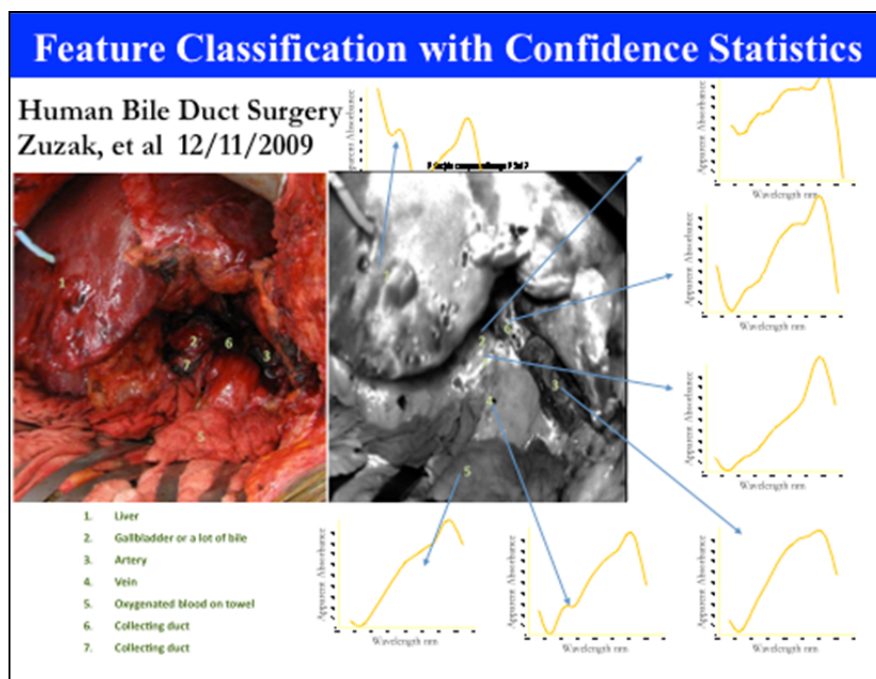


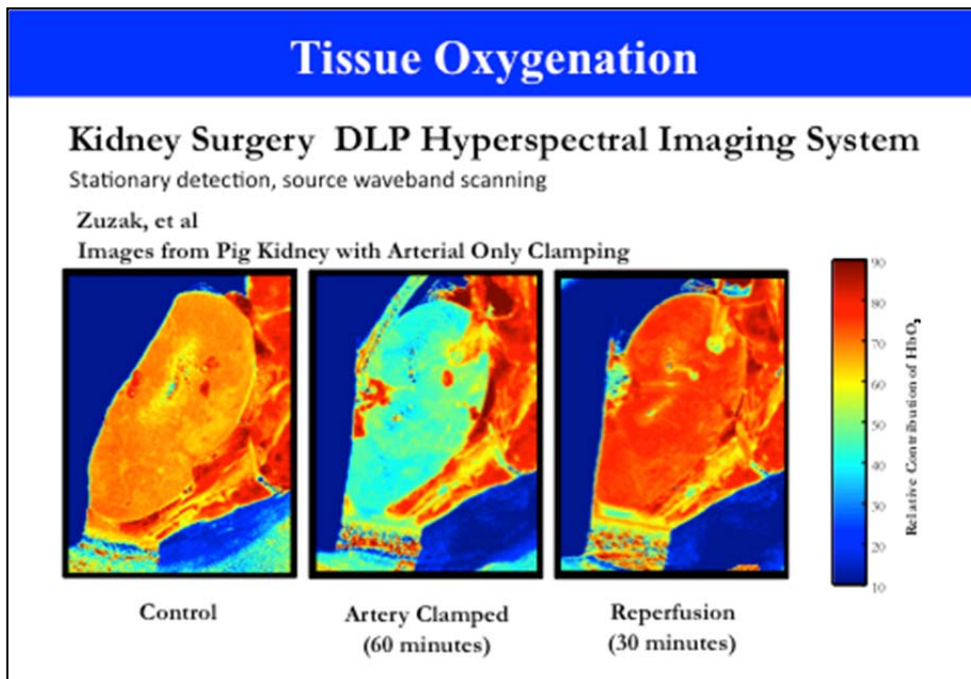
Science Afternoon at NIST with a Focus on Color and Perception Monday, November 14, 2011



