

BIOGRAPHICAL SKETCH

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|--|---|-------|----------------------|
| NAME Zaver M. Bhujwalla | POSITION TITLE Professor of Radiology and Oncology Director, Division of Cancer Imaging Research | | |
| eRA COMMONS USER NAME (credential, e.g., agency login) zaver_bhujwalla | | | |
| EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)</i> | | | |
| INSTITUTION AND LOCATION | DEGREE <i>(if applicable)</i> | MM/YY | FIELD OF STUDY |
| Univ. of Bombay, India (St. Xavier's College) | B.Sc. | 1980 | Physics, Mathematics |
| Univ. of Bombay, India (Cancer Research Institute) | M.Sc. | 1982 | Biophysics |
| Univ. of London, UK (Middlesex Hospital Med School) | M.Sc. | 1985 | Radiation Biology |
| Univ. of London, UK (Royal Postgrad. Med School) | Ph.D. | 1988 | Radiation Biology |

A. Personal Statement

Dr. Bhujwalla is Professor of Radiology and Oncology. She is an internationally recognized scientist and a pioneer in the applications of MR imaging and multi-modality imaging to understand cancer and the tumor microenvironment. Dr. Bhujwalla is an elected Fellow of the International Society of Magnetic Resonance in Medicine (ISMRM) and the American Institute of Biomedical Engineers in 2007. She is currently associated with the editorial boards of *Molecular Imaging*, *NMR in Biomedicine*, *Cancer Biology and Therapy*, and *Contrast Media and Molecular Imaging*. Dr. Bhujwalla is currently President of the World Molecular Imaging Society. At Johns Hopkins University School of Medicine, she serves as Director of the Division of Cancer Imaging Research, the Cancer Molecular and Functional Imaging Program, and the BRB Molecular Imaging Center and Cancer Functional Imaging Core, in the Dept. of Radiology. Dr. Bhujwalla also serves as Chair of the Career Development Advisory Committee in the Dept. of Radiology at Johns Hopkins University.

B. Positions and Honors

Positions and Employment

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|---------|--|
| 1982-83 | Bhabha Atomic Research Center, Division of Radiation Protection, Mumbai, India |
| 1983-84 | Hospital Physicist, Dept. of Radiation Oncology, Tata Memorial Center, Mumbai, India |
| 1989-91 | Postdoctoral Research Fellow, NMR Research Division, Dept. of Radiology, Johns Hopkins Univ. School of Medicine, Baltimore, MD |
| 1991-92 | Instructor, NMR Research Division, Dept. of Radiology, Johns Hopkins Univ. School of Medicine, Baltimore, MD |
| 1992-98 | Assistant Professor, Division of MR Research, Dept. of Radiology, Johns Hopkins Univ. School of Medicine, Baltimore, MD |
| 1998-02 | Associate Professor of Radiology, Johns Hopkins Univ School of Medicine, Baltimore, MD |
| 2000-02 | Associate Professor of Oncology, Johns Hopkins Univ. School of Medicine, Baltimore, MD |
| 2002 | Professor of Radiology, Johns Hopkins University School of Medicine, Baltimore, MD |
| 2002 | Professor of Oncology, Johns Hopkins University School of Medicine, Baltimore, MD |
| 2012 | Director, Division of Cancer Imaging Research |

Honors

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|------|--|
| 2006 | The Negendank Lecture "To Image and Imagine: Molecular and Functional Imaging of Cancer" Cancer Study Group of the ISMRM |
| 2007 | Fellow of the American Institute for Medical and Biological Engineering (AIMBE) |
| 2007 | Fellow of the International Society of Magnetic Resonance in Medicine (ISMRM) |
| 2009 | Outstanding Teacher Award, International Society of Magnetic Resonance in Medicine, Honolulu |
| 2012 | President of the World Molecular Imaging Society |
| 2012 | Distinguished Investigator, Academy of Radiology Research. |

10/24/2012

National Committees

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|--------------|--|
| 1996, 97, 98 | Reviewer for the Radiological Sciences Study Section of the USAMRMC Breast Cancer Program |
| 1998 | Reviewer for the California Breast Cancer Research Program |
| 1998 | Reviewer for the Susan Komen Breast Cancer Foundation |
| 1998, 99, 00 | Ad Hoc Reviewer for the NIH Diagnostic Radiology Study Section |
| 2000 | Reviewer for the USAMRMC Prostate Cancer Program |
| 2001 | Reviewer for NCI RFA:01-014 (P50) to est. <i>In vivo</i> Cellular and Molecular Imaging Cancer Centers |
| 2006 | Reviewer for NCI RFA CA-06-014, Tumor Microenvironment Network |
| 2003-07 | Reviewer for the NIH Medical Imaging Study Section |
| 2010 | Reviewer for the NIH P30 COBRE III Transitional Center |
| 2011- | Ad Hoc Reviewer for the NIH Division of Clinical and Translational Science 2 Stage Review |

