

## Commentary

# Ethical center-piece for genetics and genomics studies: Broad advice on figure and gel manipulation

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As a new open access journal that aims to explore the boundaries of science that rely on genetic and genomic tools, Biomedical Genetics and Genomics (BGG) will undoubtedly receive ample submissions whose data sets are illustrated by figures and in many cases, by gels that are used to serve as a form of proof of molecular analyses. As a new journal, the editors and readership should be made aware of some of the risks associated with figure and gel manipulation and should establish a set of guidelines and rules that are able to detect and deal with figure/gel manipulation when it occurs. In some cases, lack of experience or pure error can lead to images that are or appear to be manipulated, but in other cases, figures have been purposefully manipulated by authors in order to trick the editors into believing that a result that they have claimed is supported by the photographic evidence they provide. In other words, the most worrying cases of figure manipulation are those cases that involve misconduct. An analysis of the instructions for authors of BGG indicates that this journal does not appear to be prepared for accidental or purposeful cases of figure manipulation, or even figure-related misconduct. Such cases can have serious academic ramifications and damage the journal's reputation is not handled quickly, or effectively. Even though there ethical guidelines at BGG that explicitly state the ethical requirements of authors and editors [1], there are no explicit instructions or guidelines related to image and figure manipulation, especially on the figure preparation page [2]. This gap in the ethical firewall would automatically invite dishonest authors who are more prone to manipulate figures, to submit to BGG. Once published, BGG could hyperlink the figure preparation page to this manuscript to alert prospective authors and peers/editors to this crude set of guidelines and warnings.

The purpose of this commentary is thus to provide rough and broad guidelines for avoiding figure manipulation to alert editors and peers what they should be looking out for when they conduct peer review for BGG. By ensuring that there is at least awareness of the issues, the journal would then be able to build a more solid and comprehensive set of guidelines to avoid figure manipulation. This paper could also serve as a supplement for a section that already exists at BGG [3]. Some excellent examples may be found in Rossner and Yamada [4], or even on PubPeer ([www.pubpeer.com](http://www.pubpeer.com)).

As a first step, some useful image manipulation guidelines currently used by several journals are listed next, *verbatim*.

### The American Journal of Botany [5]

#### "Image Manipulation"

The following guidelines are adapted from *The Journal of Cell Biology's* (Rockefeller University Press) instructions for authors (available at <http://jcb.rupress.org/site/misc/print.xhtml#digim>).

For further guidance on acceptable and unacceptable digital image manipulation, see *J Cell Biol* (2002) 158: 1151 (<http://www.jcb.org/cgi/content/full/158/7/1151>); and the Office of Research Integrity's Online Learning Tool for Research Integrity and Image Processing (<http://ori.hhs.gov/education/products/RIandImages/default.html>). Images that will be compared with each other must be acquired and processed under the same conditions. No specific feature within an image may be enhanced, obscured, moved, removed, or introduced. The grouping of images from different parts of the same micrograph or gel, or from different micrographs or gels, fields, or exposures, must be made explicit by the arrangement of the figure (*i.e.*, using dividing lines) and in the text of the figure legend. Adjustments of brightness, contrast, or color balance are acceptable if they are applied to every pixel in the image and as long as they do not obscure, eliminate, or misrepresent any information present in the original, including the background. Manipulations such as background subtraction or white-balancing must be explained in the Materials and Methods. Non-linear adjustments (e.g., changes to gamma settings, changes in color balance or tonal range based on threshold settings) must be disclosed in the figure legend. Questions raised about a manuscript will be referred to the Editor-in-Chief, who will request the original data from the authors for comparison to the prepared figures and who may refer the matter to the Publication Ethics Subcommittee of the *AJB* Editorial Board. If the original digital image data cannot be produced by an author when asked to provide it, the manuscript may be rejected or acceptance of the manuscript may be revoked. Any case in which the manipulation affects the interpretation of the data will result in revocation of acceptance. Cases of suspected misconduct may be reported to an author's home institution or funding agency, following procedures recommended by COPE (<http://publicationethics.org/resources>) or, for U.S. authors, referred to the Office of Research Integrity (ORI; <http://ori.hhs.gov/>). The latter part related to COPE is already aligned with current BGG policies related to broad ethical guidelines which the publisher states follows COPE guidelines.

