Johannes M. Nitsche
Curriculum Vitae

Present position, address and contact information

Professor of Chemical Engineering
SUNY Distinguished Teaching Professor

Department of Chemical and Biological Engineering, Furnas Hall
University at Buffalo, The State University of New York
Buffalo, New York 14260–4200

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Areas of activity in research and teaching

■ Mechanistic modeling of biological transport processes in the areas of skin, phospholipid membrane and biological pore permeability, with applications to topical and transdermal drug development and risk assessment of chemical exposures. ■ Mechanistic modeling of binding processes that immobilize molecules and affect their transport rates in biological tissues. ■ Fluid mechanics and transport phenomena; molecular diffusion in pores and microstructured materials; multiscale modeling, theory of homogenization/coarse graining; applied mathematics.

■ Senior capstone design experience, chemical process and plant design, exposure to industrial reality; cohesion and unification of curriculum through spiral learning. ■ Fluid mechanics, mass transfer, biological transport processes. ■ Mathematics and computation for chemical engineers. ■ Undergraduate and graduate core courses and curriculum.

Academic degrees

June 1989 Doctor of Philosophy in Chemical Engineering
Massachusetts Institute of Technology

June 1984 Bachelor of Chemical Engineering (with High Distinction)
University of Minnesota

June 1984 Bachelor of Mathematics (with High Distinction)
University of Minnesota

Present position and professional experience

February – May 2018: Sabbatical leave (guest of Professor Gabriel Wittum and Dr. Arne Naegel), Goethe Center for Scientific Computing, Goethe University, Frankfurt a.M., Germany.

July 18–29: Sabbatical leave visit (guest of Dr. H. Frederick Frasch), Health Effects Laboratory Division (HELD), National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV.

November 6, 2014 – present: SUNY Distinguished Teaching Professor, Department of Chemical and Biological Engineering, University at Buffalo, The State University of New York, Buffalo, NY.

June 16, 2014 – December 2017: Director of Undergraduate Studies, Department of Chemical and Biological Engineering, University at Buffalo, The State University of New York, Buffalo, NY.
September 1999 – November 5, 2014: Professor, Department of Chemical and Biological Engineering, University at Buffalo, The State University of New York, Buffalo, NY.

February 19 – March 14 and August 5–22, 2008: Sabbatical leave as visiting scientist (guest of Dr. H. Frederick Frasch), Health Effects Laboratory Division (HELD), National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV.

January – mid-February and mid-March – July 2008: Sabbatical leave (guest of Professor Gennadiy Zhegunov), Department of Chemistry and Biochemistry, Kharkov State Veterinary Academy, Kharkov, Ukraine.

May – July 2003: Fulbright Scholar in the Russian Federation (Research award, Far-Eastern State Technical University, Vladivostok).

March – July 1999: Sabbatical leave as Gastdozent (guest of Professor Ulrich W. Suter), Department of Materials, Institute of Polymers, The Swiss Federal Institute of Technology, Zürich.

August 1998 – February 1999: Sabbatical leave as visiting scientist, the Procter & Gamble Company, Miami Valley Laboratories, Cincinnati, OH.

September 1995 – August 1999: Associate Professor, Department of Chemical Engineering, State University of New York at Buffalo, Buffalo, NY.

August 1990 – August, 1995: Assistant Professor, Department of Chemical Engineering, State University of New York at Buffalo, Buffalo, NY.

July 18 – August 23, 1997, July 9 – August 21, 1996, July 28 – August 17, 1995, July 28 – August 24, 1993, July 23 – August 16, 1992, and July 15 – August 15, 1991: Visitor (guest of Professor George K. Batchelor), Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge, England.

September 1989 – July 1990: NSF-NATO Postdoctoral Fellow, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge, England; postdoctoral advisor: Professor George K. Batchelor.

June – August 1989: Postdoctoral Associate, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA.

September 1987 – May 1989: Graduate Research Assistant, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA.

September 1984 – August 1987: NSF Graduate Fellow, Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA.

