**Intraoperative assessment of breast physiology via in vivo optical biopsy: Potential for cancer diagnostics**

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**Motivation**
- Optical spectroscopy is a method that could provide real-time discrimination of malignant tissues for application in:
  - Adjunct to core-needle biopsy
  - Intraoperative tumor margin assessment
  - Monitoring tumor response to therapy
- The purpose of this study is to measure the optical signatures of normal and malignant breast in vivo to serve as a foundation for future studies and applications

**Optical Signals Can Probe...**

**Absorption**
- Hemoglobin saturation, vascularity
- Water content
- Lipid content
- Cellular metabolism
- Structural protein content
- Amino acids
- Size and density of scattering centers

**Fluorescence**

**Scattering**

**Data Analysis**
- Raw spectral data
- Calibrated spectral data
- Parameter extraction
- Classification accuracy
- Linear or non-linear support vector machine
- Key variables
- Cross validation

**Intraoperative Procedure**
1. Incision made in skin
2. Ultrasound used to guide needle-biopsy cannula to site of interest
3. Needle is retracted, and probe inserted through cannula to interface with tissue
4. Optical measurement made
5. Probe retracted, and biopsy of interrogated tissue made through cannula
6. On average, 3 tissue sites interrogated per patient
7. Biopsied tissues histopathologically analyzed for concordance analysis

**Results**

**Representative Spectra**

**Extracted Optical Properties**

**Tissue Parameter Extraction, All Samples**

**Variables Display Differences**

**SVM Classification**

**Enrollment / Sample Statistics**

**Conclusions and Future Work**

- Diffuse reflectance spectroscopy can discriminate between malignant and non-malignant tissues on the basis of extracted physiological parameters
- More robust classification algorithm expected with more malignant samples (larger balanced training set)
- Analysis of fluorescence spectra from in vivo study in progress, as well as a study on the effect of lymphazurin contamination on extraction accuracy
- Future work will include determining the contribution of methemoglobin in optically assessed tissues

Acknowledgments
- Study patients
- NIH
- Duke Ambulatory Surgery Center Staff