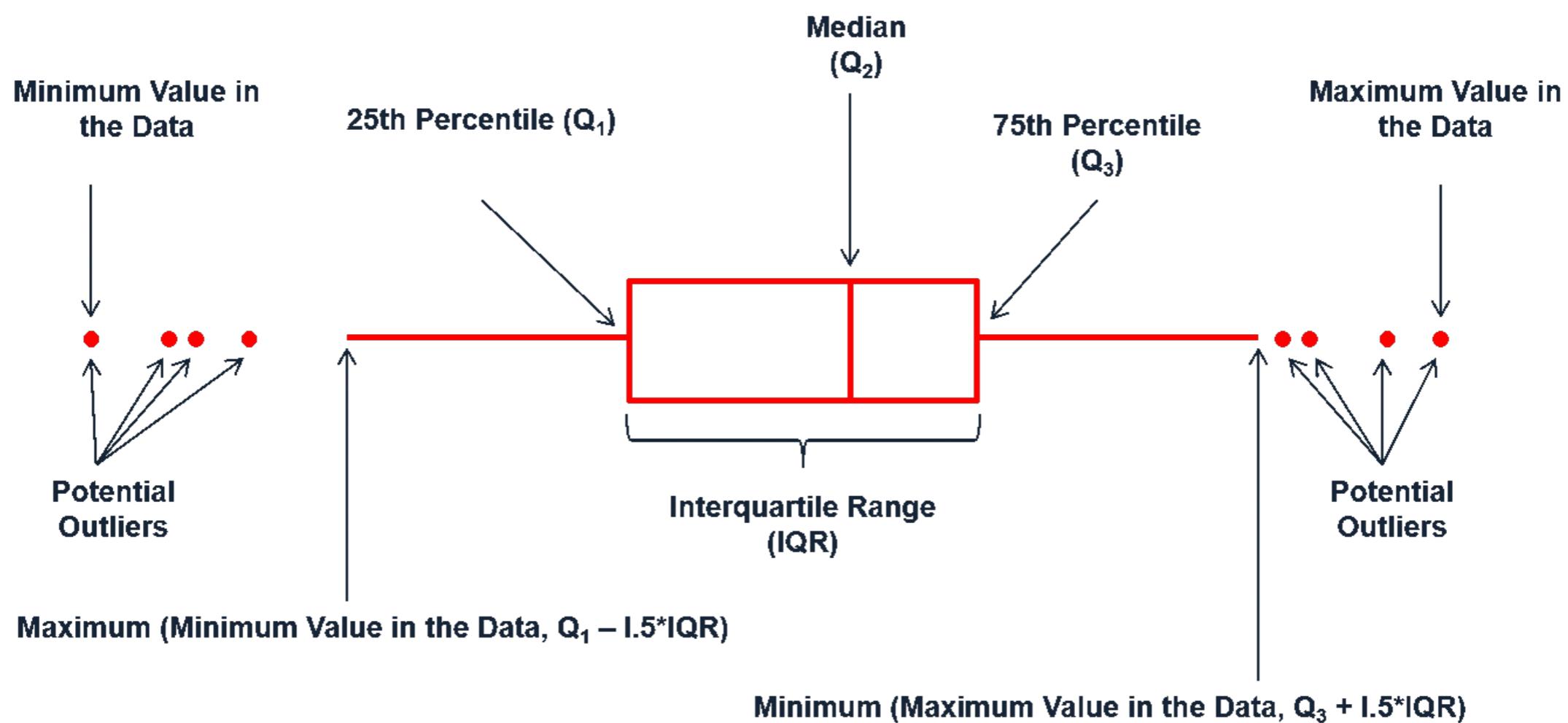
Supplemental Figure 3. No changes in ADPR_i current density or frequency distribution in Ca²⁺ fluorescence in the presence of peptides. A) ADPR_i current density was significant ($p=0.0489$, $n=6$) for the peptide tat Cterm. B) Histogram of number of events vs. frames (1 frame=10sec, total 120 frames) in HEK293 cells expressing TRPM2 in response to H₂O₂ in the presence of peptides. All electrophysiology data represented as mean \pm SD, statistical significance at $p<0.05$ for $n\geq 4-10$ (at least 3 experimental days/condition). For Ca²⁺ imaging, histogram was generated from $n\geq 25-53$ (4-6 experimental days).

