

REBECCA ANNE SEGAL

Department of Mathematics
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EDUCATION:

Ph. D. in Applied Mathematics August 2001
(Concentration in Computational Mathematics)
North Carolina State University, Raleigh, NC
"Patterns of air flow and particle deposition in the diseased human lung"
Advisor Prof. Michael Shearer.

BA in Mathematics May 1994
Bryn Mawr College, Bryn Mawr, PA

CURRENT POSTION:

Assistant Professor August 2006-present
Department of Mathematics
Virginia Commonwealth University, Richmond, VA

PREVIOUS POSITIONS:

Temporary Teaching Fellow September 2005-August 2006
Mathematics Department
University of Bristol, Bristol, UK

Part-time Lecturer January 2005-August 2005
Mathematics Department
University of Bristol, Bristol, UK

Postdoctoral Fellow July 2001-December 2004
CIIT Centers for Health Research
Research Triangle Park, NC

HONORS/AWARDS:

1. Travel funds from AWM for \$1400 to attend SMB meeting in Knoxville, 2012
2. Travel funds from AWM for \$1200 to attend SMB meeting in Toronto, 2008
3. Fellow, Center for the Study of Biological Complexity, 2007
4. Funded postdoctoral presenter at the AWM workshop concurrent with Annual SIAM meeting, Philadelphia, 2002
5. Funded graduate student presenter at the AWM workshop concurrent with Annual SIAM meeting, Atlanta, 1999
6. Winner of a Risk Assessment Award for SOT Poster Presentation, Annual SOT Conference, New Orleans, 1999
7. Student Paper Award at 2nd National SIAM Student Conference, Tallahassee, FL, 1998
8. Performance bonus: simulations of particle deposition fractions in lung, US EPA, 1998

RESEARCH:

Publications

Journal Publications

1. RA Segal, RF Diegelmann, KR Ward, A Reynolds “A Differential Equation Model of Collagen Accumulation in a Healing Wound” *Bulletin of Mathematical Biology*. 2012(74):2165–2182 (IF=1.847)
2. NB Menke, JW Cain, DM Chan, RA Segal, TM Witten, DG Bonchev, RF Diegelmann, KR Ward. *An In Silico Approach to the Analysis of Acute Wound Healing. Wound Repair and Regeneration*. 2010(18): 105–113. (IF=2.445) [Corresponding author]
3. GJM Garcia, JD Schroeter, RA Segal, J Stanek, GL Foureman, JS Kimbell. Dosimetry of nasal uptake of soluble and reactive gases: a first study of inter-human variability. *Inhalation Toxicology*. 2009, 21(7): 607–618. (IF=1.831)
4. RA Segal, GM Kepler, JS Kimbell. Effects of Differences in Nasal Anatomy on Airflow Distribution: A Comparison of Four Individuals At Rest. *Annals of Biomedical Engineering*. 2008(36): 1870-1882. (IF = 2.346)
5. J.S. Kimbell, R.A. Segal, B Asgharian, B.A. Wong, J.D. Schroeter, J.P Southall, C.J. Dickens, G Brace, F.J. Miller. “Characterization of Deposition from Current Nasal Spray Devices Using a Computational Fluid Dynamics Model of the Human Nasal Passages.” *J. of Aerosol Medicine*. 2007(20): 59-74. (IF=1.945)
6. D. Wexler, R.A. Segal, J.S. Kimbell. “Aerodynamic effects of inferior turbinate reduction – Computational fluid dynamics simulation” *Archives of Otolaryngology – Head & Neck Surgery*. 2005(131): 1102-1107. (IF=1.734)
7. R.A. Segal, T.B. Martonen, C.S. Kim, M. Shearer. “Computer Simulations of Particle Deposition in the Lungs of Chronic Obstructive Pulmonary Disease Patients” *Inhalation Toxicology* 2002(14):705-720. (IF=2.167)
8. Martonen, T. B., Musante, C. J., Segal, R. A., Schroeter, J. D., Hwang, D., Dolovich, M. A., Burton, R., Spencer, R. M., and Fleming, J. S. “Lung models: strengths and limitations” *Respiratory Care* 2000(45):712-736.
9. X. Guan, R.A. Segal, M. Shearer, T.B. Martonen. “Mathematical Model of Airflow in the Lungs of Children II: Effects of Ventilatory Parameters” *Journal of Theoretical Medicine*. 2000(3):51-62.
10. R.A. Segal, T.B. Martonen, C.S. Kim. “Comparison of Computer Simulations and Human Data for Particle Deposition in Healthy Subjects” *Journal of Air and Waste Management Association* 2000(50):1262-1268.
11. R.A. Segal, X. Guan, M. Shearer, T.B. Martonen. “Mathematical Model of Airflow in the Lungs of Children I: Effects of Tumor Sizes and Locations” *Journal of Theoretical Medicine*. 2000(2):199-213.

