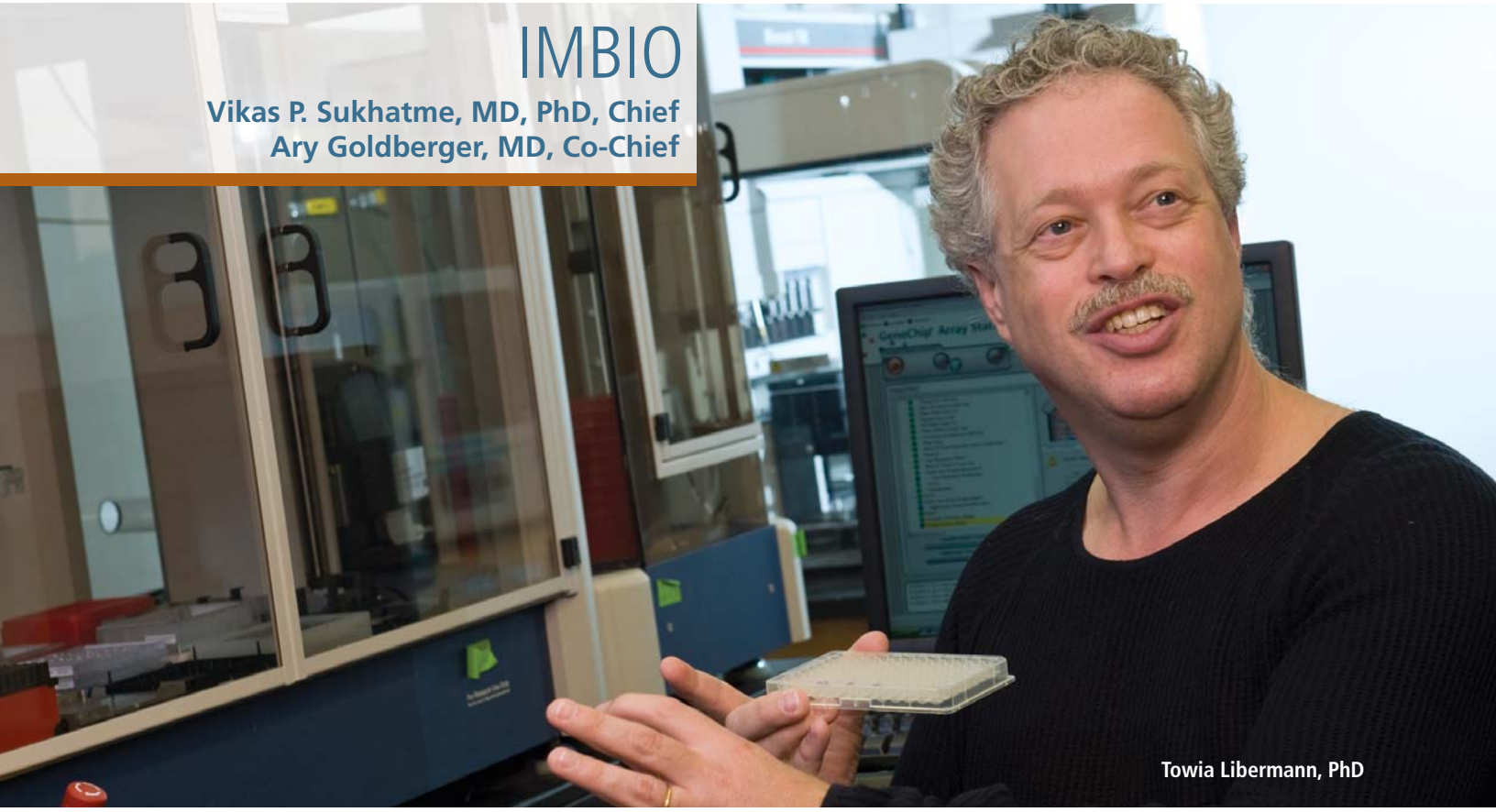
IMBIO

Vikas P. Sukhatme, MD, PhD, Chief
Ary Goldberger, MD, Co-Chief



Towia Libermann, PhD

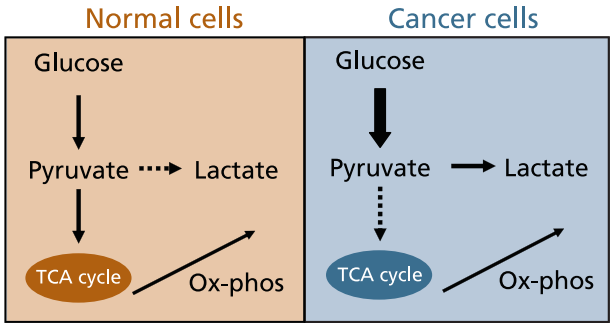
A central goal of Interdisciplinary Medicine and Biotechnology (IMBIO) is to gather data from biological systems – from cells to man – and then to analyze it in novel ways. Division members are interested in genomic, metabolomic and proteomic signals (Towia Libermann, Manoj Bhasin, Vikas Sukhatme, Pankaj Seth, Junichi Hanai, Jian-guo Ren, Zaheed Husain and Barden Chan) especially in the context of cancer, "sociologic" data on biomedical scientists (Griffin Weber), and physiologic data (Ary Goldberger, Chung-Kang Peng, Madalena Costa). The hope is that the hardware to elicit and detect signals from biological systems both in vivo and ex vivo and its analysis with sophisticated computational methods will lead to novel insights into disease pathophysiology.

