15 Prism Graphs for Education and Inspiration
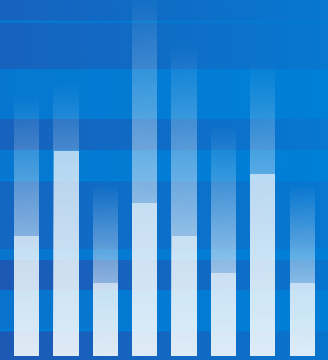
Real examples and tutorials of how to create beautiful graphs, from the Prism user community

Prism

The Art and Science of Data Visualization in Prism

All researchers want to create effective graphs. Data visualization is critical to research. But **good** data visualization is difficult.
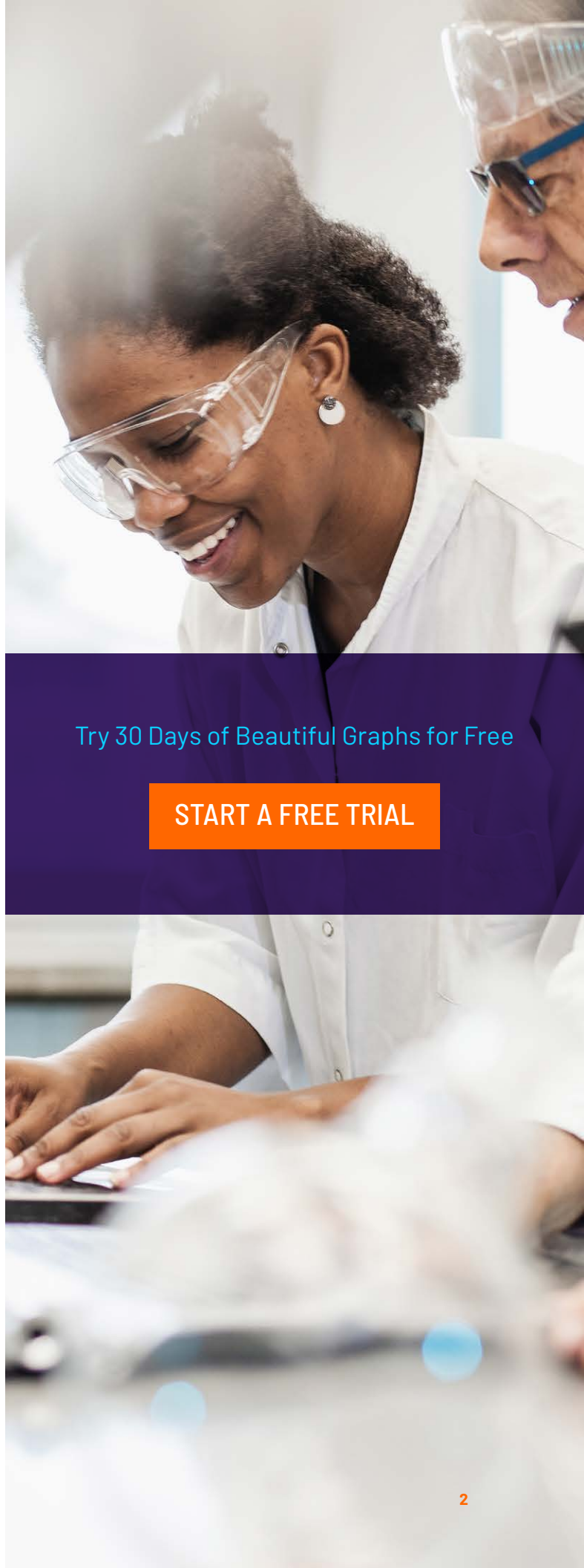
There are many ways in which data can be misinterpreted or impossible to decipher in the wrong graph.

We believe that one of the best ways to inspire the creation of great graphs is to showcase real examples of creative methods for presenting scientific data. That is why we asked Prism users to submit their favorite graphs to develop a resource that offers inspiration, tips, and instruction.

In this piece you will discover:

- Real examples of unique and creative graphs made in Prism
- Steps to create these graphs in Prism
- More about Prism's graphing capabilities

We hope you find it useful.

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ANDREW SPEIDELL

Georgetown University Medical Center.
Funded by HHS grants NS079172 and NS074916
to Dr. I Mocchetti and T32NS041231 to A. Speidell

TITLE:

Aged p75+/+gp120tg mice show impairments in a task of spatial navigation

Summary data showing performance in measures obtained in the Morris Water Maze (MWM) navigation task. A. Latency to locate the submerged escape platform in the maze over five training days (TDs) of acquisition and five days of reversal learning. B. Duration in the target quadrant is different between groups on the first probe day (P). C. Passes over the former location of the target platform is likewise different between the same groups. D. Duration in the reversal target quadrant is different between groups on the reversal probe trial. E. Number of passes over the reversal target platform is different between groups. Control measures for locomotion and exploration in the MWM are equivalent across groups. F. Swim speed in the initial habituation trial to the MWM apparatus. G. Percent of the first acquisition trial spent exploring in the center of the MWM. *p<0.05 **p<0.01 ***p<0.001.
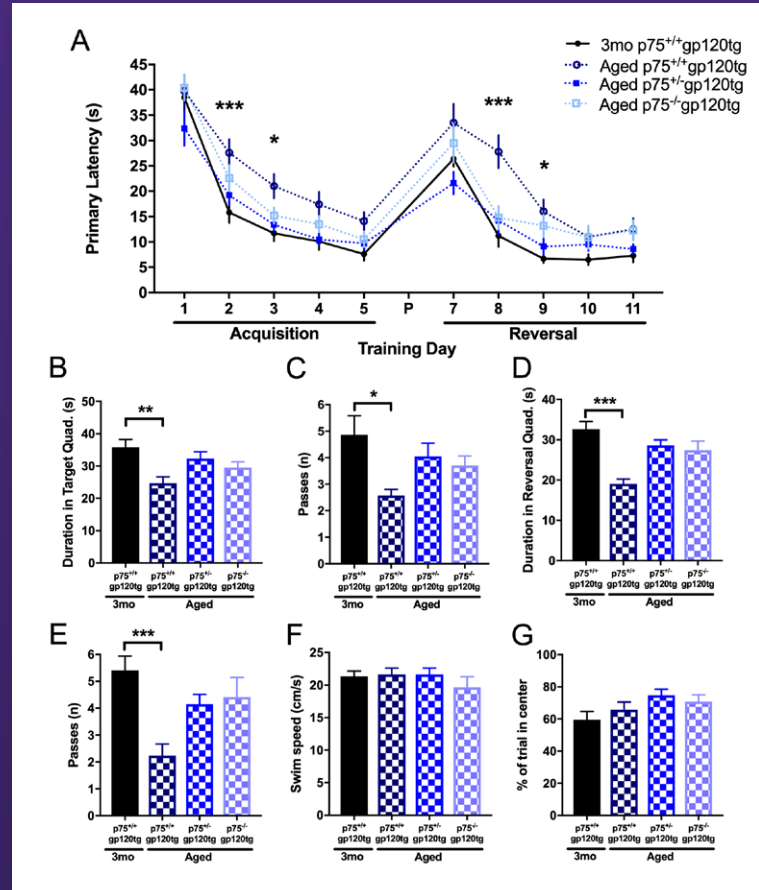
Prism Capabilities