Box-and-whisker plots

Graphics for distribution of values

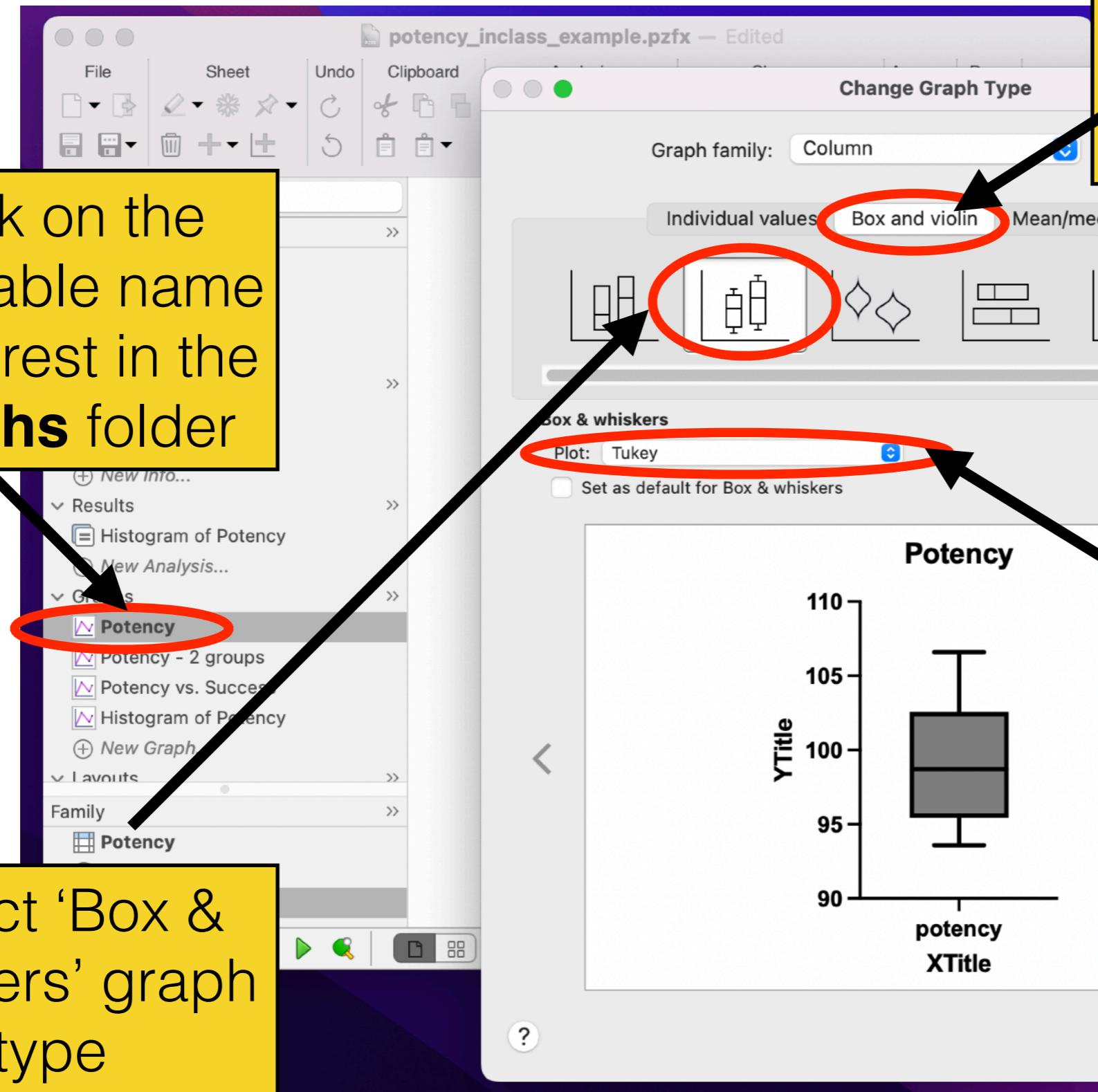
Box-and-Whisker Plots

- Box-and-whisker plots, or just box plots, give you an idea about the distribution of the data without plotting every single point.



Create a Box-and-Whisker Plot

1. Click on the data table name of interest in the **Graphs** folder



3. Select 'Box & whiskers' graph type

2. Select 'Box and violin' from top row

4. Select the 'Tukey' method for the plot

Box-and-whisker plot for research dissemination

MOLECULAR CANCER THERAPEUTICS | SMALL MOLECULE THERAPEUTICS

First-in-Class Inhibitors of Oncogenic CHD1L with Preclinical Activity against Colorectal Cancer **AC**

Joshua M. Abbott¹, Qiong Zhou¹, Hector Esquer¹, Laura Pike¹, Travis P. Brioneske¹, Sébastien Rinaldet Adedoyin D. Abraham¹, Dominique A. Ramirez², Paul J. Lunghofer², Todd M. Pitts^{3,4}, Daniel P. Rega Aik Choon Tan^{3,4}, Daniel L. Gustafson^{2,4}, Wells A. Messersmith^{3,4}, and Daniel V. LaBarbera^{1,4}

