



# Publishing High-Quality Figures

**A supplement to the video “Publishing Figures:  
Eight Tips for Achieving High-Quality Results”**

**A training resource of the ISMTE**

# Table of Contents

- Introduction..... 3
- I. Image Resolution and Size..... 3
- II. Color Considerations..... 4
- III. Figure Style Guidelines..... 5
- IV. Involving Authors..... 5
- V. Training Staff..... 6
- VI. Reviewing Proofs of Figures..... 7
- VII. Microsoft Office® Considerations..... 7
- Appendix A (Example Figure Style Guidelines)..... 9
- Appendix B (Example Frequently Asked Questions for Authors)..... 10

## Introduction

Publishing high-quality figures is a critical component to achieving a visually cohesive and professional-looking journal. Images, photos, and graphs tell the reader a story, conveying data and information necessary for understanding the research process and results.

Poor quality figures can impact a reader's experience and result in an overall negative perception of the journal's quality. Factors such as improper sizing, poor resolution, and inconsistent style can ultimately detract from the journal's overall visual appeal. The good news is that there are several simple measures your editorial office can take to improve the publication of figures in your journal. The following guide is a supplement to the video "Publishing Figures: Eight Tips for Achieving High-Quality Results". The guide and video are intended to be used in tandem, as they both contain unique and valuable information to help you achieve maximum results.

### I. Image Resolution and Size

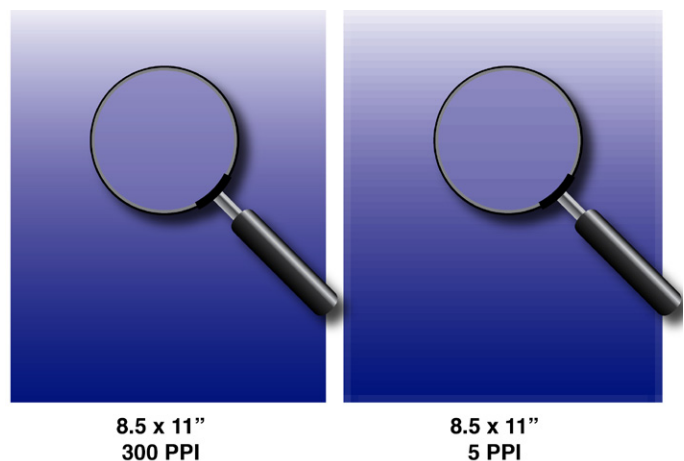
*When assessing whether an image is suitable for print, first look at two file attributes: the size and the resolution. Size and resolution are different, although both are important. When you're working with digital files, it's important to understand the distinction, and to know how to assist authors who may not.*

- What is resolution, and how is ppi different from dpi?

Resolution is the number of pixels in a given area (usually inches); this measurement determines the quality of a printed image (the "fineness of detail"). Resolution is often given as "pixels per inch" or ppi. Sometimes this is mistakenly referred to as dots per inch (dpi), although this term is not technically the same as pixels per inch ("dpi" actually refers to the dots of ink in printing). Size is the width and height of the final printout (the "print size"). A file can print at the correct column width, but can be high or low resolution, depending upon how the image was captured or saved.

- Why resolution is important:

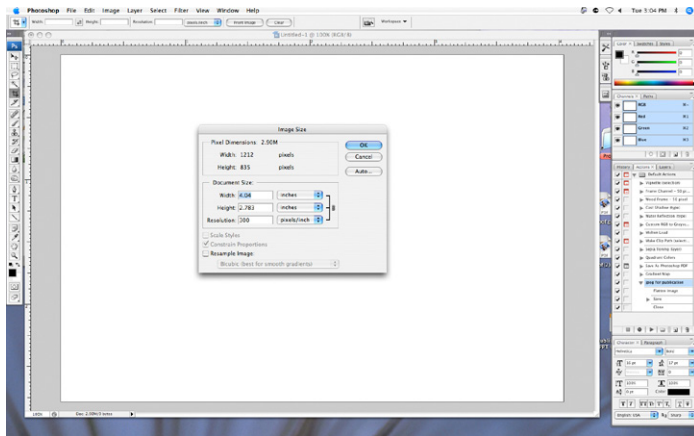
The resolution of an image determines its "sharpness" (at high resolution), or alternatively, its "blurriness" (at low resolution). For a good quality print, an image should have at least 300 ppi. It is often assumed that an image that looks good on a computer monitor will print well in a journal, but that is not necessarily true. Images on a screen require a much lower resolution (approximately 100 ppi) to display adequately. It's important to look at both the physical print dimensions and the ppi to determine if the print will be good quality.



Same size, different resolutions

- How to check image file resolution:

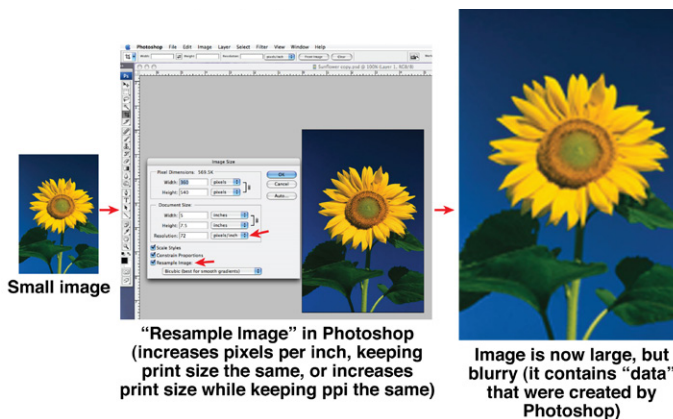
You can determine both the size and resolution of a jpeg or tiff image file within Adobe Photoshop®. Go to Image > Image Size. In the dialogue box, you will find both the Resolution and the Print Size given in whatever units the program has set to the default (these could be percent, inches, centimeters, millimeters, picas, points, or columns; you can change this under your Photoshop Preferences menu). Resolution should be at least 300 ppi to produce a high-quality journal print. Also in the "Image Size" dialogue box, you will see that the Width, Height, and Resolution attributes can be linked together or unlinked, by unchecking or checking the "Resample Image" box.



