

Alburuj Rahman
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EDUCATION

Cornell University
Major: Biological Sciences (Computational). Current cGPA: 3.1. Senior, B.S.

RESEARCH EXPERIENCE

Microbial Denitrification Research

Cornell University, Department of Microbiology
Professor James Shapleigh

Ithaca, NY
Fall 2013 – present

- used DNA samples collected from an ecological forest to study organisms that utilize key enzymes involved in denitrification in soil microbial communities in order to test the hypothesis of modularity
- taxonomic classifications and functional characteristics were studied using local blast searches
- DNA samples were sequenced using Illumina sequencing and reads were obtained
- a metagenomic database sequence analysis tool was used to analyze sequence data
- built custom databases and developed programs to process data and for further analysis
- used statistical tests, did sequence alignments, and various analyses of gene distribution

Proteomics Research

University of Michigan, Department of Biochemistry
Professor Philip Andrews

Ann Arbor, MI
Summer 2013

- studied proteins through mass spectroscopy data
- explored proteomics databases and software
- did *de novo* analysis on tandem mass spectroscopy data to search for crosslinked peptides and then amino acid sequence analysis through MSEpedite software
- wrote a program in C++ to find crosslinked peptides using peaklists generated from the mass spectrometer

Clinical Lab and Computational Genetics Research

The Ohio State University Hospital, Clinical Lab
Professor Clay Marsh and Prof. Melissa Piper

Columbus, OH
Dec. 2012 – Summer 2013

- studied RNA expression (microRNA and mRNA) and the microvesicles from serum/plasma of patient blood samples and looked for biomarkers
- did realtime PCR and genotyping for mouse hypoxia-inducible factor (HIF) and idiopathic pulmonary fibrosis (IPF) studies, using several different genes including housekeeping controls, and further statistical analysis using the cyclic threshold values measured
- used Ingenuity's IPA software to analyze microarray RNA data, finding biological functions and creating a new network of mapped pathways between RNA molecules
- used connectivity map and data to study drugs linked to IPF

Protein Crystallography Research
Cornell University, *Department of Molecular Medicine*
Professor Holger Sondermann

Ithaca, NY
Summer 2012 – Spr. 2013

- studied proteins implicated in bacterial biofilm formation through crystallography by finding proper constructs for their expression and determining their crystal structure and protein functions
- chose primers for protein expression, used PCR for cloning, and then performed ligations and transformation for expression
- purified the proteins that were able to expressed through chromatography
- the purified products are used in further steps of crystallography: screening using crystallization sets to get initial crystals, optimization, and x-ray diffraction at the Cornell High Energy Synchrotron
- high-resolution diffraction from crystals can be used to solve structures using modeling software

Cellulase and Protein Engineering Research
Cornell University, *Department of Molecular Biology and Genetics*
Professor David Wilson

Ithaca, NY
Summer 2012

- DNS assay experiments (1 and 24 hour) using Cel5A enzyme and BMCC cellulose
 - Some experiments used antibodies to study their effect in inhibiting enzyme activity
- Created models of Cel5A using Pymol and MDGTools, by adding glucose cleaving ligand to active site of enzyme

Craniospinal Irradiation Radiation Therapy Research
Ohio State University *Dept. of Radiation Medicine*
Professor Jian Wang

Columbus, OH
Summer 2008 – 2010

- Used treatment planning software, *Eclipse*, to carry out simulations to find best method to administer homogeneous x-ray radiation beams to patient's body
- Created a phantom torso patient to study
- Adjusted field (beam) alignment, rotation, and intensity until hot and cold spots of over and under-radiation were eliminated
- Administered Intensity Modulated Radiation Therapy (IMRT) to further improve method of treatment

Ohio State Protein Crystallography
Ohio State University, *Dept. of Molecular Biochemistry*
Professor Charles Bell

Columbus, OH
Mar. 2010 – Aug. 2011

- Studied a bacterial single-stranded annealing protein involved in DNA repair, synthesis, and homologous recombination
- Purified protein to use in crystallization
- Tested protein with crystallization screening kits to create initial crystals
- Further optimized conditions of crystal formation to grow larger crystals
- Used x-rays to diffract the largest crystals to get diffraction spots, which could be used to create an electron density map, allowing one to study structure of protein

Cervical Cancer Radiation Therapy Research
Ohio State University *Dept. of Radiation Medicine*
Professor Nina Mayr

Columbus, OH
Summer 2009

- Completed dose collection and analysis of patient data
- Converted paper records of patients to digital files
- Compiled patient dose information in Microsoft Excel for simulations
- Worked under the Center for Clinical and Translational Science Summer Research Experience Program with a National Institute of Health grant

EXTRACURRICULAR

At Cornell

- Cornell Undergraduate Research Board (CURB) Peer Mentor to six undergraduate students, Fall-Spring 2013-2014 (4 semesters)
- Feed My Starving Children (food packaging for children in Africa) | First Congregational Church
- 3rd place and semi-finalist, HILC Ping Pong Tournament, Cornell University, Fall 2012
- Cornell Table Tennis Club, webmaster, Fall 2012-2013
- Red belt (Fall 2013), Tae Kwon Do, Cornell University, Fall 2011- Present

Outside Scholarship

- Acceptance as Program for Advising in Scholarship & Service (PASS) Diversity Scholar, the Ohio State University, 2011 (scholarship)
- Finalist, The Leadership Award, CAA Alumni Scholarships, University of California, Berkeley, 2011

PUBLICATIONS

Papers

- "Reducing Hot Dose Spots in Craniospinal Irradiation Using a New IMRT approach", Alburuj R. Rahman, Jian Z. Wang, Z. Huang, J. Montebello, Journal of Undergraduate Research at Ohio State (JUROS), p. 23-27 (2011).
- "Crystallization of a Bacterial Single Stranded Annealing Protein", Alburuj R. Rahman, Charles Bell, Jinwei Hu, JUROS (2013).
- "Study of modular denitrification in microbial communities through sequence analysis" (in preparation...)