Prism can create full publication-quality layouts containing multiple figures and data sets using customizable arrangements for preparing figures for publication or presentation.

Have a graph you'd like to submit? Email us at suggestions@graphpad.com!

How to Create This Graph

The graph was made using data taken in the morris water maze comparing four different experimental groups. Figure A was made using grouped data with mean, SD, and n calculated elsewhere and then plotted using this summary data as superimposed symbols (at mean/median) with connected line. The text at the bottom was added with the text tool under the "write" toolbar. The bar graphs are simple column data plots with the magic wand tool used to make everything look similar. The significance stars and bars were added with the text tool under the write toolbar. The figure was arranged in "layouts."

CLAUDIA KIELKOPF

This research was carried out by Claudia Kielkopf, Madhubrata Ghosh, Ganesh Anand and Simon Brown.

TITLE:

Butterfly Plot

Hydrogen/deuterium exchange mass spectrometry quantifies the exchange of protein backbone amide hydrogen to deuterium. The exchange rate is determined by structural protection and a comparison of two states, e.g. free protein vs. ligand-bound protein, thereby provides insights into conformational changes. This butterfly plot shows the relative uptake of deuterium in percent of apoD peptides, in the ligand-free form (apo, positive values) and the progesterone-bound form (prog, negative values). The plot does not reveal major changes in deuterium exchange over time, however, significant changes are present in nine peptides, e.g. in peptide 49-61 and in peptide 130-169.
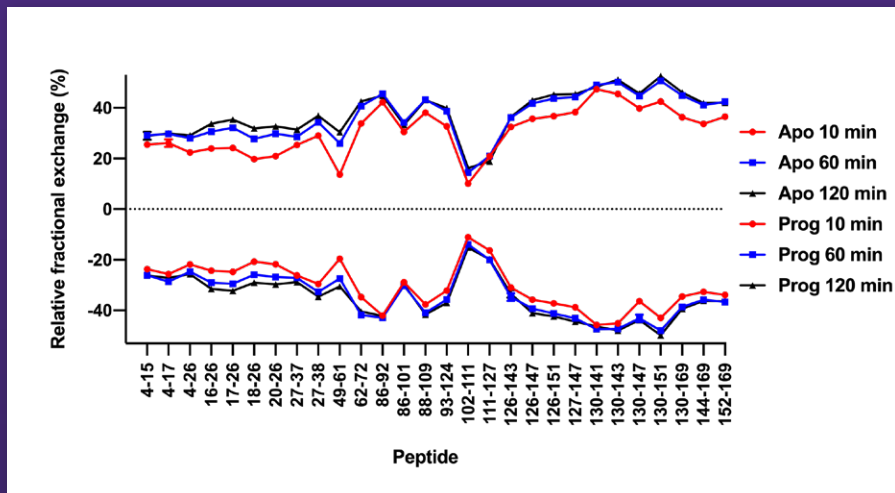
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Prism Capabilities

Prism allows you to compare groups of data on a "mirrored" Y axis: use positive values for one group of data and negative for the other to create the "mirrored" effect. Optionally (not shown), custom ticks and text can be used to re-label the negative portion of the Y axis to become a "mirrored" positive axis. This type of visualization is sometimes referred to as a "Butterfly Plot."

How to Create This Graph

This XY graph plots the peptide number on the X-axis and the deuterium exchange in % in comparison to the undeuterated sample on the Y-axis. The error bars show standard deviations. The X-axis crosses the Y-axis at -53% and a custom dotted line has been added at Y=0%. The X-axis had been elongated to allow sufficient spacing between peptide numbers.

BETHANY SENN

Department of Animal Sciences, University of Florida
Graph published in paper entitled "RNA-Seq reveals novel genes and
pathways involved in bovine mammary involution during the dry period
and under environmental heat stress." DOI:10.1038/s41598-018-29420-8

TITLE:

Upstream regulators involved in bovine mammary gland early involution

Ingenuity Pathway Analysis (IPA) upstream regulators in bovine mammary tissue comparing 3 days after cessation of milking vs. 3 days before cessation of milking (i.e. non-lactating/involution vs. lactating). The upstream regulator significance of enrichment at $p \leq 0.05$ with log2 fold change $\geq |1.0|$. Upstream regulators are grouped by functional categories with log2 fold change (equivalent to expression log ratio) in blue bars, Z-score (activated: > 2, inhibited: < -2) in orange bars, and significance of enrichment (–log10 P-value) in gray dots, all relative to involution.
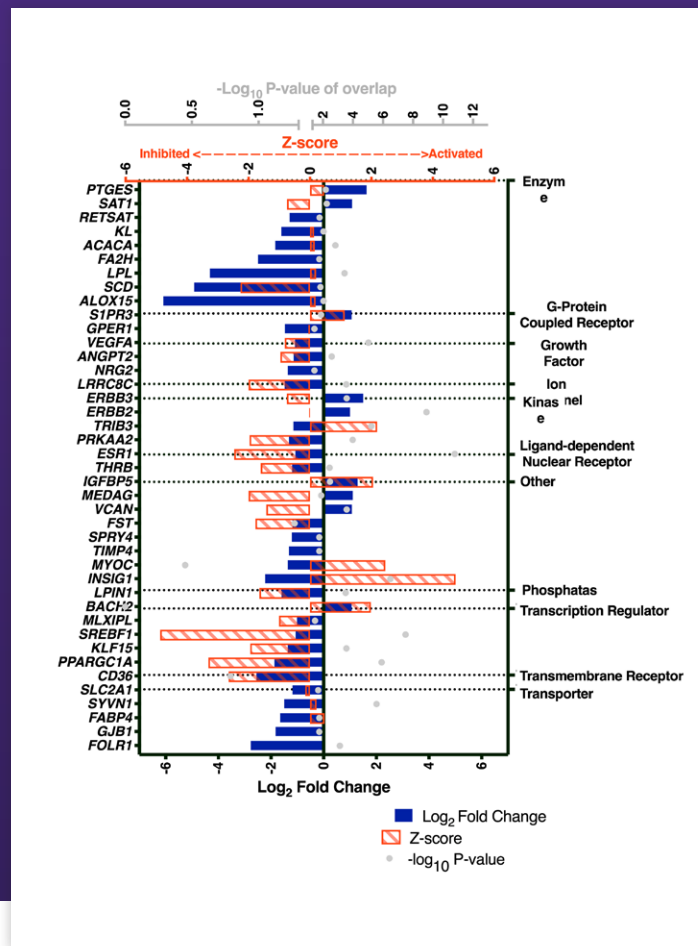
Prism Capabilities

