

RAMU ANANDAKRISHNAN

Assistant Professor, Biomedical Sciences

Edward Via College of Osteopathic Medicine (VCOM), Blacksburg, VA

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PERSONAL STATEMENT

In 2006, I left a successful career as a senior executive in the Information Technology (IT) industry, to pursue a lifelong interest in science, with the goal of making a more significant contribution to society. With a diverse nontraditional background spanning executive management, engineering, computer science, biophysics, systems biology and cancer genomics, I bring unique interdisciplinary perspectives and approaches to scientific problems and projects. Most recently, I developed a novel approach for identifying multi-hit combinations of genetic mutations responsible for individual instances of cancer. The approach identified several potentially novel genetic markers and therapeutic targets for cancer. I am now conducting in vivo experiments, including CRISPR/Cas9 gene editing of cell lines, to validate these markers and understand their role in cancer. This work is being done in my Biosafety Level 2 wet lab, made possible by the generous support of Edward Via College of Osteopathic Medicine (VCOM), and assistance from my colleagues and students.

EDUCATION

PhD	Virginia Tech, Blacksburg, VA Computer Science Dissertation: "Speeding up electrostatic computations for molecular dynamics" Committee: Alexey Onufriev (chair), David Bevan, Jianhua Xing, Adrian Sandu, Yang Cao	December 2011
MBA	University of Maryland, College Park, MD Finance	May 1979
BS	Indian Institute of Technology, Kanpur, India Mechanical Engineering	May 1977

HONORS AND AWARDS

Top 100 Scientific Reports cancer papers	2019
Featured Article, Nucleic Acids Research	2012
Davenport Fellowship, Virginia Tech	2011

ACS/CCG Student Research Excellence Award	2011
Computer Sciences Corp. Presidents Excellence Award	1995

GRANTS

VCOM Research Eureka Accelerator Program (REAP)	2020-2021
Title: "Investigate the effect of a rare mutation in Fetuin-B on the progression of Acute Myeloid Leukemia"	
Role: PI	
Amount: \$57,000	
VCOM Research Eureka Accelerator Program (REAP)	2019-2020
Title: "Investigate the role of OR2T7, a novel prognostic marker and potential therapeutic target, in the progression of glioblastoma"	
Role: PI	
Amount: \$53,000	
VCOM Research Eureka Accelerator Program (REAP)	2017-2018
Title: "Determine the number of germline and somatic mutations (hits) required to tumorigenesis in childhood cancers, and understand their relative importance"	
Role: PI	
Amount: \$41,000	

RESEARCH EXPERIENCE

Edward Via College of Osteopathic Medicine, Blacksburg, VA Assistant Professor, Biomedical Sciences	2016-present
University of Pittsburgh, Pittsburgh, PA Postdoctoral Associate, Zuckerman Lab	2015 to 2016
Virginia Tech, Blacksburg, VA Postdoctoral Associate, Onufriev Lab	2012 to 2015
Virginia Tech, Blacksburg, VA Graduate Research Assistant, Onufriev Lab	2006 to 2012

TEACHING EXPERIENCE

Edward Via College of Osteopathic Medicine, Blacksburg, VA Assistant Professor, Biomedical Sciences	August 2018
<ul style="list-style-type: none"> Delivered two lectures for the Medical School Genetics course with ~200 students. The lectures covered "Central dogma, DNA/RNA structure, and DNA synthesis and repair" 	

- Delivered two lectures in the Master of Arts in Biomedical Sciences program for the Biochemistry course. The lectures covered “Amino acids, Intro to protein structure, and Structure-function relationship in proteins.”
- Developed and graded exam questions for these topics

Virginia Tech, Blacksburg, VA Spring 2013, 2014, 2015
Guest Lecturer, Department of Computer Science

- CS4414 Issues in scientific computing.
- CS2104 Introduction to problem solving in CS.
- Delivered a series of three lectures on graphical processing unit (GPU) programming, developed and graded homework assignments and exams, tutored students.

Virginia Tech, Blacksburg, VA August 2010 to December 2010
Teaching Assistant, Department of Computer Science

- CS4114 Formal Languages. Gave three lectures, developed and graded homework assignments and exams, tutored students.