Checking figure image size in Adobe Photoshop

- Why you shouldn't "upsample":

When the size of the image is linked to its resolution (by unchecking "Resample Image"), any increase in resolution causes the print size of the image to decrease. When the size of the image is independent of its resolution (by checking "Resample Image"), the resolution can be increased while keeping the print size consistent. However, this latter case of adding pixels is called "upsampling" or "interpolating", and it can lead to blurry, unusable images. In this case, Photoshop essentially takes an educated guess regarding where to add pixels. In other words, the program adds data to the image that don't really exist. The end result is technically higher in resolution, but the overall result is a blurrier, less accurate image. We do not recommend this method. If your images are too small, it is better to publish them at a smaller size, or request larger ones from the author, rather than to upsample them and publish blurry images.



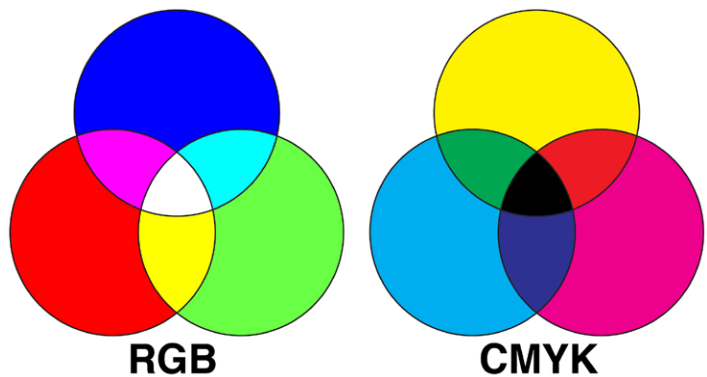
"Upsampling" leads to blurry images

## II. Color Considerations

Color is an important element of figure quality. Authors typically pay for color printing and thus have high expectations for their color images. To manage these expectations, the following issues are critical to understand:

- RGB vs. CMYK:

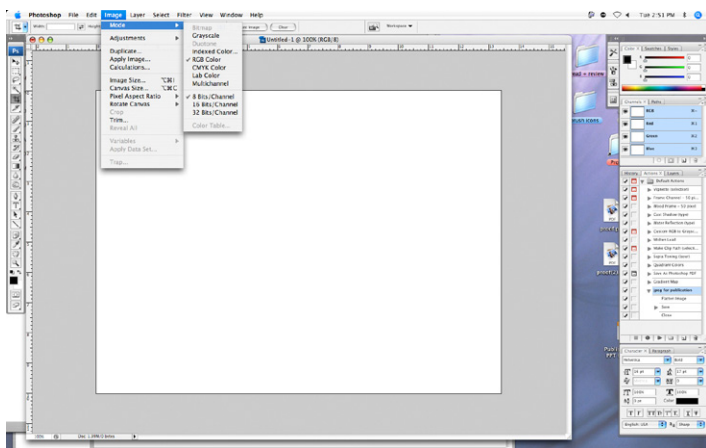
RGB is a color mode used by computer monitors, video screens, digital cameras, and other technologies through which light is emitted. RGB mixes three colors (red, green, and blue) in various combinations to build all the colors in the images we see. CMYK is a color mode that uses four print inks (cyan, magenta, yellow, and black) mixed together in various ways to create all of the colors in printed images. CMYK digital files simulate the four-color printing process used by printers. Although images in RGB mode usually appear brighter and more attractive on screen (particularly with certain types of images such as fluorescent cell stains), converting digital images to CMYK mode will show a more faithful preview of what to expect in print publications.



Two color modes most commonly encountered in print files

- How to check a figure's color mode:

To check the color mode of an image in Photoshop, open the image and go to Image > Mode. The menu to the right will display the various color modes and a check mark will appear next to the file's current color mode setup. To change to a new color mode, simply select a new color mode from this menu.



Checking figure color mode in Adobe Photoshop

• Mac vs. PC issues:

Macs and PCs display color differently, so digital images will appear slightly brighter or darker, depending upon which system is used to view them. This can make quite a bit of difference, especially if the author is depending upon subtle color gradations to tell a story in their figures.

• Color shift from screen to print:

Regardless of how well a computer monitor is calibrated, the colors on a monitor are created using light, and the colors in print media are created using ink, so the two are never going to appear exactly the same. In addition, the editorial office has no control over the monitors each author is using to view their digital images at the time of submission. The bottom line is that some images may never print as vibrantly as authors might like, but this is the nature of four-color printing.

**III. Figure Style Guidelines (see Appendix A for example style guidelines)**

*To achieve a consistent look in your journals, educate authors, and maximize the efficiency of your staff, it is necessary to develop and implement a set of style points for all figures. Tips:*

- Develop and maintain style guidelines. Work with a graphic designer (internally or perhaps through your publisher) to develop a set of style points that can be applied to all figures. Ensure that your

editor is satisfied with the style prior to implementation. Suggestions for the development and maintenance of style guidelines include:

**Consider** elements such as font size and style, capitalization, figure resolution, color quality, layout, line weight, figure labeling, and scientific notation.