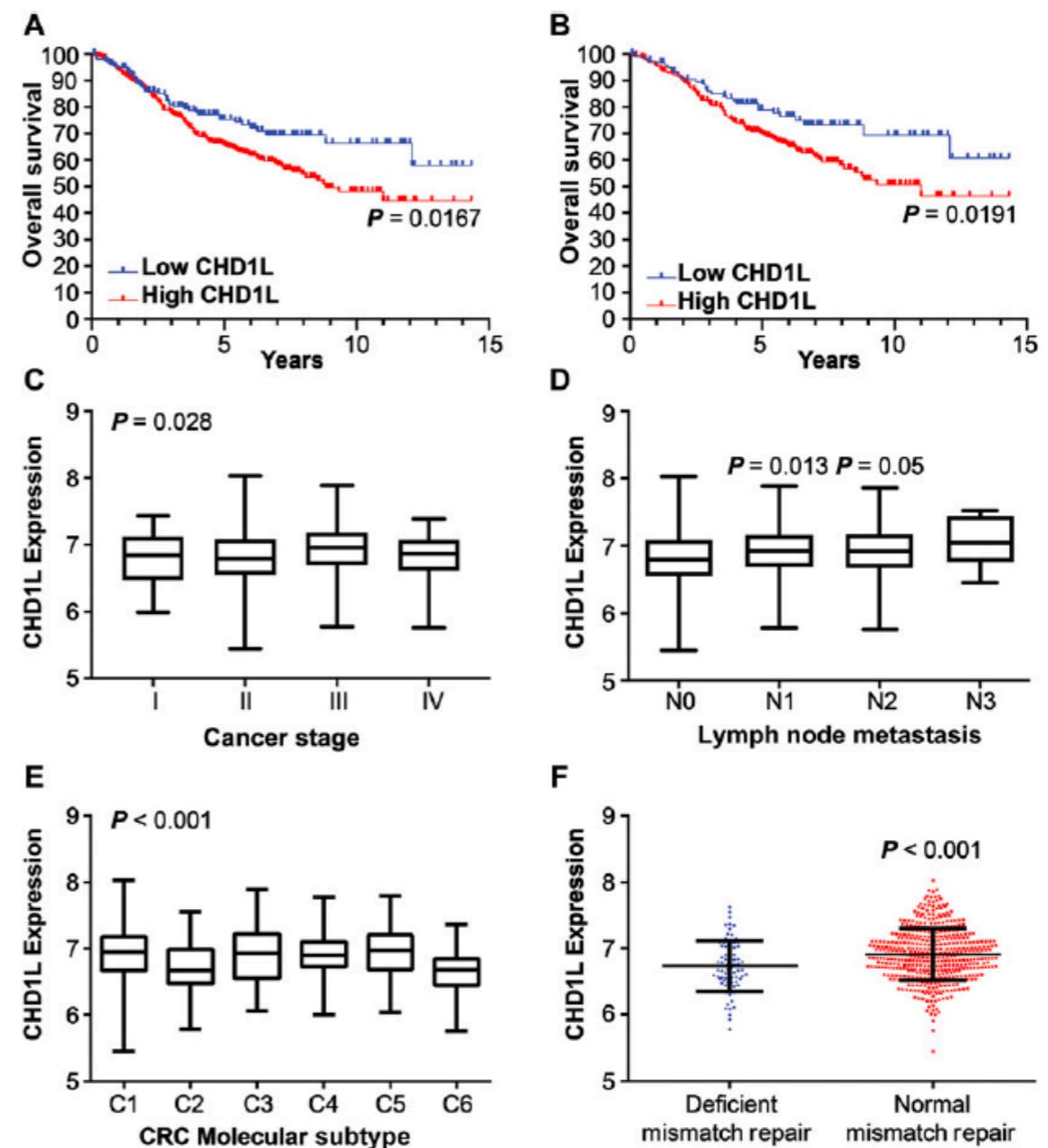


Figure 1

Clinicopathologic characteristics associated with CHD1L expression. **A**, OS of CHD1L expression in patients with colorectal cancer, $P = 0.0167$. **B**, OS of CHD1L expression in stage II/III patient cohort, $P = 0.0191$. **C**, Differential expression of CHD1L in colorectal cancer by stage, $P = 0.028$. **D**, Differential expression of CHD1L among N staging in patients with colorectal cancer, $P = 0.013$ (N1), 0.05 (N2) relative to N0. **E**, Differential expression of CHD1L among colorectal cancer molecular subtypes, $P < 0.001$. **F**, Expression of CHD1L between patients with colorectal cancer with normal and deficient DNA mismatch repair, $P < 0.001$.