Layouts in Prism can also be used to overlay multiple graphs with similar dimensions (and/or axis ranges) to create a single data visualization with many different layers of information in multiple different graph styles.

How to Create This Graph

This graph is a layout of three separate grouped data sets including the fold change (expression level, blue), z-score (activation status, orange) and significance (log p-value, gray) of upstream regulators indicated to play a role in the bovine mammary gland involution. The blue and orange bar graphs are separated bar graphs, and the gray dots are part of an interleaved bar graph with symbols instead of bars. The orange and gray graphs

had axes removed or relocated to lay on top of the blue graph in layouts and sizes were slightly modified so the symbols would lay nicely on top of the blue bars while still making all three layers visible. The bottom blue graphic includes additional dashed lines to separate the upstream regulators into their functional groups (as indicated on the right y-axis, added in the graph editing settings). Text was either added or altered in font, size, color change, and bolded.

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WILLIAM ZHANG

The full figure and accompanying manuscript are published in the Annals of Internal Medicine and can be accessed at annals.org/aim/article/doi/10.7326/M18-1037.

TITLE:

One-year percentage changes in levels of 9 urinary biomarkers among incident CKD case participants and matched control participants without CKD, stratified by randomization group, in SPRINT

The black bars denote incident CKD cases, and the gray bars denote matched controls without CKD. The dotted lines represent baseline. The y-axes are truncated at +/- 80%. Error bars denote the 95% confidence intervals. Brackets with p-values represent comparisons of 1-year changes between respective groups at bracket tails. P-values <0.05 were considered statistically significant and have been bolded.
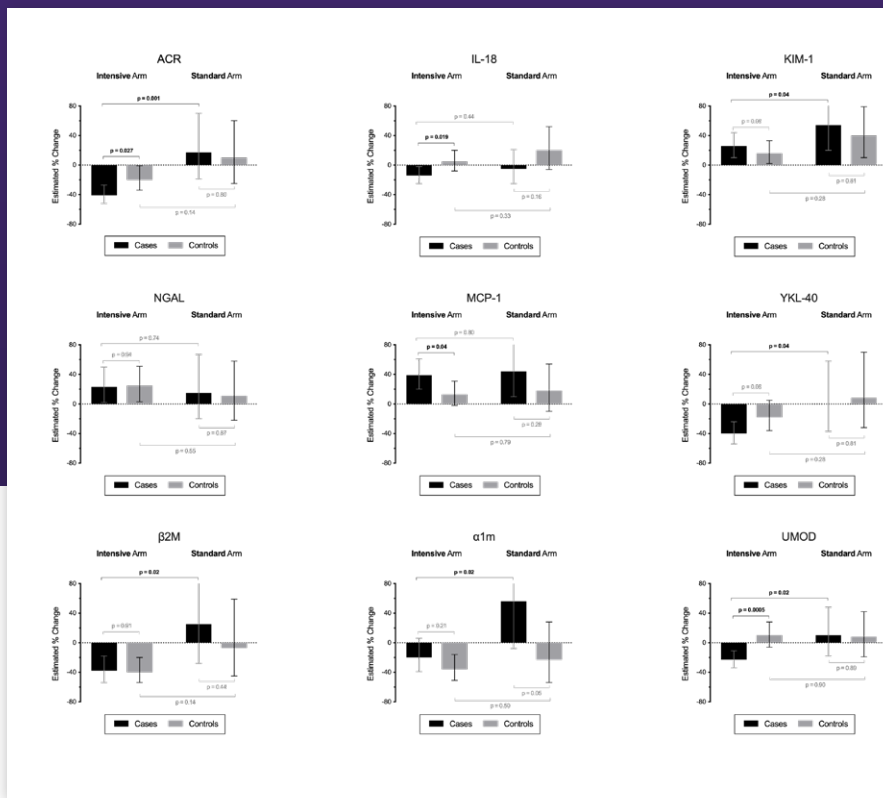
Prism Capabilities

In addition to arranging multiple graphs together in a publication-ready layout, Prism also provides easy tools to annotate your graphs; for example, brackets with centered text boxes can be added to indicate p-values directly on your graph.

How to Create This Graph

Individual graphs were created with the "Grouped" table template using the option to "Enter and plot error values already calculated elsewhere" with "Mean (or median), Upper/Lower limits". Brackets and p-values were then added to each graph using brackets with centered text and arranged to indicate which comparisons corresponded to which p-values. The nine graphs were then combined using the "Layout" function with a landscape, 3x3 standard arrangement template. Only one figure legend was retained and placed within the upper left graph.