Book Publication

1. RA Segal “Air flow and particle deposition: Patterns in the diseased human lung” 2010 VDM Publishing
http://www.amazon.com/Air-flow-particle-deposition-Patterns/dp/3639295277/ref=sr_1_11?ie=UTF8&qid=1303406661&sr=8-11

Newsletter Feature

1. R.A. Segal, J.M. Sheppard, J.S. Kimbell. “Using Fieldview to Locate the Nasal Valve in a CFD Model of the Human Nasal Passages” *Fluent News* 2003 (12):15.

In Process

1. C.C. Doucette and R.A. Segal. "Modeling the Barrier-Effect of Roadways: A Cellular-Automata Neighborhood " (in preparation for submission to Computers, Environment and Urban Systems)
2. A.R Reynolds, R.L. Cooper, S. Truett, R.A. Segal "Wound healing under duress: Effect of elevated cortisol" (in preparation for submission to Journal of Theoretical Biology)
3. R.A. Segal and N.L. O'Neil "An Agent Based Model of Tumor Growth and Response to Radiotherapy" (in preparation)
4. R.L. Cooper , A.R. Reynolds, R.A. Segal "An ODE Model of the Effect of Estrogen on Wound Healing" (in preparation)
5. R.A. Segal "Deposition of Nanoparticles in Human Nasal Passages: Effect of Morphological Variation" (in preparation)

Grants Awarded

1. Joint PI (With Angela Reynolds) Jeffress Grant 2011-2012 "Mathematical Modeling of the Effects of Systemic Cortisol and Estrogen on Wound Healing Treatments": \$21,250
2. Joint PI (With Angela Reynolds) Jeffress Grant Renewal 2012-2013 "Mathematical Modeling of the Effects of Dynamic Oxygen on Wound Healing Treatments": \$10,000

Presentations

Invited

1. Overview of Modeling Techniques for Wound Healing, Society of Mathematical Biology Annual meeting Knoxville, July 2012
2. Nanoparticle Deposition in the Human Nasal Passages. Invited Talk at Joint Mathematics Meeting, Boston, January 2012
3. Modeling the Effects of Systemic Cortisol and Estrogen on Wound Healing. Invited Talk at AMS Sectional Meeting, Wake Forest University, October 2011
4. Modeling the Effects of Systemic Cortisol and Estrogen on Wound Healing. Invited Talk at AWM 40th and Forward, Brown University, September 2011
5. Deposition Patterns of Nanoparticles in Human Nasal Passages. Invited Talk at Joint Mathematics Meeting, New Orleans January 2011
6. A Model of Wound Healing via Collagen Accumulation. Invited Talk at American Mathematical Society regional meeting at University of Richmond. November 2010
7. An ODE Model of Collagen Accumulation during Wound Healing. Invited Talk Society of Industrial and Applied Mathematics-Life Sciences meeting. Pittsburgh July 2010
8. Effect of Nasal Geometry on Respiratory Health. Invited seminar speaker, Virginia State University, Petersburg. November 2009.
9. Analyzing Complexities of Wound Healing, Society of Mathematical Biology Annual meeting Vancouver, July 2009.
10. The Dynamics of a Healing Wound, Complex Biological Systems Group Theme Days at University of Pittsburgh, May 2009
11. Invited Guest Lecturer at Old Dominion University, Norfolk. Course in math modeling for health science majors, 3 hour lecture. April 2009.

