

LYNN SCHREYER

a.k.a. Lynn Schreyer Bennethum

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Education:

Ph.D. in Applied Mathematics, Purdue University; West Lafayette, IN (1994)

Thesis Advisor: Jim Douglas, Jr.

Thesis Title: *Multiscale, Hybrid Mixture Theory for Swelling Systems with Interfaces*

M.S. in Mathematics, Purdue University; West Lafayette, IN (1990)

M.S. in Mechanical Engineering, Northwestern Univ.; Evanston, IL (1988)

B.S. in Mechanical Engineering, Magna Cum Laude, University of New Mexico; Albuquerque, New Mexico (1986)

Primary Research Interests:

Development and analysis of mathematical models for natural and biological systems that are inherently multidisciplinary using upscaling approaches, continuum mechanics and thermodynamics with a particular focus on modeling flow and deformation of multiphase mixtures in porous media. The approach has applications in energy, medicine, soil science and mechanics. Examples include:

- Medicine: Model of drug delivery polymers; mechanics of biopolymers
- Soil Science: Darcy's law for swelling clays; generalization of Forcheimer's law and Fick's law; vapor transport
- Soil Mechanics: Generalization of Terzaghi's stress principle; deformation of clay soils
- Mechanics: Hybrid mixture theory for swelling porous media; thermodynamics of swelling potential in porous media; macroscale thermodynamics of chemical potential
- Sociology: Movement of refugees
- Methodology: Upscaling approaches for modeling dynamics of porous media.

In addition, collaborations to develop governing equations for specific problems. Recent and ongoing examples include: population dynamics of refugees; lamella-based modeling of reactive transport in nonuniform flow; wildfire dynamics; and submarine propulsion.

Professional Experience:

Professor, Department of Mathematics and Statistics, Washington State University (2021-present)

Associate Professor, Department of Mathematics and Statistics, Washington State University (2016-2021)

Visiting Faculty, Dept of Env Sci and Engr, Colorado School of Mines (2011).

Associate Chair, Math Dept, University of Colorado Denver (2004-2013)

Visiting Faculty, Civil, Env and Arch Engr, UC Boulder (2003-2004)

(Interim) Associate Chair, Math Dept, University of Colorado Denver (2002-2003)

Associate Professor, Math Dept, University of Colorado Denver (2002-2015)

Assistant Professor, Math Dept, University of Colorado Denver (Aug. 1996-2002)

Post Doc, Agronomy Department, Purdue University (Jan. 1995-July 1996)

Honors:

2014 UC Denver College of Liberal Arts and Sciences Teaching Award

2013 InterPore Rosette in recognition of major contribution to the International Society for Porous Media.

External Funding:

- \$ 263,382; Experimental and Numerical Tribological Investigation into Water Lubricated Stem Bearings. \$23,051 to WSU. co-PI; with Ron Rorrer, CU Denver Mechanical Engineering. Funded by the U.S. Navy and subcontracted through the University of Colorado Denver. 3/1/18-08/31/19.
- \$246,092; Developing and Validating a Model to Understand Mixed Lubrication Regions for Fluid-Film Bearings Phase II Option 1 Period 2. \$6123 to WSU. co-PI; with Ron Rorrer, CU Denver Mechanical Engineering. Funded by the U.S. Navy and subcontracted through the University of Colorado Denver. 11/15/16-08/29/17.
- \$508,032; Developing and Validating a Model to Understand Mixed Lubrication Regions for Fluid-Film Bearings Phase II Option 1. \$74,994 to UC Denver. co-PI; with Ron Rorrer, CU Denver Mechanical Engineering. Funded by the U.S. Navy and subcontracted through XDOT. 6/1/15-11/14/16.
- \$152,827; Developing and Validating a Model to Understand Mixed Lubrication Regions for Fluid-Film Bearings Phase II Base Effort co-PI; with PI Ron Rorrer, CU Denver Mechanical Engineering. Funded by the U.S. Navy and subcontracted through XDOT. 01/01/15-05/31/16.

- \$21,400; Developing and Validating a Model to Understand Mixed Lubrication Regions for Fluid-Film Bearings Phase I Option; co-PI; with PI Ron Rorrer, CU Denver Mechanical Engineering. Funded by the U.S. Navy and subcontracted through XDOT. 04/30/13-10/25/13.
- \$53,304; Physics First Science Partnership, Aligning Science with Math Curriculum, Professional Development for Teachers and Increased Academic Achievement in Science/Math; Colorado Department of Education, Math Science Partnership; Lead PI, with Randy Tagg and Carole Basile/Robert Talbot with Aurora Public School District.; 08/01/2011-07/31/2014.
- \$51,167; A New Approach to Modeling Laminar to Turbulent Transition, DARPA HR0011-11-C-0028 subcontracted through NorthWest Research Associates; PI. 01/19/2011-07/18/2011.
- \$621,000; DDDAS: Data Dynamic Simulation for Disaster Management, NSF CNS-0325314; Co-PI (PI: Mandel). 05/22/2006-08/01/2007.
- \$87,374; Adapting InterMath to a Non-Traditional Urban University, NSF 03-598: DUE-CCLI-Adaptation and Implementation; Lead PI, July 2004 - June 2007.
- \$98,863; Modeling Composite Materials, NSF, DMS program, IGMS; PI. Sept. 2003 - June 2005.