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MARTIN KOLAR
IBD Clinical and Research Centre
ISCARE, Prague, Czech Republic

TITLE:

Early trough levels vs. late response to infliximab in IBD

Correlation of biosimilar infliximab serum levels and clinical response at week 54. Box plots show comparison of median infliximab levels at weeks 2, 6 and 14 between the responding and non-responding groups in both CD and UC. Drug levels were compared using the Mann–Whitney test.
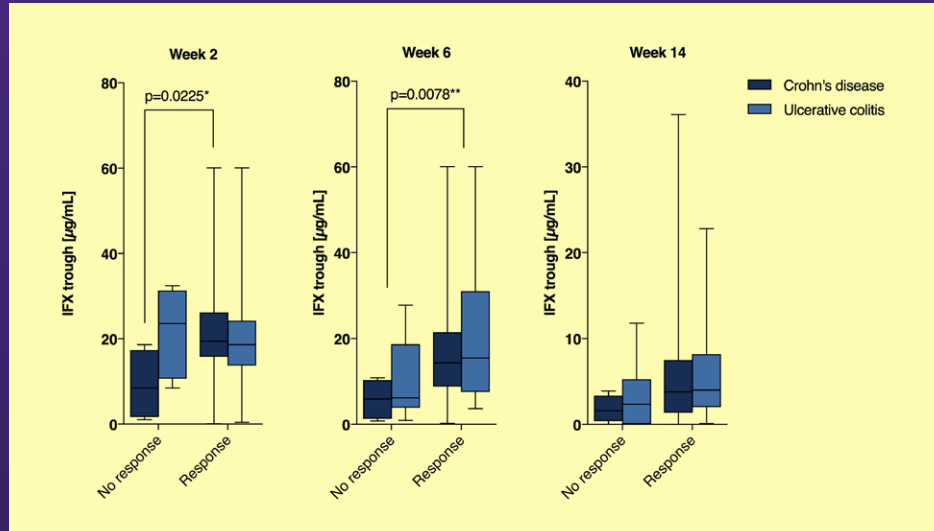
Prism Capabilities

Prism also provides a vast number of options for customizing the appearance of your graphs through color, font, and line styles. Combining a number of individual features together (layouts, brackets with centered text, custom color schemes, unique fonts, and specified line weights) allows you to add your own personal touch to any graph you create in Prism.

How to Create This Graph

3 grouped box and whiskers graphs arranged on a layout with a colored background. For each graph, the font was changed to Avenir LT 55 Roman, custom color choices were applied to each graph, and line thicknesses were customized.
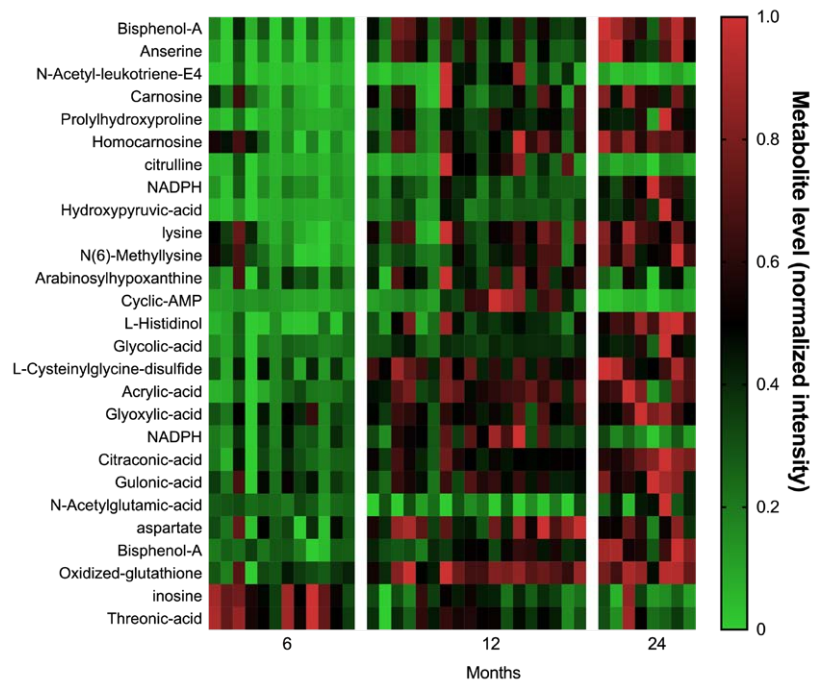
**Have a graph you'd like to submit?
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HOLLY HUNSBERGER

Columbia University in
collaboration with BERG, LLC

TITLE:

Metabolomic alterations in the aging brain

A heat map indicating metabolites that are up-regulated (red) or down-regulated (green) across ages (6 months, 12 months, 24 months) in the aging brain.

Prism Capabilities

Prism provides the ability to generate heat maps from Grouped data tables. In this example, vertical gaps were created in the heat map by including a column of blank data. However, Prism also provides the means to add combinations of vertical and horizontal gaps of custom widths between any specified columns or rows of data to easily create a visual separation of the data in the corresponding heat map.

How to Create This Graph

This is a grouped table format (plotting a single Y value for each point). Metabolite names were entered in the first column and then all samples with their metabolite values into the y columns. Data was plotted by selecting "heat map" under "grouped" graph. Many features of the default heatmap were then customized. In this case, red and green were used to indicate amount of metabolites present in each sample. A blank column between each age group was added to create separation of the three ages, with custom labels for the ages in text beneath each section. The heat map border and column labels were both turned off, while the legend was included, showing the range of values with text indicating that these values represent intensity of the metabolite. For the metabolite names appearing on the left side, the text font or size can be changed depending on personal preference. Heat maps are a fun and creative way to express complex data quickly!

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MINNA CHEN
University of Pennsylvania, adapted
from doi: 10.1002/mabi.201800248

TITLE:

Ejection Fraction

Ejection fraction, a measure of cardiac function, 28 days after delivery of PBS (n=15), composites without IL-10 (n=8), or composites with IL-10 (n=10) to rat MI and measured via pressure-volume catheterization (mean ± SD; *p<0.05, **p<0.01; healthy values in shaded boxes).
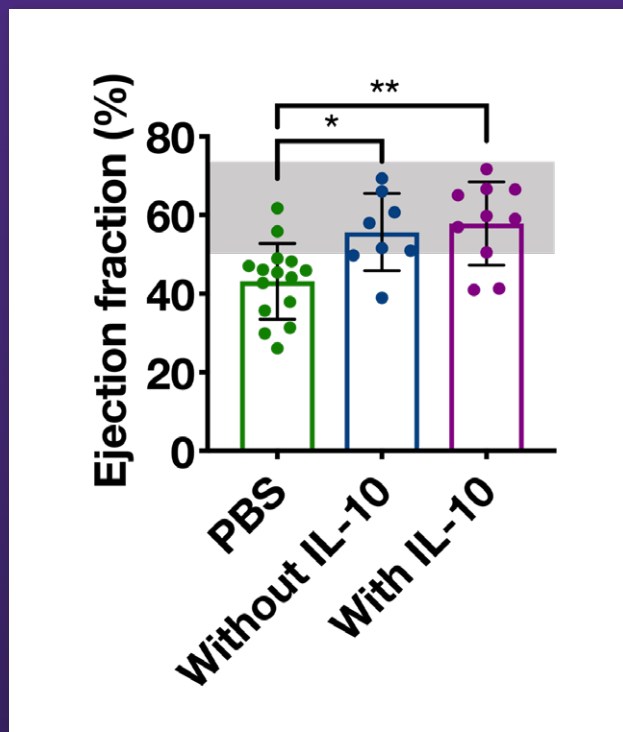
Prism Capabilities

