

## Supplementary Information

### Label-free Raman spectroscopy provides early determination and precise localization of breast cancer-colonized bone alterations

Chi Zhang<sup>1†</sup>, Paul T Winnard Jr.<sup>2†</sup>, Sidarth Dasari<sup>3</sup>, Scott L Kominsky<sup>4</sup>, Michele Doucet<sup>4</sup>, Swaathi Jayaraman<sup>4</sup>, Venu Raman<sup>2, 5,\*</sup>, Ishan Barman<sup>1, 5\*</sup>

<sup>1</sup>Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD, USA.

<sup>2</sup>Division of Cancer Imaging Research, Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, USA.

<sup>3</sup>Indiana University School of Medicine, Indianapolis, IN, USA.

<sup>4</sup>Department of Orthopaedic Surgery, Johns Hopkins University School of Medicine, Baltimore, MD, USA.

<sup>5</sup>Department of Oncology, Johns Hopkins University School of Medicine, Baltimore, MD, USA.

†These authors contributed equally to this work.

**Running Title:** Raman spectroscopic determination of early bone metastasis

**Keywords:** Raman spectroscopy, breast cancer, bone metastasis

#### \*Correspondence:

Ishan Barman  
Johns Hopkins University  
Whiting School of Engineering  
Department of Mechanical Engineering  
Latrobe Hall 103  
Baltimore, MD 21218, USA.  
Office Phone: 410-516-0656  
E-mail: [ibarman@jhu.edu](mailto:ibarman@jhu.edu)

Venu Raman  
The Johns Hopkins University School of Medicine  
The Russell H. Morgan Department of Radiology and Radiological Science  
Division of Cancer Imaging Research  
720 Rutland Avenue, Rm 340 Traylor Building  
Baltimore, MD, USA 21205  
Office Phone: 410-955-7492  
E-mail: [vraman2@jhmi.edu](mailto:vraman2@jhmi.edu)

**Conflict of Interest:** The authors disclose no potential conflicts of interest.

**Table S1A.** Classification results for the SVM-derived decision algorithm as a function of time point and location in the spine

Site	Week 0	Week 2	Week 4	Week 5	Average
Lumbar vertebrae	95%	100%	100%	100%	98.8%
Sacral vertebrae	90%	100%	100%	90%	95.0%
Caudal vertebrae	65%	100%	100%	100%	91.3%

**Table S1B.** Classification results for the SVM-derived decision algorithm using only the selected spectral features as a function of time point and location in the spine

Site	Week 0	Week 2	Week 4	Week 5	Average
Lumbar vertebrae	85%	100%	95%	100%	95.0%
Sacral vertebrae	90%	100%	100%	100%	97.5%
Caudal vertebrae	65%	100%	100%	100%	91.3%