INDUSTRY EXPERIENCE

Accenture, Boston, MA 1997 - 2006
Partner, Financial Services division

Managed large (100 – 200 person, \$25 – \$40 million) software engineering projects for Bank of America and Sallie Mae. Projects included the development, maintenance and operation of application systems for loan origination and servicing, online banking, investment and consumer banking, accounting, and payroll.

Computer Sciences Corp, Greenbelt, MD 1988 - 1997
Director of IT, Government Services division

Managed a 40 person IT department with a \$5 million annual budget. Developed and supported insurance coverage and claims systems for automobile and flood insurance.

SYCOM, Inc., Reston, VA 1987 - 1988
Team Lead, Government Services division

Developed and implemented the Toxic Release Inventory System, the Chemicals in Commerce System, the Automated Document Control Register, and the Facilities Index System for the EPA.

META Systems, McLean, VA 1982 - 1987
Partner, Database System

Developed and implemented the Maritime Telephone/Telex Call Billing and other administrative support systems for telecommunication companies.

US Chamber of Commerce, Bethesda, MD 1979 - 1982

Systems Programmer, IT Services

Installed, monitored and tuned the IBM MVS Operating System, TCAM teleprocessing system, ADABAS DBMS, and other system software, on an IBM 360 mainframe computer.

PEER REVIEW PUBLICATIONS

1. Anandakrishnan, R, et. al., DNA sequencing of anatomy lab cadavers to provide hands-on precision medicine introduction to medical students *BMC medical education* 20 (1), 1-14 (2020)
2. Kinney, N, Hickman, M, Anandakrishnan, R, Garner, HR, Crossing complexity of space-filling curves reveals entanglement of S-phase DNA, *PloS one* 15 (8), e0238322, (2020)
3. Al Hajri, Q., Dash, S., Feng, W.-c., Garner, H. R. & Anandakrishnan, R. Identifying multi-hit carcinogenic gene combinations: Scaling up a weighted set cover algorithm using compressed binary matrix representation on a GPU. *Scientific Reports* 10, 1-18 (2020)
4. Kinney, N. *et al.* CAGm: a repository of germline microsatellite variations in the 1000 genomes project. *Nucleic Acids Res* 47, D39-D45 (2019).
5. Kinney, N. *et al.* Abundance of ethnically biased microsatellites in human gene regions. *PloS One* 14 (2019).
6. Fenley, A., Anandakrishnan, R., Kidane, Y., Adamas, D. & Onufriev, A. V. The nucleosome: from structure to function through physics. *Biopolymers and Cell* 35, 171-171 (2019).
7. Dash, S. *et al.* Differentiating between cancer and normal tissue samples using multi-hit combinations of genetic mutations. *Scientific Reports* 9, 1-13 (2019).
8. Anandakrishnan, R., Varghese, R. T., Kinney, N. A. & Garner, H. R. Estimating the number of genetic mutations (hits) required for carcinogenesis based on the distribution of somatic mutations. *PLoS Computational Biology* 15, e1006881 (2019).
9. Fenley, A. T., Anandakrishnan, R., Kidane, Y. H. & Onufriev, A. V. Modulation of nucleosomal DNA accessibility via charge-altering post-translational modifications in histone core. *Epigenetics & Chromatin* 11, 11 (2018).
10. Anandakrishnan, R., Izadi, S. & Onufriev, A. V. Why computed protein folding landscapes are sensitive to the water model. *J Chem Theory Comput* 15, 625-636 (2018).
11. Kinney, N., Varghese, R. T., Anandakrishnan, R. & Garner, H. R. S. ZDHHC3 as a risk and mortality marker for breast cancer in African American women. *Cancer Informatics* 16, 1176935117746644 (2017).
12. Anandakrishnan, R. & Zuckerman, D. M. Biophysical comparison of ATP-driven proton pumping mechanisms suggests a kinetic advantage for the rotary process depending on coupling ratio. *PloS One* 12 (2017).