One very useful feature that Prism offers is the ability to show a combination of individual data points (as a scatter plot) along with a summary of the same data (as a bar with error bars) on the same graph. Simply selecting this graph type in Prism will automatically create this visualization. Like the previous example, this graph also uses custom grid lines with shading between them to demonstrate a specific region of interest.

How to Create This Graph

This is a column graph showing individual values. The graph type is scatter plot with bar and the plot type is mean with SD. Custom text and lines to indicate significance were added, as well as a shaded area to indicate values in the "healthy" region. "Prism was essential in creating this graph because it allows me to easily display both the individual data points and summary data (mean, SD) on one graph."

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9

CLINT PENICK

The Biomimicry Center,
Arizona State University

TITLE:

Emergence of ant social dominance hierarchies

This figure shows different combinations of three dominance behaviors present in ants can lead to three types of dominance hierarchies in an agent-based model. (A) When only "dominance biting" was present, a linear hierarchy emerged with a ranked group of dominant individuals. (B) When "policing" was added, a despotic hierarchy emerged with a single dominant individual and no competitors. (C) Finally, when "antennal dueling" was added, a shared hierarchy emerged with a group of equally-ranked dominant individuals. Antennal dueling is an enigmatic behavior that has previously lacked a functional explanation, but these results show that it likely produces a "winner-winner effect" that allows for the emergence of shared-dominance structures similar to alliances and coalitions in higher vertebrates.
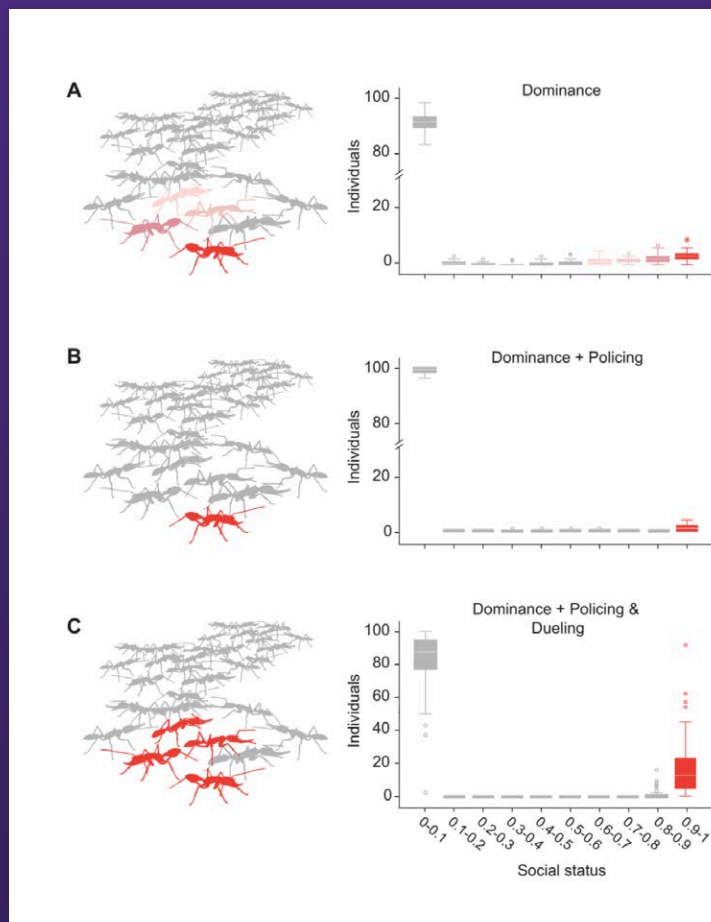
Prism Capabilities

Another example of Prism's versatility, the use of custom color in these box-and-whisker graphs quickly draws the observer's attention to specific components in the corresponding figures. Additionally, these graphs demonstrate Prism's ability to include axis breaks, providing a means to display multiple data sets together that may span a wide range of values.

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How to Create This Graph

The graphs were created as box plots in Prism so that each box represents the first and third quartiles, the horizontal line indicates the median, and whiskers extend to the farthest points not considered outliers (outliers shown as circles). Colors were added to the plots to indicate the dominant individuals in each hierarchy type, and these correspond to the colors in the accompanying images. The box plots were created using a layout in Prism, and the ant images were created separately in Adobe Illustrator. The entire panel was combined in Illustrator for publication.

FIONA SOPER
Cornell Universty

TITLE:

Dual stable isotope plot of nitrate samples from a tropical watershed

Nitrogen and oxygen stable isotope values for nitrate samples taken from different water pools within a Costa Rican rainforest watershed.
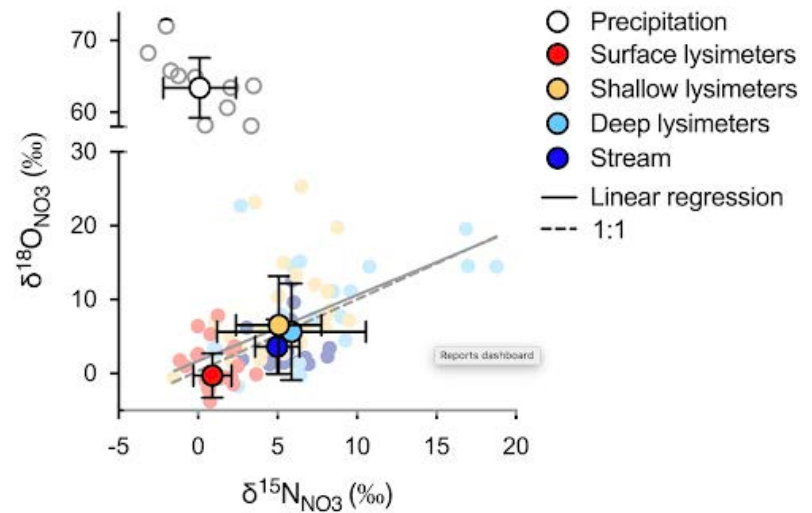
Prism Capabilities

This graph displays a number of very useful features of XY graphs in Prism. First, this graph demonstrates how Prism makes it possible to graph error bars in both the Y direction, and also to graph X error bars as well. Secondly, as in the previous example, this graph also provides a demonstration of axis breaks in Prism. Finally, through layouts and the use of color, individual values along with symbols summarizing this data can be shown together.

