This week we're going to take a look at exactly what you DO with the photographs after you've made them.

And, once again, frankly we could devote a full six week course to just this idea alone--presenting your work.

But we'll try to cover this topic as best we can in just a couple of tutorials for you for this week.

So let's start with a few figures just to dissect them and get you to think more about how you create figures with your images.

Let's first take a look at a figure that the researchers made for a grant submission.

And here we see a host of the pieces of devices, and the full devices, all labeled.

They wanted to show what they were capable of creating--of course which is important.

But there's so much going on, the question is whether we want to bother looking anywhere.

By the way, just a note, I didn't make any of these images of the research, but I knew that a few of the original images were in color.

So first of all, why not use the color renditions if you have them.

Now, let's concentrate on the composition of the figure.

Why not somehow find a way that makes some sort of compositional sense?

So here, we re-ordered all these devices according to scale, so we're giving the readers some idea of how to look at this very busy figure.

In addition, we removed most of the labeling and we created a key to the images.

And that key would be labelled with letters, so that if you wanted more information about this particular image within the figure, for example its scale, like this one, you would then find that letter in the caption and get more information.

So, you might not agree (but I hope you do) if you look at them side-by-side, I hope you see that, once again: by simplifying, editing down your figures to the essential pieces, and organize them to tell your story, that the reader--and in this case grant reviewer--enjoys looking at your figure and understands the contents of your figure.

If you're using up space in your article, your presentation, or your grant submission, why not use that space so that the viewers actually want to look.

In this example, you are seeing two photographs that I made quite a while ago, depicting two ends of a long device.

The device was too long to get into one frame.

So the researcher used these two photographs in one figure.

The left and the right side of the device are combined, indicating that it's much longer, as you can see with this notation.

And we see all sorts of labels and arrows and SEM inserts.

What I suggested first from the very beginning is--please, give us a little more space to breathe!

So many figures are packed so tightly with stuff, and we actually don't know how to even start looking at it.

So for example, adding space around the perimeter, is what I did here by inserting the whole figure into an area with a larger canvas size.

And then, I questioned the labeling.

If you are labeling within an image, it's imperative to simplify your labeling and clean it up and make it nice and neat.

And here's what mean by that.

Try to put all your labels lined up as best you you can, either vertically and / or horizontally.

Next, question whether you really have to use a combination of upper- and lower-case letters.

Why not make all of your labels lower-case.

Get rid of your arrows.

Arrows with arrowheads are completely unnecessary.

They are distractions as labels.

Lines without the arrow heads are much better to use.

They're just more refined.

Rethink your colors.

How about using blue instead of fuscia?

Please?

So, I hope you agree that this is cleaner way of labelling your figures.

And, in the end, I also questioned the need for the SEM inserts.

I'm not sure we are really see more information about the structure of the device with these additional SEMs.

The optical image says all that we want to say.

And so I would have deleted the SEMs.

But if you insist on including inserts (maybe because, you just wanted to show that you were capable of making them, which is fine)...

At the very least, orient the inserts in the way that the rest of the optical image is oriented.

Here we're rotating these SEM inserts 90 degrees to make them more relevant to the full image.

And now let's look at them side by side.

Once again, I hope that you agree that the re-do is a much cleaner and simplified figure, which makes it much more accessible.

Let's look at another figure.

This photograph up here, made by the researcher, shows the device.

And here you see yet another point of view of that same device.

Down here we have a CAD drawing to represent an important part of the device where E. coli or traveling from one chamber to another.

And this other final piece of the figure is a micrograph of that very same important connection between the two chambers.

The question is, number one, are these photographs more than "good enough"?

I know that we talk about this a lot, but it's really important to think about it.

It's pretty clear when you put a photograph in your figure, it's important to have the best photograph you can make.

I wasn't convinced that these images were the best they could be, and so I offered to make another representation of the device.

And so, here, this is the image that I made, which, I hope you agree, looks better.

We decided to replace the first picture in the graphic.

The next question is something I feel pretty important to consider.

In this next photograph, ask ourselves: are we really giving more information, or, frankly, is it just redundant.

So we collaboratively decided that it's not an important piece in the figure.

It's not saying anything that we are not already saying.

So we deleted it.

We're simplifying, we're editing down the figure to the essential pieces.

After I looked at other images that they made in the lab, I suggested that we include a fluorescing image from their files of E. coli going from one chamber to the next, to sort of match the lower right SEM of the same area.

And they agreed.

And what I also suggested was to invert the fluorescing image so that it would work well with the rest of the pieces.

After all remember fluorescence in this situation is basically a tagging technique, telling us evidence of the presence of a particular structure, in this case E.coli.

We are not measuring or quantifying florescence--and we'll talk about that later when we discuss image manipulation.

So in this case it's perfectly fine to reverse the grayscale image, making this piece easier to read.

So we replaced the image we deleted, with this fluorescing image.

The researchers then decided they preferred another CAD drawing to replace the first one, which is fine.

And finally, we aligned and resized all the images to give us equal framing.

So we finally came up with we believed was a clearer figure.

Less redundant.

And it worked quite well, as you can see, in the published paper.

So we should compare them side-by-side, and once again, I hope you can see that second one is a marked improvement.

This is what we do on campus.

We work together in groups to dissect all sorts of draft submissions.

It really works very well, I encourage you to do the same on your own campuses.

Here's another figure that another group of researchers put together.

The tin sulphide powder which yields some information, then becomes deposited--and we see that somehow in an SEM of that layer--and ultimately the idea is to show how the researchers fabricated this solar cell.

It's about process.

So we went through a whole series of iterations and questions.

I've edited them down here so you can see a number of the attempts by the researchers.

So when I came into the picture, I first questioned whether the graph really had to be included in this figure.

Perhaps it could be have been placed elsewhere in the article.

And then we discussed whether it was important to show the powder.

They asked that i come up with another way of portraying the tin sulphide.

I tried it in vials.

I then suggested putting the SEM within an illustration, showing the various layers.

And then I made a photograph of the solar cell, which I think is better from their rendition, I hope you agree.

And we eventually evolved the final figure into this.

We concentrated on the picture of the solar cell.

Did not need the vials of powder, just showing the layers of the material.

Much easier for the reader to see and understand what is going on in this figure.

Again, editing and simplifying.