Scatter plots

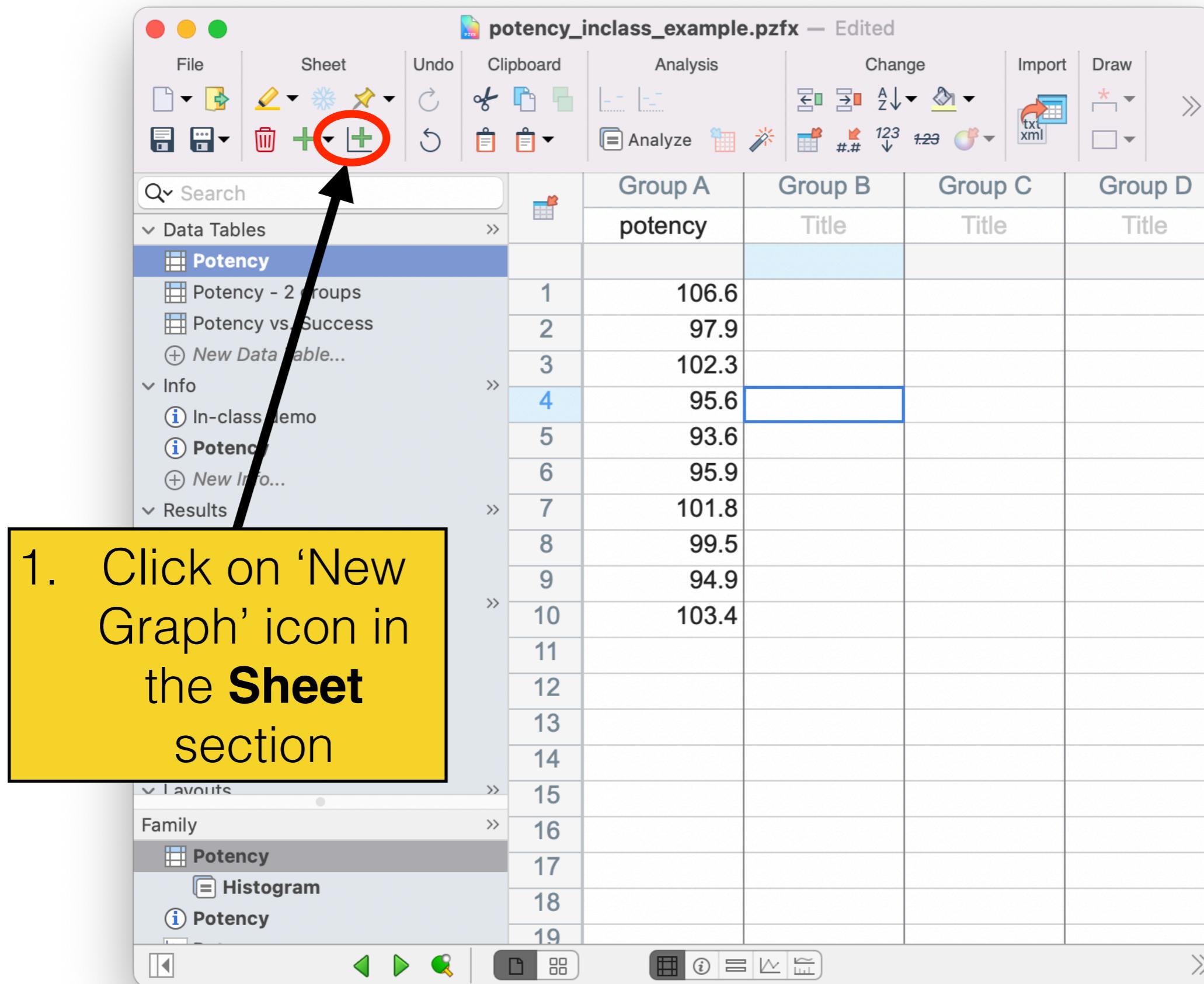
Graphics for distribution of values

Scatter Plots with a Single Variable

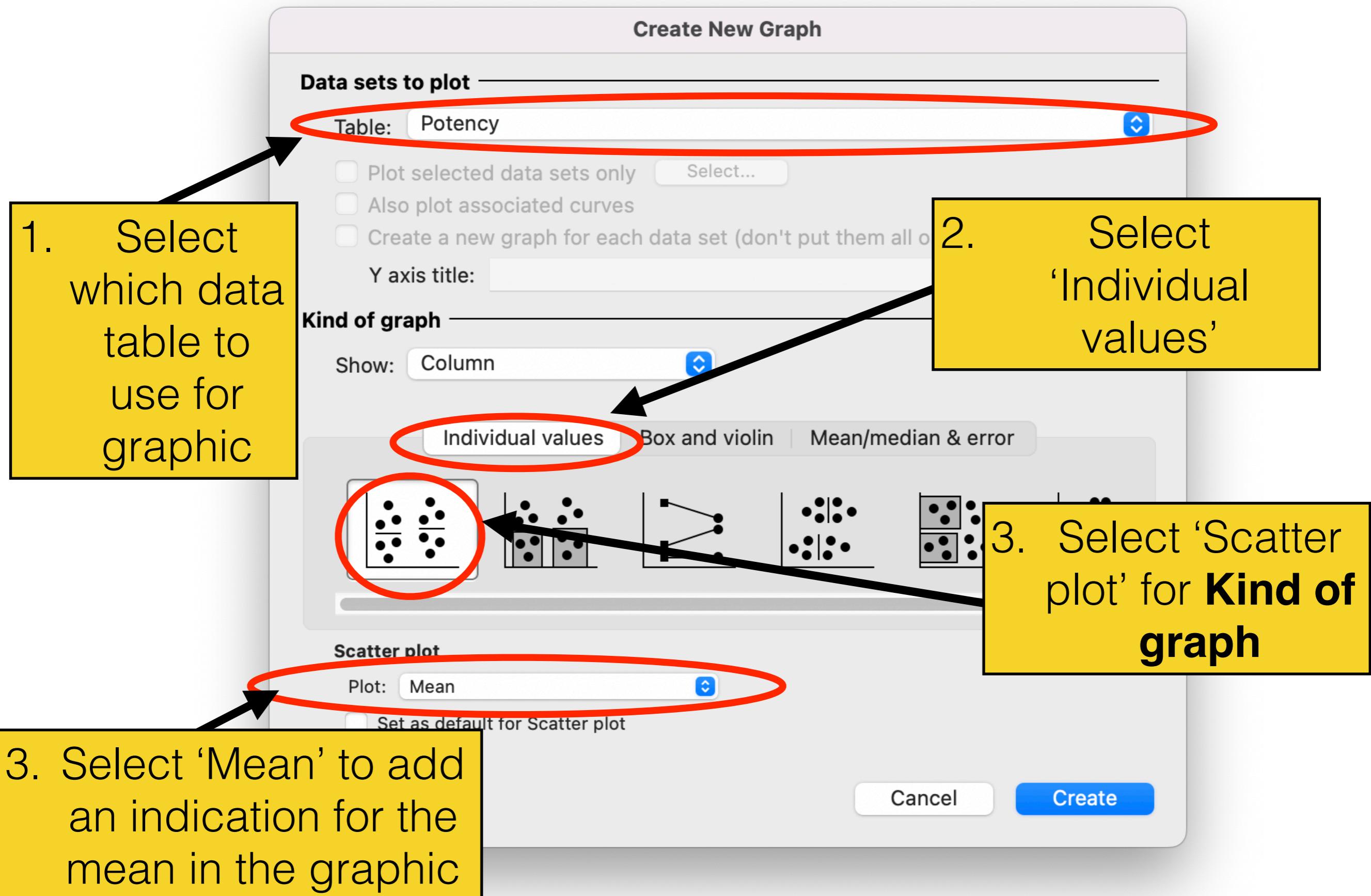
Scatter plots are used to display every data point.
This makes it easier to:

- Find outliers
- Generate a general idea of scatter
- Estimate statistical summary measures

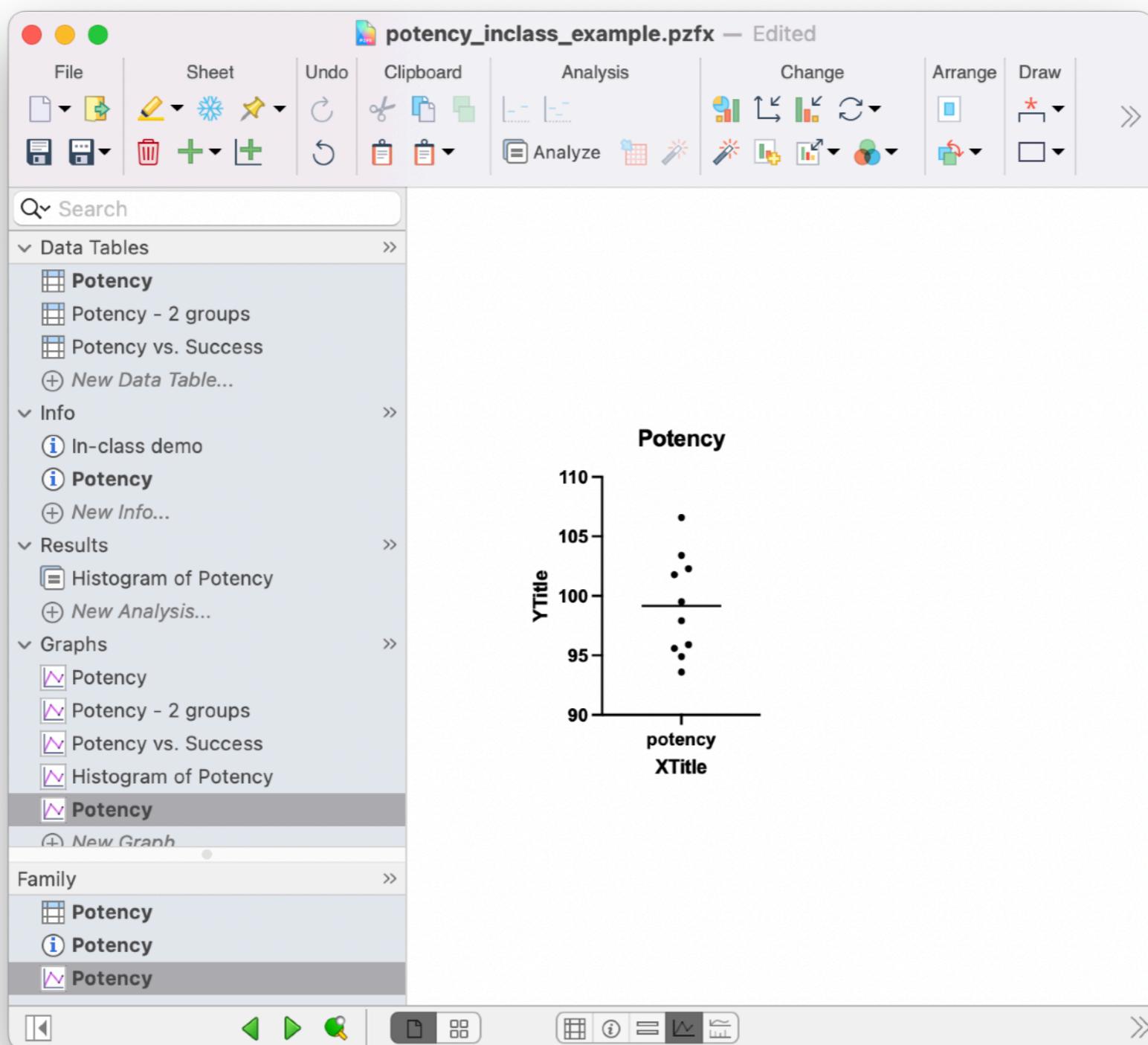
Create a New Graphic in GraphPad



Create a Scatter Plot for a Single Variable



Scatter Plots with a Single Variable



Scatter plot with a single variable for research dissemination

J Antimicrob Chemother
doi:10.1093/jac/dkaa299

Journal of
Antimicrobial
Chemotherapy

Pharmacokinetics and renal safety of tenofovir alafenamide with boosted protease inhibitors and ledipasvir/sofosbuvir

Kristina M. Brooks  ¹, Jose R. Castillo-Mancilla ², Mary Morrow ³, Samantha MaWhinney ³, Joshua Blum ^{2,4}, David L. Wyles ^{2,4}, Sarah E. Rowan ^{2,4}, Mustafa E. Ibrahim ¹, Jia-Hua Zheng ¹, Bethany Johnson ¹, Joe Gomez ¹, Ye Ji Choi ¹, Francesca Cendali ¹, Hannah Haas ¹, Laura Roon ¹, Lane R. Bushman ¹, Peter L. Anderson ¹ and Jennifer J. Kiser ^{1*}