How to Create This Graph

This graph uses the Layout function to overlay a XY scatterplot of individual data points with another XY plot showing the data mean and range. The linear regression fit to the original data is also overlaid. The plot uses a split Y axis to highlight outlier data, and the 1:1 line was added manually using the Draw function.

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SK KAYUM ALAM

The Hormel Institute,
University of Minnesota

TITLE:

Survival Curve

Kaplan Meier curve depicting overall survival within the total cohort of 201 NSCLC patients based on the expression of IKKα mRNAs. The normalized read count for IKKα mRNAs were obtained from The Cancer Genome Atlas dataset (TCGA). The difference between the two groups was calculated using Log-rank (Mantel-Cox) test. HR: hazard ratio.
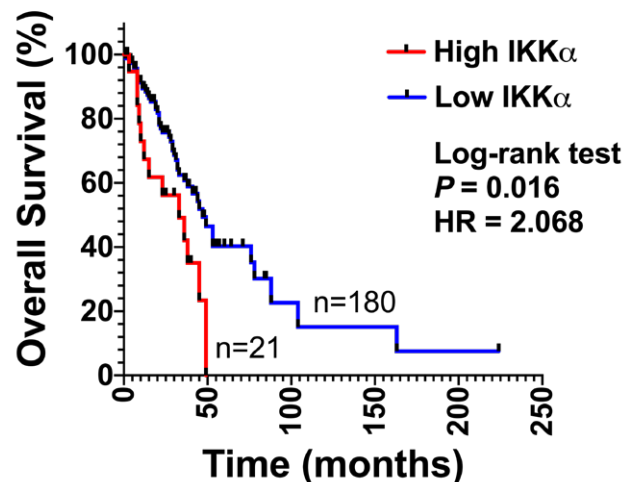
Prism Capabilities

One very unique feature of Prism is that survival analysis and graphing is performed automatically. Once the data are entered into the appropriate data table, Prism will automatically generate a Kaplan-Meier survival plot, and will compare survival curves using the log-rank (Mantel-Haenszel) and Gehen-Breslow-Wilcoxon tests. Importantly, this graph also demonstrates how analysis results can be copied from results sheets and pasted onto the graph. If the analysis is changed (for example because the data or analysis parameters change), the results on the graph will automatically be updated accordingly.

How to Create This Graph

This survival curve was created by first selecting the Survival tab from the Welcome dialog in GraphPad Prism 8. Experimental data were entered into the generated table with elapsed time entered as number of days. The statistical comparison was performed, and statistical details were copied from the analysis results to the graph.

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HYUNJI PARK

Georgia Institute of Technology

TITLE:

Nanoparticle size distribution

This graph shows yet another customization option for visualizing the amount of error in data. Here, instead of showing individual symbols for every data point — or showing a single point with error bars — this graph shows only a line connecting the means of replicate data at each X value. In addition, instead of individual error bars at each X value, the region between the upper and lower error bars has been shaded to visually represent the error. Though not shown here, when performing linear/nonlinear regression, Prism also provides the option of plotting either confidence or prediction bands along with the fit curve.
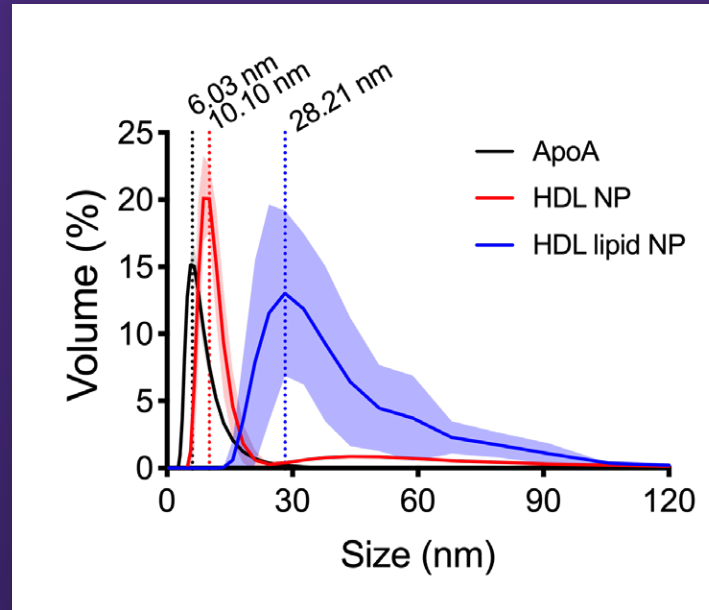
Prism Capabilities

Hydrodynamic nanoparticle (eHNP-A1-S1P) size distribution measured by dynamic light scattering (DLS) method (n=8). The size of nanoparticle was compared to the ApoA1 protein (n=8).

How to Create This Graph

Data were entered into an XY data table with replicates. The 'connecting line with error bars' graph type was chosen, and the error bar style was chosen to be a solid line. An area fill was shown for each data set with the option to shade the region between within the error bands.

