

## Biomedical Engineering

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## Core Faculty Profile

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### Research Interests

Optical imaging, Minimally invasive optical diagnosis and imaging of early cancer, Coherent backscattering spectroscopy for tissue diagnosis, Fractal organization of cells and tissues, Analysis of nano- and micro-architecture of living tissues using light scattering spectroscopy, Light scattering and propagation in random/turbid media.

### Selected Publications

#### RECENT JOURNAL PUBLICATIONS

1. Pradhan, D. Dhwanil, V. Turzhitsky, **V. Backman**, "Quantification of the Disorder Strength of Nanoscale Refractive Index Fluctuations of Biological Tissue: Inverse Participation Ratio (IPR) Analysis", submitted (2009).
2. H. K. Roy, H. Subramanian, D. Damania, T. Hensing, D. Ray, A. Bogojevic, P. Pradhan, J. Rogers, N. Hasabou, I. Capoglu, **V. Backman**, "Alterations in Nanoscale Architecture in Buccal Epithelial Cells as a Marker for Lung Cancer", submitted (2009).
3. H. K. Roy, A. J. Gomes, S. Ruderman, V. Turzhitsky, J. D. Rogers, V. Stoyneva, L. K. Bianchi, M. J. Goldberg, Y. L. Kim, E. Yen, A. Kromine, M. Jameel, **V. Backman**, "Optical Measurement of Rectal Microvasculature as an Adjunct to Flexible Sigmoidoscopy: Gender-Specific Implications", submitted (2009).
4. Capoglu, J. Rogers, A. Taflove, **V. Backman**, "[Accuracy of the Born Approximation in Calculating the Scattering Coefficient of Biological Continuous Random Media](#)", Optics Letters, 34(17), 2679-2681 (2009).
5. V. Turzhitsky, J.D. Rogers, N. Mutyal, H. K. Roy, **V. Backman**, "Characterization of light transport in scattering media at sub-diffusion length scales with Low-coherence Enhanced Backscattering", IEEE JSTQE, in press (2009) (invited paper).
6. J. D. Rogers, I. R. Capoglu, **V. Backman**, "[Nonscalar elastic light scattering from continuous media in the Born approximation](#)", Optics Letters, 34(12), 1891-1893 (2009).
7. H. Subramanian, H. K. Roy, P. Pradhan, M. J. Goldberg, R. E. Brand, C. Sturgis, T. Hensing, D. Ray, J.-S. Chang, J. Mohammed, **V. Backman**, "[Nanoscale Cellular Changes in Field Carcinogenesis Detected by Partial Wave Spectroscopy](#)", Cancer Research, 69(13), 5357-5363 (2009).
8. V. Turzhitsky, Y. Liu, N. Hasabou, M. Goldberg, H. K. Roy, **V. Backman**, R. Brand, "[Investigating Population Risk Factors of Pancreatic Cancer by Evaluation of Optical Markers in the Duodenal Mucosa](#)", Disease Markers, 25, 313-321 (2009) (invited paper).
9. H. K. Roy, V. Turzhitsky, Y. Kim, M. J. Goldberg, P. Watson, J. D. Rogers, A. J. Gomes, A. Kromine, R. E. Brand, M. Jameel, N. Hasabou, P. Pradhan, **V. Backman**,

