nature structural & molecular biology

Go figure

A picture may be worth a thousand words, but ensuring that those words make sense is important, especially in the context of a scientific figure. Here are some tips for making your figures count.

Leonardo da Vinci's illustrations are a clear demonstration of the power of figures. With a few strokes of a pen, strategic labeling and a concisely written legend, he conveyed concepts, such as the design of the helicopter, that would have been extraordinarily difficult to convey through prose alone. Well, we aren't all Leonardos, though looking at some *NSMB* submissions, there may be at least a few such illustrative geniuses out there. For the rest of us, given that the message of a paper can be delivered or lost through good or bad use of figures, here are some tips.

Before we delve into the specifics, it's worth stating the obvious: in writing the paper, you are telling the reader a story, and the figures are there to support that story. Each figure should make just one point, adding one thread to the story you are weaving. It is not necessary or desirable to walk through every experiment or control; just describe the most important and most convincing experiments and controls (we all know that behind every good figure lie many experiments). Each figure should, as much as possible, be self-explanatory, so that the reader can get the gist of the story just by looking at the figures. It is extremely helpful to provide a model to connect the new results presented in the paper with previous work in the field (see below).

See guidelines. There are journal-specific policies for figure presentation, and it is good to be familiar with them relatively early in the process. Some things are required at initial submission: we, for example, ask for certain data for an X-ray crystallography or solution structure, and these are required for review. On the other hand, although we don't allow bold font in figures, font type certainly isn't something to lose sleep over at the initial stage. As the manuscript progresses through the process, however, it might save time later to be aware of such details. At all stages, the figures should be clear and legible. Early on, make the reviewers' lives easier by uploading files at the smallest file size where everything is clear. The final versions, by contrast, need to be at high resolution so as not to delay publication.

How many figures? Although our Guide to Authors provides guidelines for determining the maximum number of display items (figures plus tables), most *NSMB* papers have six or seven. Many more than this, and you might end up making the same point across multiple figures, diluting your overall message. Consider how a Results section is partitioned—usually into subsections that describe distinct sets of results conveying a common message. The figures should complement and reinforce those subsections. For some authors, creation of the figures comes first, and the Results sections arise from the logical ordering of the figures. Either way, the figures and the Results should complement and reinforce one another. This doesn't mean, however, that you should add extraneous figures: a figure should be included only when it is needed to support key conclusions and is necessary for understanding the paper.

How many panels? The obvious answer is not too many. In our Guide to Authors, we ask that you stick to one panel, and when (as mostly turns out to be the case) multiple panels are present, they should be logically connected. Too many panels make the figure, and its legend, difficult to follow. Although we often spend some time reorganizing your figure panels on the proof before you see it to ensure that the paper is easy to follow, there's little we can do if a figure is unwieldy to start with. In general, any panel whose data can be stated briefly in words—for example, a small table or a two-item bar graph—should be conveyed in a sentence of text instead.

What's in a label? Labels are key to keeping a figure as clear and stand-alone as possible. Keep labels minimal, concise and large enough that they will not become invisible if the figure is scaled down. Be particularly careful with figures that are associated with large datasets or show annotated genomic regions. Also note that many journals ask for sans serif fonts in figure labels; thus, it's worth heading straight to Arial and Helvetica especially for items that will be difficult to change later.

Getting colorful. Using color to distinguish data points is an obvious strategy. But too much color can be overwhelming and even confusing (your magenta may be someone else's purple, and you know things are getting out of hand if your legend mentions both salmon and fuchsia). Keep colors consistent across figures and place the key in a clear place. Finally, remember our policy on the use of red and green, which color-blind readers may not be able to distinguish (see *Nat. Struct. Mol. Biol.* **14**, 173, 2007).

A legendary figure. Even Leonardo had descriptive legends (though they were in mirror writing, contrary to current journal guidelines). The best type of figure legend is concise, informative and not redundant with the figure or the methods section. Scale bars, error bars and additional notation in the figure (asterisks and arrows) should all be defined.

A model paper. A figure illustrating the final model conveys the big picture. It encompasses what the paper says and what it suggests about how the system might work, and provides an impetus for future work. So it's surprising how many papers are submitted without them. A model at the end of a paper has resonance with the abstract, in that it summarizes the paper and its implications. Many authors are reluctant to do this, arguing that they are uncertain about aspects of the model. But speaking for ourselves, having a model on which to hang results provides a useful framework. Some papers even have a model figure at the beginning, then set out to show how the results support this initial figure. This strategy can, if used informatively and without hype, be a powerful mode of presentation, but it should be used with care.

These are just a few guidelines and suggestions for handling figures. Among the issues we haven't addressed is the question of which figure panels should go into Supplementary Information; this point, and the issues that surround it, merit a separate discussion. Until then, remember that simplicity rules in scientific figures, as in life. If only implementing this precept were a little easier. ∎