Abstracts

- "To Reduce Hot Dose Spots in Craniospinal Irradiation: A Two-Field IMRT Approach with Matching Beam Divergence", A.R. Rahman et al, Abstract in Med. Phys., Vol. 36, No. 6, June 2009, p.2658
- "Reduction of Hot and Cold Dose Spots in Craniospinal Irradiation: A New IMRT Approach with Matching Beam Divergence", A.R. Rahman, J.F. Montebello, M. Weldon, L. Lu, N. Gupta, Z. Huang, N.A. Mayr, Jian Z. Wang (in draft form for submission to a refereed journal; delayed by the sudden passing away of J. Wang)
- "To Reduce Hot Dose Spots in Craniospinal Irradiation: A Two-Field IMRT Approach with Matching Beam Divergence", Alburuj R. Rahman, Book of Abstracts, Spring Educational Symposium, Ohio River Valley Chapter-AAPM, U. of Cincinnati, Cincinnati, March 7, 2009

SCIENTIFIC PRESENTATIONS

Over 20 total presentations, including:

Research done at Cornell

- CURB Fall 2013, Spring 2014, and Fall 2014 Research Forum, Public Poster Session presentation "Study of modular denitrification in microbial communities through sequence analysis"
- "Reducing the cost of drilling for geothermal energy", Fall 2011

- “The Effect of Starter Fertilizer on Algal Growth and Biomass in Simulated Aquatic Ecosystems”, Fall 2011

Research done at Ohio State

- General Assembly of American Association of Physicists in Medicine (AAPM), 2009
- American Association of Physicists in Medicine (AAPM), 2009
- Denman Undergraduate Research Forum, Ohio State, "A Novel Technique Using IMRT For Effective Craniospinal Irradiation" (May 12, 2010) and "Crystallization of a Bacterial Single Stranded Annealing DNA Repair Protein" and "Obtaining Atomic Level Crystal Structures of ssDNA Annealing Proteins: RecT and Red β " (May 12, 2011)
- Ohio Health Westerville, "Crystallization of a Bacterial Single Stranded Annealing DNA Repair Protein", Capstone Presentations: Medical Pathways to the Future, June 8, 2010
- Washington DC Government Trip and Court Practice
- Battelle Science Technology Engineering and Mathematics (STEM) Fair Presentation
- Center for Clinical and Translational Science Summer (CCTS) Research Experience Program presentation, August 2009 and August 2010

LABORATORY SKILLS

pipetting, making buffers, use of common equipment (e.g. spectrophotometer), making agarose gels, genotyping sequences, making assays, crystallography and purification

SKILLS/INTERESTS

- Proficient in computer software: Pymol, Mathematica, Adobe Photoshop, Treatment Planning Software *Eclipse*, video editing, MS Office
- Proficient in languages: Java, C++, and R
- Knowledge of using Windows, Macintosh, and Linux operating systems
- Violin (13 years), photography, video editing

AWARDS/ACCOMPLISHMENTS/RECOGNITIONS

- Dean’s List (Spring 2014)
- “TechColumbus Student Innovation Award” (1st place, \$2500 scholarship) | Feb. 2010
- Semi-finalist, "TechColumbus Student Innovation Award" | Feb. 2011
- Ohio Science Day certificate of Superior Ranking (40/40), District Level | March 2010
- "Excellent Rating Certificate", Ohio Academy of Science, State Science Day (SSD), Ohio State University, May 7, 2011, Title: "Crystallization of a Bacterial Single Stranded Annealing DNA Repair Protein" (12th Grade); congratulations: Director, Ohio Department of Health, Secretary of State, OH, Regents, University System, Ohio Department of Education
- Traveler’s grant for a Speaker, AAPM-Ohio Chapter Symposium, U of Cincinnati, 2009
- Member of the National Honors Society, High School | March 2010
- NIH-funded Center for Clinical and Translational Science (CCTS) Scholarship: Summer Research Experience Program | Summer 2009 and 2010
- "Governor’s Thomas Edison Award for Excellence in Biotechnology and Biomedical Technologies" and Scholarship, 2nd place, Ohio Department of Development, SSD, May 9, 2011, Title: "Crystallization of a Bacterial Single Stranded Annealing DNA Repair Protein" (12th Grade) Congratulations: OH State Representative
- 1st Place in "Biology Research Award" on submitted papers, Columbus Technical Council (CTC), April 29, 2011 (12th Grade); "To Reduce Hot Dose Spots in Craniospinal Irradiation: A Two-Field IMRT Approach with Matching Beam Divergence"