- ["Association between Rectal Optical Signatures and Colonic Neoplasia: Potential Applications for Screening"](#), Cancer Research, 69(10), 4476-4483 (2009).
10. H. Subramanian, P. Pradhan, Y. Liu, I. Capoglu, J. Rogers, H. Roy, R. Brand and **V. Backman**, ["Partial-wave microscopic spectroscopy detects subwavelength refractive index fluctuations: an application to cancer diagnosis"](#), Optics Letters, 34(4), 518-520 (2009).
  11. S.-C. Kong, A. Taflove, **V. Backman**, ["Quasi one-dimensional light beam generated by a graded-index microsphere"](#), Optics Express, 17(5), 3722-3731 (2009).
  12. S.-C. Kong, A. V. Sahakian, A. Taflove, **V. Backman**, ["High-Density Optical Data Storage Enabled by the Photonic Nanojet from a Dielectric Microsphere"](#), JJAP, 48, 03A008, 1-3 (2009).
  13. A. J. Gomes, H. K. Roy, V. Turzhitsky, Y. Kim, J. D. Rogers, M. J. Goldberg, A. Kromine, M. Jameel, **V. Backman**, ["Rectal Mucosal Microvascular Blood Supply Increase is Associated with Colonic Neoplasia"](#), Clinical Cancer Research, 15(9), 3110-3117 (2009).
  14. V. Turzhitsky, A. J. Gomes, Y. L. Kim, Y. Liu, A. Kromine, J. D. Rogers, M. Jameel, H. K. Roy, **V. Backman**, ["Measuring Mucosal Blood Supply in vivo with a Polarization Gating Probe"](#), Applied Optics, 47(32), 6046-6057 (2008).
  15. H. Subramanian, P. Pradhan, Y. Liu, I. Capoglu, X. Li, J. Rogers, A. Heifetz, D. Kunte, H. K. Roy, A. Taflove, **V. Backman**, ["Optical Methodology for Detecting Histologically Unapparent Nanoscale Consequences of Genetic Alterations in Biological Cells"](#), PNAS, 105(51), 20124-20129 (2008).
  16. I. R. Capoglu, A. Taflove, **V. Backman**, ["Generation of an incident focused light pulse in FDTD"](#), Optics Express, 16(23), 19208-19220 (2008).
  17. A. Heifetz, S.-C. Kong, A. V. Sahakian, A. Taflove, **V. Backman**, "Photonic Nanojets", J. Computational and Theoretical Nanoscience, 6(9), 1979-1992 (2009) (invited paper).
  18. S. C. Kong, A. V. Sahakian, A. Taflove, **V. Backman**, ["Photonic Nanojet-enabled Optical Data Storage"](#), Optics Express, 16(18), 13713-13719 (2008).
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  20. S. C. Kong, A. V. Sahakian, A. Heifetz, A. Taflove, **V. Backman**, ["Robust Detection of Deeply Subwavelength Pits in Simulated Optical Data-Storage Disks Using Photonic Jets"](#), Applied Physics Letters, 92(21), 211102, 1-3(2008) (cover article).
  21. H. K. Roy, V. Turzhitsky, Y. L. Kim, Y. Liu, M. J. Goldberg, R. E. Brand, N. Hasabou, M. Jameel, and **V. Backman**, ["Spectral Slope from the Endoscopically-Normal Mucosa Predicts Concurrent Colonic Neoplasia: A Pilot Ex-Vivo Clinical Study"](#), Diseases of Colon and Rectum, 51, 1381-1386 (2008).
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  23. A. Heifetz, A. Taflove, **V. Backman**, ["Subdiffraction optical resolution of a gold nanosphere located within the nanojet of a Mie-resonant dielectric microsphere"](#), Optics Express, 15 (25), 17334-17342 (2007).
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  25. A. Kaushiva, V. M Turzhitsky, **V. Backman**, G. A. Ameer, ["A biodegradable vascularizing membrane: A feasibility study"](#), Acta Biomaterialia, 3 (5), 631-642 (2007).
  26. H. Subramanian, P. Pradhan, Y. Kim, **V. Backman**, ["Penetration depth of low-coherence enhanced backscattering of light in sub-diffusion regime"](#), Phys.Rev. E, 75, 041914, 1-9 (2007).
  27. Y. Liu, R. E. Brand, V. Turzhitsky, Y. L. Kim, H. K. Roy, N. Hasabou, C. Sturgis, D. Shah, C. Hall, **V. Backman**, ["Optical Markers in Duodenal Mucosa Predict the Presence of Pancreatic Cancer"](#), Clinical Cancer Research, 13(15), 4392-4399 (2007) (feature article).

**National Science Foundation Press Release:**

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- [a Grid-enabled Lookup-based Optimization Application: Light Scattering Spectroscopy](#), IEEE Transactions on Information Technology in BioMedicine , 11 (2), 170-178 (2007).
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  31. H.K. Roy, **V. Backman**, M. Goldberg, ["Colon Cancer Screening: The Good, the Bad and the Ugly"](#), Archives of Internal Medicine, 166, 2177-2179 (2006) (editorial).
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