Editorial Advisory Boards

Current *Cancer Biology and Therapy, Molecular Imaging, NMR in Biomedicine, Contrast Media and Molecular Imaging*

Previous *Cancer Research, Lancet Oncology*

Professional Societies

| | |
|---------|--|
| | American Association of Cancer Research |
| 2007 | American Institute for Medical and Biological Engineering, USA - Elected Fellow. |
| 2003-04 | International Society of Magnetic Resonance in Medicine, USA. Chair, Cancer MR Study Group; 2007 - Elected Fellow Radiation Research Society, USA |
| 2005-07 | Society for Molecular Imaging, Council Member |

C. Selected Peer-reviewed Publications (from 142)

Most relevant to the current application

Selected Peer-reviewed Publications (from 140)

1. Mori N, Glunde K, Takagi T, Raman V, Bhujwala ZM. Choline Kinase Down-Regulation Increases the Effect of 5-Fluorouracil in Breast Cancer Cells. *Cancer Res.* 2007; 67(23):11284-90.
2. Glunde K, Pathak AP and Bhujwala ZM. Molecular Functional Imaging of Cancer: To Image and Imagine. *Trends Mol Med.* 2007 Jul;13 (7):287-97.
3. Stasinopoulos I, Mori N, Bhujwala ZM. The Malignant Phenotype of Breast Cancer Cells is Reduced by COX-2 Silencing. *Neoplasia.* 2008; 10(11):1163-9.
4. Li C, Penet MF, Winnard P Jr, Artemov D, Bhujwala ZM. Image-Guided Enzyme/Prodrug Cancer Therapy. *Clin Cancer Res (front cover).* 2008; 14(2):515-22.
5. Penet MF, Glunde K, Jacobs MA, Pathak AP, Bhujwala ZM. Molecular and Functional MRI of the Tumor Microenvironment. *J Nucl Med.* 2008 May;49(5):687-90.
6. Mikhaylova M, Stasinopoulos I, Kato Y, Artemov D, Bhujwala ZM. Imaging of Cationic Multifunctional Liposome-Mediated Delivery of COX-2 siRNA. *Cancer Gene Ther.* 2009; 16(3):217-26.
7. Krishnamachary B, Glunde K, Wildes F, Mori N, Takagi T, Raman V, Bhujwala ZM. Noninvasive Detection of Lentiviral-Mediated Choline Kinase Targeting in a Human Breast Cancer Xenograft. *Cancer Res.* 2009; 69(8):3464-71.
8. Penet MF, Pathak AP, Raman V, Ballesteros P, Artemov D, Bhujwala ZM. Noninvasive Multiparametric Imaging of Metastasis-Permissive Microenvironments in a Human Prostate Cancer Xenograft. *Cancer Res.* 2009; 69(22):8822-9.
9. Shah T, Wildes F, Penet M-F, Winnard PT, Glunde K, Artemov D, Ackerstaff E, Gimi B, Kakkad S, Raman V, and Bhujwala ZM. Choline Kinase Overexpression Increases Invasiveness and Drug Resistance of Human Breast Cancer Cells. *NMR Biomed.* 23(6):633-42, 2010.
10. Kakkad, S., Solaiyappan, M., O'Rourke, B., Stasinopoulos, I. Ackerstaff, E., Raman, V., Bhujwala, Z. M., and Glunde, K. Hypoxic Tumor Microenvironments Reduce Collagen I Fiber Density. *Neoplasia*, 2010, 12(8):608-17.

11. Li C, Penet MF, Wildes F, Takagi T, Chen Z, Winnard PT Jr, Artemov D, Bhujwalla ZM. Nanoplex Delivery of siRNA and Prodrug Enzyme for Multimodality Image-Guided Molecular Pathway Targeted Cancer Therapy. *ACS Nano* 2010; 4:6707-16.
12. Glunde K, Artemov D, Penet MF, Jacobs MA, Bhujwalla ZM. Magnetic Resonance Spectroscopy in Metabolic and Molecular Imaging and Diagnosis of Cancer. *Chem Rev* 2010; 12:110(5):3043-59.
13. Stasinopoulos, I, Penet M-F, Chen Z, Kakkad S, Glunde K, Bhujwalla ZM. Exploiting the Tumor Microenvironment for Theranostic Imaging. *NMR in Biomedicine*, 2010.
14. Shah T, Stasinopoulos I, Wildes F, Kakkad S, Artemov D, Bhujwalla ZM. Noninvasive imaging identifies new roles for cyclooxygenase-2 in choline and lipid metabolism of human breast cancer cells. *NMR Biomed.* 2012 May;25(5):746-54.
15. Krishnamachary B, Penet MF, Nimmagadda S, Mironchik Y, Raman V, Solaiyappan M, Semenza GL, Pomper MG, Bhujwalla ZM. Hypoxia Regulates CD44 and Its Variant Isoforms through HIF-1 α in Triple Negative Breast Cancer. *PLoS One.* 2012;7(8):e44078.
16. Chen Z, Penet MF, Nimmagadda S, Li C, Banerjee SR, Winnard PT Jr, Artemov D, Glunde K, Pomper MG, Bhujwalla ZM. PSMA-Targeted Theranostic Nanoplex for Prostate Cancer Therapy. *ACS Nano.* 2012 Sep 25;6(9):7752-62.

