

Figure manipulation: assessing what is acceptable

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The Journal of Cell Biology instituted electronic submission of manuscripts in December, 2001. Our brief experience in handling the review process electronically has raised an important issue regarding the manipulation of digital images that I would like to bring to the attention of the members of the cell biology community, who are our authors and reviewers. Our concern is not that the manipulation of digital images is happening with greater frequency, but that there is the potential for it to be detected less frequently by our reviewers.

We are aware that most people who receive a manuscript for review electronically simply print out the file they receive and read the printed manuscript. Many image manipulations, however, are masked on the printout, and thus reviewers are approving data that they may have questioned if they received glossy figures. Often the manipulations are visible if the reader takes the time to look at the figures on the screen, instead of on the printout.

I encourage reviewers to take this extra step when they have finished reviewing the printed manuscript.

In the face of this potential loss of quality control, we at the *JCB* have instituted an additional step in our production process whereby the image files for accepted manuscripts are scrutinized by digital image experts for any indication of improper manipulation. If they raise any concerns, the authors in question will be required to submit the original data that was used to make the figures to the *JCB* editorial office for examination.

I encourage senior authors to undertake a similar step of quality control before their manuscripts are ever submitted. They should examine the final figure files (especially bands on gels) closely using the zoom feature or the magnifying glass tool, which is available in all image and presentation applications. This should not be construed as an act of mistrust. Despite the growing popularity of scientific ethics courses in many graduate programs, it is possible

that some young investigators are not aware of what constitutes "improper manipulation". For their benefit, here are a couple of gross examples:

(1) Adjusting the contrast/brightness of a digital image is common practice and is not considered improper if the adjustment is applied to the whole image. Adjusting the contrast/brightness of only part of an image is improper, however, and this practice can usually be spotted by someone scrutinizing a file.

(2) Juxtaposing two lanes that were not next to each other in an original gel is common practice when preparing figures from hard copy photographs of the gel, and is acceptable manipulation if the figure is digital. Taking a band from one digital image and placing it in a lane in another is improper manipulation, which can usually be spotted by someone scrutinizing a file.

I hope that raising awareness of this issue among reviewers and authors will help to reduce the number of examples of manipulated images that make it as far as our production department.