**Use** AMA, APA, or other style manuals as a foundation.

**Evaluate** what will be most legible, useful, and appropriate for your audience.

**Document** all style modifications as the style evolves.

**Publicize** updates to the style manual to authors and staff to ensure that your publication is consistent.

- Publicize style guidelines. It's important that your authors and staff are aware of your style guidelines. Examples for places to publicize your guidelines include:

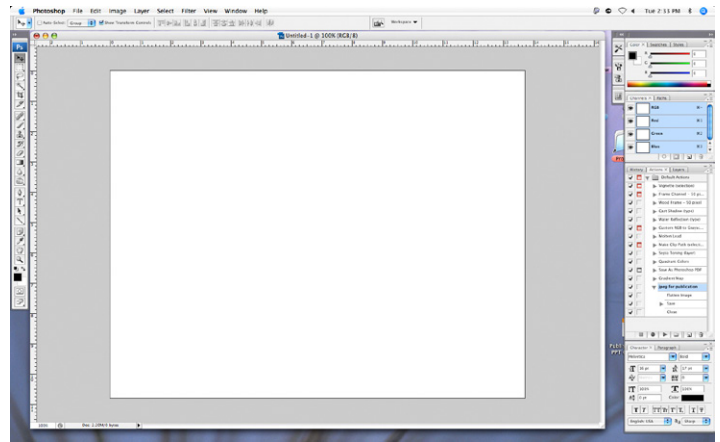
- Instructions to authors (print and online)
- Manuscript management system
- Manuscript submission checklists
- Decision letters

**IV. Involving Authors**

*One of the easiest ways to publish high-quality figures is to educate your authors on how to prepare their figures prior to submission. Tips:*

- Make sure authors have a copy of your style guidelines. When authors have access to your style guidelines early in the figure development process, they are more likely to submit figures that adhere to your expectations.
- Request new figures when those submitted don't meet your guidelines. It is often easier to make small changes yourself rather than requesting new figures, but in doing so, authors will not be aware of what you expect. Therefore, it is worthwhile to ensure they understand and comply with your style guidelines by requesting new figures.

- Develop a list of Frequently Asked Questions (FAQs) about figures. A list of FAQs will help educate your authors and minimize staff time in responding to questions (see [Appendix B](#) for example FAQs).
- Provide convenient means for transferring large figure files. Authors will become frustrated trying to email large files and will therefore sometimes settle for emailing smaller—and therefore lower resolution—files to get the job done. To avoid this issue, provide your authors with an FTP site to upload files, providing support for use of the site when necessary.



Adobe Photoshop

## V. Training Staff

*A key step in publishing high-quality figures is having a staff that can evaluate submitted figures and modify them if necessary.*

- At the bare minimum, consider investing in the necessary training and software applications to equip your staff to evaluate author-submitted figures. In-person seminars, online courses, and self-paced DVDs on graphics training abound and are relatively affordable.
- Ideally, if budget and staffing availability permit, train your staff to modify author-submitted images. Altering font size, font type, line weight, shading, and figure size are easy tactics to developing a consistent style.
- Software/equipment necessary for modifying figures:

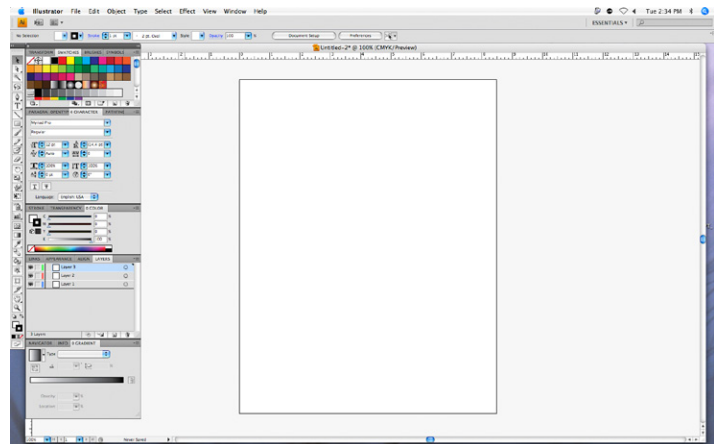
### **Adobe Photoshop®**

Photoshop is the industry standard for working with digital graphics.

Although the Adobe software requires more training and experience than Microsoft Office®, it provides an impressive amount of flexibility and power for evaluating and manipulating graphics files.

### **Adobe Illustrator®**

Once editorial office staff have become proficient with Photoshop, they will have a head start on mastering Illustrator, as it has a similar user interface. Although it is not necessary to use both software packages to manage smaller figure edits, it is very helpful to have at least basic Illustrator skills to help with major figure modifications performed on a routine basis.



Adobe Illustrator

### **Microsoft (MS) Office®**

Although we recommend discouraging authors from submitting materials in the MS Office file formats, you will likely still receive a large number of these file types. Therefore, it is useful to have at least a basic working knowledge of these products.

## VI. Reviewing Proofs of Figures

The publication of high-quality figures can be achieved by reviewing article proofs as provided by your designer, publisher, or compositor. To facilitate the review process, both authors and editorial office staff should be aware of several key points.

- What authors need to know:

**The editorial office might edit the author's figures after submission.** It is essential that authors are forewarned in multiple places, including the instructions to authors.

**The author will have a chance to review any edits made by the staff.** This can be handled in the first-proof stage, allowing enough time for the author to review a second proof if needed.

**The author is responsible for thoroughly proofing the figures** to verify their accuracy. This point should be made clear so there are no misunderstandings later if any errors are missed. Consider including a notice on the proof indicating that the artwork has been modified and should be carefully checked by the author for accuracy.

**The more the author complies with the journal's figure guidelines, the less their figures will need to be modified.** This is sometimes helpful in encouraging compliance with guidelines.