13. Izadi, S., Anandakrishnan, R. & Onufriev, A. V. Implicit solvent model for million-atom atomistic simulations: insights into the organization of 30-nm chromatin fiber. *J Chem Theory Comput* **12**, 5946-5959 (2016).
14. Anandakrishnan, R., Zhang, Z., Donovan-Maiye, R. & Zuckerman, D. M. Biophysical comparison of ATP synthesis mechanisms shows a kinetic advantage for the rotary process. *Proc Natl Acad Sci* **113**, 11220-11225 (2016).
15. Lin, H., Chen, W., Anandakrishnan, R. & Plewczynski, D. Application of machine learning method in genomics and proteomics. *The Scientific World Journal* **2015** (2015).
16. Anandakrishnan, R., Drozdetski, A., Walker, R. C. & Onufriev, A. V. Speed of conformational change: comparing explicit and implicit solvent molecular dynamics simulations. *Biophysical J* **108**, 1153-1164 (2015).
17. Izadi, S., Anandakrishnan, R. & Onufriev, A. V. Building water models: a different approach. *J Phys Chem Lett* **5**, 3863-3871 (2014).
18. Anandakrishnan, R., Baker, C., Izadi, S. & Onufriev, A. V. Point charges optimally placed to represent the multipole expansion of charge distributions. *PLoS One* **8** (2013).
19. Anandakrishnan, R., Aguilar, B. & Onufriev, A. V. H++ 3.0: automating pK prediction and the preparation of biomolecular structures for atomistic molecular modeling and simulations. *Nucleic Acids Res* **40**, W537-W541 (2012).
20. Anandakrishnan, R. A Partition Function Approximation Using Elementary Symmetric Functions. *PLoS One* **7** (2012).
21. Anandakrishnan, R., Daga, M. & Onufriev, A. V. An $n \log n$ generalized Born approximation. *J Chem Theory Comput* **7**, 544-559 (2011).
22. Warren, A. S., Anandakrishnan, R. & Zhang, L. Functional bias in molecular evolution rate of *Arabidopsis thaliana*. *BMC Evol Biol* **10**, 125 (2010).
23. Anandakrishnan, R. *et al.* Accelerating electrostatic surface potential calculation with multi-scale approximation on graphics processing units. *Journal of Molecular Graphics and Modelling* **28**, 904-910 (2010).
24. Anandakrishnan, R. & Onufriev, A. V. An $N \log N$ approximation based on the natural organization of biomolecules for speeding up the computation of long range interactions. *J Comput Chem* **31**, 691-706 (2010).
25. Aguilar, B., Anandakrishnan, R., Ruscio, J. Z. & Onufriev, A. V. Statistics and physical origins of pK and ionization state changes upon protein-ligand binding. *Biophys J* **98**, 872-880 (2010).
26. Anandakrishnan, R. & Onufriev, A. Analysis of basic clustering algorithms for numerical estimation of statistical averages in biomolecules. *J Comput Biol* **15**, 165-184 (2008).

INVITED TALKS

Rationally designing personalized combination therapies for treating cancer, GBCB Seminar Series, Virginia Tech, Blacksburg, VA, April 2019.

Electrostatics in biomolecular modeling and simulation, Indian Institute of Technology, Kanpur, India, January 2014.

Computational Biology: where computer science meets math, physics, chemistry and biology, Indian Institute of Technology, Kanpur, India, January 2012.

An $n \log n$ generalized Born approximation, American Chemical Society Annual Conference, Anaheim, March 2011.

Computational Biology: where computer science meets math, physics, chemistry and biology, Indian Institute of Technology, Kanpur, India, January 2012.

PROFESSIONAL AFFILIATIONS

American Association of Cancer Research, 2017-Present

American Association for the Advancement of Science, 2019-Present
Biophysical Society, 2015 – 2018

American Chemical Society, 2011 - 2015

PROFESSIONAL SERVICE

NIH Scientific Review Panel member for Genomics, Computational Biology and Technology (GCAT)

Guest Editor for:

- The Scientific World Journal (Bioinformatics), 2014.

Peer-Reviewed Articles for:

- Bioinformatics
- Bioinformatics and Biology Insights
- Biomedical Engineering and Computational Biology
- Journal of Theoretical and Computational Chemistry
- PLoS ONE
- PLoS Computational Biology
- Journal of Molecular Graphics and Modelling

COMMUNITY SERVICE

Newport Community Action Committee

President, 2011 – 2015, Managed the operation of the Newport Recreation Center, Library and Museum (www.newportrecreation.com).

OTHER

US Citizen