

Austin J. Baird PhD

BIOMEDICAL ENGINEERING GROUP LEADER · DISTINGUISHED MEMBER OF THE TECHNICAL STAFF

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About

I have a passion for computational biological modeling and a track record of accomplishments related to this wonderful field. I'm always inspired by new approaches and methods that consistently expand what's possible and what's known. I'm looking to make a broad impact in this research area and have a strong track record of leadership, scholarship, and project management.

Education

University of North Carolina at Chapel Hill

Chapel Hill, NC

PHD IN APPLIED MATHEMATICS

August 2014

- *Thesis:* Modeling Valveless Pumping Mechanisms
- *Advisor:* Dr. Laura Miller, *Committee:* Forest, M. Gregory, Adalsteinsson, David, White, Brian, Mucha, Peter, Kier, William M.

University of California, Santa Cruz

Santa Cruz, CA

BA IN MATHEMATICS

June 2008

- *Honors Thesis:* Modeling Native California Grassland Populations

Experience

Applied Research Associates, Inc.

Raleigh, NC

BIOMEDICAL MODELING GROUP LEADER (SENIOR ENGINEER, DISTINGUISHED MEMBER OF THE TECHNICAL STAFF)

December 2018 - PRESENT

- Lead a multidisciplinary team across 4 different projects. In charge of agile development processes, product roadmap, delivery scheduling, and direct communication with government customers
- Led and won six million dollars in research and development funds through Defense Health Agency and Army Research Lab grants
- Lead technical physiology modeler and principal investigator of the BioGears, BurnCare training application, and the traumatic brain injury angiogenesis projects
- Organized teaming across three research hospitals and multiple small businesses
- Communicate research progress through multiple conferences and peer reviewed publications, including the BioGears 2020 conference
- Oversaw implementation of all models associated with BioGears releases 7.0-7.3

Applied Research Associates, Inc.

Raleigh, NC

STAFF ENGINEER 2

January 2017 - December 2018

- Expanded the BioGears physiology model by adding gastro-intestinal digestion/absorption, diuretic drug, pain stimulus, epinephrine release models
- Nominated and won federal innovation award in collaboration with Telemedicine & Advanced Technology Research Center (TATRC) government lab
- Updated the BioGears build library to be hosted on github, modernized development timeline
- Won two government contracts totaling 4 million dollars in additional research and development funding
- Oversaw implementation of all models associated with BioGears releases 6.1-6.3

Applied Research Associates, Inc.

Raleigh, NC

STAFF ENGINEER

February 2016 - January, 2017

- Implemented a new renal system model in the BioGears engine with local autoregulation
- Contributed to updated blood/gas model and matrix circuit solver implementation
- Led validation and unit testing of C++ code base
- Oversaw Jenkins cloud build testing environment including daily reporting and system validation

Webassign

Raleigh, NC

CONTENT DEVELOPER

August 2015 - February 2016

- Created detailed solutions for the differential equation teaching application including step-by-step instructions
- Coordinated content outlines with leadership teams to detail requirements

Duke University

Durham, NC

VISITING ASSISTANT PROFESSOR

August 2014 - August 2015

- Analyzed how pressure changes induced by heart failure affect the hemodynamic and reabsorptive function of the kidney
- Taught two semesters of introduction to partial and ordinary differential equations, developed all course materials
- Developed computational mathematical model of the kidney and coordinated work with University of Ontario research hospital clinicians. Presented results at experimental biology, Boston MA
- Investigated blood clotting in the renal veins using the immersed boundary method

University of North Carolina, Chapel Hill

Chapel Hill, NC

GRADUATE RESEARCH FELLOW

September 2010 - August 2014

- Developed a fully coupled fluid-structure interaction code in C++ and Python to test the performance of valveless pumping
- Created a new computational valveless pumping mechanism using muscle cells to provide neuro-mechanical forcing in the system
- Presented and work at 12 conferences, domestic and abroad and published results
- Led wet lab organism maintenance and worked with lab-mates to collect particle image velocity data from
- Collaborated with colleagues from the Biology department to collect experimental results to validate computational models

Publications

JOURNAL ARTICLES

Open source pharmacokinetic/pharmacodynamic framework: tutorial on the BioGears Engine

