

Syracuse University

SURFACE

Chemistry - Faculty Scholarship

College of Arts and Sciences

8-2010

Noninvasive, In-Vivo, Tissue Modulated Near Infrared Spectroscopy of Fingertips: Resonance Raman Spectrum of Human Hemoglobin

Bin Deng
Syracuse University

Jerry Goodisman
Syracuse University

George Shaheen
LighTouch Medical Inc

Rebecca J. Bussjager
LighTouch Medical Inc

Joseph Chaiken
Syracuse University

Follow this and additional works at: <https://surface.syr.edu/che>

 Part of the [Chemistry Commons](#)

Recommended Citation

Deng, Bin; Goodisman, Jerry; Shaheen, George; Bussjager, Rebecca J.; and Chaiken, Joseph, "Noninvasive, In-Vivo, Tissue Modulated Near Infrared Spectroscopy of Fingertips: Resonance Raman Spectrum of Human Hemoglobin" (2010). *Chemistry - Faculty Scholarship*. 74.

<https://surface.syr.edu/che/74>

This Article is brought to you for free and open access by the College of Arts and Sciences at SURFACE. It has been accepted for inclusion in Chemistry - Faculty Scholarship by an authorized administrator of SURFACE. For more information, please contact surface@syr.edu.

Noninvasive, In-Vivo, Tissue Modulated Near Infrared Spectroscopy of Fingertips: Resonance Raman Spectrum of Human Hemoglobin

Bin Deng, Syracuse University
Jerry Goodisman, Syracuse University
George Shaheen, LighTouch Medical Inc
Rebecca J. Bussjager, LighTouch Medical Inc
J. Chaiken, Syracuse University, LighTouch Medical Inc

TISSUE MODULATION

Tissue modulation refers to using external stimuli such as mechanical pressure and temperature to produce various spatiotemporal distributions of blood and conceivably other fluids in tissues. Having the capacity to execute tissue modulation¹ allows forms of difference spectroscopy to be used to isolate spectroscopic signals from specific components of the tissues noninvasively and in vivo. In the case of human fingertips we can think of the tissues present in the probed volume as being static tissue, plasma and red blood cells (RBCs). Static tissues deform under mechanical pressure based tissue modulation and the only possible fluid motions² involve plasma and RBCs. Figure 1 shows the difference spectrum produced, negative modulated fluorescence and positive modulated Raman, when simultaneously a small amount of RBCs move into and some plasma is move out of the probed volume. We present spectra for all limiting forms of tissue modulation and show prototypical spectra that include fluorescence Rayleigh/Mie and Raman scattering.

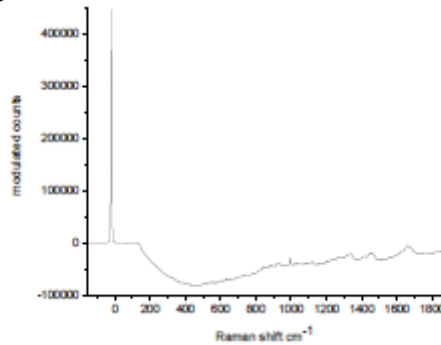
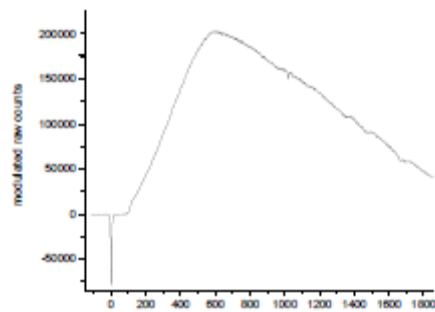
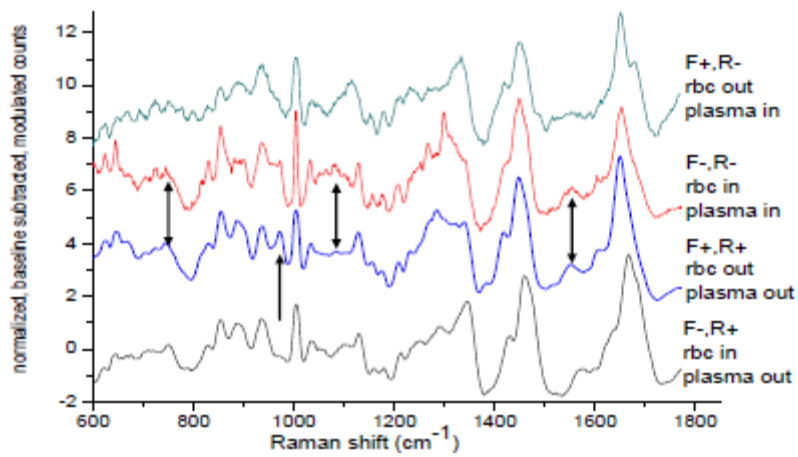


Figure 1. Example of archetypical tissue modulated spectrum due to movement of relatively small volume of RBCs into probed volume and some plasma out of probed volume.

Figure 2 shows a positive modulated fluorescence component with a negative modulated Raman component. Figure 3 shows baseline corrected Raman spectra of 4 types with resonance Raman features indicated.



example of archetypical tissue modulated spectrum due to movement of small to average volume of RBCs out of observation region and some plasma into region



ACKNOWLEDGMENTS

This research was supported by LightTouch Medical.

REFERENCES

1. J. Chaiken, B. Deng, R. J. Bussjager, G. Shaheen, D. Rice, D. Stehlik, J. Fayos, *Rev. Sci. Instrum.* **81**, 034301(2010)
2. J. Chaiken, J. Goodisman, B. Deng, R. J. Bussjager, G. Shaheen, *J. Biomed. Opt.* **14**, 050505 (2009).