Honors and Awards

AIChE Professor of the Year Award 2016–2017, AIChE Student Chapter, May 12, 2017.

AIChE Professor of the Year Award 2004–2005, AIChE Student Chapter, April 29, 2005.

Fulbright Scholar award in the Russian Federation (Research award, May – July 2003, Far-Eastern State Technical University, Vladivostok).

AIChE Professor of the Year Award 2001–2002, AIChE Student Chapter, April 20, 2002.

Honorary Member, Golden Key National Honor Society, SUNY-Buffalo Chapter (1997).

Teacher of the Year Award, Tau Beta Pi, SUNY-Buffalo Chapter, August 24, 1997.

Professor of the Year Award, AIChE Student Chapter (1996).

SUNY Chancellor's Award for Excellence in Teaching (awarded 1995).

NSF Young Investigator Award (1992–97).

NSF-NATO Postdoctoral Fellowship (awarded February 1989).

NSF Graduate Fellowship (academic years 1984–85, 85–86, 86–87).

Publications in refereed scientific journals

J.M. Nitsche, G.F. Teletzke, L.E. Scriven and H.T. Davis, Phase and tension behavior of water, carbon dioxide, and decane: Comparison of a lattice-gas model and the Peng-Robinson equation. *Fluid Phase Equilibria* **14**, 203–208 (1983).

J.M. Nitsche, G.F. Teletzke, L.E. Scriven and H.T. Davis, Phase behavior of binary mixtures of water, carbon dioxide and decane predicted with a lattice-gas model. *Fluid Phase Equilibria* **17**, 243–264 (1984).

L.C. Nitsche, J.M. Nitsche and H. Brenner, Existence, uniqueness and regularity of a time-periodic probability density distribution arising in a sedimentation-diffusion problem. *SIAM J. Math. Analysis* **19**, 153–166 (1988).

J.M. Nitsche and H. Brenner, Sedimentation and dispersion of Brownian particles in spatially periodic potential fields. *J. Chem Phys.* **89**, 7510–7520 (1988).

K.W. Limbach, J.M. Nitsche and J. Wei, Partitioning of nonspherical molecules between bulk solution and porous solids. *AIChE Journal* **35**, 42–52 (1989).

J.M. Nitsche and H. Brenner, On the formulation of boundary conditions or rigid nonspherical Brownian particles near solid walls: Applications to orientation-specific reactions with immobilized enzymes. *J. Colloid Interface Sci.* **138**, 21–41 (1990).

J.M. Nitsche and J. Wei, Window effects in zeolite diffusion and Brownian motion over potential barriers. *AIChE Journal* **37**, 661–670 (1991).

G.K. Batchelor and J.M. Nitsche, Instability of stationary unbounded stratified fluid. *J. Fluid Mech.* **227**, 357–391 (1991).

J.M. Nitsche, Hydrodynamic coupling and non-equilibrium distribution in pore diffusion of nonspherical fine particles. *Particulate Sci. Technol.* **9**, 135–148 (1991).

J.M. Nitsche, New applications of Kahl's VLE analysis to engineering phase behavior calculations. *Fluid Phase Equilibria* **78**, 157–190 (1992).

G.K. Batchelor and J.M. Nitsche, Instability of stratified fluid in a vertical cylinder (with an Appendix by M.R.E. Proctor). *J. Fluid Mech.* **252**, 419–448 (1993).

J.M. Nitsche and K.W. Limbach, Partition coefficients for distribution of rigid non-axisymmetric solutes between bulk solution and porous phases: Toward shape-selective separations with controlled-pore materials. *Ind. Eng. Chem. Research* **33**, 1391–1396 (1994).

J.M. Nitsche, Teaching thermo with the help of friends. *Chem. Eng. Educ.* **28**, 168–173 (1994).

J.M. Nitsche and G. Balgi, Hindered Brownian diffusion of spherical solutes within circular cylindrical pores. *Ind. Eng. Chem. Research* **33**, 2242–2247 (1994).