¹Department of Pharmaceutical Sciences, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of Colorado Anschutz Medical Campus, Aurora, CO, USA; ²Division of Infectious Diseases, School of Medicine, University of Colorado Anschutz Medical Campus, Aurora, CO, USA; ³Department of Biostatistics and Informatics, Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, USA; ⁴Division of Infectious Diseases, Denver Health and Hospital Authority, Denver, CO, USA

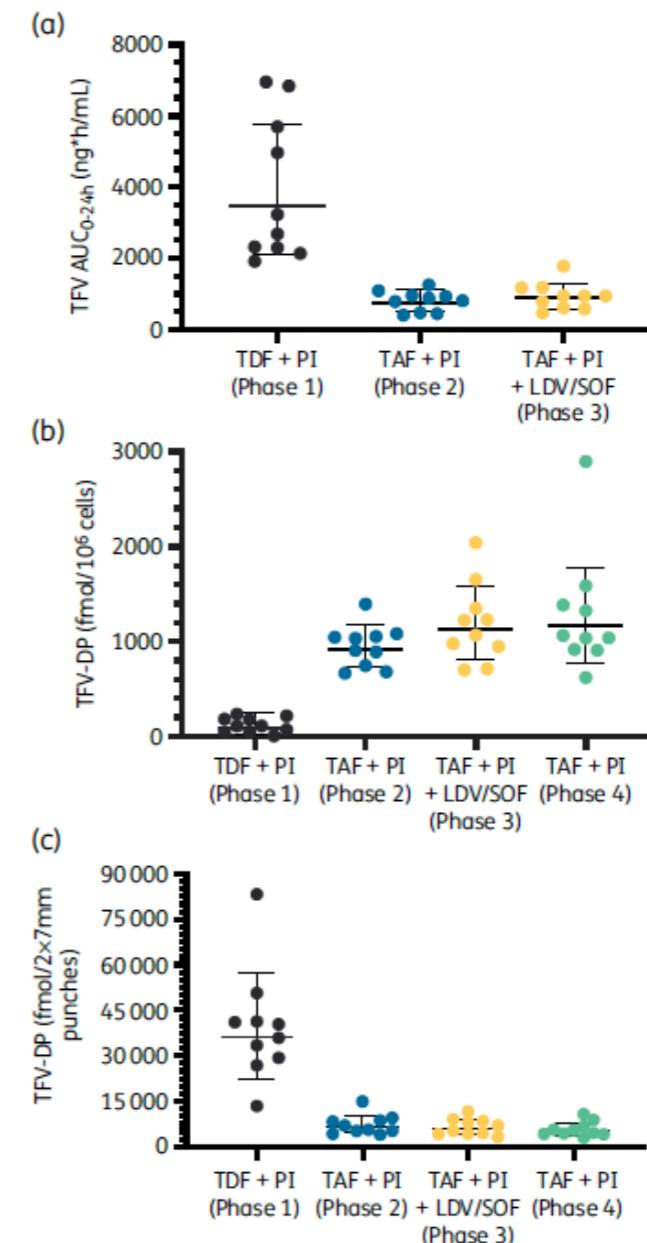


Figure 2. Geometric mean (geometric SD) (a) plasma tenofovir exposures over 24 h, (b) TFV-DP concentrations in PBMCs and (c) TFV-DP concentrations in DBS (results with 2x7 mm punches for TDF and TAF) across study phases. This figure appears in colour in the online version of JAC and in black and white in the printed version of JAC.