- What the editorial office staff needs to review:

The editorial staff should watch for the following items when reviewing proofs:

**Are the figures set at an appropriate size?** Is the text legible?

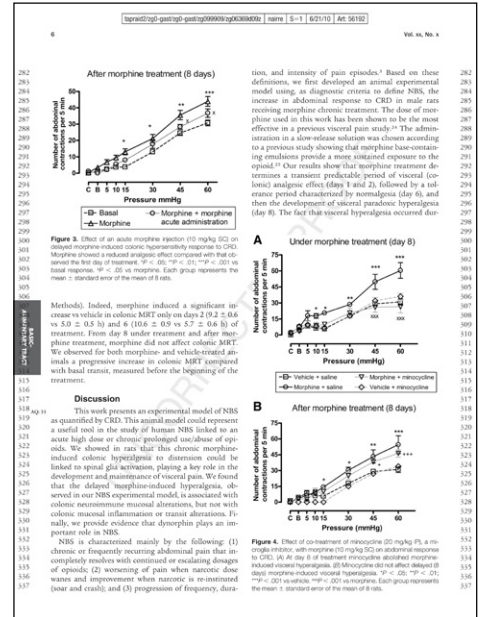
**Is the resolution adequate?** Do the prints appear to be good quality? You can't determine the exact resolution by looking at figures on screen in a digital proof, but you can get a sense of whether it looks blurry or clear, and this is usually sufficient.

**How does the overall figure quality look** (including color reproduction)?

**Has the designer/compositor made addition-**

**al edits to the figures?** If so, are they acceptable? If your designer/compositor is making any revisions that don't comply with your journal's style guidelines, you should meet to discuss how to unify your style.

Journal article proof



## VII. Microsoft Office Considerations

Authors often take advantage of the Microsoft (MS) Office suite for figure layout because it is readily available and fairly easy to use. However, MS file formats (doc, ppt, xls) pose special problems for the editorial office staff. We therefore advise requiring authors to send high-resolution jpegs or tiffs in addition to MS-formatted files. Be aware of the following potential problems with MS files:

- Embedded color photos might experience a color shift (that is, their color is displayed incorrectly). This problem is particularly noticeable in Word® documents and can pose problems when color is important to conveying information such as in histology or fluorescence images.
- Fonts don't always display correctly. Special fonts such as Greek symbols can be lost, and the editorial office staff has no way of knowing what the

correct text should be (and no way of correcting the problem).

- Charts, tables, and figures don't display correctly. When a chart, table, or figure has been created in one MS application (such as Excel®) and then embedded into another MS application (such as PowerPoint®), the final result may be misaligned.
- Word and Excel don't allow direct export to jpeg and tiff formats. To convert a Word or Excel file to jpeg or tiff formats, an intermediate step using Adobe Acrobat® is necessary. The process is as follows:

**In Word or Excel, print the file to PDF.**

Open the PDF file in Adobe Photoshop, setting the resolution to at least 300 ppi (400 is recommended to ensure quality isn't lost if the figure must be resized).

**Use "Save As"** to save the file as a jpeg, tiff, or whichever file type is needed.

- Files created in the newest versions of MS Office can be difficult to open with older versions of the software.

This document was developed by Sarah Williamson, MA, Senior Medical Illustrator, American Gastroenterological Association (AGA) and Lindsey Brounstein, Publications and Graphics Manager, AGA. It was edited by Erin Dubnansky, Senior Director of Scholarly Publishing, AGA.

The 2010–2011 ISMTE Training Committee (Erin Dubnansky, Chair; Kathy Brister, Maggie Haworth, Glenn Landis, and Maru Tapia) conceived of, contributed expertise to, and oversaw the project.

# Appendix A: Example Figure Style Guidelines

## LINE ART CHECKLIST

- Fonts are an acceptable sans serif font (HelveticaNeue, Helvetica, or Arial)
- All symbols are in Symbol font (only exception is if you are not redrawing any of the text)
- *P* values (capitalized, italic, no initial zeros)
- *R* values (capital, not italic, initial zeros ok), and *r* values (lower case, not italic, initial zeros ok)
- No hatch marks
- No 3-D style
- All 'liter' symbols are capitalized (e.g. mL, dL, L)
- Initial word is capitalized in all text (including axis labels, legends, and notes)
- Initial symbols on axis labels are spelled out (% , #)
- Panel labels are 18 pt, bold, capitals
- Axis label orientation
- X-axis is horizontal
- Y-axis, rotated 90° counter clockwise
- Y-axis on right side of graph (when two y-axes) rotated 90° clockwise
- Labels along x-axis (when too long to be horizontal) rotated 45° or 90° counter clockwise
- No boxes enclosing graphs (only exception is box and whisker plots)
- Font sizing (should be consistent throughout graphs within each manuscript; no smaller than 5 pt and no larger than 12 pt)
- Alignment
- Total redraws: use rulers and alignment tool to ensure that axis labels, numbers, and text are aligned
- Partial redraws: use your eye to ensure that nothing is noticeably out of alignment
- Line weights (.75 pt – 1.00 pt [2.00 pt for lines within flowcharts]; consistent within document)
- Boxes around figure keys (unless figure spaces is too limited to include it)
- Outline grey or colored bars/symbols with black
- Arrows are (at least close to) appropriate style (Illustrator arrowhead 2 scaled to 50%)
- Tic marks on graphs face outward and are used only for labeled quantities
- Figure key designators are squares, rather than rectangles
- Axis labels are bold
- Numbers on axes are not bold

# *Appendix B: Example FAQs for Authors*

1. Why do you frequently redraw the artwork for the journals?
2. What are your journal style guidelines? Can you provide some figure style assistance?
3. What is the maximum number of figures and figure panels I can submit with my article?
4. Is it OK to reproduce figures from previously published articles?
5. We are the authors of the original article and have the original graph(s). Can they be reproduced from the originals without going to the publisher?
6. Which figure file formats do you accept, and why?
7. Why do you ask authors to upload each figure separately?
8. Why do you require CMYK instead of RGB format?
9. What is the difference between “raster” and “vector?” How does this apply to my figures?
10. How can I determine if my images are of sufficient quality for publication?
11. You have asked me for higher quality figures. How do I improve the quality of my image submission?
12. What is the difference between JPEG and TIFF file formats? Which format should I use for my image files?
13. How do I convert my PDF file to a high-resolution JPEG or TIFF?
14. I created my figures in Microsoft Word, Excel, or PowerPoint, but your instructions state that you do not accept these file formats. Why are Microsoft files problematic for your Graphics staff? What do I do now?
15. Can I use an image I downloaded from the Internet?
16. I changed the resolution of my file and sent it back to you, but I received another e-mail stating that my image file was still of insufficient resolution. Why did this happen? What else can I do?
17. My files are too large to upload. How do I make them smaller?
18. Why don't the images in my proof look as good as my original figures?
19. Can I submit my figures by mail as hard copies?
20. I have done the best I can with my figures; however, I am not very skilled with graphics software. Can you fine-tune my figures for me?
21. How can I get help if my question wasn't answered here?