12. Special Session on Mathematical Modeling in Wound Healing at 2008 Annual Meeting of the Society of Mathematical Biology, Toronto, July 2008
13. Nasal Geometry Impact on Health of Individuals Differential Equations Seminar, University of Virginia, Charlottesville, March 11, 2008
14. Inter-individual Differences in Nasal Airflow Distribution. Frontiers in Applied Mathematics, Newark, May 2007.
15. What Good is Your Nose? Bristol Laboratory for Advanced Dynamics Engineering (BLADE) Seminar Series, Bristol, October 2004.
16. Three-Dimensional Computer Modeling of the Human Upper Respiratory Tract. 10th Congress of the International Rhinologic Society and 22nd International Symposium on Infection and Allergy of the Nose Seoul, October 2003.

Contributed

1. Effect of Cortisol on Wound Healing (poster with Angela Reynolds) at the Math Bio Institute Tissue Engineering Workshop, Columbus, April 2012
2. In Silico Approach to the Analysis of Acute Wound Healing (poster with Angela Reynolds) at the Math Bio Institute Wound Healing Workshop, Columbus, March 2009
3. Overview of Current Trends in Biomath, Inaugural Biomath Seminar Series talk, VCU, September 2008
4. Nasal Airflow Distribution in Human Subjects SIAM Life Sciences, Montreal, August 2008
5. Mathematical Model for Wound Healing. Annual Southeast-Atlantic Region Conference on Differential Equations, Murray State, Murray, KY October 2007
6. Airflow in the nasal passages – effect of boundary conditions. British Applied Mathematics Colloquium, Bristol, April 2007.
7. Three-Dimensional Computer Modeling of the Human Nasal Passages. British Applied Mathematics Colloquium, Liverpool, April 2005.
8. Correlation of Nasal Surface-Area-to-Volume Ratio with Predicted Inhaled Gas Uptake Efficiency in Humans. Society of Toxicology Annual Meeting, Baltimore, March 2004.
9. Effects of Differences in Nasal Anatomy on Airflow Distribution: A Comparison of Three Individuals. Society of Toxicology Annual Meeting, Salt Lake City, March 2003.
10. Effects of boundary conditions on particle deposition predictions in human nasal passages. Fourth World Congress Biomechanics, Calgary, August 2002.
11. Effects of boundary conditions on particle deposition predictions in human nasal passages. Association of Woman in Mathematics Workshop at the Annual Society of Industrial and Applied Mathematics Conference, Philadelphia, July 2002.
12. Automating Three-Dimensional Mesh Reconstruction of Human Nasal Airways from Digitized MRI Scans. FIDAP 2002 Users' Group Meeting, Evanston, June 2002.
13. Mesh Construction of Human Nasal Airways from Medical Images for Use in Flow Simulations. Postdoctoral Seminar, CIIT Centers for Health Research, Research Triangle Park, NC, May 2002.
14. Particle Trajectories in the Cancerous Lungs of Children PM 2000: Particulate Matter and Health. Charleston, Jan 2000.
15. Comparison of Computer Simulations and Human Data for Particle Deposition in Healthy Subjects. PM 2000: Particulate Matter and Health, Charleston, Jan 2000.
16. Particle Deposition in Airway Disease Models. Southeast Regional Mathematics in Industry Workshop, Raleigh, Oct 1999.
17. Comparison of Particle Deposition in Healthy Subjects and COPD Patients Using

