RAMU ANANDAKRISHNAN

Assistant Professor, Biomedical Sciences
Director of Biostatistics
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. I am currently investigating a novel mechanism associated with the etiology of cancer – clonal hematopoietic mutations in tumor infiltrating immune cells. In addition to machine learning and bioinformatics approaches, I am now conducting *in vitro* experiments, including CRISPR/Cas9 gene editing of cell lines, to validate this mechanism. 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 — December 2011
Computer Science
Dissertation: “Speeding up electrostatic computations for molecular dynamics”
Committee: Alexey Onufriev (chair), David Bevan, Jianhua Xing, Adrian Sandu, Yang Cao

MBA University of Maryland, College Park, MD — May 1979
Finance

BS Indian Institute of Technology, Kanpur, India — May 1977
Mechanical Engineering

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) 2023-2024
Title: “Preliminary validation of a blood-based screening assay for lung cancer”
Role: PI
Amount: $40,000

VCOM Research Eureka Accelerator Program (REAP) 2022-2023
Title: “Confirming immunosuppressive clonal hematopoietic (CH) mutations in tumor infiltrating immunocytes (TII) from lung adenocarcinoma (LUAD) samples”
Role: PI
Amount: $40,000

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 2016-present
Assistant Professor, Biomedical Sciences

University of Pittsburgh, Pittsburgh, PA 2015 to 2016
Postdoctoral Associate, Zuckerman Lab

Virginia Tech, Blacksburg, VA 2012 to 2015
Postdoctoral Associate, Onufriev Lab

Virginia Tech, Blacksburg, VA 2006 to 2012
Graduate Research Assistant, Onufriev Lab

TEACHING EXPERIENCE

Edward Via College of Osteopathic Medicine, Blacksburg, VA 2021-present
Assistant Professor, Biomedical Sciences

- Course director for MED 8700: Research and Scholarly Activity rotation for 3rd and 4th year medical students (~1000 students across 4 campuses). Designed research project or clinical case study requirements and curriculum. Worked with faculty to identify projects/cases and mentors for students.
- MED 7314: Preventive Medicine, Epidemiology, and Public Health: Foundations in Research and Biostatistics (~170 students). Lectures in Research and Biostatistics.
- BMS 5920: Research and Biostatistics lectures 1-9 for the Master of Arts in Biomedical Sciences program (~100 students).
- BMS 5312: Human Genetics lectures 1-2 and 15-17 for the Master of Arts in Biomedical Sciences program (~100 students). The lectures covered human chromosome and cancer genetics
- BMS 5104: Biochemistry lectures 6-7 for the Master of Arts in Biomedical Sciences (~100 students). The lectures covered amino acids and protein structure-function relationship

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

- CS4414 Issus 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. R Anandakrishnan, IJ Zyvoloski, LR, Zyvoloski, NK Opoku, A Dai, V Antony. Potential immunosuppressive clonal hematopoietic mutations in tumor infiltrating immune cells in breast invasive carcinoma. *Scientific Reports* 13 (1) 13131 (2023)
2. H Montano, R Anandkrishnan, VB Carruthers, RY Gaji. TgTKL4 Is a Novel Kinase That Plays an Important Role in Toxoplasma Morphology and Fitness. *Msphere* 8 (2), e00649-22 (2023)
3. S Dash, MAH Monil, J Yin, R Anandakrishnan, F Wang. Distributing Simplex-Shaped Nested for-Loops to Identify Carcinogenic Gene Combinations. *2023 IEEE International Parallel and Distributed Processing Symposium (IPDPS)* 974-984 (2023)
4. AK Sharp, D Newman, G Libonate, M Borns-Stern, DR Bevan, AM Brown, R Anandakrishnan. Biophysical insights into OR2T7: Investigation of a potential prognostic marker for glioblastoma. *Biophysical Journal* 121 (19), 3706-3718 (2022)
5. R Anandakrishnan, H Tobey, S Nguyen, O Sandoval, BG Klein, BM Costa. Cranial manipulation affects cholinergic pathway gene expression in aged rats. *Journal of Osteopathic Medicine* 122 (2), 95-103 (2022)

6. Kinney, N., Kang, L., Bains, H., Lawson, E., Husain, M., Husain, K., Sandhu, I., Shin, Y., Carter, JK, Anandakrishnan, R.... & Garner, H. Ethnically biased microsatellites contribute to differential gene expression and glutathione metabolism in Africans and Europeans. *PloS one*, 16(3), e0249148 (2021)
7. Dash, S., Al-Hajri, Q., Feng, W. C., Garner, H.R., Anandakrishnan, R. Scaling Out a Combinatorial Algorithm for Discovering Carcinogenic Gene Combinations to Thousands of GPUs. In 2021 *IEEE International Parallel and Distributed Processing Symposium (IPDPS)* 837-846 (2021)
8. Anandakrishan, 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)
9. 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)
10. 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)
11. Kinney, N., Titus-Glover, K., Wren, J.D., Varghese, R.T., Michalak, P., Liao, H., Anandakrishnan, R., Pulenthiran, A., Kang, L. and Garner, H.R. CAGm: a repository of germline microsatellite variations in the 1000 genomes project. *Nucleic Acids Res* **47**, D39-D45 (2019).
12. Kinney, N., Kang, L., Eckstrand, L., Pulenthiran, A., Samuel, P., Anandakrishnan, R., Varghese, R.T., Michalak, P. & Garner, H.R.. Abundance of ethnically biased microsatellites in human gene regions. *PloS One* **14** (2019).
13. 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).
14. Dash, S. *et al.* Differentiating between cancer and normal tissue samples using multi-hit combinations of genetic mutations. *Scientific Reports* **9**, 1-13 (2019).
15. 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).
16. 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).
17. 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).
18. 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).

19. 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).
20. 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).
21. 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).
22. Lin, H., Chen, W., Anandakrishnan, R. & Plewczynski, D. Application of machine learning method in genomics and proteomics. *The Scientific World Journal* **2015** (2015).
23. 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).
24. Izadi, S., Anandakrishnan, R. & Onufriev, A. V. Building water models: a different approach. *J Phys Chem Lett* **5**, 3863-3871 (2014).
25. 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).
26. Anandakrishnan, R., Aguilar, B. & Onufriev, A. V. H++ 3.0: automating p K prediction and the preparation of biomolecular structures for atomistic molecular modeling and simulations. *Nucleic Acids Res* **40**, W537-W541 (2012).
27. Anandakrishnan, R. A Partition Function Approximation Using Elementary Symmetric Functions. *PloS One* **7** (2012).
28. Anandakrishnan, R., Daga, M. & Onufriev, A. V. An n log n generalized Born approximation. *J Chem Theory Comput* **7**, 544-559 (2011).
29. Warren, A. S., Anandakrishnan, R. & Zhang, L. Functional bias in molecular evolution rate of Arabidopsis thaliana. *BMC Evol Biol* **10**, 125 (2010).
30. 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).
31. 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).
32. 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).
33. 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.

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)

Academic editor PLoS One 2021-present
Guest Editor 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