Refereed Publications

- 2021 L. Schreyer, N.K. Voulgarakis, **Z. Hilliard**, S. Lapin, and L. Cobb *Modeling Refugee Movement Based on a Continuum Mechanics Phase-Field Approach of Porous Media*, SIAM Journal of Applied Mathematics, 81-5, 2061-2082, doi.org/10.1137/19M130056X.
- 2021 H.L. Schreyer, B.C. Lampe, L.G. Schreyer, J.C. Stormont *Microscale Analysis Demonstrating the Significance of Shear and Porosity in Hydrostatic Compression of Porous Media*, International Journal of Rock Mechanics and Mining Sciences, 145, 104751
- 2021 L. Schreyer, Z. Hilliard *Derivation of Generalized Cahn-Hilliard Equation for Two-Phase Flow in Porous Media Using Hybrid Mixture Theory*, Advances in Water Resources, 149, 103839, doi.org/10.1016/j.advwatres.2020.103839.
- 2021 K. Wuttanachamsri, L. Schreyer *Effects of the Cilia Movement on Fluid Velocity: I Model of Fluid Flow due to a moving Solid in a Porous Media Framework*, Transport in Porous Media, 136(2), 699-714, doi.org/10.1007/s11242-020-01539-1.

- 2020 F.Z.B. Seighalani, H. Joyner, L. Schreyer *Identification of Factors Affecting Wear Behavior of Semi-Hard Cheeses*, Journal of Food Engineering, 292, 110348 doi.org/10.1016/j.jfoodeng.2020.110348
- 2020 K. Wuttanachamsri, L. Schreyer *Effects of the Cilia Movement on Fluid Velocity: II Numerical Solutions over a Fixed Domain*, Transport in Porous Media, 134(2), 471-489, doi.org/10.1007/s11242-020-01455-4.
- 2019 L. Schreyer, D.M. O'Carroll, S. Ranganathan, M. Schmidt *Editorial for Special Issue in Honor of InterPore's 10th Anniversary*. Transport in Porous Media, 130(1), pp. 1-4, doi.org/10.1007/s11242-019-01330-x.
- 2019 V. Joekar-Niasar, L. Schreyer, M. Sedighi, M. Icardi, and J. Huyghe *Coupled Processes in Charged Porous Media: From Theory to Applications*. Transport in Porous Media, 130(1), pp. 183-214, doi.org/10.1007/s11242-019-01257-3.
- 2017 T.R. Ginn, L.G. Schreyer, X. Sanchez-Vila, M.K. Nassar, A.A. Ali, and S. Krautle *Revisiting the Analytical Solution Approach to Mixing-Limited Equilibrium Multicomponent Reactive Transport Using Mixing-Ratios: Finding a Unique Basis, Fixing Errors, and Dealing with Multiple Minerals*. Water Resources Research, 53(11), pp. 9941-9959.
- 2017 T.R. Ginn, L. Schreyer, and K. Zamani *Phase Exposure-Dependent Exchange*. Water Resources Research, 53(1) pp. 619-632.
- 2016 M. Addassi, L. Schreyer, B. Johannesson, and H. Lin, *Pore-Scale Modeling of Vapor Transport in Partially Saturated Capillary Tube with Variable Area Using Chemical Potential*. Water Resources Research, 52(9) pp. 7023-7035 doi:10.1002/2016WR019165
- 2016 L. Schreyer *Note on Coussy's Thermodynamic Definition of Fluid Pressure for Deformable Porous Media*. Transport in Porous Media, 114(3) pp. 815-821 doi: 10.1007/s11242-016-0745-4
- 2015 K. Chamsri and L.S. Bennethum, *Permeability of Fluid Flow Through a Periodic Array of Cylinders*. Applied Mathematical Modelling, 39(1), pp. 244-254. doi:10.1016/j.apm.2014.05.024
- 2014 K.J. Wojciechowski, J. Chen, L. Schreyer-Bennethum, and K. Sandberg *Well-posedness and Numerical Solution of a Nonlinear Volterra Partial Integro-differential Equation Modeling a Swelling Porous Material*. Journal of Porous Media, Volume 17(9), pp. 763-784.
- 2014 L. Schreyer-Bennethum *Effective Stress for Saturated and Unsaturated Porous Media - A Differential Approach*. Invited. Vadose Zone Journal, 13(5), doi:10.2136/vzj2013.06.0108.