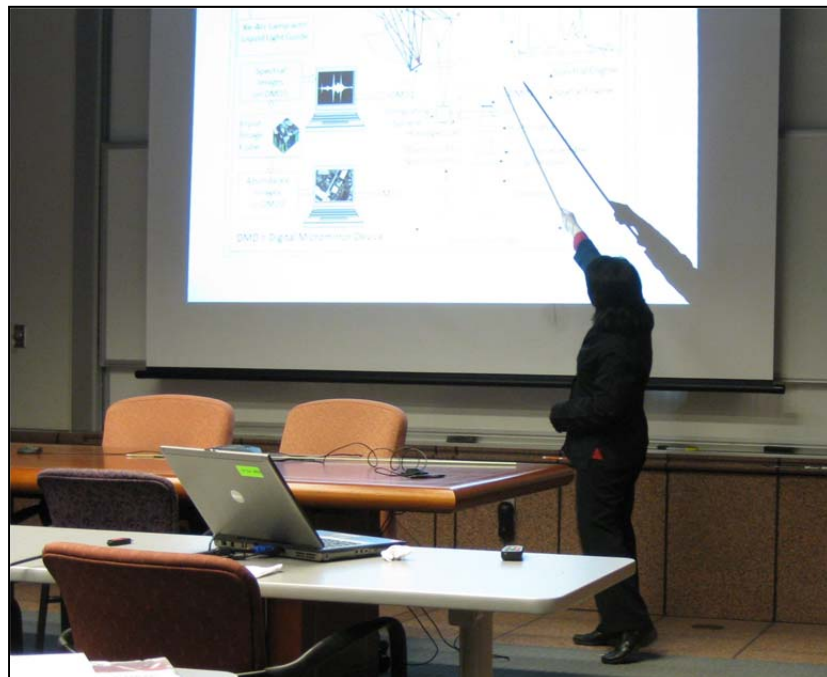
Dr. Maritoni Litorja, known as Toni, spoke this evening about her background and work at NIST and about the science of color. Toni is in the Optical Radiation Group, and her work focuses on how the information from light and imaging can be used to provide new information through new measurements with greater confidence.



Her group is especially interested in the use of imaging in medicine, such as using new kinds of imaging, including hyperspectral imaging in which an entire spectra of each pixel is taken, to help doctors differentiate among the many shades of red in the open abdomen of a surgery patient as he searches for an elusive bile duct, or "surgery by color".



Another application that the Optical Radiation Group is working on is using imaging for detection of biomarkers remotely such as oxygenation levels in tissue and in areas far from the location of the oximeter that may be attached to a patient's finger. In this figure, the levels of oxygen during a partial nephrectomy are being monitored to ensure minimal damage while providing a clean working area for the surgeon. An advantage of imaging is it's noninvasive and nondestructive properties – information can be gained without cutting the patient open or taking blood or other body fluids.



Toni explained how a hyperspectral image projector worked in comparison to projectors we're more accustomed to using, such as the one projecting the presentation!




For this Science Afternoon, we were fortunate to have three teachers from Florida in communication through a webinar, thanks to of Carl's careful attention. Welcome Piedad, La'Talia, and Kerlyn, all from Miami! Since we recorded this presentation we'll also have a podcast available soon.



In her presentation on *The Science of Color* Toni gave an overview of the biology of the eye and how color and images are interpreted by the brain, as well as the tools we use for measuring light and color.

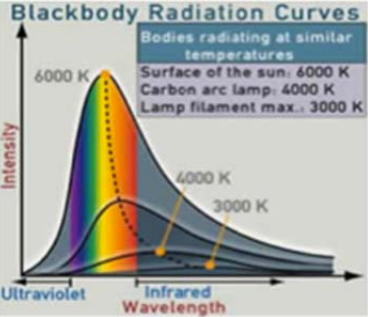
Color Temperature

Color Temperature—a numerical description of the light color (red-hot, blue-hot)
Expressed in Kelvin units



Blackbody Radiation Curves
Bodies radiating at similar temperatures


- Surface of the sun: 6000 K
- Carbon arc lamp: 4000 K
- Lamp filament max.: 3000 K