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ANDRE O'REILLY BERINGHS

University of Connecticut — Xiuling Lu's Research Laboratory

TITLE:

Oxygenation Dynamics of Pharmaceutical Formulations

Real time change in oxygen content dissolved in pharmaceutical formulations upon pure oxygen bubbling (oxygenation). #1: saline (control), #2: formulation.
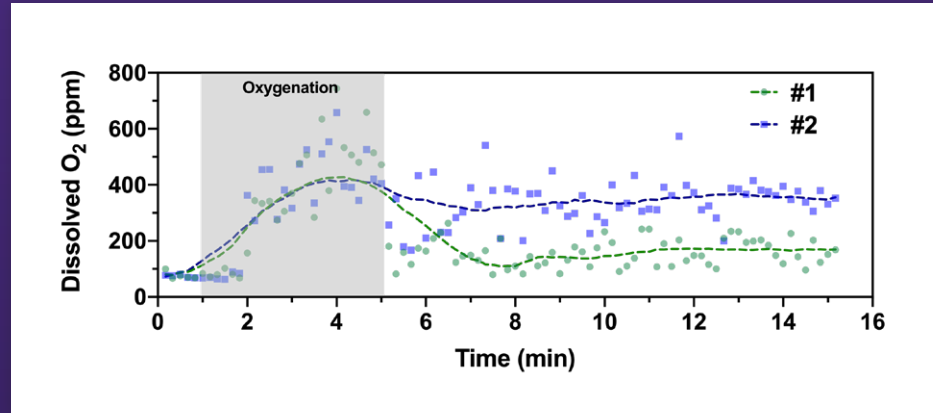
Prism Capabilities

Sometimes it's important to examine trends within data. Prism provides a number of options for fitting curves/splines such as smoothing splines or LOWESS curves to your data. These curves provide a visual representation of the local trends in the data as demonstrated by this graph. This graph makes use of a smoothing spline, and also highlights a region of interest. However, instead of using custom gridlines with shading between them (a potential option), this region of interest was actually generated by using the built-in drawing tools in Prism to create a semi-transparent rectangle in the desired area.

How to Create This Graph

Data were entered into an XY data table and the colors and symbol shapes were customized. To generate the curves, a smoothing spline was generated, and the resulting line style was customized to a dashed line. To create the region indicating oxygenation, a rectangle was drawn and the fill color was set to a semi-transparent gray color.

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TITLE:

Triple Plot Overlay

This figure includes data from a large preclinical trial whereby randomized groups of adult male Sprague-Dawley rats received one of various treatments to test the neuroprotective efficacy of candidate agents, P7C3-A20 or P7C3-S321, against the neurotoxic anticancer drug, paclitaxel (PTX). Using two behavioral pain tests (panels A and B) and a histological assessment of paw skin innervation (panel C), these data reveal that treatment with P7C3-A20 (and to a lesser extent, P7C3-S321) protects against the neurotoxic deficits produced by PTX. Panels A and B are integrated timecourse data from behavioral assays that measure changes in an animal's sensitivity to either mechanical (A) or cold stimulation (B). Panel C shows innervation density values determined from microscope images of immunolabeled paw skin biopsies. Data points for each treatment group are aligned top to bottom. Each dot represents data points for individual animals, with group means ± SEM denoted by horizontal black lines.
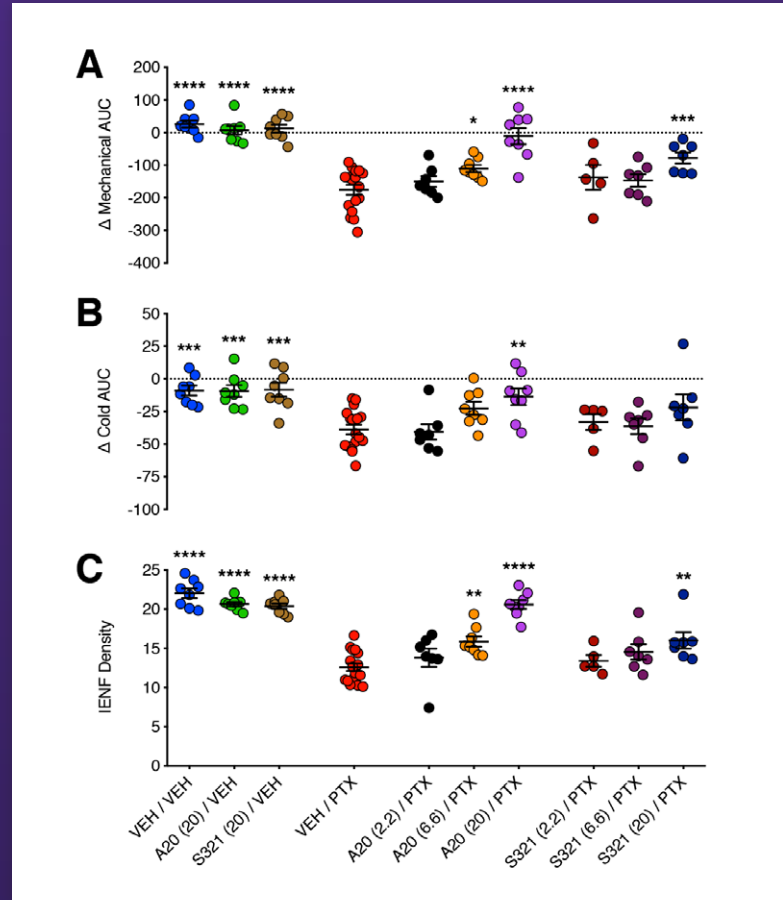
Prism Capabilities

This set of graphs shows another way that layouts can be used in Prism to great effect. Unlike previous examples, the graphs of this layout are neither overlaid, nor are they fully independent: all three graphs share a single, common X axis. This allows for easy comparison of data across each graph.

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How to Create This Graph

First, three different scatter plot graphs under the Column graph family were created to display individual data points for all animals in each group. A 1 x 3 portrait-oriented layout was generated to overlay the three plots that were scaled-adjusted to 55%. To reduce redundancy, the X-axis was removed for the upper two plots. Plot shape and size, horizontal spacing of groups, and color selection, and alignments were important issues here to avoid confusion on corresponding datasets. Final touch-ups included adjustments to parameters such font size, Y-axis title distance, and symbol size.