- 2012 L. Schreyer-Bennethum *Macroscopic Flow Potentials in Swelling Porous Media*, *Transport in Porous Media*, 94(1), pp. 47-68.
doi:10.1007/s11242-012-9987-y
- 2011 L. Schreyer-Bennethum and L. Albright, *Evaluating the Incorporation of Technology and Application Projects in the Higher Education Mathematics Classroom*, *International Journal of Mathematical Education in Science and Technology*, 42(1), pp. 53-63.
doi:10.1080/0020739X.2010.510216
- 2008 J. Mandel, L. S. Bennethum, J. D. Beezley, J. L. Coen, C. C. Douglas, M. Kim, and A. Vodacek, *A Wildland Fire Model with Data Assimilation*. *Mathematics and Computers in Simulation*, 79(3), pp. 584-606.
doi:10.1016/j.matcom.2008.03.015
- 2008 T.F. Weinstein, L.S. Bennethum, J.H. Cushman, *Multiscale, Three-Phase Theory for Swelling Drug Delivery Systems. Part I: Constitutive Theory*. *Journal of Pharmaceutical Sciences*, 97(5), pp. 1878-1903.
- 2008 T.F. Weinstein, L.S. Bennethum, J.H. Cushman, *Multiscale, Three-Phase Theory for Swelling Drug Delivery Systems. Part II: Flow and Transport Models*. *Journal of Pharmaceutical Sciences*, 97(5), pp. 1904-1915.
- 2007 L. Schreyer-Bennethum, *Theory of Flow and Deformation of Swelling Porous Materials at the Macroscale*. *Computers and Geotechnics*, special issue on Chemo-Mechanical Interaction in Geomaterials, 34, pp. 267-278.
- 2006 T. Weinstein and L. S. Bennethum *On the Derivation of the Transport Equation for Swelling Porous Materials with Finite Deformation*. *International Journal of Engineering Science*, 44(18-19), pp. 1408-1422.
- 2006 L. S. Bennethum *Compressibility Moduli for Porous Materials Incorporating Volume Fraction.*, *Journal of Engineering Mechanics*, 132(11), pp. 1205-1214.
- 2005 J. Mandel, L.S. Bennethum, M. Chen, J.L. Coen, C.C. Douglas, L.P. Franca, C.J. Johns, M. Kim, R. Kremens, V. Kulkarni, G. Qin, A. Vodacek, J. Wu, W. Zhao, A. Zornes, *Towards a Dynamic Data Driven Application System for Wildfire Simulation*, in V.S. Sunderam et al. (Eds): *Computational Science - Proceedings ICCS'2005*, *Lecture Notes in Computer Science* 3515, pp. 532-639.
- 2004 J. H. Cushman, L. S. Bennethum, and P. P. Singh, *Toward Rational Design of Drug Delivery Substrates: I. Mixture Theory for Two-Scale Biocompatible Polymers*. *Multiscale Modeling and Simulation*, 2(2), pp. 302-334.
- 2004 J. H. Cushman, P. P. Singh, and L. S. Bennethum, *Toward Rational Design of Drug Delivery Substrates: II. Mixture Theory for Three-Scale Biocompatible*