Planck's radiation law

Common labels:
Color Temperature
Color coordinated temperature
CCT

Incandescent light bulb: 2700 K
LED lamps: 5000 K



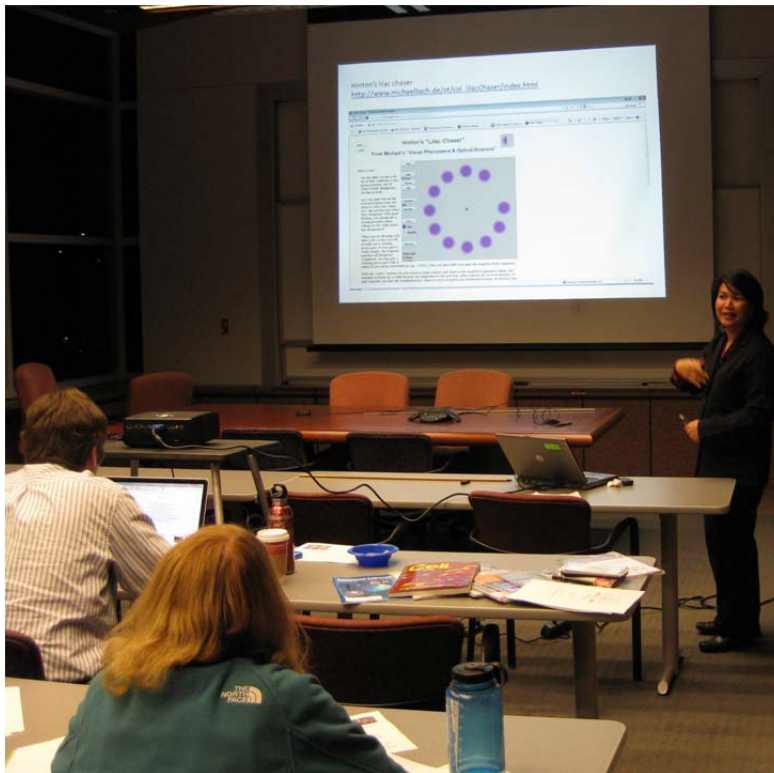
Oxyacetylene torch flame,
>3000 ° C

Note that our everyday description:
Warm lighting—tends towards red
Cool lighting- tends towards blue
...is opposite to the spectrum!

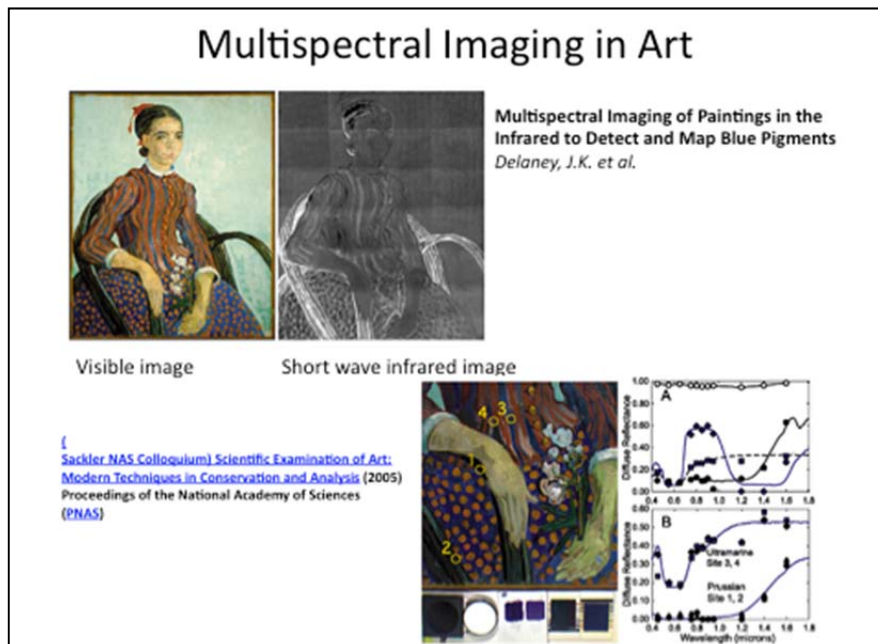
The lighting industry is mature, Toni said, with standards in place, although some of the terminology may appear odd, like color temperature: a numerical description of the light color expressed in Kelvin.



Teachers paid close attention, as these concepts are ones that they teach, and Toni provided background information to increase their knowledge and understanding. Plus they all acknowledge human interest in most things having to do with light and color.



In preparation for the talk Toni had researched multiple websites that the teachers might find of interest, and gave brief descriptions of what each website had to offer.



For example, Toni spoke of the use of imaging techniques in art forensics, as scientists search to determine the identity of paints used, or even to see what thrifty artists painted over, such as Picasso's *Le Gourmet*, which hyperspectral imaging revealed a long-lost painting of a woman's face! See <http://www.nga.gov/resources/scienceresearch/analyticalimg.shtm>



Of course, the optical illusions and ways that the brain works to interpret and hold images was another favorite part of the evening. Chromatic adaptation, chromatic saturation, persistence of vision, etc. Can you tell the difference among the different shades of red in the circle to the right?
Maybe...

Toni ended the presentation with several ways of teaching color, starting with art images, how color technology works, and/or optical illusions, giving resources for all three perspectives. Teachers were enthusiastic about the presentation – from all three viewpoints – and eager to integrate the materials in their classrooms. Thank you, Toni! Toni can be contacted at Maritoni.Litorja@NIST.gov.



An added bonus for the evening was the presence of Victoria and Samantha, Toni's daughters. Even these potentially harsh critics admitted that the material on optical illusions and color perception was fascinating.