The paradox of color space display

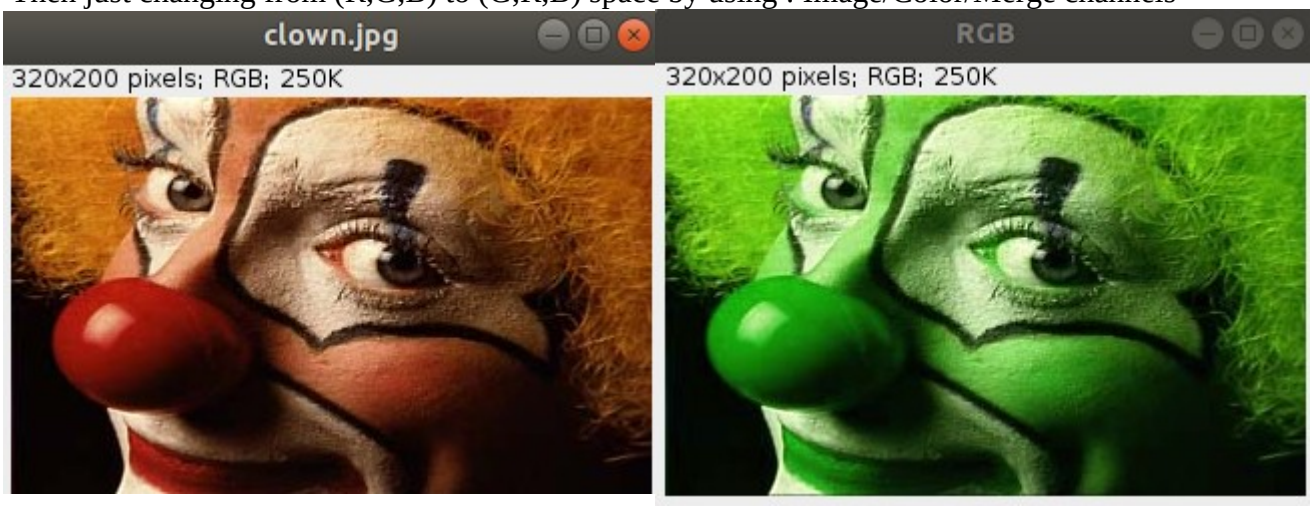
https://en.wikipedia.org/wiki/HSL_and_HSV

On your default display, the RGB additive way is used. So if you want to display another color space (or deconvoluted space or composite image) you have no other choice to put channel 1 in the R channel, channel2 in the G channel and component 3 in the B channel.
And try to find out a way to make you understandable.

Normandy image:

Split into the three channels : Image/Color/Split channels

Then just changing from (R,G,B) to (G,R,B) space by using : Image/Color/Merge channels



See the paradox ? Play as well with arrange channels

So when you are dealing with many other space color representation the same issue arises.

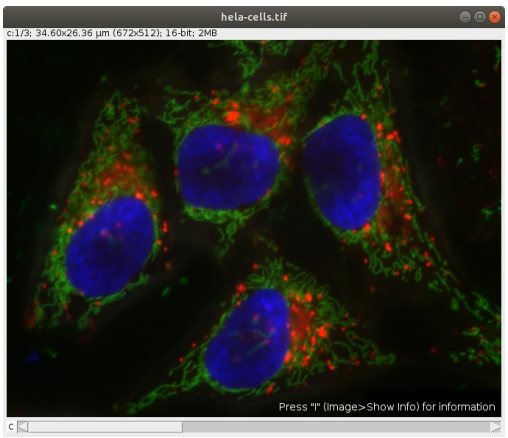
$$\begin{bmatrix} R_{\text{linear}} \\ G_{\text{linear}} \\ B_{\text{linear}} \end{bmatrix} = \begin{bmatrix} +3.24096994 & -1.53738318 & -0.49861076 \\ -0.96924364 & +1.8759675 & +0.04155506 \\ +0.05563008 & -0.20397696 & +1.05697151 \end{bmatrix} \begin{bmatrix} X_{D65} \\ Y_{D65} \\ Z_{D65} \end{bmatrix}$$