- Polymers and a Computational Example*. Multiscale Modeling and Simulation, 2(2), pp. 335-357.
- 2004 L. S. Bennethum and T. Weinstein, *Three Pressures in Porous Media*. Transport in Porous Media, 54 (1), pp. 1-34.
- 2003 P. P. Singh, J. H. Cushman, L. S. Bennethum, and D. E. Maier, *Thermomechanics of Swelling Biopolymeric Systems*, Transport in Porous Media, 53(1), pp. 1-24.
- 2002 J. H. Cushman, L. S. Bennethum, and B. X. Hu, *Primer on Upscaling Tools for Porous Media*, Advances in Water Resources, 25(8-12), pp. 1043-1067.
- 2002 L. S. Bennethum and J. H. Cushman, *Multicomponent, Multiphase Thermodynamics of Swelling Porous Media with Electroquasistatics: I. Macroscale Field Equations*, Transport in Porous Media, 47(3), pp. 309-336.
doi:10.1016/0020-7225(95)00089-5
- 2002 L. S. Bennethum and J. H. Cushman, *Multicomponent, Multiphase Thermodynamics of Swelling Porous Media with Electroquasistatics: II. Constitutive Theory*, Transport in Porous Media, 47(3), pp. 337-362.
doi:10.1016/0020-7225(95)00090-9
- 2000 L. S. Bennethum, M. A. Murad, and J. H. Cushman, *Macroscale Thermodynamics and the Chemical Potential for Swelling Porous Media*, Transport in Porous Media, 39(2), pp. 187-225.
doi:10.1023/A:1006661330427
- 1999 L. S. Bennethum and J. H. Cushman, *Coupled Solvent and Heat Transport of a Mixture of Swelling Porous Particles and Fluids: Single Time-scale Problem*, Transport in Porous Media, 36(2), pp. 211-244.
- 1997 L. S. Bennethum, M. A. Murad and J. H. Cushman, *Modified Darcy's Law, Fick's Law, and Terzaghi's Effective Stress Principle for Swelling Clay Soils*, Computers and Geotechnics, 20(3/4), pp. 245-266.
- 1997 L. S. Bennethum and T. Giorgi, *Generalized Forchheimer Equation for Two-Phase Flow Based on Hybrid Mixture Theory*, Transport in Porous Media, 26(3), pp. 261-275.
- 1997 X. Feng and L. S. Bennethum, *A Domain Decomposition Method for Solving a Helmholtz-like Problem in Elasticity based on the Wilson Nonconforming Element*, Mathematical Modelling and Numerical Analysis, 31(1), pp. 1-25.
- 1996 L. S. Bennethum, M. A. Murad, and J. H. Cushman, *Clarifying the Macroscale Chemical Potential for Mixture Theory*, International Journal of Engineering Science, 34(14), pp. 1611-1621.

- 1996 L. S. Bennethum and J. H. Cushman, *Multiscale, Hybrid Mixture Theory for Swelling Systems. Part I: Balance Laws*, International Journal of Engineering Science, 34(2).
- 1996 L. S. Bennethum and J. H. Cushman, *Multiscale, Hybrid Mixture Theory for Swelling Systems. Part II: Constitutive Theory*, International Journal of Engineering Science, 34(2), pp. 147-169.
- 1995 M. A. Murad, L. S. Bennethum, and J. H. Cushman, *A Multi-Scale Theory of Swelling Porous Media: I. Application to One-Dimensional Consolidation*, Transport in Porous Media, 19, pp 93-122.
- 1993 J. Douglas, Jr., J. Santos, D. Sheen, and L. S. Bennethum, *Frequency Domain Treatment of One-Dimensional Scalar Waves*, Mathematical Models and Methods in Applied Sciences, 3, pp 171-194.

Publications in Refereed Symposia Proceedings:

- M. A. Murad, L. S. Bennethum, and J. H. Cushman, *A Multiscale Theory for Consolidation of Swelling Clay Soils*, Proceedings of the Fourteenth International Conference on Soil Mechanics and Foundation Engineering, Hamburg, Sept. 1997.

Non-Refereed Publications

- INVITED L. Schreyer-Bennethum *Macroscopic Pressure in Swelling Porous Media* Poromechanics IV, Proceedings of the Fourth Biot Conference in Poromechanics. Hoe I. Ling, A. Smyth, and R. Betti (eds.), DEStech Publications, Inc., PA, USA, 2009.
- L. S. Bennethum, *What Can We Learn From Compressibility Experiments?* Poromechanics III-Biot Centennial (1905-2005), Proceedings, 3rd Biot Conference on Poromechanics, Abousleiman, Y., Cheng, A.G.-D., and Ulm, F.-J. (eds.), A.A. Balkema, London, 2005.
- L. S. Bennethum, *Flow and Deformation: Understanding the Assumptions and Thermodynamics* in Proceedings of the XVth International Conference on Computational Methods in Water Resources (CMWR XV), June 13-17, 2004, Chapel Hill, NC, Volume 1, pp. 349-357.
- L. S. Bennethum, *Charge Neutrality - Does it Exist?* in Proceedings of Symposium on the Mechanics of Physicochemical and Electromechanical Interactions in Porous Media, May 18-23, 2003, The Netherlands. pp. 259-266. 2005.

- L. S. Bennethum and T. Weinstein, *Pressures in Swelling Clay Soils* in Chemo-Mechanical Coupling in Clays, from Nano-Scale to Engineering Applications. C. Di Maio, T. Hueckel, and B. Loret, editors. A. A. Balkema Publishers: Tokyo, pp. 135-148 (2002).