G.K. Batchelor and J.M. Nitsche, Expulsion of particles from a buoyant blob in a fluidized bed. *J. Fluid Mech.* **278**, 63–81 (1994).

Y.-T. Wu and J.M. Nitsche, On diffusion-limited site-specific association processes for spherical and nonspherical molecules. *Chem. Eng. Sci.* **50**, 1467–1487 (1995).

G. Balgi, D.E. Leckband and J.M. Nitsche, Transport effects on the kinetics of protein-surface binding. *Biophys. J.* **68**, 2251–2260 (1995).

J.M. Nitsche, Pore diffusion of nonspherical Brownian particles. *Ind. Eng. Chem. Research* **34**, 3606–3620 (1995). [Invited contribution to special issue honoring 35 years of the textbook "Transport Phenomena" by R.B. Bird, W.E. Stewart and E.N. Lightfoot.]

J.M. Nitsche, On the asymptotic structure of far-field electrostatic interactions between charged molecules and charged surfaces. *Ind. Eng. Chem. Research* **35**, 3241–3247 (1996). [Invited contribution to special issue honoring Professor Eli Ruckenstein on the occasion of his 70th birthday.]

J.M. Nitsche and P. Roy, Shear-induced alignment of nonspherical Brownian particles near walls. *AIChE Journal* **42**, 2729–2742 (1996).

J.M. Nitsche, On Brownian dynamics with hydrodynamic wall effects: A problem in diffusion near a fiber, and the meaning of the no-flux boundary condition. *Chem. Eng. Commun.* **148–150**, 623–651 (1996). [Invited contribution to special Festschrift volume honoring Professor Howard Brenner on the occasion of his 65th birthday.]

D.S. Vaidya, J.M. Nitsche, S.L. Diamond and D.A. Kofke, Convection-diffusion of solutes in media with piecewise constant transport properties. *Chem. Eng. Sci.* **51**, 5299–5312 (1996).

D.S. Vaidya, J.M. Nitsche, S.L. Diamond and D.A. Kofke, Convection-diffusion of solutes in dynamic media. *Adsorption* **3**, 41–54 (1996).

D.S. Vaidya, J.M. Nitsche, S.L. Diamond and D.A. Kofke, Perturbation solution to the convection-diffusion equation with moving fronts. *AIChE Journal* **43**, 631–644 (1997).

D.S. Vaidya, S.L. Diamond, J.M. Nitsche and D.A. Kofke, Potential for use of liquid crystals as dynamically tunable electrophoretic media. *AIChE Journal* **43**, 1366–1368 (1997).

J.M. Nitsche and G.K. Batchelor, Break-up of a falling drop containing dispersed particles. *J. Fluid Mech.* **340**, 161–175 (1997).

P. Roy and J.M. Nitsche, A study towards the scale-up of size-exclusion separations by stagewise countercurrent contact. *Sep. Sci. Technol.* **32**, 2237–2266 (1997).

F. Cao, R. Eckert, C. Elfgang, J.M. Nitsche, S.A. Snyder, D.F. Hülser, K. Willecke and B.J. Nicholson, A quantitative analysis of connexin-specific permeability differences of gap junctions expressed in HeLa transfectants and *Xenopus* oocytes. *J. Cell Sci.* **111**, 31–43 (1998).

T.M. Suchyna, J.M. Nitsche, M. Chilton, A.L. Harris, R.D. Veenstra and B.J. Nicholson, Different ionic selectivities for connexins 26 and 32 produce rectifying gap junction channels. *Biophys. J.* **77**, 2968–2987 (1999).

V. Sikavitsas, J.M. Nitsche and T.J. Mountziaris. Transport and kinetic processes underlying biomolecular interactions in the BIACORE optical biosensor. *Biotechnol. Prog.* **18**, 885–897 (2002).

G.B. Kasting, N.D. Barai, T.-F. Wang and J.M. Nitsche. Mobility of water in human stratum corneum. *J. Pharm. Sci.* **92**, 2326–2340 (2003).