## 1. Why do you frequently redraw the artwork for the journals?

All artwork must adhere to our journal style guidelines. When we receive your submission, our Graphics staff will assess and sometimes modify your figures. Although we request that all figures be sent to us correctly formatted, we make all final changes in-house to facilitate production.

The most common changes we make to figures include the following: re-sizing images, reinforcing of faint/thin lines or fonts that may be difficult for the reader to see in print, re-arranging figure plates for better use of page space, correcting text according to AMA style, sizing fonts for consistency, and removing hatch marks within graphs.

You will have an opportunity to review any modifications to the redrawn figures during

the proof stage, and you will be able to submit your comments before publication.

2. **What are your journal style guidelines? Can you provide some figure style assistance?**

We use the following guidelines for creating and modifying the graphs:

**Fonts:**

Helvetica is the preferred font. However, if you cannot use Helvetica, you must substitute another sans-serif font such as Arial. Serif fonts are not acceptable. (*Serif fonts* are a style of typefaces which have “serifs,” or small, extra strokes that adorn each character. *Sans-serif fonts* lack these extra embellishments; they are cleaner, simpler fonts, created from uniformly-weighted lines.)

**Examples of serif fonts:**

- Times New Roman
- Palatino
- Garamond

**Examples of sans-serif fonts:**

- Helvetica
- Arial
- Myriad

Symbol font may be used for special characters, and Courier may be used for sequence alignments. All fonts must be outlined (Type > Create Outlines) or embedded (select “Embed Fonts” in “save as EPS” dialogue box) when submitted in vector files such as Illustrator .eps.

**Capitalization:**

Please use sentence-style capitalization within figures. Capitalize the first word of each figure axis, figure key label, figure title, etc.; subsequent words should be lower case. Single-word labels should all be capitalized.

**Font sizes:**

Fonts should be 6 points or larger, but the largest font should not exceed 13 points (the only exception being 18-point panel labels [A, B, C...]). Font styles and sizes should be consistent throughout your figures. All fonts must be legible at actual print size.

**Scientific notation:**

*P* values (probability) are capital and italicized, with no zero before the decimal (for example,  $P < .01$ ).

*r* values (bivariate correlation coefficient) are lowercase.

*R* values (multivariate correlation coefficient) are capital.

***Graph style:***

Graphs should not include hatches or other patterns. Instead, choose colors or shades of gray with enough contrast to stand out and make clear the meaning of the graph. Graph bars should be delineated with grays that differ by at least 20% in value. Graph lines should be .75—1.0 line weight. Please do not submit 3-D style graphs.

***Axis labels:***

Larger X and Y axis labels should be bold Helvetica. Axis numbers should be slightly smaller, using regular Helvetica. Use only X and Y axis lines, when appropriate. Avoid the use of complete boxes to enclose graphs. Use tick marks for only the major axis labels; smaller tick marks should be left off.

***Figure keys and figure legends:***

Figure keys must be included within the figure, not the legend. Figure legends should be saved as part of the main text, not within the figures.

***Color and grayscale:***

Keep in mind that figures might be photocopied by readers. Also, individuals who are color-blind should be able to understand the meaning of your figures. Therefore, please avoid the combination of red and green. Make sure that lines, colors, and symbols are easy to read by using high contrast, easily distinguishable dotted lines. Additional information regarding use of color in figures can be found here:

<http://jfly.iam.u-tokyo.ac.jp/color/>.

***Figure layout:***

Avoid unnecessary spacing within your figure layout. In addition, avoid using unnecessary boxes (especially with heavy lines) to enclose graphs or images. This will ensure that your images and text conform to our journal style, and are as large and readable as possible.

***Panel labels:***

Each panel of a multi-part figure must be labeled with a bold, capital, 18-point letter (A, B, C...). Whenever possible, do not place this letter over other text or images.

***Column sizes:***

Our journal columns are as follows: 1 column = approximately 85 mm, 1.5 columns = approximately 133 mm, 2 columns = approximately 174 mm. Your figures should print at one of these sizes, and still be readable and high quality.

**3. What is the maximum number of figures and panels per figure I can submit with my article?**

This varies by journal, and by the type of article you are submitting. Please reference the Instructions to Authors for this information. Also please note that any figures in excess of the section limits may be moved to the online supplemental materials.

**4. Is it OK to reproduce figures from previously published articles?**

Yes, we can reproduce the figure(s). However, the author is responsible for determining the copyright holder of the source material and obtaining permission to modify or reproduce the material according to the copyright holder's policies. We request a copy of the permission form or other documentation that permission has been granted. The original source must be cited in the manuscript or figure legend(s).

**5. We are the authors of the original article and have the original graph(s). Can they be reproduced from the originals without going to the publisher?**

Although you created the original graph(s), the answer to the above question still applies. In some cases, the copyright may reside with the publisher, if those are the terms of your original copyright agreement. If this is the case, you can send us your figure(s), but we will still require written documentation that permission for republication has been granted.

**6. Which figure file formats do you accept, and why?**

Our preferred file formats have been chosen for compatibility with our industry-standard software, resulting in the best print quality and faithful color reproduction. Preferred formats allow us to make the necessary edits consistent with our journal style, and are much less likely to cause significant production delays.