Teaching:

Courses taught at WSU:

Undergraduate:

MATH 315 Differential Equations
MATH 220 Introduction to Linear Algebra

Slash-listed:

MATH 440/540 Applied Math 1: Partial Differential Equations

Graduate:

MATH 503 Complex Analysis
MATH 570 Introduction to Continuum Mechanics
MATH 581 Topics in Mathematics: Professional Development

Courses taught at CU Denver:

Undergraduate:

MATH 1130 Precalculus,
MATH 1401 Calculus I,
MATH 2411 Calculus II,
MATH 2421 Calculus III,
MATH 3191 Applied Linear Algebra,
MATH 3200 Ordinary Differential Equations,
MATH 3511 Mathematics of Chemistry,
MATH 4470 Partial Differential Equations,
MATH 4779 Math Clinic,
MATH 4791 Continuous Modeling

Graduate:

MATH 5070 Applied Analysis,
MATH 5733 Partial Differential Equations,
MATH 5779 Math Clinic,
MATH 5791 Continuous Modeling,
MATH 6131 Real Analysis,
MATH 6735 Introduction to Continuum Mechanics,
MATH 7760 Mathematical Foundations of Finite Element Methods,
MATH 7921 Readings of Mathematics of Science and Engineering - Lie Group Theory (F00,S02), Electro-Mechanics (S03), Mixture Theory for Porous Materials (F'07)

Other:

MATH 5009 Rocky Mountain Middle School Math and Science Partnership: Math Modeling-Using and Applying Math (Summer 2006,2007,2008) (With Gary Olson and Tony Russo)

MATH 5011 Rocky Mountain Middle School Math and Science Partnership: Math and Physics of Musical Instruments (Summer 2009, 2011) (With Ron Rorrer)

Selected Presentations: (Over 50 presentations, of which 20 were invited, meaning I received monetary reward for giving the presentation).

- Boise State Mathematics Colloquium *Developing a Deterministic Model for Refugee Migration*, Nov. 5, 2019, Boise, ID
- Second Biennial Meeting of the SIAM Pacific Northwest Section *Derivation of Macroscale Multiphase Flow Equations Using Hybrid Mixture Theory and Phase Field Approach* Oct 18-20, 2019, Seattle, WA.
- InterPore 11th Annual Meeting *Microscale Analysis of Deforming Saturated Porous Media: Terzaghi Stress Principle and the Significance of Shear and Plasticity in Hydrostatic Compression* May 6-10, 2019, Valencia, Spain.
- InterPore 11th Annual Meeting *Comparing Upscaled Governing Equations for Transport and Flow Derived via Hybrid Mixture Theory and Homogenization* May 6-10, 2019, Valencia, Spain.
- SIAM Conference on Mathematical and Computational Issues in the Geosciences *Microscale Analysis Demonstrating the Significance of Shear and Plasticity in Hydrostatic Compression of Porous Media* March 11-14, 2019, Houston, TX.
- WSU Porous Media Seminar *Developing a Deterministic Model for Mammal Migration based on Physics of Fluid Flow Through Porous Media* Feb. 15, 2019, Pullman, WA
- **Invited** New Mexico State Department of Mathematics Colloquium *Developing a Deterministic Model for Mammal Migration based on Physics of Fluid Flow through Porous Media*, Feb. 8, 2019, Las Cruces, NM.
- WSU Porous Media Seminar *Macroscale and Microscale Analysis of Deforming Saturated Porous Media: Terzaghi Stress Principle and the Significance of Shear and Plasticity in Hydrostatic Compression* Oct. 16, 2018, Pullman, WA
- 2018 SIAM Annual Meeting *Deformation of Porous Media at Multiple Scales*, July 9-13, 2018, Portland, OR
- InterPore 10th Annual Meeting and Jubilee *A Terzaghi-Like Principle for Swelling Porous Materials* , May 14-17, 2018, New Orleans, Louisiana
- 2017 Pacific Northwest Section SIAM *Development of a Deterministic Model for Refugee Flow*, Corvallis, OR, Oct 27-29, 2017.
- 9th International Conference on Porous Media *Modeling Vapor Transport Through Partially Saturated Porous Media at the Pore Scale Using Chemical Potential*, Rotterdam, Netherlands, May 9, 2017.