M. MCDANIEL, J. CARTER, J. M. KELLER, S. A. WHITE, A. BAIRD

CPT: pharmacometrics & systems pharmacology 8.1 (2019) pp. 12–25. Wiley Online Library, 2019

A Whole-Body Mathematical Model of Sepsis Progression and Treatment Designed in the BioGears Physiology Engine

M. MCDANIEL, J. KELLER, S. WHITE, A. BAIRD

Frontiers in physiology 10 (2019) p. 1321. Frontiers, 2019

Neuromechanical pumping: boundary flexibility and traveling depolarization waves drive flow within valveless, tubular hearts

A. BAIRD, L. WALDROP, L. MILLER

Japan Journal of Industrial and Applied Mathematics 32.3 (2015) pp. 829–846. Springer, 2015

A mathematical model and MATLAB code for muscle–fluid–structure simulations

N. A. BATTISTA, A. J. BAIRD, L. A. MILLER

Integrative and comparative biology 55.5 (2015) pp. 901–911. Oxford University Press, 2015

Numerical study of scaling effects in peristalsis and dynamic suction pumping

A. BAIRD, T. KING, L. MILLER

Contemp. Math 628 (2014) pp. 129–148. 2014

Modeling Valveless Pumping Mechanisms

A. BAIRD

College of Arts and Sciences, Department of Mathematics (2014). 2014

CONFERENCE PROCEEDINGS

A Full-Body Model of Burn Pathophysiology and Treatment Using the BioGears Engine

M. MCDANIEL, A. BAIRD

2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 2019

Electro-dynamic suction pumping at small scales

A. BAIRD, L. MILLER

APS Division of Fluid Dynamics Meeting Abstracts, 2013

Funding Secured

Defense Health Agency

Fredrick, MD

SUSTAIN: PRONLONGED FIELD CARE TRAINING FRAMEWORK

Q3 2018

- *Role:* Lead Physiology Modeler and Proposal Manager
- *Amount:* 2.2 million

Defense Health Agency

Orlando, FL

BURN CARE: VIRTUAL PATIENT APPLICATION TO TRAIN THERMAL INJURY

Q2 2017

- *Role:* Principal Investigator
- *Amount:* 2.1 million

Army Research Labs

Raleigh, NC

FAST COMPUTATIONAL SIMULATIONS OF TRAUMATIC BRAIN INJURY

Q1 2017

- *Role:* Principal Investigator
- *Amount:* 353 thousand

Defense Health Agency

Fredrick, MD

BIOGEARS FOLLOW-ON RESEARCH AWARD

Q4 2016

- *Role:* Principal Investigator
- *Amount:* 1.9 million

Projects

BioGears Physiology Engine

Raleigh, NC

C++, ARM, GITHUB, JAVA, PYTHON, XML

Feb 2016 - PRESENT

- A whole body physiology engine programmed in C++
- Lumped parameter physics based cardio-pulmonary model with compartment overlays for complete systems biology modeling support
- Models include: circulation, drug pharmacokinetics-pharmacodynamics, traumatic brain injury, pneumothorax, urine concentration, blood coagulation, pain stimulus, infection, digestion absorption, and others
- Multi-platform build support and agile process development

BurnCARE Medical Training Application

Raleigh, NC

ANDROID, UNREAL ENGINE 4, C++

Jan 2018 - PRESENT

- Burn care application developed in Unreal Engine 4 for the Android tablet platform
- Modular concept designed to teach individual, unique burn treatment requirements
- Collaborative effort with the U.S. Army Institute of Surgical Research
- Led the grant writing effort and secured 2.1 million dollar grant to fund effort in competitive selection process

Sustain: Prolong Field Care Training Framework

Raleigh, NC

C++, JAVASCRIPT, PYTHON

Jan 2018 - PRESENT

- Modular framework to connect different software critical for prolonged care training
- Scenario builder, Unreal Engine 4 training game, networking code, DDS virtual patient management code, and learning record database portal
- Led the grant writing effort and secured 2.2 million dollar grant to fund effort in competitive selection process

Traumatic Brain Injury Angiogenesis

Raleigh, NC

C++, PYTHON, PARAVIEW, 3DSLICER

Jan 2017 - PRESENT

- Army Research Labs funded basic research project on angiogenesis after a traumatic brain injury
- Visual studio c++ managed code base
- 3D fractal model of the vasculature with dynamical system model of the VEGF protein interaction and role in the angiogenesis process

