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How to.... make the best figures

What is a good figure?

A good figure clearly conveys a message. It informs and does not confuse the audience. Ideally, the figure is also visually attractive. This is where graphic design comes in (color and font choice, balance of individual components on the page, alignment of different parts of the figure).

In a piece of written text, a good figure can be read and understood without the reader having to go through the entire text. This is achieved by giving each figure its own figure legend (see below).

Take or Make?

Depending on the assignment, it may be okay for you to use existing figures. It can be tempting to take an image from the literature, because it obviously saves you a lot of time and effort. However, remember that an existing figure rarely says exactly what you want it to say. It is also likely to contain more details than necessary. So watch out with abbreviations that you don't define and other words/components that you don't explain: if you use the wrong figure, it may confuse your reader more than help them understand a concept! In this case, it may help to edit the figure: maybe you can erase certain parts, or insert arrows to draw the reader's attention to the main point.

Whatever you do, if you take a figure from an existing publication you need to acknowledge this in the figure legend. This can be done by adding a sentence at the end of the legend as follows:

For an unedited figure: "Image taken from Alberts et al. (2018)."

For an edited figure: "Image adapted from Alberts et al. (2018)."

If you don't include this information, the reader will naturally assume that you drew the figure yourself.

Draw from scratch

Idea and concept

Think about what you want the figure to illustrate. For a presentation, keep your figures clean and simple. A figure in a written report or article can contain more details, because the reader can spend more time with the figure (but here too: less is more).

What is the best way to convey information? Sometimes it may be a table, rather than a figure. Sometimes you will need a cartoon, other times you may need a



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picture/image or a chart/diagram. Does everything fit in one single panel or do you need multiple panels (e.g. an 'off' and an 'on' state of a signaling pathway; a 'before' and 'after' treatment condition; an experiment set up and timeline and the actual experimental results).

Execution

It is well worth the time investment to learn how to use a professional graphic design program, such as **Adobe Illustrator**. Once you can draw your own figures, you will never look back and it will come in handy for internship reports, scientific papers, literature theses, conference posters, PhD theses, Christmas cards and birthday dinner menus. Multiple tutorials on YouTube will help you get started.

Those looking for an alternative may be interested in trying **Inkscape**.

You don't have to draw everything from scratch. You can download a nice selection of science clipart here: <https://smart.servier.com>

A really nice addition to the graphic design toolbox is **Biorender**. Get your own free account at www.biorender.org, generate your figures online (if you have a free account you can save them via a screenshot) and you will dazzle everybody with the quality of your designs.

Resolution

Note that for high, publication quality print figures, you need a higher resolution (typical 300 dpi minimum) than for the screen (typically 72 dpi resolution). This is one reason why it is not advisable to draw images that ultimately need to be printed in **Powerpoint** (designed for the screen and so typically generating 72 dpi images).

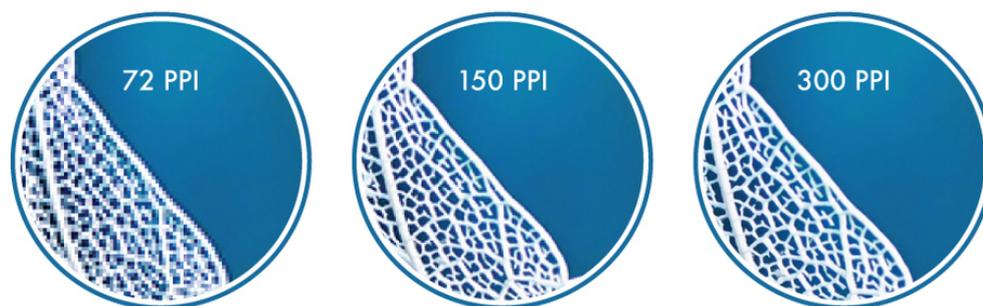


Figure 1. Resolution matters. Image taken from <https://www.shutterstock.com/blog/ppi-vs-dpi-resolution-guide>

Compression

When saving or exporting a figure, take care of potential compression artifacts. When you save an image in TIFF format, you will maintain the original quality. JPG figures are usually smaller, because of smart color compression algorithms. This helps



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reduce file size, but depending on the settings (you can usually choose how high or low you want the quality of your JPG image to be when you are saving/exporting), it will throw away more or less information from your figure. And once it's gone, it's really gone!

For more information on image formats: <https://www.peernet.com/image-format-guide/> and <https://www.shutterstock.com/blog/jpg-vs-png-vs-pdf>

Note that quite frequently you can save an image as PDF and import that file into Illustrator, after which you can break the high resolution PDF image down into each of the individual components for further formatting and editing (of course, when it comes to scientific data you **never** edit/modify the data itself, but you can edit the appearance of the data (color, line thickness, etc.).

Figure legend

In a Powerpoint/Keynote presentation, a figure can be a stand-alone item (make sure the title of the slide captures the take home point of the figure). But in print, every figure should come with a legend. A proper figure legend contains the following components: The number of the figure, the title of the figure and (if needed), a description of what exactly we see in the figure. Make sure you also define all abbreviations, scalebars, etc. As always: don't leave your reader guessing!

Example:

Figure 1. A cartoon depicting the organelles in an animal cell. The cytoplasm (depicted in yellow) is filled with dedicated subcellular structures that play a role in protein trafficking (red) and energy maintenance (green). Genetic information is stored in the cell nucleus (blue). ER = endoplasmic reticulum. Scale bar = 1 μ m.