- American Mathematical Society Western Sectional Meeting *Modeling Swelling Polymers with a Nonlinear Volterra Partial Integrodifferential Equation*, Pullman, WA, April 22, 2017.
- University of Idaho Department of Mathematics Colloquium *Introduction to Modeling of Porous Media via Hybrid Mixture Theory and Results on Modeling Swelling Porous Media*, Moscow, ID, March 30, 2017.
- Washington State University Math Bio Seminar *Modeling the Movement of Mucus in Lungs*, Pullman, WA, March 7, 2017.
- American Geophysical Union 2016 *Modeling Vapor Transport Through Partially Saturated Porous Media at the Pore Scale Using Chemical Potential*, San Francisco, CA, Dec. 16, 2016.
- **Invited** Politecnico Di Torino, Department of Mathematical Science *Modeling of Porous Media via Hybrid Mixture Theory: Results on Flow Potentials*, Torino, Italy, June 17, 2016.
- 8th International Conference on Porous Media *Modeling Vapor Transport Through Partially Saturated Porous Media at the Pore Scale Using Chemical Potential*. Cincinnati, Ohio, May 9-12, 2016.
- Washington State University Mathematical Biology Seminar *Introduction to Modeling of Porous Media via Hybrid Mixture Theory and Results on Flow Potentials*. Pullman, WA, Feb. 2, 2016.
- University of Wyoming Computational and Applied Math Seminar *Modeling of Porous Media via Hybrid Mixture Theory and Results on Flow Potentials*. Laramie, Wyoming, Nov. 6, 2015.
- Washington State University *Introduction and the Modeling of Refugee Movement* Department of Mathematics and Statistics, Pullman, Washington, Sept. 3, 2015.
- Cargese Summer School on Flow and Transport in Porous and Fractured Media: Development, Protection, Management and Sequestration of Subsurface Fluids *Chemical Potential, Gibbs Potential, and Swelling Potential*. Cargese, France, July 20-Aug 1, 2015.
- **Invited** 10th Workshop on Applications of Physics of Porous Media *Incorporating Volume Fraction as an Internal Variable. Theoretical Generalization of Compressibility Relations: Terzaghi Stress Principle and Wave Propagation in a Saturated Porous Medium*, Ensenada, Mexico, Nov. 2-5, 2014.
- **Invited** Lund University, LTH, Construction Sciences *Chemical Potential: Introduction to Electrochemical Potential* Lund, Sweden, Sept. 18, 2014.
- **Invited** Ruhr University, Institute of Mechanics *Compressibility of Porous Materials, Thermodynamics, and the Total Differential* Bochum, Germany, Sept. 16, 2014.
- University of Colorado Denver Center for Computational Math *Chemical Potential: Introduction to Electrochemical Potential for Swelling Porous Media*, Denver, CO, Sept. 8, 2014.
- Interpore 2014 *Constitutive Equation for Time Derivative of Volume Fraction - Theoretical Determination via Dynamic Compressibility Experiment and Wave Propagation*, Milwaukee, WI. May 27-30, 2014.

- University of Colorado Boulder Applied Math Colloquium *Introduction to Modeling of Porous Media via Hybrid Mixture Theory and Results On Flow Potentials* Boulder, CO, Jan. 24, 2014.
- American Geosciences Union Fall Meeting 2013 *Enhanced Vapor Diffusion in Unsaturated Porous Media: Explanation Via Hybrid Mixture Theory*. San Francisco, CA. December 9-13, 2013.
- SIAM Conference on Mathematical and Computational Issues in the Geosciences *Compressibility of Porous Materials with Compressible Fluids using Thermodynamics*. University of Padova, Italy. June 17-20, 2013. Also co-organized a mini-symposia consisting of 2 sessions.
- SIAM Annual Meeting (co-organized a session) *Modeling Evaporation and Transport in Porous Media* Minneapolis, MN, July 9-13, 2012.
- Gordon Research (on Organizing Committee) Conference on Flow and Transport in Permeable Media *Diffusion Models in a Capillary Tube*. Les Diablerets, Switzerland, June 24-29, 2012.
- Interpore 2012 *Comparison of Nonlinear Evaporation and Diffusion Models in a Capillary Tube Geometry*. Purdue University, West Lafayette, IN. May 14-16, 2012.
- American Geosciences Union Fall Meeting 2011 *Macroscale Potentials for Charged Swelling Porous Media*. San Francisco, CA. December 5-9, 2011. Also chaired a poster session and judged student posters.
- SIAM Conference on Mathematical and Computational Issues in the Geosciences *Macroscale Potentials for Charged Swelling Porous Media*. Long Beach, CA. March 21-24, 2011. Also co-organized a mini-symposia consisting of 4 sessions.
- NSF Workshop on Mathematical Modeling and Computer Simulations for Soft Materials *Modeling Swelling Porous Materials using Volume Fraction*. Colorado State University, Fort Collins, CO, Sept. 13-17, 2010.
- **Invited** Gordon Research Conference on Flow and Transport in Permeable Media *Chemical Potential, Gibbs Potential, and Phase Transition*. Bates College, Lewiston, ME, July 11-16, 2010.
- **Invited** Goethe Center for Scientific Computing, *Introduction to Hybrid Mixture Theory with Applications to Flow through Porous Media*. Goethe University Frankfurt, July 2, 2010.
- **Invited**. 2010 InterPore Conference *Hybrid Mixture Theory for Charged Porous Media with Application to Modeling a Drug Delivery System*. Texas A&M, College Station, TX. March 14-17, 2010.
- SIAM Conference on Mathematical and Computational Issues in the Geosciences *Osmotic, Swelling, and Disjoining Pressures at Multiple Scales*. Leipzig, Germany. June 15-18, 2009. Also co-organized a mini-symposia consisting of 4 sessions.
- SIAM Conference on Mathematical and Computational Issues in the Geosciences *Forchheimer Equation for Two-Phase Flow Based on Hybrid Mixture Theory*. Leipzig, Germany. June 15-18, 2009.
- The Fourth Biot Conference on Poromechanics. *Macroscopic Pressure in Swelling Porous Media*. Columbia, NY. June 8-10, 2009.