Book Chapters (selected)

1. Penet, M-F., Glunde, K., Jacobs, M. A., Mori, N., Artemov, D. and Bhujwalla, Z. M. Oncological Applications of MR Spectroscopy. In: *Molecular Imaging in Oncology*, Informa Publishing, 2008.
2. Glunde, K., Gillies, R. J., Neeman, M., and Bhujwalla, Z. M. Molecular and Functional Imaging of the Tumor Microenvironment. In: *Molecular Imaging: Principles and Practice*, BC Decker Inc., 2009.
3. Penet, M-F., Artemov, D., Mori, N., Bhujwalla Z. M. MR Spectroscopy and Spectroscopic Imaging of Tumor Physiology and Metabolism. In: *Imaging in Medical Diagnosis and Therapy*, Taylor & Francis Publishers, 2011.

Inventions, Patents

Non-Invasive Imaging of Extracellular pH by Magnetic Resonance Methods using extrinsic ¹H and ¹⁹F probes.

D. Research Support

Ongoing Research Projects as Principal Investigator

2P50CA103175-06A2 (Bhujwalla) 08/01/03 - 07/31/16

NCI JHU ICMIC Program

This center grant funds an *in vivo* Cellular and Molecular Imaging Center at Johns Hopkins. The program consists of four research components, four developmental projects, one career development award and four resources.

P30CA06973 (Nelson) 05/07/97 - 04/30/17

NCI Cancer Center Support Grant

Cancer Functional and Molecular Imaging Program – Co-Director

Cancer Functional Imaging Core - Resource Director

The Sidney Kimmel Comprehensive Cancer Center conducts basic, clinical and translational research to reduce cancer morbidity and mortality. As Resource Director, our goal is to provide an imaging resource for the Sidney Kimmel Comprehensive Cancer Center.

R01CA82337 (Bhujwalla) 07/01/99 - 03/31/16

NCI

Hostile Environments Promote Invasion and Metastasis

COX-2 is a critically important target in cancer that significantly influences a range of characteristics such as angiogenesis, invasion and metastasis. In this application we intend to uncover new targets that interact with COX-2, and identify the effect of COX-2 expression on extracellular matrix structure and function. We also intend to develop probes to noninvasively image COX-2 expression and activity that will allow us to further understand the role of this enzyme in cancer and allow us to effectively target it.

R01CA138515 (Bhujwalla) 07/01/09 - 06/30/14

NIH

Image-Guided Prodrug and siRNA Targeting of Cancer

This purpose of this grant is two-fold – to develop effective treatment strategies utilizing image guided prodrug enzyme-siRNA treatment that will minimize damage to normal tissue and secondly to use these strategies to target metastatic lesions.

R01CA136576 (Bhujwalla)

07/01/09 - 06/30/14

NIH

Imaging Hypoxia and Cancer Stem Cells

The goal of this project is to understand the role of the tumor microenvironment and choline metabolism in harboring or creating stem-like cancer cells.

R01CA073850 (Bhujwalla)

04/01/97 - 11/30/14

NCI

Functional Imaging of the Metastatic Phenotype

To determine if cancer cell dissemination occurs from hypoxic or normoxic tumor regions in metastasis permissive environments, and investigate the sequence of establishment of hypoxic foci in lymphatic metastatic sites and ascites.

Completed Projects Within Last Three Years as Principal Investigator

NCI 1R21CA128957 (Bhujwalla)

07/01/07-06/30/10

Image-Guided Pro-Drug/Enzyme Therapy

The aim of this study is to develop a conjugate with a prodrug enzyme and MRI and optical reporters for image guided prodrug therapy.

NCI R21CA140904-01 (Bhujwalla)

07/01/09-06/30/11

Molecular Imaging of Cancer Cachexia

State-of-the-art imaging techniques will be used in combination with molecular characterization to understand cancer-induced cachexia and the cachexia cascade in preclinical tumor models.