Please note that all images must be high resolution, meaning at least 300 pixels per inch (ppi). Low-resolution files (less than 300 ppi) will not be accepted.

***Preferred file formats:***

- Tagged Image File Format (.tiff or .tif)
- Joint Photographic Expert Group Image File (.jpeg or .jpg) — high quality only

***Acceptable but not preferred:***

- Adobe Photoshop document (.psd)
- Adobe Illustrator File (.ai) — please embed or outline all fonts
- Adobe Illustrator Encapsulated PostScript file (.eps) — please embed or outline all fonts
- Adobe InDesign (.indd) — please embed or outline all fonts
- Portable Document Format File (.pdf)
- Graphical Interchange File Format (.gif)
- Bitmap Image File (.bmp)
- Targa Graphic (.tga)
- Portable Network Graphic (.png)
- Portable Bitmap Image (.pbm)
- Picture File (.pct or .pict)
- Microsoft Paint Bitmap Image (.msp)

- Paintbrush Bitmap Image File (.pcx)
- X11 Bitmap Graphic (.xbm)

***Not accepted:***

- Microsoft Word Document (.doc)
- Microsoft Excel Spreadsheet (.xls)
- Microsoft PowerPoint Presentation (.ppt)
- Microsoft PowerPoint Open XML Document (.pptx)
- Canvas Image File, Canvas Drawing File, Canvas Image Format (.cnv, .cvi, .cvs, .cvx)
- CorelDRAW Image File (.cdr)
- FreeHand Drawing File (.fh9 or fhd)
- QuarkXPress Document (.qxp)
- Texture File (.tex)
- LaTaX Equation Editor File
- Cricketgraph File
- SigmaPlot File
- ChemDraw File
- DeltaGraph File
- MDL ISIS/Draw File

If you are having trouble converting your images to the proper file format, or if you have questions about the acceptability of a specific file format, please contact us early in the process of creating your figures for assistance.

**7. Why do you ask authors to upload each figure separately?**

Multi-part figure plates (A, B, C...) can be submitted to us whole. However, separate figures (Figure 1, Figure 2...) need to be submitted in separate files to allow our online manuscript submission system to automatically generate a PDF for reviewers to view. In addition, upon acceptance of your manuscript for publication, our publisher needs separate image files for the composition process. Most importantly, submitting separate image files facilitates the submission and peer review process, so you can see faster results. Also, we do not accept many applications that contain multiple figures, such as Microsoft PowerPoint®, Word®, and Excel®.

**8. Why do you require CMYK instead of RGB format?**

CMYK (cyan, magenta, yellow, and black) is a color format designed for print, which simulates the four-color printing process used by the commercial printers that we use for publication. RGB (red, green, and blue) is the color mode used by computer monitors, video screens, digital cameras, and other technologies through which light is emitted. Vibrant colors look great in RGB onscreen (especially fluorescent stains) – but your RGB image will experience a color shift when printed, often with unpredictable results. To ensure a better match between your submitted image and the final print, we require all color figures to be submitted in CMYK color mode.

9. What is the difference between “raster” and “vector?” How does this apply to my figures?

**Raster images** are images created from tiny dots called pixels. Raster files inherently contain a large amount of information, and each pixel is a small but important piece of information in the overall image. Raster images lose quality when they are scaled up and down. When you talk about resolution or pixels per inch, you are describing the qualities of a raster file.

- **Advantages:** Fine, subtle detail and color.
- **Disadvantages:** Pixels can be seen when zoomed in on an image; they will look like small “steps” or jagged blocks. When a raster image is low quality or resolution it is often described as looking “pixelated.” Raster images cannot be scaled beyond the size were intended to be printed.
- **Examples:** Photographs (grayscale or full color), x-rays, histology slides, scanned images.

**Vector images** are described with mathematical coordinates. Vector images tend to have smooth contours, straight crisp lines, and/or text. Since a vector image needs a much smaller amount of data to describe the shapes of the image and/or text, the file size remains very small. However, the same subtle detail and color shading cannot be achieved as compared with pixel images. Vector images, by definition, do not have resolution; they can be scaled to any size without a loss of quality or resolution.

- **Advantages:** Very small file size, crisp delineation of text and shapes with no blurring effect, ability to scale an image as large as desired and not lose the quality of the lines and image.
- **Disadvantages:** Limited range of shading and effects
- **Examples:** Text in Word and PowerPoint documents, graphs and shapes created in Illustrator, charts in Excel, text and lines in PDF format, any graphic element that can be scaled indefinitely without losing quality or “sharpness.”

When you export a shape you created in PowerPoint to a JPEG, you are taking a vector image and changing it into a raster image.

**Combination Raster/Vector Images:**

Most figure plates are a combination of raster and vector image types. These generally involve the placement of a photo or series of photos into a program such as PowerPoint or Illustrator, with subsequent adding of labels or other graphic elements.

- **Advantages:** Retains the qualities of the photo, but enables easy addition and modification of labels and shapes. Ideal for print.
- **Disadvantages:** Large file size.
- **Examples:** JPEG image (raster) placed within PowerPoint, and then labels and arrows (vector) are added; TIFF file (raster) is placed into Adobe Illustrator®, and then text and symbols are added (vector); the entire figure plate is then re-exported into a JPEG (raster).

## 10. How can I determine if my images are of sufficient quality for publication?

When we assess whether an image is suitable for journal print, we first look at two file attributes: the size and the resolution. Size and resolution are slightly different, although both are important for print.

Resolution is the number of pixels in a given area; this measurement determines the quality of a printed image (the “fineness of detail”). Resolution is often given as “pixels per inch” or ppi. For a good quality print, an image should have at least 300 pixels per inch (300 ppi). Sometimes this is also referred to as 300 dots per inch (dpi), although this term is not technically the same as pixels per inch.

Size is the width and height of the final printout (the “print size”). This attribute is independent of the resolution; a file can print at the correct column width, but can be high or low resolution, depending upon how the image was captured or saved.