EMILY LING-LIN PAI

Institution: department of Psychiatry, Neuroscience graduate program, UCSF

TITLE:

Interneuron Neurite Complexity Analysis

This is a graph showing the Sholl analysis (morphology analysis) results of cortical interneurons generated from perinatal control and MAF transcription factor deletion conditional mutant mice. From the result, we can see that with double deletion of Mafb and c-Maf, cortical interneurons failed to generate the proper numbers of neurites; while losing c-Maf alone, cortical interneurons have neurite overgrowth.
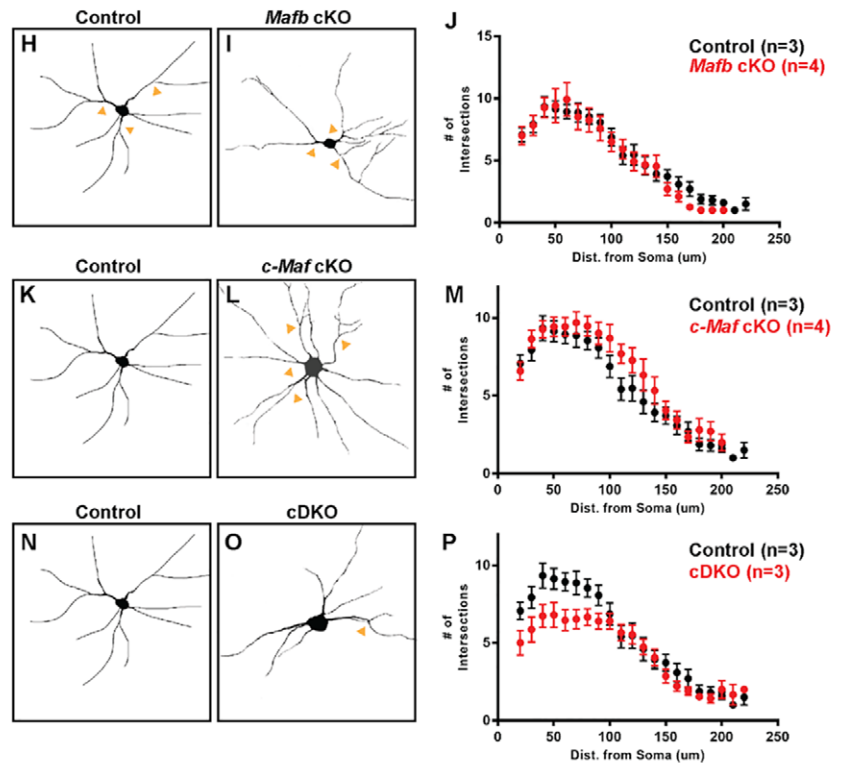
Prism Capabilities

Here is yet another example in which Prism graphs were combined with images to generate a complete, publication-quality figure quickly and easily. In these graphs, it can be seen that the data sets are displayed as a single point for each set of replicates at the mean of the replicates with error bars to indicate standard error of the mean (SEM).

How to Create This Graph

The graph was generated using the XY data table format. For each genotype, 20-30 individual cells were analyzed, and entered as replicate values. This data is displayed on the resulting graphs as Mean +/- SE, and show the numbers of intersections per 10um step output directly from the sholl analysis result.

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MIKKEL HØJLUND
University of Southern Denmark

TITLE:

Waterfall plot: Young outpatients with schizophrenia

Changes from baseline visit to follow-up visit in total antipsychotic dose in young out-patients with schizophrenia subject to life-style interventions (physical exercise, life style advice, smoking cessation etc.)
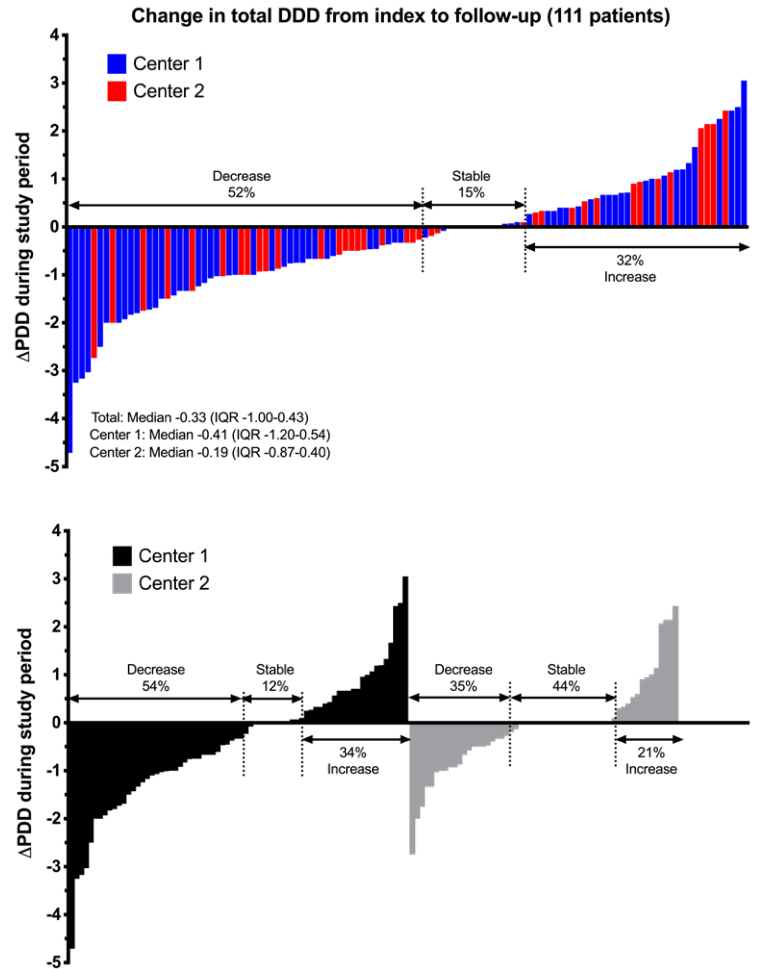
Prism Capabilities

Finally, this graph demonstrates a "waterfall plot" made in Prism by organizing data from smallest to largest prior to data entry into a grouped data table. These graphs also demonstrate how Prism can display grouped data in a variety of ways: here the data are shown as "interleaved" bars (top) and "separated" bars (bottom). Other options include showing bars as stacked as well as superimposed.

How to Create This Graph

Grouped data, showing two series, sorted by value, either interleaved to create a single "waterfall plot," or separated to display a single waterfall plot for each group. These waterfall plots are often utilized in oncology to show change in tumor size during treatment, but in this work they're being used to illustrate changes in total antipsychotic dose.

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Discover why 750,000 scientists, from students to Nobel Prize winners, use Prism to create and customize publication-quality graphs:

- Countless ways to customize. Once you've made your graph, you can customize any part of it. The possibilities are endless.

- Keep your data and graphs in sync. Because graphs and data are linked, if your data changes your graph will automatically be updated.

- Automate your work. Use the Prism Magic tool to make one (or more) graphs look like another — it's a huge time saver!

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