J.M. Nitsche, H.-C. Chang, P.A. Weber and B.J. Nicholson, A transient diffusion model yields unitary gap junctional permeabilities from images of cell-to-cell fluorescent dye transfer between *Xenopus* oocytes. *Biophys. J.* **86**, 2058–2077 (2004).

P.A. Weber, H.-C. Chang, K.E. Spaeth, J.M. Nitsche and B.J. Nicholson, The permeability of gap junction channels to probes of different size is dependent on connexin composition and permeant-pore affinities. *Biophys. J.* **87**, 958–973 (2004).

K. Kretsos, G.B. Kasting and J.M. Nitsche, Distributed diffusion-clearance model for transient drug distribution within the skin. *J. Pharm. Sci.*, **93**, 2820–2835 (2004).

T.-F. Wang, G.B. Kasting and J.M. Nitsche, A multiphase microscopic diffusion model for stratum corneum permeability. I. Formulation, solution, and illustrative results for representative compounds. *J. Pharm. Sci.* **95**, 620–649 (2006).

J.M. Nitsche, T.-F. Wang and G.B. Kasting, A two-phase analysis of solute partitioning into the stratum corneum. *J. Pharm. Sc*i. **95**, 649–666 (2006).

T.-F. Wang, G.B. Kasting and J.M. Nitsche, A multiphase microscopic diffusion model for stratum corneum permeability. II. Estimation of physicochemical parameters, and application to a large permeability database. *J. Pharm. Sci.* **96**, 3024–3051 (2007).

H.F. Frasch, A.M. Barbero, J.M. Hettick and J.M. Nitsche, Tissue binding affects the Kinetics of theophylline diffusion through the stratum corneum barrier layer of skin *J. Pharm. Sc*i. **100**, 2989–2995 (2011).

J.M. Nitsche and H.F. Frasch, Dynamics of diffusion with reversible binding in microscopically heterogeneous membranes: General theory and applications to dermal penetration. *Chem. Eng. Sci.* **66**, 2019–2041 (2011).

R. Ibrahim, J.M. Nitsche and G.B. Kasting, Dermal clearance model for epidermal bioavailability calculations. *J. Pharm. Sci.* **101**, 2094–2108 (2012).

J.M. Nitsche and G.B. Kasting, A correlation for 1,9-decadiene/water partition coefficients. *J. Pharm Sci.* **102**, 136–144 (2013).

J.M. Nitsche and Kasting, A critique of Abraham and Acree's correlation for deca-1,9-diene/water partition coefficients. *New J. Chem.* **37**, 283-285 (2013).

J.M. Nitsche and G.B. Kasting, Permeability of fluid-phase phospholipid bilayers: Assessment and useful correlations for permeability screening and other applications. *J. Pharm Sci.* **102**, 2005–2032 (2013). [Editor's pick — selected by the Editors to be featured on the journal's website in the special virtual issue “Editors' Picks (APR 2013 - JUN 2013)”. Paper “was selected for this distinction because the Editors felt it contained ‘particularly original and significant’ scientific findings.”]

J.M. Nitsche and G.B. Kasting, A Microscopic Multiphase diffusion model of viable epidermis permeability. *Biophys. J.* **104**, 2307-2320 (2013).

J.M. Nitsche and G.B. Kasting, A universal correlation predicts permeability coefficients of fluid- and gel-phase phospholipid and phospholipid-cholesterol bilayers for arbitrary solutes. *J. Pharm. Sci.* **105**, 1762-1771 (2016).

J.M. Nitsche and G.B. Kasting, How predictable are human stratum corneum lipid/water partition coefficients? Assessment and useful correlations for dermal absorption. *J. Pharm. Sci.* **107**, 727-738 (2018).

L.C. Nitsche, J.M. Nitsche and G.B. Kasting, Microscopic models of drug/chemical diffusion through the skin barrier: effects of diffusional anisotropy of the intercellular lipid. *J. Pharm. Sci.* **108**, 1692-1712 (2019). [Selected as a “featured article” from the May 2019 issue displayed on the journal’s website for 30 days. Subsequently selected to be featured on the journal’s website

for 3 months in the Virtual Issue: Most Original and Most Significant Scientific Findings because the Editors felt it contained "particularly original and significant" scientific findings.]