Scatter Plots (2 variables)

Dependent vs. Independent Variables

- A scatter plot is used to visualize the relationship between two variables (often a dependent variable and an independent variable).
 - Typically, the **dependent** variable is plotted on the vertical (y) axis and the **independent** variable is plotted on the horizontal (x) axis.

Create a Scatter Plot

The screenshot shows the SigmaPlot interface with two yellow callout boxes containing numbered instructions.

1. Click on data table of interest in **Graphs section**

A red circle highlights the "Potency vs. Success" entry in the "Graphs" section of the left sidebar. A black arrow points from this entry to the first yellow callout box.

2. Select 'Points only' graph type

A red circle highlights the "Points only" icon in the "Change Graph Type" dialog box. A black arrow points from this icon to the second yellow callout box.

Potency vs. Success

Success Rate

Potency (units.mL⁻¹)

Graph family: XY

Points only

Plot:

Set as default for Points only

OK

?

File Sheet Undo Clipboard

Search

Data Tables

- Potency - 2 groups
- Potency vs. Success
- New Data Table...

Info

- In-class demo
- Potency
- New Info...

Results

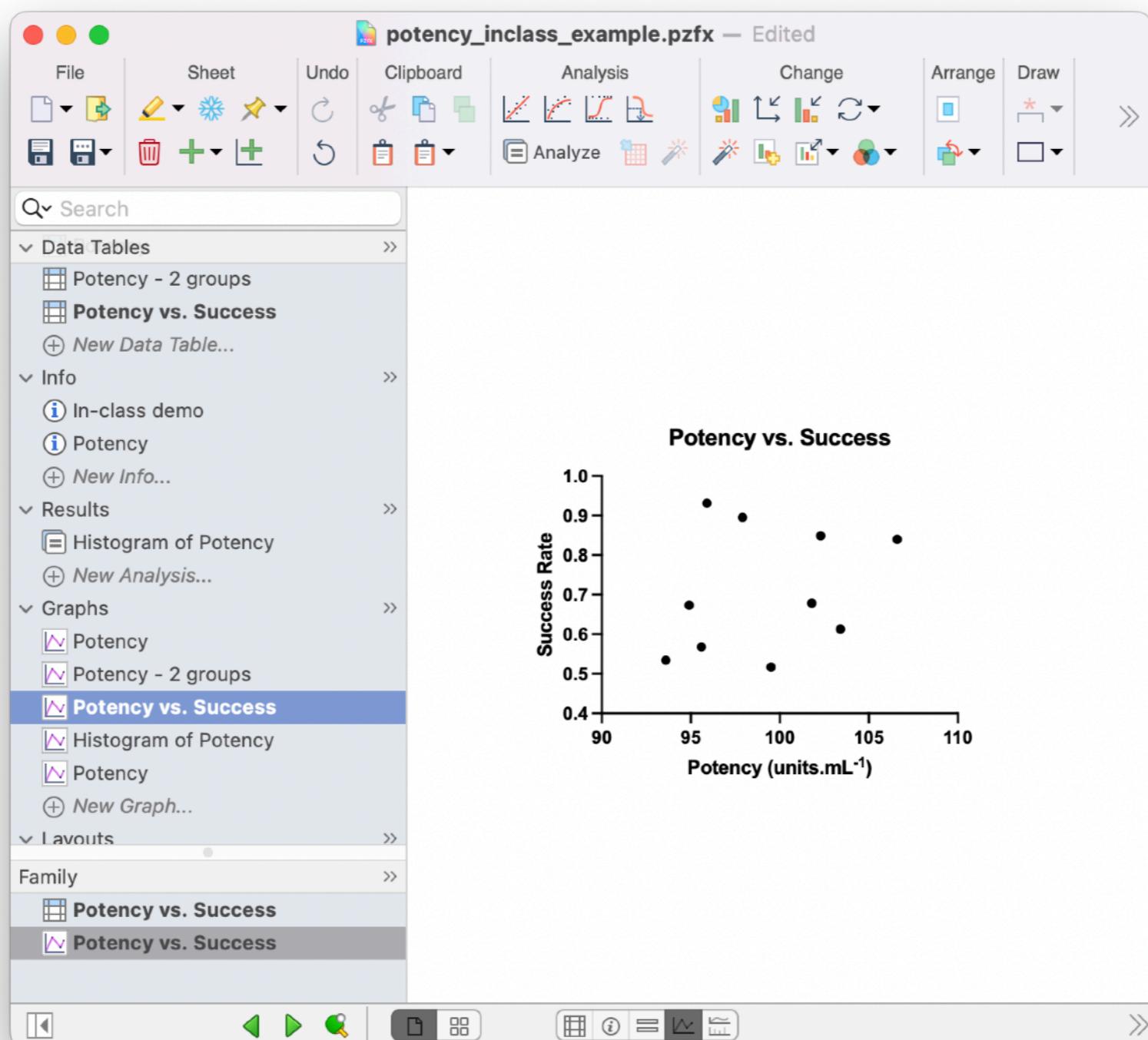
- Histogram of Potency
- New Analysis...

Graphs

- Potency
- Potency - 2 groups
- Potency vs. Success**
- Histogram of Potency
- Potency
- New Graph...