- Computer Simulations and Human Data. Third Colloquium on Particulate Air Pollution and Human Health, Durham, June 1999.
18. Mathematical Model of Airflow in a Child's Lung. Association of Woman in Mathematics Workshop at the Annual Society of Industrial and Applied Mathematics Conference, Atlanta, May 1999.
 19. Comparison of Computer Simulations and Human Data for Particle Deposition in Healthy and COPD Subjects. Annual Society of Toxicology Meeting, New Orleans, March 1999.
 20. Mathematical Model of Effects of Carcinomas on Airflow Patterns in the Lungs of Children. Annual Society of Toxicology Meeting, New Orleans, March 14-18, 1999.
 21. Environmental Simulations with the Cray T90: Effects of Air Pollutants on Children's Lungs. 1997 Cray Fellows Research Day, North Carolina Supercomputing Center, May 1998.
 22. Simulation of Airflow in a Child's Lung. Second National SIAM Student Conference, SIAM-SEAS Conference, Florida State University, Tallahassee, March 1998. Featured Student Talk.
 23. Effects of Air Pollution in the Lung. Modeling Discussion Group, EPA, NC August 1997.
 24. Environmental Simulations with the Cray T90: Effects of Air Pollutants on Children's Lungs. Cray Grant Program Review Day, North Carolina Supercomputing Center, May 1997.
 25. Flow through a Multi-branching Airway. SIAM-SEAS Conference, NCSU, April 1997.

TEACHING:

Courses taught

- MATH 141 – College Algebra with Modeling Applications
- MATH 301 – Differential Equations
- MATH 307 – Multivariate Calculus
- MATH 380 – Introduction to Mathematical Biology
- MATH 515 – Numerical Analysis I
- MATH 516 – Numerical Analysis II
- MATH 533 – Partial Differential Equations
- MATH 582 – Computation Methods in Mathematical Biology
- MATH 591 – Introduction to Analysis for Educators
- MATH 585 – Biomath Seminar – Topic: Fluids

New courses developed

- MATH 715 – Advanced Numerical Analysis
 - New course in development for Ph.D. students. To be offered Spring 2013.
- MATH 591 – Introduction to Analysis
 - New course developed. This course required teaching advanced theoretical calculus to high school teachers.
- MATH 585 – Biomath Seminar
 - This is a new course developed as part of the undergraduate track for math majors in mathematical biology. This course requires students to read and discuss current and historically relevant papers in mathematical biology.
- MATH 582 – Computational Modeling in Mathematical Biology.
 - This is a new course developed as part of the new undergraduate/graduate track for math majors in mathematical biology. We explored a variety of biological systems and developed mathematical models and then solved the models computationally.
- MATH 515 – Numerical Analysis I
- MATH 516 – Numerical Analysis II
 - Revamped this course sequence using Matlab.

MATH 141 – College Algebra, Faculty Coordinator

- Funding from Vice Provost for Instruction for Math 141 Support
 - \$4792 for Professional Development for Math 141 Instructors, Fall 2012
 - \$4000 for additional development of Lon-CAPA material, Summer 2012
 - \$9434 for Professional Development for Math 141 Instructors, Fall 2011
- Invited Talk “Successful Strategies for Teaching College Algebra”, STEM Education Conference, VMI, October 2012
- Coordinate professional development for the instructors by conducting training workshops; oversee weekly curriculum meetings: instituted and coordinate peer classroom visits.
- Oversee common assessments (quizzes, tests and final exam).
- Oversee annual revision of course pack workbook. Because the format of the course is data driven, it is a large undertaking to keep the data current and relevant.

CTE Podcasting Program

- Participant in first CTE podcasting program to explore uses of this new technology for educational purposes.

CTE Tablet Program

- Participant in the CTE tablet program to explore uses of this new technology for educational purposes.