Manuscripts in preparation

J. Wang, J.M. Nitsche, G.B. Kasting, G. Wittum and A. Nägel, Transdermal and lateral effective diffusivities for drug transport in stratum corneum from a microscopic anisotropic diffusion model. In preparation for submission to *Eur. J. Pharm. Biopharm.* (2021).

J.M. Nitsche and G.B. Kasting, Transverse and lateral transport coefficients of SC lipid bilayers follow density-dependent trends for phospholipids. In preparation for submission to *J. Pharm. Sci.* (2021).

O. Denisova and J.M. Nitsche, Conclusions about osmotic fragility from a detailed erythrocyte model. In preparation for submission to *J. Theor. Biol.* (2021).

Invited review article

J.M. Nitsche, Cellular microtransport processes: Intercellular, intracellular, and aggregate behavior. *Annu. Rev. Biomed. Eng.* **1**, 463–503 (1999).

Invited book chapters

J.M. Nitsche and G.B. Kasting, Biophysical models for skin transport and absorption. In: M.S. Roberts and K.A. Walters, eds., *Dermal Absorption and Toxicity Assessment*, 2nd ed. New York: Informa Healthcare (2007), pp. 251–269.

G.B. Kasting GB, M.A. Miller and J.M. Nitsche, Absorption and evaporation of volatile compounds applied to skin. In: K.A. Walters and M.S. Roberts, eds., *Absorption, Efficacy and Toxicology of Dermatologicals and Cosmoceuticals*. New York: Informa Healthcare (2007).

G.B. Kasting and J.M. Nitsche JM, Mathematical models of skin permeability: microscopic transport models and their predictions. In: Querleux B, ed., *Computational Biophysics of the Skin*. Singapore: Pan Stanford Publishing (2014), pp. 187–216.

Non-refereed publication in trade journal

G. Kasting, S. Farahmand, J. Nitsche, P. Kern and G.F. Gerberick, Epidermal bioavailability of volatile compounds. *Perfumer & Flavorist* **35**, 28–38 (2010).

U.S. Government reports

J.M. Nitsche, Essential Computational Model for UGR-E Development: Final Report for Contract Number W911QY-09-P-0313. DoD Combat Feeding Program, Natick Soldier Research, Development and Engineering Center (NSRDEC), U.S. Army Soldier Systems Center (SSC), Natick, MA. Submitted May 7, 2010.

J.M. Nitsche, A Framework to Quantify Uptake of Drug/Chemical Solutes Within the Corneocyte Phase of the Stratum Corneum. Health Effect Laboratory Division (HELD), National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV. Submitted July 28, 2018.

Industrial internal reports

J.M. Nitsche, "Predictive Theoretical Model of Follicular Transport and Delivery." P&G Monthly Report, Skin Beauty Care Technology Division, Procter & Gamble Miami Valley Laboratories, Ross, Ohio, September 1, 1999.

J.M. Nitsche, "Theoretical Model of Follicular Delivery: Microscopic Geometry and Approach." P&G Monthly Report, Skin Beauty Care Technology Division, Procter & Gamble Miami Valley Laboratories, Ross, Ohio, October 1, 1999.

Google Scholar citation count

Citations 2119; h-index 23; i10-index 37

Presentations at technical conferences and seminars

(Oral presentations unless indicated otherwise; first author is speaker unless indicated otherwise; invited presentations and seminars indicated as such)

64 presentations and seminars prior to 1999.

J.M. Nitsche and G.B. Kasting, "A Skin Blood Flow Model to Address Topical Delivery to the Hair Follicle." Poster, 6th Gordon Research Conference on the Barrier Function of Mammalian Skin, Il Ciocco, Barga, Tuscany, April 18–23, 1999.