Scatter Plots (2 variables)

Dependent vs. Independent Variables



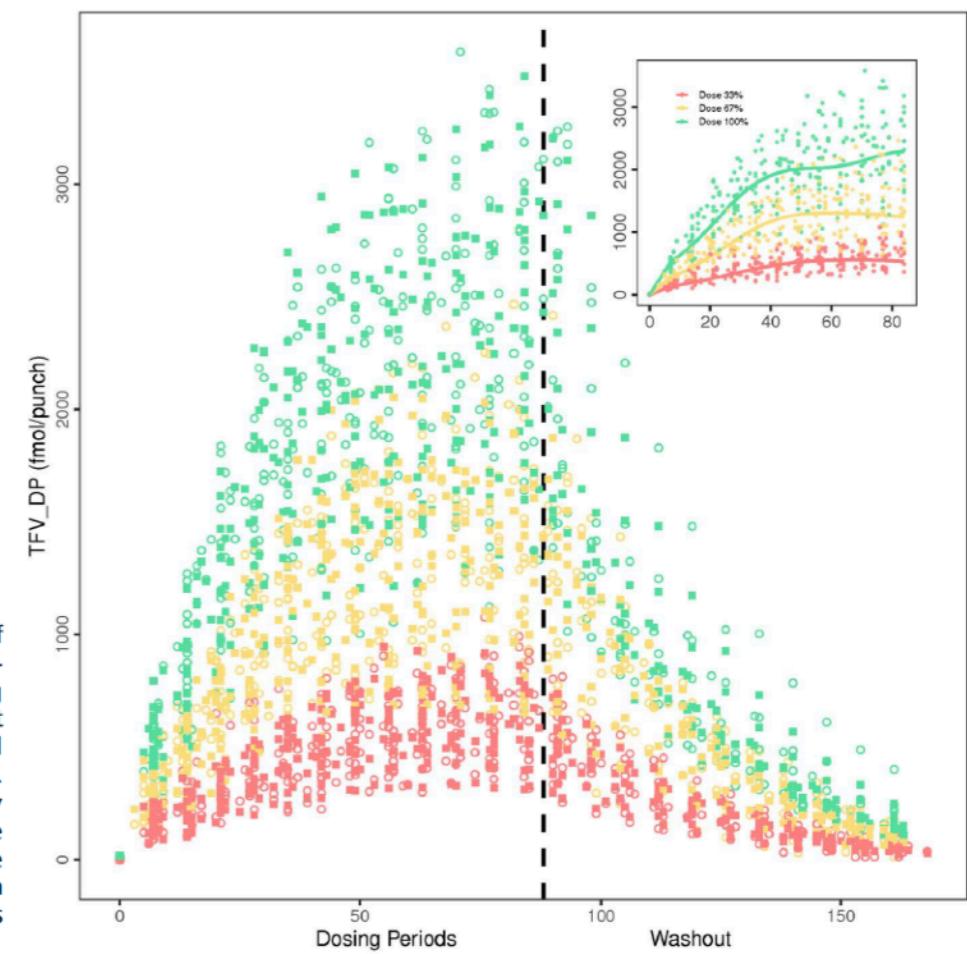
Scatter plot with two variables for research dissemination

CLINICAL SCIENCE

Intracellular Tenofovir-Diphosphate and Emtricitabine-Triphosphate in Dried Blood Spots Following Tenofovir Alafenamide: The TAF-DBS Study

Jenna Yager, PharmD,^a Jose Castillo-Mancilla, MD,^b Mustafa E. Ibrahim, MS,^a
Kristina M. Brooks, PharmD,^a Cricket McHugh, MPH,^a Mary Morrow, MS,^c Scott McCallister, MD,^d
Lane R. Bushman, BS,^a Samantha MaWhinney, ScD,^c Jennifer J. Kiser, PharmD, PhD,^a and
Peter L. Anderson, PharmD^a

FIGURE 1. TFV-DP in DBS by day of therapy/study for 33% (red), 67% (yellow), and 100% (green) TAF/FTC dosing regimens. Open circles represent observed concentrations, and filled squares represent fitted concentrations. Both dosing periods are included (day 0 through day 84), followed by the washout period. The modeled average for each dosing regimen overlaid on observed data from the dosing periods is shown in the inset.



Key tips for preparing a
graphic for research
dissemination

Essentials for a publication-ready graphic

- Both axes are labelled appropriately and include units.
- Graphic has a figure legend that describes the main point/outcome in the title (never include the type of graphic in title, e.g., Histogram of values).
- Tell the reader what each point/line represents.
- If you are including error bars, specifically indicate what they represent, e.g., standard errors, standard deviations, 95% confidence interval.
- Often specific journals have requirements about what should and should not be included in the figure legend. Look at the instructions to authors and at previous manuscripts in the same journal.

What did we learn?

- Graphics are usually better than tables for presenting data
- Bar charts are good for nominal or ordinal data or for comparing a summary measure, e.g., means across groups
- Histograms, box-and-whisker plots, and scatter plots give the reader more information about the distribution of the data
- Scatter plots with two variables quickly display the relationship between the two variables.