

Adobe Studio on Adobe Photoshop CS2


# Enhance scientific and medical images

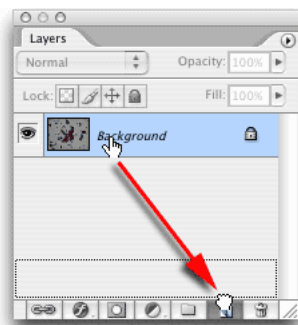
Light, shadow and detail interact in wild and mysterious ways in microscopic photography, posing special challenges for the researcher and educator. With Adobe® Photoshop® CS2, it's a snap to enhance the detail in any image, whether it's destined for publication or the classroom.

## Create layers to protect your original image

With Photoshop CS2, you can use layers to enhance your scientific images while keeping the original data intact. You can do this in two simple ways—by duplicating the original data layer and working only with the duplicate layers, and by using adjustment layers, which lie above the data and modify only how that data appears to the viewer. Adjustment layers can also simply be hidden or deleted to reveal the original image.


### 1 Duplicate the original background image.

When you first open a captured microscopic image, it contains a single layer labeled Background. Drag the layer to the New Layer  button at the bottom of the Layers palette, or choose Layer > Duplicate Layer. The image is duplicated in a new layer labeled Background Copy.



To duplicate any layer, drag it to the New Layer button in the Layers palette.

### 2 Hide the original layer.


Click the eye icon  next to the original background layer to hide the background, preserving your original image data in the Photoshop document. You can reveal this layer again at any time by clicking the empty eye icon box.

### 3 Give the duplicate layer a more meaningful name.

Double-click the label Background Copy and type a descriptive name, such as Cytology Slide 1. Press Enter or Return to save the new name. The layer is now highlighted to indicate it remains selected. You are now ready to bring out all of the detail you can get from the image.

## Use a Levels adjustment layer to bring out the detail

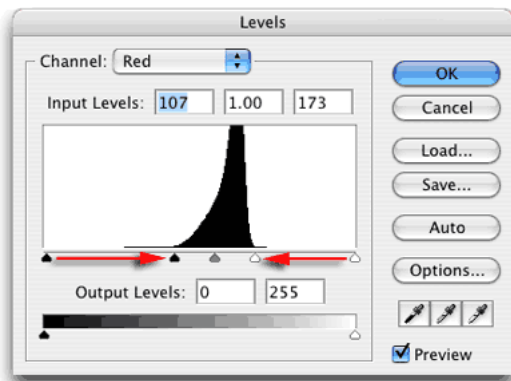
### 1 Create the adjustment layer.

With the Cytology Slide 1 layer still selected, click the Create Adjustment Layer  button and choose Levels from the pop-up menu, or choose Layer > New Adjustment Layer > Levels. The Levels command is an easy yet powerful tool for enhancing detail, giving much finer results than you can achieve with simple brightness or contrast adjustments.

### 2 Evaluate and adjust the histogram for the red color channel.

The histogram at the center of the Levels dialog box shows the relative number of pixels in the shadows (at the left of the histogram), midtones (middle), and highlights (right). Although you can adjust all color channels (RGB) in the image at once, here we will adjust each color channel individually, for greater precision. Adjusting the levels for each channel separately also allows you to adjust the color of the image, because you are modifying the relative amounts of red, green, and blue. Adjusting all channels simultaneously maintains the original color.


Choose Red from the Channel menu and make sure that Preview is selected, so that you see the effects of your changes as you experiment with different settings. Drag the shadows input slider (the black triangle below the histogram) to the right, until you reach the left edge of the distribution curve. Next, drag the highlights input slider (the white triangle) to the left, until you reach the right edge of the distribution curve. You can also drag the midtones slider (the gray triangle) to the right or left to adjust contrast in the midtones.

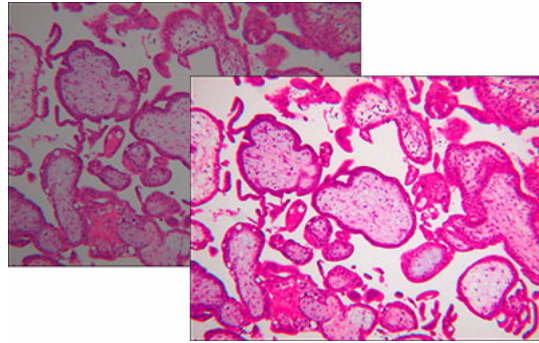


*Drag the shadow and highlights controls in the Levels adjustment dialog box to precisely control the brightness and contrast in an image.*

### 3 Evaluate and adjust the remaining color channels.

Choose Green from the Channel menu and repeat step 2, then choose Blue and repeat step 2 once more. When you are finished, click OK to apply your changes.