T.-F. Wang, J.M. Nitsche and G.B. Kasting, "Microstructural Model for the Permeability of Skin." Paper No. 258b, AIChE 1999 Annual Meeting, Dallas, October 31 – November 5, 1999.

G.B. Kasting and J.M. Nitsche, "Mathematical Model for Topical Delivery to the Hair Follicle." 7th International Conference on Perspectives in Percutaneous Penetration, La Grande Motte, France April 25–29, 2000.

G.B. Kasting and J.M. Nitsche, "A Skin Blood Flow Model to Address Topical Delivery to the Hair Follicle" (poster). American Association of Pharmaceutical Scientists Annual Meeting, New Orleans, November 14–18, 1999.

J.M. Nitsche and E. Benfeldt, "Theory and Experiments on the Operation of a Microdialysis Probe in Vitro and in Dermal In Vivo Systems." North American Membrane Society Meeting (NAMS) 2000 Meeting, Boulder, CO, May 23–27, 2000.

T.-F. Wang, J.M. Nitsche and G.B. Kasting, "Microstructural Model for the Permeability of Skin." Paper No. 314l, AIChE 2000 Annual Meeting, Los Angeles, November 12–17, 2000.

J.M. Nitsche, T.-F. Wang, K. Kretsos, G.B. Kasting and E. Benfeldt, "Microstructural Model for the Permeability of Skin: Progress Report for IPAA (& NSF GOALI) Project." Seminar, Procter & Gamble Miami Valley Laboratories, Ross, OH, December 8, 2000.

J.M. Nitsche and E. Benfeldt, "Theory and In Vitro Experiments on the Operating Characteristics and Dynamics of a Skin Microdialysis Probe." XXIX Summer School ``Advanced Problems in Mechanics'' (APM 2001), St. Petersburg (Repino), Russia, June 21–30, 2001.

T.-F. Wang, G.B. Kasting and J.M. Nitsche, "A Two-Dimensional Diffusion Model for the Assessment of Pathways through the Stratum Corneum (Barrier) Layers of Skin." Paper No. 296g, AIChE 2001 Annual Meeting, Reno, Nevada, November 4–9, 2001.

K. Kretsos, G.B. Kasting and J.M. Nitsche, "Distributed Diffusion-Dispersion-Clearance Model for Transient Drug/Chemical Distribution within the Skin." Paper No. 112i, AIChE 2001 Annual Meeting, Reno, Nevada, November 4–9, 2001.

J.M. Nitsche, "Average Transport Mechanics of Microstructured Materials with Diffusion and Reversible Binding: Application to Drug Transport through Skin.'' XXX Summer School "Advanced Problems in Mechanics" (APM 2002), St. Petersburg (Repino), Russia, June 27 – July 6, 2002.

J.M. Nitsche, "Effective Diffusion in Biological Tissues with Reversible Binding: Application to Drug Transport through Skin." Paper No. 304b, AIChE 2002 Annual Meeting, Indianapolis, Indiana, November 3–8, 2002.

J.M. Nitsche, "Dynamics of Continuous Deformable Bodies immersed in a Fluctuating Solvent." XXXI Summer School – Conference "Advanced Problems in Mechanics" (APM 2003), St. Petersburg (Repino), Russia, June 23 – July 2, 2003.

J.M. Nitsche, "Rates of Convection-Diffusion of Flexible Molecules by a Kinetic Theory for Continuously Deformable Bodies: Hydrodynamic Coefficients." XXXII Summer School – Conference "Advanced Problems in Mechanics" (APM 2004), St. Petersburg (Repino), Russia, June 24 – July 1, 2004.

J.M. Nitsche, "Micromechanics of Molecular Diffusion through Multiscale 'Brick-and-Mortar' Composite Materials, with Application to the Permeability of Human Skin." XXXIII Summer School – Conference "Advanced Problems in Mechanics" (APM 2005), St. Petersburg (Repino), Russia, June 28 – July 5, 2005.