Graduate Student Advising

- Thesis advisor
 - Nicole O’Neil “An agent based model of radiation therapy for a cancerous tumor”, August 2012
 - Cheri Doucette “Impact of major highway location on health of population”, May 2012
 - Kalimah Vereen “SIR model of Malaria with vaccine”, May 2008
- Currently Masters student:
 - Paul Solomonsky “A Partial Differential Equation Analysis of Implantable Wound Repair Models”, anticipated December 2012.
- Committee member:
 - Erich Foster, Masters in Mathematics, May 2009.
 - Michael Serrate, Masters in Mathematics, December 2009.
 - Alireze Ashari, Ph.D. in Mechanical Engineering, December 2010.
 - Michael Tien, Ph.D. in Mechanical Engineering May 2011.
 - Seyed Hosseini, Ph.D. in Mechanical Engineering, August 2011.
 - Thomas Bucher, Masters in Mechanical Engineering, August 2012.

Grants Awarded

1. VCU CTE Grant 2012 “Implementation of Skills Support in Lon-CAPA for Math 141: College Algebra”: \$5000
2. University of Bristol Education Committee Learning and Teaching Award 2005 “Using Maple TA to provide Continuous Assessment in Multivariable Calculus”: £11,000

IRB Submission

- Submitted IRB approval for “Study of Effectiveness of Online Skills Review for College Algebra”

SERVICE:

Profession

- Elected to position of Clerk, Association for Women in Mathematics 2010-2014
- Reviewer for 8 journals
 - Medical & Biological Engineering & Computing
 - Journal of Theoretical Biology
 - Journal of Aerosol Science
 - Bulletin of Mathematical Biology
 - Inhalation Toxicology
 - Annals of Biomedical Engineering
 - Engineering Applications of Computational Fluid Mechanics
 - Journal of Biomechanics
- Minisymposium/Special Session Organizer
 - Survey of mathematical modeling techniques for wound healing, SMB meeting, 2012
 - Special Session on Advances in Mathematical Biology, JMM, 2012
 - Opportunities for Leadership, SMB meeting, 2009
 - Dispersal Phenomena in Ecology, SMB meeting, 2009
 - Recent Advances in Mathematical Modeling in Medicine, JMM, 2009
- Judge for AWM Essay Contest, 2010
- Mentor at SMB meeting, 2009
- Mentor at the AWM Joint Mathematics Meeting workshop, Washington, DC 2009
- Session Chair (Fluids 8) at British Applied Mathematics Colloquium, Bristol 2007

University

- UWE exchange program for math and stats majors – worked to set-up an exchange program with the mathematics department at University of West of England to strengthen VCU's connection with this international campus partner.
 - Hosted 3 students from UWE in 2010-2011
 - Hosted 3 students from UWE in 2012-2013
- Judge for VCU Education Abroad Scholarship Competition (2011,2012)
- Discovery Lecture Series (2008) – participated on panel for undecided majors.

College

- HAS Library committee (2006-present)
- Science Day (2008) – initiated and organized department participation in event for incoming freshmen during orientation week

Department

- Chair, Math 141 (2011-present) – faculty coordinator for Math 141. This course has annual enrollment over 1500 students, with approximately 25 different instructors/adjuncts
- Department Tea (2008-present) – established and administer department tea
- Biomath Seminar (2009-present) – established and administer research seminar series in Biomath
- Chair, Biomath committee (2011-present) – planning and implementation of new undergraduate Biomath track, includes development of new course; discussed mission, goals, organization, design of new PhD track in Biomath.

- Assessment Committee (2011-present) – drafted new mission, goals, objectives for the department
- Lower Level Math Committee (2011-present) – discuss issues pertaining to the challenges of teaching lower level mathematics (100-200 level courses.)
- Women in Math (2009-present) – submitted grants with Norma Ortiz-Robinson to Google for summer program for female junior high school students (not funded) and to AWM for SK Day outreach program (pending)
- Student Activities Committee (2009-present) – organized welcome back event for math majors
- Credential Committee (2006-2008) – choose undergraduate department award recipients

Community

- President of Parent Advisory Council, VCU Child Development Center (2012-present)
- Science Fair Project Mentor for High School Student (2011-2012)
- Summer Research Mentor for High School Students (2011,2012)