You can determine both the size and resolution of a JPEG or TIFF image file within Adobe Photoshop®. Go to Image > Image Size. In the dialogue box, you will find both the Resolution, and the Print size (the Width and Height), given in whatever units the program has set to the default (these could be percent, inches, centimeters, millimeters picas, points, or columns; you can change this under your Photoshop Preferences menu). Resolution should be at least 300 ppi.

Also in the Image Size dialogue box, you will see that the Width, Height, and Resolution attributes can be linked together or unlinked, by unchecking or checking the “Resample Image” box. When the size of the image is linked to its resolution (by unchecking the Resample Image), any increase in resolution causes the print size of the image to decrease.

When the size of the image is independent of its resolution (by checking the Resample Image box), the resolution can be increased while keeping the print size consistent. However, this latter case of adding pixels is called “upsampling” or “interpolating,” and it can lead to blurry, unusable images. In the case of adding pixels (interpolating), Photoshop essentially takes an educated guess regarding where to add pixels. In other words, the program adds data to the image that doesn’t really exist. The end result is technically higher in resolution, but the overall result is a less accurate image. We do not recommend this method. If your images are too small, it is better to send them at their original size for us to evaluate, rather than to “upsample” them and send us blurry images.

## 11. You have asked me for higher quality figures. How do I improve the quality of my image submission?

This depends upon how your original image was captured, which software package was used, and how your image plates were exported or saved.

Your original photo or image capture should be of the best possible quality. If your

image is a scanned photo, x-ray, slide, or other transparency, your scanner settings need to be set to the highest possible resolution for output. You may need to re-scan your image if you did not originally use an adequate resolution setting (300 ppi or higher). Likewise, microscope and digital camera settings should be on high-resolution settings. Certain types of images, such as screen capture, are inherently limited in resolution. If your original image was captured at low resolution, we will work with the best you can provide, as we understand it may not be possible to re-capture the original image.

Please note: if you are starting with a low-resolution image, adding pixels (“upsampling”) in Photoshop will not improve your image quality, but will only make a blurry, artificially high-resolution image (please see *“How can I determine if my images are of sufficient quality for publication?”*).

When working with simple line graphs that do not include photos or scans, it is best not to embed one Microsoft application into another (for example, Excel graphs in a PowerPoint document). Your best option, if you cannot export directly to a high-resolution JPEG, may be to “Save As” or use the “Print” function to create a PDF document, and then open the PDF from within Adobe Photoshop. You can then set the resolution of the Photoshop document in the dialogue box to 300 ppi or higher (please see *“I created my figures in Microsoft Word, Excel, or PowerPoint, but your instructions state that you do not accept these file formats. What do I do now?”*).

If you have created figure layouts with photos or graphs in combination with text or other shape elements in a layout program such as Adobe Illustrator or Microsoft PowerPoint, it may just be a matter of using the correct export settings. You do not need to set up the file resolution of a new PowerPoint or Illustrator file when you create it, but any photo you place in these programs needs to be of sufficient resolution for publication. In addition, you will need to follow the correct instructions for exporting JPEGs and TIFFs from PowerPoint in order to achieve optimal results.

If you are creating a figure layout from a new Photoshop file, make sure you are setting up your file correctly at the outset. To set up a high-resolution blank Photoshop file, open Photoshop, and go to File > New. In the dialogue box, set the Width and Height to a print size that is at least as large as our journal size (1 column = approximately 85 mm, 1.5 columns = approximately 133 mm, 2 columns = approximately 174 mm; column height = approximately 237 mm). The Resolution setting should be 300 ppi or higher. Click OK once your settings are done; you can now place images and text onto this new canvas.

**12. What is the difference between JPEG and TIFF file formats? Which format should I use for my image files?**

JPEG (Joint Photographic Experts Group) and TIFF (Tagged Image File Format) files are both industry standards for color images. JPEG and TIFF are the preferred file formats for sending the figure files for publication. Most software packages can save images in

these formats in the “Save As” or “Export” dialogue boxes.

JPEG (.jpg or .jpeg) is a “lossy” file format, meaning that some data is lost each time the file is saved using a file compression setting less than “Maximum” (that’s why a JPEG has a much smaller file size); however, the file is still very high in quality, as long as the “Maximum” setting is used when saving. In fact, you will generally not notice the difference in quality, particularly in print. JPEG is an excellent file format for very large color images because it compresses the files, while preserving the quality of the image. JPEGs are a great way to transmit files via the Web for journal production, due to their smaller file size. We work most commonly with JPEGs.

TIFF (.tif or .tiff) is a “lossless” file format, meaning that it does not compress your image when it is saved. In addition, you are able to keep any layers that you may have created in Photoshop when working on your file. TIFF format is great for an image with fine detail, or when the color is extremely important. However, TIFF files are much larger than JPEGs, and may pose some difficulties for uploading. Use this format when smaller file size is not critical, particularly when you plan to make multiple edits to a file, or when you are saving an original backup copy.

**13. How do I convert my PDF file to a high-resolution JPEG or TIFF?**

To convert your PDF into an acceptable high-resolution image file, open Adobe Photoshop, and then go to File > Open. Then select your PDF and open it within Photoshop. You will have the opportunity to select the resolution in the next window; set this resolution to ~350 ppi. Save the file as the desired file type (be sure to choose “Maximum Quality” if you are saving as a JPEG).

**14. I created my figures in Microsoft Word, Excel, or PowerPoint, but your instructions state that you do not accept these file formats. Why are Microsoft files problematic for your Graphics staff? What do I do now?**

*Microsoft Word*

Placing images within Word documents can introduce artifacts, color shifts, and image deterioration which will adversely affect the final image print. To best assess the image resolution, we need images to be sent in their original (preferably TIFF or JPEG) format. In addition, if you have added fonts or other graphic elements to your photo, these may not display properly when we open the Word document on our computers.