J.M. Nitsche, "Microscopic Model for Stratum Corneum Permeability" (invited presentation). Gordon Research Conference on Barrier Function Of Mammalian Skin, Mount Holyoke College, South Hadley, MA, August 7–12, 2005.

A. Verma, B.J. Nicholson and J. M. Nitsche, "Hindered Convection-Diffusion Model of Ion Transport through Nanometer-Sized Gap-Junction Biological Pores." Paper No. 248g, AIChE 2005 Annual Meeting, Cincinnati, OH, October 30 – November 4, 2005.

Y. Dancik, G.B. Kasting and J. M. Nitsche, "A Computational Model of Transient Drug/Chemical Diffusion through Human Skin in the Vicinity of a Hair Follicle." Paper No. 489h, AIChE 2005 Annual Meeting, Cincinnati, OH, October 30 – November 4, 2005.

Y. Dancik, G.B. Kasting and J. M. Nitsche, "A Computational Model of Transient Drug/Chemical Diffusion through Human Skin in the Vicinity of a Hair Follicle." Poster, International Conference on Perspectives in Percutaneous Penetration, La Grande Motte, France, April 18–22, 2006.

J.M. Nitsche, "Microscopic Diffusion Models of Skin Permeability" (invited seminar). Department of Chemical Engineering, Clarkson University, Potsdam, NY, April 18, 2006. Very similar seminars also presented as invited seminars at: (i) Department of Chemical and Biological Engineering, University at Buffalo, State University of New York, Buffalo, NY, April 26, 2006; and (ii) School of Pharmacy and Pharmaceutical Sciences, University at Buffalo, State University of New York, Buffalo, NY, February 8, 2007.

J.M. Nitsche, "Brownian Dynamics of Continuous Deformable Macromolecular Models in Shear Flow." XXXIV Summer School – Conference "Advanced Problems in Mechanics" (APM 2006), St. Petersburg (Repino), Russia, June 25 – July 1, 2006.

J.M. Nitsche, "Average Transport Mechanics of Microstructured Materials with Diffusion and Reversible Binding." Interdisciplinary Symposium: Intersections Between Transport Phenomena, Microfluidics, Biological Systems, and Biomed/Pharm Technology at the 2006 International Conference on Bio and Pharmaceutical Science and Technology, sponsored by the Fine Particle Society, San Diego, CA, December 18–20, 2006.

J.M. Nitsche, "Microscopic Diffusion Models of Skin Permeability: Toward Better Predictions of Transient Absorption" (invited seminar). Unilever Research & Development, Trumbull, CT, July 31, 2007.

J.M. Nitsche, "Scientific Letters from Ukraine." Department of Chemical and Biological Engineering, University at Buffalo, State University of New York, Buffalo, NY, November 5, 2008.

J.M. Nitsche, with collaborators G.B. Kasting and H.F. Frasch, "Advances in Dermal Absorption Modeling: Transient Effects of Solute-Tissue Binding, and Transport Theory for the Viable Epidermis" (invited seminar). Unilever Research & Development, Trumbull, CT, August 25, 2009.

J.M. Nitsche, "Dynamics of Diffusion with Reversible Binding in Microscopically Heterogeneous Membranes: General Theory and Applications to Dermal Penetration (invited seminar). Department of Chemical and Biological Engineering, University at Buffalo, State University of New York, Buffalo, NY, November 17, 2010.

J.M. Nitsche (presenter) and G.B. Kasting, "Phospholipid-Cholesterol Bilayer Permeability Is Predictable." Paper 216ah (poster), AIChE Annual Meeting, San Francisco, CA, November 3–8, 2013.

J.M. Nitsche, "What *Really* Happens in Diffusion With Reversible Trapping, and What Are the Implications for Biological Diffusion Models?" Paper 302d, AIChE Annual Meeting, San Francisco, CA, November 3–8, 2013. [Identified as a "Best Presentation" of session.]

J.M. Nitsche, "Problems in Dermal Absorption as Vehicles for Teaching Diffusion and Mass Transfer." Paper 366c, AIChE Annual Meeting, San Francisco, CA, November 3–8, 2013.