Look at the Layers palette to see the adjustment layer you just created above the Cytology Slide 1 layer. You can turn off the adjustment temporarily by clicking the eye icon next to the adjustment layer, or delete the adjustment layer by dragging it to the Delete button . You can also double-click the adjustment layer to make further modifications, and all without permanently altering the pixel data in the layer below.



*Before (left) and after (right) applying a Levels adjustment layer.*


## Discriminate cell contents with a Color Balance adjustment layer

A Levels adjustment brings out the detail in a slide by improving the contrast between highlights and shadows, but for images of stained cells, adjusting the color balance is an effective way to help distinguish individual features. Here we will start with a confocal image with little interior detail, and use a Color Balance adjustment layer to bring out detail in the shadows.

### 1 Duplicate the background layer.

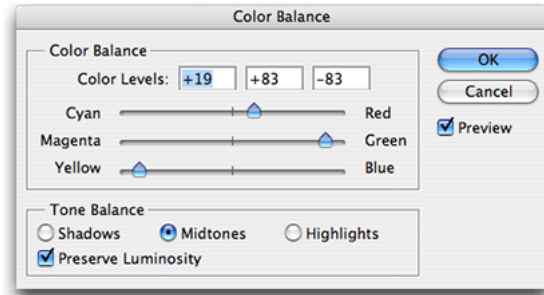
Drag the background layer to the New Layer button. The new layer is selected in the Layers palette, ready for editing.

### 2 Create a Color Balance adjustment layer.

Click the Create Adjustment Layer  button and choose Color Balance from the menu. Alternatively, you can choose Layer > New Adjustment Layer > Color Balance.

### 3 Adjust the color balance for maximum detail.

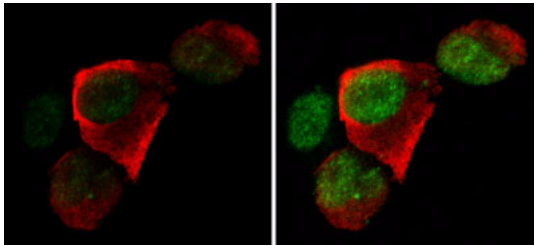
First, enable the Preview check box to see the potential effect of your changes. Then, under Tone Balance, select Midtones and adjust the Cyan, Magenta, and Yellow sliders to accentuate cell detail. If necessary, you can select Highlights and/or Shadows to discretely adjust the detail in these ranges.



A Color Balance adjustment layer easily brings out details in stained microscopic images.

#### 4 Apply your changes.

When you achieve a color balance that brings out as much detail as possible, click OK to apply the adjustment layer.



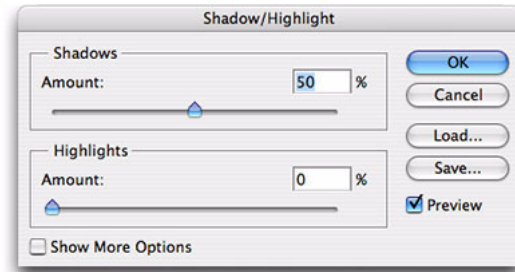
Before (left) and after (right) applying a Color Balance adjustment layer.

## Brighten shadow detail with the Shadow/Highlights adjustment

Brightening an image can bring out detail in the shadows, but it can also clip detail in the highlights. The Shadow/Highlight adjustment prevents clipping, by correcting only those areas that need adjustment.

#### 1 Open and duplicate an image.

Open an image with properly exposed highlights but overly dark shadows. Duplicate the image by dragging the background layer to the New Layer button, then choose Image > Adjustment > Shadow/Highlight.



The Shadow/Highlight adjustment brings more detail out of shadow or highlight regions in an image without affecting other areas.

#### 2 Evaluate the shadow adjustment.

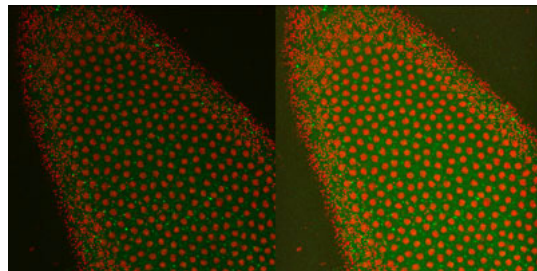
You should see improvement in the shadow detail as soon as the Shadow/Highlight dialog box appears. If the default adjustment doesn't show enough detail in the shadows, drag the Shadows slider to the right.

#### 3 Evaluate the highlights.

If you need to dim the highlights to see more detail in those regions, drag the Highlights slider to the right.

#### 4 Fine tune your changes, if needed.

As you make your adjustments, notice that you can adjust the shadow detail without affecting the highlights, and vice versa. If you need finer control over the adjustment, enable the Show More Options check box to show settings for tonal width and radius, color correction and midtone contrast.



Cells before (left) and after (right) enhancing with Shadow/Highlight.