2009–2010 HIGHLIGHTS

Drs. Sukhatme, Hanai and Husain continue their foray into tumor metabolism and tumor immunology and the interface of the two, with projects that extend from laboratory research to clinical trials. The group collaborates on these studies with Dr. Seth in IMBIO and with the Lenkinski group in radiology and is exploring novel methods for non-invasive imaging of metabolic pathways in tumors (see call-out). They have recently identified malic enzyme 2 as a novel cancer target. Dr. Chan is investigating the role of an angiogenic protein Tie-1 in atherosclerosis and cancer.

Drs. Goldberger, Peng and Costa continue their focus on understanding nonlinear dynamics and continue to develop quantitative algorithms to probe some of the generic features of complex systems and apply them to such diverse areas as heart rhythms in health and

Drs. Sukhatme and Seth, in collaboration with Dr. Lenkinski's group in the Radiology Department are pioneering new technologies for imaging metabolic pathways in cancer. In particular, they are studying the Warburg effect (enhanced glycolysis followed by fermentation (conversion of pyruvate to lactate)), a phenomenon which occurs in a majority of cancers. By utilizing magnetic resonance spectroscopy with hyperpolarized pyruvate, they were able to show that the Warburg effect can be imaged in real time in a tumor bearing animal. Moreover, the effects of drugs – expected to reverse the Warburg effect – which have been known to kill tumor cells, can now be followed in vivo in a noninvasive manner. It is anticipated that hyperpolarized magnetic resonance spectroscopy will be available for human use within a few years.



Schematic of how normal and cancer cells differ in their metabolism of pyruvate. The right hand panel illustrates the "Warburg effect" – the fact that even under aerobic conditions, cancer cells show a greater flux of pyruvate to lactate than do normal cells.

disease, forecasting drug toxicity, complexity analysis of coding and noncoding human DNA sequences and gait stability. Drs. Libermann, Xuesong Gu and Bhasin run the BIDMC Genomics Center and Cancer Proteomics Core at the Dana-Farber Cancer Institute. Their research has a major focus in renal, prostate and ovarian cancer.

Dr. Weber is a medical bioinformatician whose research focuses on ways in which biomedical informatics can improve medical education, research and patient care. He has established a Biomedical Research Informatics Core (BRIC), to provide informatics services to BIDMC researchers and is a major investigator in the Harvard Catalyst.

SELECTED PUBLICATIONS

Boguski MS, Mandl KD, Sukhatme VP. Drug discovery. Repurposing with a difference. *Science* 2009; 324:1394-5.

Arredouani MS, Lu B, Bhasin M, Eljanne M, Yue W, Mosquera JM, Li V, Rubin MA, Libermann TA, Sanda MG. Identification of the transcription factor simple-minded homologue 2 as a potential biomarker and immunotherapy target in prostate cancer. *Clin Cancer Res* 2009; 15:5794-802.

Weber GM, Churchill S, MacFadden D, McMurry J, Murphy SN, Nigrin DJ, Kohane IS. The Shared Health Research Information Network (SHRINE): A prototype federated query tool for clinical and translational data repositories. *J Am Med Inform* 2009; 16:624-30.

Cao P, Hanai J, Tanksale P, Imamura S, Sukhatme VP, Lecker SH. Statin-induced muscle damage and atrogin-1 induction is the result of a geranylgeranylation defect. *FASEB J* 2009; 23:2844-54.

Kang HG, Costa MD, Priplata AA, Starobinets OV, Goldberger AL, Peng CK, Kiely DK, Cupples LA, Lipsitz LA. Frailty and the degradation of complex balance dynamics during a dual-task protocol. *J Gerontol A Biol Sci Med Sci* 2009; 64:1304-11.

Konstantinopoulos PA, Fountzilas E, Goldsmith J, Bhasin M, Pillay K, Gebhardt MC, Libermann TA, Spentzos D. Integrated expression analysis of soft tissue sarcomas: implications for classification, oncogenic pathway activation and chemotherapy resistance. *PLoS One* 2010; 5:e9747.

Thomas RJ, Mietus JE, Peng CK, Goldberger AL, Crofford LJ, Chervin RD. Impaired sleep quality in fibromyalgia: Detection and quantification with ECG-based cardiopulmonary coupling spectrograms. *Sleep Med* 2010; 11:497-8.

Bhasin M, Yuan L, Keskin DB, Otu HH, Libermann TA, Oettgen P. Bioinformatic identification and characterization of human endothelial cell-restricted genes. *BMC Genomics* 2010; 11:342.

HONORS AND AWARDS

Madalena D. Costa, PhD was named one of the first Affiliate Faculty members of the Wyss Institute for Biologically Inspired Engineering at Harvard University.

Ary L. Goldberger, MD was appointed as senior Core Faculty of Wyss Institute for Biologically Inspired Engineering at Harvard University and was Keynote speaker for the 26th Annual Medical Student Research Day at Wake Forest University School of Medicine.

FACULTY

Manoj Bhasin, PhD
Barden Chan, PhD
Madalena D. Costa, PhD
Ary L. Goldberger, MD
Xuesong Gu, PhD
Junichi Hanai, MD, PhD
Zaheed Husain, PhD
Towia A. Libermann, PhD
Chung-Kang Peng, PhD
Jian-guo Ren, PhD
Pankaj Seth, PhD
Vikas P. Sukhatme, MD, PhD
Griffin Weber, MD, PhD

RESEARCH FUNDING

	Direct	Indirect
Federal	1,223,228	341,207
Non Federal	1,649,992	81,775