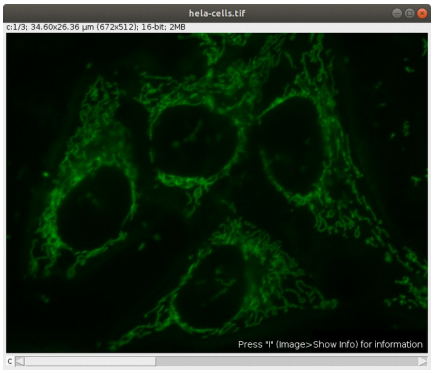
From https://en.wikipedia.org/wiki/SRGB

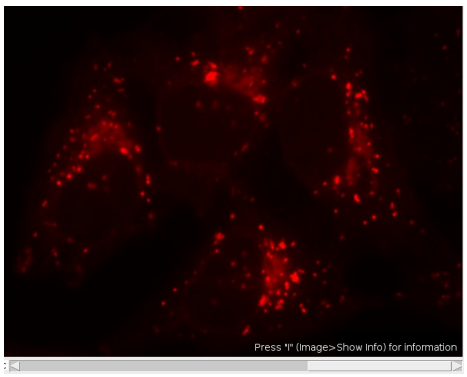
$$\begin{bmatrix} X_{D65} \\ Y_{D65} \\ Z_{D65} \end{bmatrix} = \begin{bmatrix} 0.41239080 & 0.35758434 & 0.18048079 \\ 0.21263901 & 0.71516868 & 0.07219232 \\ 0.01933082 & 0.11919478 & 0.95053215 \end{bmatrix} \begin{bmatrix} R_{\text{linear}} \\ G_{\text{linear}} \\ B_{\text{linear}} \end{bmatrix}$$

You will be able to play with these linear transformation with ***color_decon.py*** code if you like.

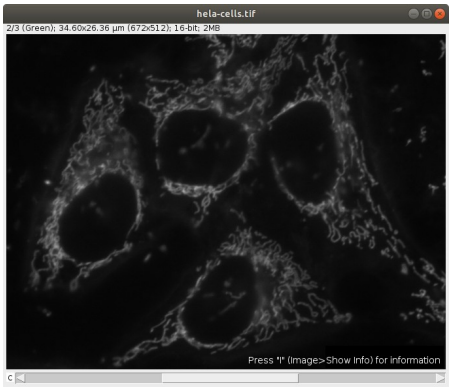
The same arises for multiplex fluorescent images. The composite image HelaCell versus the RGB channels corresponding to the various fluorescent markers. Play with arranging channels and color/composite display. If you use Shift+I you get yellow color corresponding to colocalisation of red and green. In composite images you can have more than 3 channels.

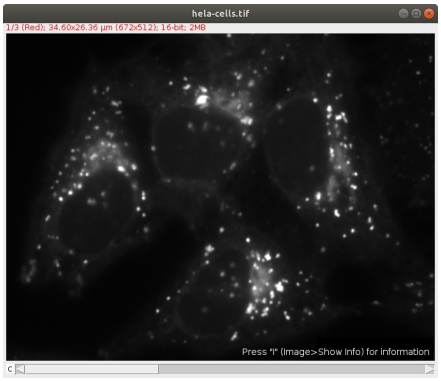






The color is related to the wavelength of excitation but the real value is the intensity for each channel possibly in grey level.





See https://petebankhead.gitbooks.io/imagej-intro/content/chapters/colors/colors.html for composite images explanation.

Once again the same arises but with different staining issues in digital histopathology (bright field microscopy). See the deconvolution part of the Color tutorial (Ruifrok et al. For unstaining images of cells stained with H&E for instance).

H : bluish– nuclei

E : pinky – cytoplasm

DAB : brownish : proteins like ki67(3,3'-diaminobenzidine) is oxidized in the presence of peroxidase and hydrogen peroxide resulting in the deposition of a brown, alcohol-insoluble precipitate at the site of enzymatic activity.DAB (3, 3'-diaminobenzidine) produces a dark brown reaction product and can be used for both immunohistochemical and blotting applications. See https://www.sinobiological.com/category/dab-ihc or https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6779686/