If you used Word to overlay text, arrows, etc, into a composite image plate and you need to export the image, you can try the following: Go to File > Print. Under the Print dialogue box, chose PDF, and save the file as a PDF. From within Adobe Photoshop, go to File > Open, and select the saved PDF file. Set the file resolution to ~350 ppi, and select Open in the dialogue box. Then save the file as a TIFF or maximum-quality JPEG.

### *Microsoft Excel*

To prepare your Excel graphs for publication, please use the “Print” function in Excel to create a PDF file of your figures. Then, from inside Adobe Photoshop, go to File > Open. Then select your PDF and open it within Photoshop. You will have the opportunity to select the resolution in the next window; set this resolution to ~350 ppi. Save the file as an acceptable file type for publication (be sure to choose “Maximum Quality” if you are saving as a JPEG).

### *Microsoft PowerPoint*

PowerPoint files are particularly problematic for our graphics staff because fonts and embedded images often do not display correctly. In addition, PowerPoint was meant for screen display in RGB color, and will not produce optimum colors for print.

Therefore, we ask that you send the original source files or figure plates created in approved software (Adobe Photoshop or Illustrator). However, if you have used PowerPoint to create your figures, you *must* export the images into high-resolution (300 ppi or higher) JPEGs or TIFFs.

In the PowerPoint export dialogue box, the default JPEG resolution is 72 ppi (pixels per inch), which is insufficient quality for print. More recent versions of PowerPoint allow you to change this setting to 300 ppi or higher under the “Options” menu before saving as a JPEG. However, in earlier versions of PowerPoint, you are not give this option. As a workaround, you may be able to save your PowerPoint document as an intermediate PDF file (“Print to PDF” under the Print dialogue box, or “PDF Maker” button), and then open the PDF from within Adobe Photoshop. Upon opening the PDF in Photoshop, you will be given the opportunity to specify the file resolution. Set the resolution at ~350 ppi, and then save the file as the desired format (JPEG or TIFF).

*Please note:* graphics staff may contact you at a later time if we encounter difficulties with figures that have been created in, or exported from, any Microsoft application.

#### **15. Can I use an image I downloaded from the Internet?**

We prefer that you don’t. Images taken from the Internet are not ideal for printing because they are often small in size, and are generally very low resolution (around 72 ppi). This resolution works well for screen display and quick download, but it does not produce a high-quality journal print.

#### **16. I changed the resolution of my file and sent it back to you, but I received another e-mail stating that my image file was still of insufficient resolution. Why did this happen? What else can I do?**

This may be because you increased the resolution of the file, but at the same time, reduced the print size. These two file attributes are linked in the Image Size dialogue box in Photoshop (please see *“How can I determine if my images are of sufficient quality*

*for publication?*”). If you increase the resolution to 300 ppi but reduce the print size to a very small area, essentially nothing has changed in your file; you have the same number of pixels as when you started.

At this point, we may need to work with your original source files (such as the original figure layouts you created). Please contact us if this is the case, and we can work with you individually to ensure that we have obtained the best possible images for final production.

#### **17. My files are too large to upload. How do I make them smaller?**

If you encounter difficulties trying to upload larger TIFF or Photoshop files to the manuscript tracking system, you can try the following:

1. Save copies of all original files before you make them smaller!
2. Flatten layers you may have created in your Photoshop document or TIFF files.
3. Crop unnecessary white space around the images.
4. If your images do not include color, change the color mode to “Grayscale.”
5. Save the final image as a high-resolution, maximum-quality JPEG.

If you are attempting to upload large PDF files, you can convert them to JPEGs first (please see *“How do I convert my PDF file to a high-resolution JPEG or TIFF?”*).

You may also FedEx your original image files on CD or DVD to our editorial office.

#### **18. Why don’t the images in my proof look as good as my original figures?**

The proof you receive is highly compressed so it can be transmitted easily via the Web. The images included in your proof are primarily for you to determine if the information and layout are correct. They will appear in grayscale, with the word “color” in the margin to mark where color printing will be used. In the final journal print, your photos will retain the same high quality as the files you originally submitted.

#### **19. Can I submit my figures by mail as hard copies?**

Yes, although the processing will take longer, you are welcome to mail hard copies of your figures to our editorial office. You will need to submit 2 complete sets of high-quality laser-generated line prints or glossy prints for photographs (either must be at least 300 ppi) in 2 separate envelopes. Please note that figures sent with a manual submission will not be returned to you.

Identify each figure with first author’s last name, figure number, and an arrow indicating the top of each figure on a self-adhesive label affixed to the back of each figure.

Attach full-page photocopies of each figure to the manuscript. Do not mount multiple-part figures; submit each section individually. However, you may include a written, suggested layout. Accompany photographs of identifiable patients with written permission to publish from the patient.

Hard copy figure submissions should be sent to our editorial office.

**20. I have done the best I can with my figures; however, I am not very skilled with graphics software. Can you fine-tune my figures for me?**

Although we will not create your figure plates for you, we can offer assistance if you are experiencing difficulty in setting up, completing, or exporting your figures. Please contact us if you need help beyond the scope of the FAQ (earlier in the process is preferable). For us to better serve you, please save all of your original high-resolution photos and other materials separately from your figure plates, as we may need access to these. In addition, upon acceptance for publication, it is likely that we will redraw some portions of your figures after we receive them (please see *“Why do you frequently redraw the artwork for the journals?”*).

Many laboratories and medical centers have a graphics department that can offer assistance in creating figure plates or exporting them at the proper resolution and format for publication. If you prefer not to make your own figures, you may wish to take advantage of this resource, if available.

**21. How can I get help if my question wasn't answered here?**

Please feel free to contact our editorial office for answers to any additional questions. Keep in mind that it is always better to contact us early in the process of creating your figures, when we can be of the greatest assistance.