## Use Smart Sharpen to correct blurred detail

New in Photoshop CS2 is the Smart Sharpen filter, an advanced yet easy-to-use way to enhance detail that is often blurred in microscopic photography. Smart Sharpen improves upon the Unsharp Mask filter, giving you greater control over different kinds of blurring, and discrete control of sharpening in different tonal ranges. Use it to sharpen images quickly and efficiently, without the halo artifacts associated with other sharpening methods.

### 1 Open and duplicate an image.

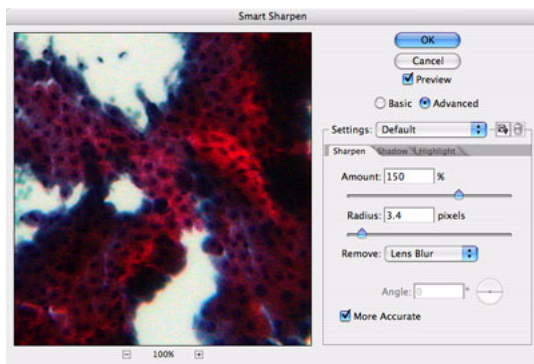
Open an image with insufficient detail and drag its background layer to the New Layer button in the Layers palette. Then choose Filter > Sharpen > Smart Sharpen.

### 2 Adjust Smart Sharpen settings.

Choose Lens Blur from the Remove menu and enter 2.0 or 3.0 in the Radius text box. Then drag the Amount slider to the right until you are satisfied with the amount of sharpening.

### 3 Make advanced adjustments in shadows and highlights if necessary.

If the blur is predominantly in the shadows or highlights, click the Advanced radio button. Use the Shadow and Highlight tabs to selectively fade the sharpening effect on shadows and highlights, respectively.



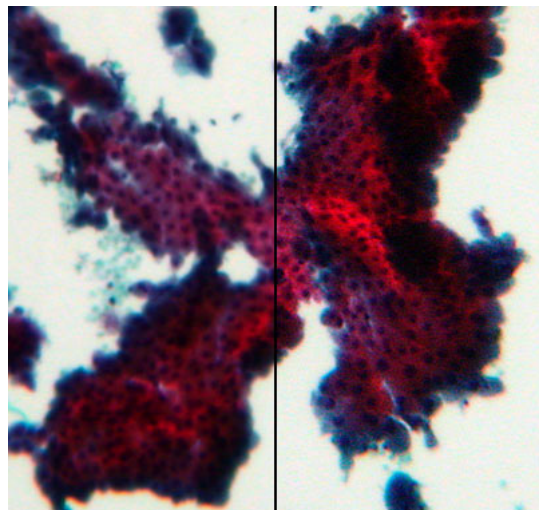
Smart Sharpen provides advanced sharpening of images, with fewer artifacts and discrete adjustments for shadows and highlights areas.

### 4 Preview and save your changes.

Evaluate your changes and adjust them until you are satisfied with the sharpening. Enable the More Accurate check box for the most precise sharpening. Click OK to apply the adjustment.

### 5 Save your settings for future use.

If you have a group of slides requiring the same kind of correction, you can correct one slide, save your settings, and then apply the saved settings to other slides in the group. Click the Save Settings button and type in a name to save the current settings in the Smart Sharpen dialog box. Once saved, they will appear under that name in the Settings menu, and can be applied with a single click.



Cells as seen through the microscope (left) and after processing with Smart Sharpen (right).

## Coordinate colors in a series of slides

After you adjust the detail and color balance in a series of slides, you may end up with a jumble of discordant colors that won't be attractive in a presentation. The Match Color command quickly and easily coordinates colors across images, for a unified, professional presentation.

**1** Open the series of images to be matched.

Start with the image whose color you want to correct. Then choose Image > Adjustment > Match Color.

**2** Select the source image.

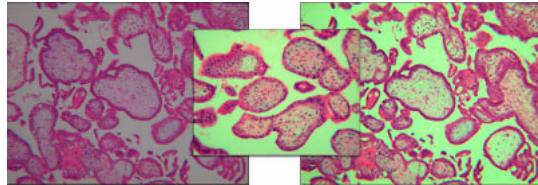
In the Image Statistics area, the Source menu shows all the images currently open in Photoshop. Choose the image whose colors you want to apply to the target image (the one being corrected). Enable the Preview check box and you will immediately see the colors in the target image change to match those in the source.

**3** Adjust luminance and intensity if needed.

You can optionally adjust the Luminance and Color Intensity sliders to fine-tune the color matching, and use the Fade slider to control the overall intensity of the effect.

**4** Save the adjustment and apply it to the remaining images in the series.

Click OK to save the adjustment, and repeat as many times as necessary to synchronize the colors in the series of images.



*An image with its original colors (left), the image being used as a source for Match Color (center) and the original image after color matching (right).*

**Written by the experts at Adobe.**

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