

Student Name:

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Lab 4: NIRS Instruments Solutions

Today we will be looking at two diffuse optical NIRS instruments developed here at the Beckman Laser Institute, University of California, Irvine: **DOSI** and **SFDI**. Please fill out the details in this worksheet as you observe and interact with today's demos. This worksheet is due at the end of today's lab, as there will be no post-lab.

1. "SFDI" stands for _____ **spatial-frequency domain imaging** _____
2. SFDI uses _____ **spatially** _____ modulated light in order to create a 2-D plane in which the _____ **point** _____ - _____ **spread** _____ function can be imaged over a wide area.
3. SFDI utilizes mathematical models of _____ **diffusion** _____ and is capable of recovering chromophores a few _____ **millimeters** _____ below the surface of tissue. In terms of speed, the main limiting factor is the time it takes to _____ **project patterns of light** _____.
4. SFDI is a non-invasive, non- _____ **contact** _____ technique and can be used to image highly fragile tissue such as surgical sites and even neural tissue.
5. At low spatial frequencies, the system is more sensitive to _____ **absorption** _____, but at high spatial frequencies, the system is more sensitive to _____ **scattering** _____.
6. In comparison to most NIRS instruments, SFDI can image a wide-area, which has been used to track _____ **viability** _____ of tissue flaps transplant.
7. "DOSI" stands for: _____ **diffuse optical spectroscopic imager** _____
8. DOSI has the capability to recover **absolute** / **relative** (*circle one*) values of oxy-, deoxy-hemoglobin, water, and lipid chromophores. This is advantageous over conventional NIRS particularly for clinical trials because:
 - I. _____ **you can track patient over multiple visits** _____
 - II. _____ **you can compare different patients** _____

9. DOSI combines two optical technologies, 1. _____ **white light spectroscopy** _____, which recovers relative intensity over the NIR spectrum, and another optical technology called 2. _____ **FDPM** _____, which recovers optical properties at discrete wavelengths.
10. For the first exercise, we will be performing an arterial occlusion using a blood pressure cuff, similar to what is done during a normal doctor's visit. During an arterial occlusion, blood flow is cut off, and _____ **oxy** _____ hemoglobin is converted to _____ **deoxy** _____ hemoglobin. The release of the occlusion cuff causes hyperemia aka rapid blood flow increase. The hyperemia response is thought to be directed related to the _____ **endothelial function** _____.
11. For the second demo, we will be performing a body composition measurement. This is a measurement which attempts to estimate total body lipid content, and is a technique calibrated against **_D_ _X_ _A_**.
12. For the last demo, we will be performing a force-grip, in which a stress-ball is squeezed in order to promote muscle activation. The slope of deoxygenation is related to a physiological metric known as the **_metabolic rate of oxygen extraction_** and is thought to be related to the oxygen extraction efficiency of the muscle. Exercising over time is theorized to increase this rate.