Editorial

Color Figures in *BJ*: RGB versus CMYK

Biophysical Journal has always striven to produce the best possible journal, and we have used the latest technology available to help us achieve that goal. In recent years, we have made changes that improved our service to authors and readers by implementing an online submission system. This has offered the convenience of uploading and previewing submission materials, and reduced our time from submission to print considerably. More recently, we have begun placing accepted papers online in our BioFAST module, so that papers may be accessed before they are published in print.

We are now pleased to announce that our printer, Dartmouth Journal Services (DJS), has created a new, simpler method for authors to submit color figures. Beginning in March, authors will be requested to submit all color image files in their original RGB color format. This will allow figures with a full spectrum of color and contrast to appear as viewed in the laboratory. Previously, *BJ* required that color images be converted from RGB to CMYK before submission. The figures were then converted once again to RGB for online purposes, resulting in loss of quality for the online version. With this change, the online version will become the definitive version, and authors will receive electronic page proofs with a figure quality that will be identical to the online *Journal*.

DJS will be presenting two seminars at the Biophysical Society Annual Meeting in Long Beach, CA, to describe the process in detail and answer author questions. We invite you to attend the first seminar on Monday, Feb. 14, at 1 p.m., which will advise attendees of the proper preparation of figures, and solutions to common problems. The second seminar, geared toward those who are more advanced with creating electronic files, will be held on Tuesday, Feb. 15, at 1 p.m. Visit http://www.biophysics.org/meeting/annmtg/events.htm for more details.

WHY IS RGB BETTER?

Over the past several years, digital technology has evolved to the point where film has become obsolete, and nearly all image-capturing devices do so digitally. In addition to the way images are captured, many technological advances have been made in how color is managed for online and print publication.

As most of you are aware, a computer monitor generates and displays color by varying the intensity of red, green, and blue light (RGB). This RGB color space, or color gamut, has a very large spectrum of color in which fluorescent greens and blues can be displayed very vibrantly (Fig. 1). In contrast to color that is created with light-emitting sources, there is color that is created by pigments printed on paper. The printing process creates color by varying the amount and combination of ink on paper, and is rendered using four colors: cyan, magenta, yellow, and black (CMYK). The net effect of these different color spaces is a mismatch between the color that can be represented in RGB but not CMYK. Many of the brilliant colors that are displayed on a monitor are not reproducible using printer's inks, and this results in a loss of image color and often detail when images are printed in the *Journal* (Fig. 2).

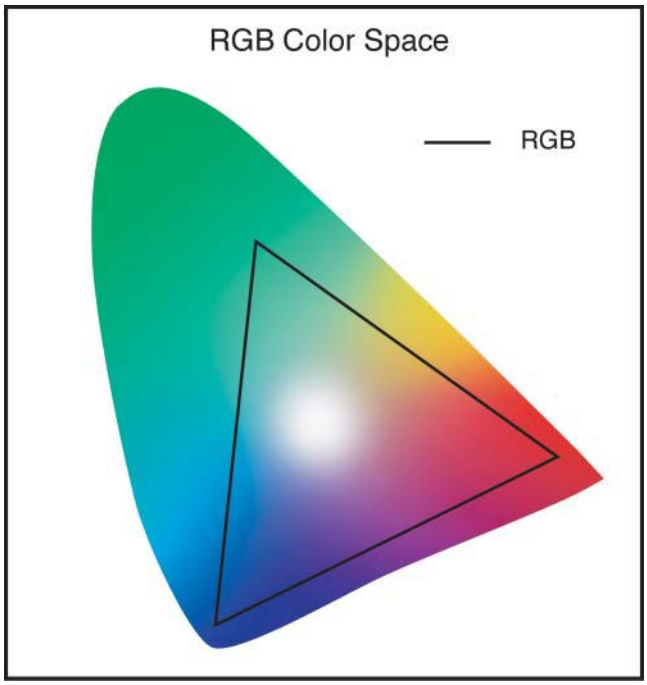

FIGURE 1 Plot of the Commission Internationale de l'Eclairage (CIE) 1931 chromaticity diagram representing all visible colors with white at the center (where all colors combine equally). The black triangle approximately represents the colors that can be displayed on a computer monitor in the RGB color space. Any color outside of this triangle indicates that the color cannot be produced on a monitor.

Because of the historical significance of the print journal, and before the advent of color-management tools, we had always asked for images to be submitted for publication in CMYK. This allowed an author to see any shift in color before publication. Images were maintained in the CMYK color space during the entire publication process, and then ultimately converted to RGB for online delivery at the very end of the process.

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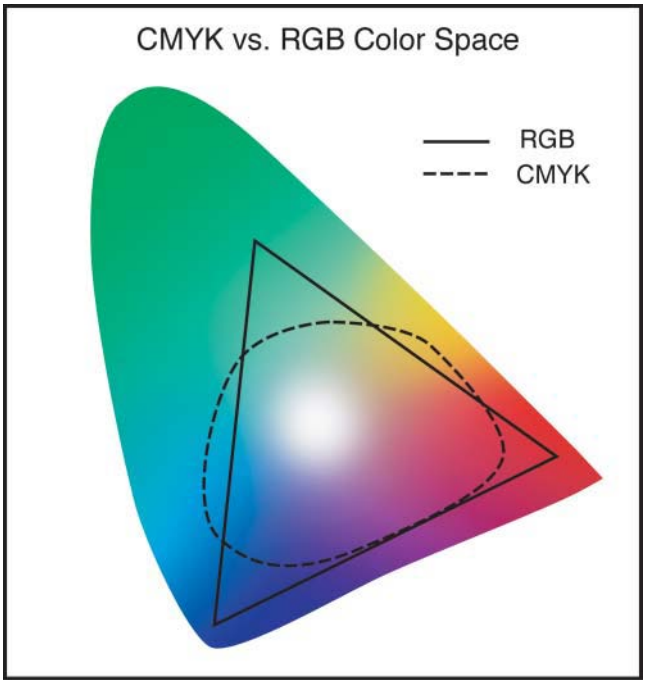

FIGURE 2 Plot of the CIE 1931 chromaticity diagram including a comparison of an RGB gamut displayed on a monitor (*black triangle*) versus the CMYK color gamut in the printed journal (*dashed line*). Notice that some areas of the RGB color gamut are outside of the CMYK gamut; it is these colors that will be affected by a conversion from RGB to CMYK.

With the advancement of software that manages color images, we can now enhance our process and adopt an ''RGB image workflow''. This new workflow will maintain RGB color through composition, proofing, and the online journal with a conversion to CMYK at the end for the print publication. This process will result in more accurate color when images are posted online, and a more controlled conversion to CMYK for the printed journal.

All of this is made possible through the work of the International Color Consortium (ICC) profiling system (http://www.color.org/). An ICC profile is a small file that is embedded or attached to a digital image. The profile provides information on how that image is to be rendered on a particular output device. The printer uses this ICC profile when converting images from RGB to CMYK color.

Beginning immediately, we are requiring RGB images with ICC profiles to be submitted with the manuscript. We will maintain the RGB color in composition, proofing, and the online journal, making a conversion to CMYK for print only. Although there will still be a loss of color in the extreme and very bright ends of the color spectrum in the print version, we will be making the RGB to CMYK conversion in a way that will maintain better detail in the image.

We are excited about this new feature, and look forward to seeing you at the Annual Meeting.

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