Selected Presentations (of 23)

Military Health System Research Symposium

"BURN CARE: VIRTUAL TABLET TRAINING TO ENHANCE BURN INJURY CARE AND TREATMENT"

Orlando, FL

August 2019

Society for Simulation in Health

BIOGEARS MODEL TO SIMULATE PATIENT RESPONSES TO SEPSIS

Raleigh, NC

March 2019

American College of Surgeons Simulation Summit

BIOGEARS: A FRAMEWORK FOR MULTISCALE PHYSIOLOGY MODELING

Chicago, IL

March 2019

Department of Defense Working Group on Computational Modeling of Human Lethality, Injury, and Impairment from Blast-Related Threats

BIOGEARS HUMAN PHYSIOLOGY ENGINE

Arlington, VA

February 2019

Virtual Physiological Human Conference

AN IN-SILICO WHOLE-BODY FRAMEWORK TO SIMULATE KINETICS AND DYNAMICS OF PHARMACEUTICALS AND ASSOCIATED REVERSAL AGENTS

Zaragoza, Spain

September 2018

International Meeting on Simulation in Healthcare

AN IN-SILICO WHOLE-BODY FRAMEWORK TO SIMULATE KINETICS AND DYNAMICS OF PHARMACEUTICALS AND ASSOCIATED REVERSAL AGENTS

Los Angeles, CA

January 2018

Chemical and Biological Defense Science and Technology Conference

BIOGEARS: SIMULATING WHOLE-BODY RESPONSE TO CHEMICAL EXPOSURE

Long Beach, CA

November 2017

Experimental Biology

IMPLICATIONS OF INCREASE RENAL VENOUS PRESSURE FOR RENAL HEMODYNAMIC AND REABSORPTIVE FUNCTION STUDIED BY A MATHEMATICAL MODEL OF THE KIDNEY

Boston, MA

March 2015

Duke Interdisciplinary Discussion Course

MOVING FLUID IN TUBES

Durham, NC

October, 2014

Society of Mathematical Biology

ELECTRO-DYNAMIC SUCTION PUMPING AT SMALL SCALES

Osaka, Japan

August 2014

Teaching Experience

Duke University, Math 353

INTRODUCTION TO ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS FOR ENGINEERS

Durham, NC

Spring 2015

Duke University, Math 353

INTRODUCTION TO ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS FOR ENGINEERS

Durham, NC

Fall 2014

University of North Carolina, Chapel Hill, Math 290

APPLIED MATHEMATICAL METHODS (COMPUTATIONAL LAB)

Chapel Hill, NC

Spring 2013

- *Course Materials:* [link](#)

Skills

Technical	Python, C++, Buildbot, Paraview, VTK, CMAKE, XML, AWS, Docker, Matlab, R
Modeling	Systems Biology, Fluid-Structure Interaction, Pharmacology (PKPD), Injury Physiology, Dynamical Systems, Protein Interaction, Angiogenesis, Circulation, Lumped Parameter
Management	Agile Development, Scrum, Personnel Management, Hiring, Public Speaking, Financial Coverage, Grant Writing, Teaming, Sub-Contractor Management

Professional Memberships

Society for Simulation in Healthcare

LEADERSHIP GROUP ON SIMULATION AND MODELING

2016 - PRESENT

IEEE: Engineering in Medicine and Biology

2018 - PRESENT

NIH Interagency Modeling and Analysis Group

2019 - PRESENT

Recommendations

Laura Miller

PROFESSOR OF BIOLOGY AND MATHEMATICS UNC, CHAPEL HILL, UNIVERSITY OF ARIZONA

- Address: Department of Biology CB 3280 Coker Hall University of North Carolina Chapel Hill, NC 27599
- Phone: 919-943-2434
- Email: fairyflies9@gmail.com
- Website: <https://sites.google.com/site/swimflypump/>

Professor M. Gregory Forest

GRANT DAHLSTROM DISTINGUISHED PROFESSOR OF MATHEMATICS AT UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL

- Address: CB 3250, UNC Chapel Hill, Chapel Hill, NC 27599-3250
- Email: forest@unc.edu
- Website: <https://aps.unc.edu/faculty-member/forest-greg/>