- **Invited** Heiland Lecture, Colorado School of Mines, *Compressibility of Porous Materials, Thermodynamics, and the Total Differential*. Golden, Colorado. Sept. 4, 2008.
- NSF Course, Curriculum, and Laboratory Improvement meeting. *Adapting Intermath to a Non-Traditional Urban University* Washington, DC, August 13-15, 2008. Also co-organized a session on "Engaging Students in Mathematics by Incorporating Real-World Problems."
- **Invited** International Union of Theoretical and Applied Mechanics Symposium on Swelling and Shrinking of Porous Materials: From Colloid Science to Poro-Mechanics. Petropolis-RJ, *Things to Consider when Modeling Flow and Deformation of Swelling Porous Media* Brazil. Aug. 6-10, 2007.
- **Invited** International Workshop on Computational Methods in Geosciences. Wildfire Modeling Xian, Shaanxi, China. July 5-7, 2007.
- Summer School in Geophysical Porous Media: Multidisciplinary Science from Nano to Global Scale (Sponsored by NSF) *Physics of Fluid Flow* Purdue University, IN (July 17-28, 2006).
- **Invited** NSF-CBMS Regional Research Conference on Mathematical and Numerical Treatment of Fluid Flow and Transport in Porous Media *Flow and Deformation in Swelling Porous Media*. University of Nevada, Las Vegas (May 22-26, 2006)
- **Invited** NSF Meeting on Applications of Modern Tools of Mathematics and Physics to Subsurface Hydrology. *Hybrid Mixture Theory: Recent Results for Swelling Porous Media*. West Lafayette, IN (Aug. 11-15, 2003).
- **Invited** IUTAM Symposium on Mechanics of Physicochemical and Electromechanical Interactions in Porous Media *Charge Neutrality - Does it Exist?* The Netherlands. May 18-23, 2003,
- **Invited** Workshop on Multiscale Modeling of Environmental Systems *Boundary Conditions between Porous Media and Bulk Fluid*. Research Triangle Park, NC (February 2-7, 2003).
- **Invited** NATO-NSF Workshop on Model-Based Simulation of Durability of Materials and Structures. *Modeling composites and soils - a hybrid mixture theoretic approach*. Prague, Czech. Rep. (July 4-6, 2002).
- **Invited** Fourth Workshop on Applications of the Physics of Porous Media. *Physical and Thermodynamic Pressures of Charged Swelling Porous Media*. Puerto Vallarta, Jalisco, Mexico (Oct. 31-Nov. 4, 2001).
- **Invited** Clay Behaviour: Chemo-Mechanical Coupling, from nano-structure to engineering applications. *Thermodynamics of Macroscale Pressure in Clay*. Maratea, Italy (June 28-30, 2001).
- **Invited** Joint Summer Research Conference: Fluid Flow and Transport in Porous Media: Mathematical and Numerical Treatment, by the American Mathematical Society (AMS), the Institute of Mathematical Sciences (IMS), and the Society for Industrial and Applied Mathematics (SIAM). *Mixture Theory for Porous Media with Quasi-Static Electrodynamics*. Mount Holyoke College, South Hadley, MA. (June 16-22, 2001).
- **Invited** Third Canada-Mexico Workshop on Applications of the Physics of Porous

Media. Puerto Vallarta, Jalisco, Mexico *Charged Swelling Porous Materials: a Hybrid Mixture Theoretic Approach* . (Oct. 22-24, 1999)

Professional Organizations:

American Mathematical Society
American Geophysics Union
InterPore
Association for Women in Mathematics
Society of Industrial and Applied Mathematics

Professional Service:

- Vice President, SIAM Pacific Northwest Section, 2020-2022. Elected. Program director of biennial meeting.
- Guest co-Editor for special issue in *Transport in Porous Media*, 130(1): “In Celebration of InterPore’s 10th Anniversary: An Overview of Porous Media Research and the Path Forward” (2019).
- Scientific Committee for the SIAM Conference on Mathematical and Computational Issues in the Geosciences Media, 2019.
- Served on NSF panels in 1998, 1999, 2004, 2005, 2009, 2015, 2019, 2021
- Chair, Jubilee Committee, *InterPore* (Jan 2016-2018). This committee was responsible for creating and developing initiatives that will significantly expand and diversify (demographically and research areas) the membership of the InterPore professional organization by its 10th anniversary meeting in 2018. Major ideas developed include major speaking events, special-issue journal, and a Future Leaders Program.
- Associate Editor of *Water Resources Research* (2011-2015). Impact factor for this journal is 3.149 in 2012.
- Member of the Editorial Board of *Advances in Water Resources* (2000-2015). Impact factor for this journal is 3.03.
- Member of the Editorial Board of *International Journal of Engineering Science* (2004-2007).
- Review papers for over 10 journals regularly including: *Advances in Water Resources*; *Chemical Engineering Science*; *Computers and Mathematics with Applications*; *Engineering Mechanics Journal*; *Journal of Molecular Liquids*; *International Journal of Engineering Science*; *Macromolecular Theory and Simulations*;

Numerical Methods for Partial Differential Equations; Proceedings of the Royal Society A: Mathematical, Physical & Engineering Sciences; SIAM Journal on Numerical Analysis; Transport in Porous Media; Water Resources Research.

- Chaired the election committee for the professional organization InterPore, an interdisciplinary organization with focus on problems involving porous media (2014).
- Scientific Committee for the 6th International Conference on Porous Media and Annual Meeting of the International Society for Porous Media, Milwaukee, WI, May 27-30, 2014.
- Organizing Committee for the SIAM Conference on Mathematical and Computational Issues in the Geosciences, University of Padova, Italy, June 17-20, 2013.
- Program Chair for InterPore2012 meeting (2011-2012). Awarded an InterPore Rosette in 2013 in recognition of major contribution to the InterPore Society for this work. InterPore is an interdisciplinary organization with focus on problems involving porous media problems. Established in 2008 and there was no administrative structure for organizing such a meeting. The first meeting (2009) had 35 speakers and posters, the second (2010) had 36 speakers and posters, the 2011 meeting had 111 oral presentations and posters, and for 2012 we had over 250 speakers and posters. We had speakers talking on biological materials, engineered materials, CO₂ sequestration, thin porous materials, hydrology, food science, heat transfer, deformation, experimental aspects, numerical work, and modeling aspect.
- Council Member for Interpore, International Society of Porous Media, 2011-2015. Elected position.
- SIAM Membership Committee, 2010-2015. Working toward revising the SIAM website and increasing the interaction between academic and industrial members.
- Organizing committee for the Gordon Research Conference on Flow and Transport in Permeable Media, June 24-29, 2012, Les Diablerets, Switzerland.
- Chair of the program committee for Fourth International Conference on Porous Media and Annual Meeting of the International Society For Porous Media, May 14-16, 2012, Purdue University, West Lafayette, Indiana.
- Chair or co-chair of organizing committee for the SIAM Conference on Mathematical and Computational Issues in Geosciences, 2005, 2007.
- Nominating committee for the SIAM Conference on Mathematical Aspects of Material Sciences (2008).

- Chair of the Society of Industrial and Applied Mathematics Activity Group on Geosciences. Jan. 2003 - Dec. 2006. Held the first SIAM Geosciences conference outside of the United States, increasing participation and membership of Europeans.
- Secretary of the Society of Industrial and Applied Mathematics Activity Group on Geosciences. Jan. 2001 - Dec. 2003.
- Participant in Computational Subsurface Sciences Workshop, sponsored by Department of Energy; Bethesda, Maryland; Jan. 9-11, 2007.
- Nominated and participated in the Department of Education and NSF joint meeting for Mathematics and Science Partnership Programs (MSPs). Washington DC, Dec. 11-12, 2007.
- Organizer and instructor for Summer School in Geophysical Porous Media: Multi-disciplinary Science from Nano to Global Scale, sponsored by the National Science Foundation. A two-week course designed to provide graduate students and post doctoral students in the fields of applied mathematics and geosciences exposure to a wide range of approaches in the study of multi-scale porous medium systems. Purdue University, July 17-28, 2006.

PhD Students Supervised:

- Jon Widen (WSU PhD, Math), current
- Ryan Whitehead (WSU PhD, Math), current
- Zachary Hilliard (WSU PhD, Math), Grove Christian School, Richmond, VA
- Tessa Weinstein (UC Denver PhD, Math), now faculty at Windward School, Los Angeles
- Keith Wojciechowski (UC Denver PhD, Math), now faculty at University of Wisconsin Stout.
- Kanognudge Wuttanachamsri, aka Kannanut Chamsri (UC Denver PhD, Math), now faculty at King Mongkut's Institute of Technology Ladkrabang, Thailand.
- Eric Sullivan (UC Denver PhD, Math), now faculty at Carroll College, Helena, Montana.