### Journal of Experimental Botany [6]

"Composite figures made by reorganizing different parts from the same or different gels/blots/exposures must be made explicit – clear dividing lines should be used to separate individual parts and the rationale for this arrangement must be explained in the legend. Presenting composite images as unedited originals, giving an impression

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that no reorganization has occurred, is unacceptable. No specific region or feature within an image should be modified (*i.e.*, moved, removed, introduced, enhanced or concealed). Brightness, contrast and colour balance adjustments are permitted if they are applied to the whole image and do not misrepresent or otherwise obscure the information provided. Disclose any nonlinear adjustments, such as changes to gamma settings, in the figure legend. You should keep ready access to all original images, which should be high quality, unedited, uncropped and high resolution. These may be requested during peer review.”

### Cell (inclusive for more than three dozen journals) [7]

“Authors should make every attempt to reduce the amount of postacquisition processing of data. Some degree of processing may be unavoidable in certain instances and is permitted provided that the final data accurately reflect that of the original. In the case of image processing, alterations must be applied to the entire image (e.g., brightness, contrast, color balance). In rare instances for which this is not possible (e.g., alterations to a single color channel on a microscopy image), any alterations must be clearly stated in the figure legend and in the Experimental Procedures section. Groupings and consolidation of data (e.g., cropping of images or removal of lanes from gels and blots) must be made apparent and should be explicitly indicated in the appropriate figure legends. Data comparisons should only be made from comparative experiments, and individual data should not be utilized across multiple figures. In cases in which data are used multiple times (e.g., multiple experiments were performed simultaneously with a single control experiment), this must be clearly stated within each figure legend. In the event that it is deemed necessary for proper evaluation of the manuscript, authors will be required to make the original unprocessed data available to the editors of the journal. All accepted manuscripts will be taken through a data presentation image screening process before publication.”

### Proceedings of the National Academy of Sciences (USA) [8]

“Figure Preparation- No specific feature within an image may be enhanced, obscured, moved, removed, or introduced. The grouping or consolidation of images from multiple sources must be made explicit by the arrangement of the figure and in the figure legend. Adjustments of brightness, contrast, or color balance are acceptable if they are applied to the whole image and if they do not obscure, eliminate, or misrepresent any information present in the original, including backgrounds. Questions about images raised during image screening will be referred to the editors, who may request the original data from the authors for comparison with the prepared figures. If the original data cannot be produced, the manuscript may be rejected. Cases of deliberate misrepresentation of data will result in rejection of the paper and will be reported to the corresponding author’s home institution or funding agency. Authors must obtain consent for publication of figures with recognizable human faces.”

### PLOS Genetics [9]

“Image manipulation- Image files should not be manipulated or adjusted in any way that could lead to misinterpretation of the information present in the original image. Inappropriate manipulation includes, but is not limited to: The introduction, enhancement, movement, or removal of specific feature(s) within an images; Unmarked grouping of images that should otherwise have been presented separately (for example, from different parts of the same gel, or from different gels, fields, or exposures); Adjustments of brightness, contrast, or color balance that obscure, eliminate, or misrepresent any information. Digital images in manuscripts nearing acceptance for publication may be scrutinized for any indication of improper manipulation. If evidence is found of inappropriate manipulation, we reserve the right to ask for original data and, if that is not satisfactory, we may decide not to accept the manuscript and may also contact the authors’ institutions to ask them to assist with investigation.”

### Frontiers in Genetics [10]

“Frontiers take concerns regarding image manipulation seriously. We request that no individual features within an image are modified (eg. enhanced, obscured, moved, removed or added). Where images are grouped together, for example, parts of gels are lined up, this must be clearly explained in the figure or in the figure text. Any change in brightness, contrast or color balance must be applied to every pixel in the image and the changes should not alter the information illustrated in the figure. Any concerns raised will be investigated and the authors will be asked to provide the original images.”

BGG has the ability of creating a data-base of studies that are valuable to geneticists provided that caution and care is taken in ensuring that principles that can avoid or reduce figure manipulation are followed. It is the hope of the author that these suggestions may be developed into a robust set of guidelines that may reduce or eliminate figure manipulation from BGG papers.

### References

1. <http://www.oatext.com/PublicationEthics.php>
2. <http://www.oatext.com/Figurepreparation.php>
3. <http://www.oatext.com/Plagiarism.php>
4. Rossner M, Yamada KM (2004) What’s in a picture? The temptation of image manipulation. *J Cell Biol* 166: 11-15. [[Crossref](#)]
5. <http://www.amjbot.org/site/misc/ifora.xhtml>
6. [http://www.oxfordjournals.org/our\\_journals/exbotj/for\\_authors/index.html](http://www.oxfordjournals.org/our_journals/exbotj/for_authors/index.html)
7. <http://www.cell.com/figureguidelines>
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