L.C. Nitsche, J.M. Nitsche and G.B. Kasting, "Modeling of Diffusion in Stratified Epithelia Using Smoothed Particle Hydrodynamics." Paper 549i, AIChE Annual Meeting, San Francisco, CA, November 3–8, 2013.

J.M. Nitsche, L.C. Nitsche and G.B. Kasting, "A New Microscopic Model of Permeability and Lateral Diffusion in the Stratum Corneum Barrier Layer of Skin." Paper 571h, 2014 AIChE Annual Meeting, Atlanta, GA, November 16–21, 2014.

J.M. Nitsche, J.R. Errington and A.J. Schultz, "The New Spiral Initiative to Unify the Chem.E. Curriculum at the University at Buffalo." Paper 559c, 2014 AIChE Annual Meeting, Atlanta, GA, November 16–21, 2014.

J.M. Nitsche, L.C. Nitsche and G.B. Kasting, "Howard Brenner's Legacy for Biological Transport Processes." Paper no. L15.00004, 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, November 23–25, 2014.

J.M. Nitsche, L.C. Nitsche and G.B. Kasting, "The Role of Diffusional Anisotropy of Dermal Lipids in Absorption of Drugs and Chemicals Through the Skin" (invited lecture). Workshop on Modeling the Barrier Function of Human Skin, Conference on Modeling Natural Barriers, Bad Wildbad, Germany, September 29 – October 1, 2015.

J.M. Nitsche, L.C. Nitsche and G.B. Kasting, "Parameterization of Diffusion and Binding Models of Skin" (invited seminar). Goethe Center for Scientific Computing (G-CSC), Goethe University Frankfurt, March 16, 2016.

L.C. Nitsche, J.M. Nitsche and G.B. Kasting, "Microscopic Diffusion Model and Particle-Based Computer Simulations of Stratum Corneum Permeability" (invited talk, 1473). InterPore 2016 – 8th International Conference on Porous Media & Annual Meeting, Cincinnati, Ohio, May 9-12, 2016.

J.M. Nitsche and H.F. Frasch, "How Do In Vitro Measurements of the Kinetics of Drug/Chemical Binding to Keratin Protein Relate to Lag Times for Transdermal Absorption Through hHuman Skin?" (invited presentation). Workshop Modeling and Simulation in Science, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia, February 24-28, 2019.

Grants awarded

J.M. Nitsche (PI), SUNY Raymond J. Riefler Memorial Fund Award, project title: "Configurational Transport Processes Underlying Enzymatic Reactions;" period: summer 1991; budget: $750.

J.M. Nitsche (PI), "NSF Research Initiation Awards: Configurational Transport Processes in Reactions with Enzymes Bound to Fabricated Tailored Supports;" grant no. CTS–9111034; period: July 1, 1991 – June 30, 1993; budget: $64,841 + $4850 SUNY matching.

T.J. Mountziaris (PI), J. Tsamopoulos (co-PI), D.A. Kofke (co-PI) and J.M. Nitsche (co-PI), "NSF Engineering Research Equipment: High Performance Graphics Workstation;" awarded June 1992; budget: $54,000 + $27,000 SUNY matching.

J.M. Nitsche (PI), ACS-PRF Type G grant: “Enhancement of Size-Exclusion and Hydrodynamic Chromatography by Tailoring of Porous Microenvironments, Flow Tuning and Stationary-Phase Staging;” grant no. 26008–G7E; period: September 1, 1992 – August 31, 1994; budget: $18,000.

J.M. Nitsche (PI), NSF Young Investigator Award; grant no. CTS–9257391; period: September 1, 1992 – August 31, 1997; annual budget: $25,000 base grant + upto $37,500 industrial matching.

D.A. Kofke (PI), S.L. Diamond (co-PI), C.R.F. Lund (co-PI), T.J. Mountziaris (co-PI), J.M. Nitsche (co-PI), M.E. Ryan (co-PI) and T.W. Weber (co-PI), NSF Leadership in Laboratory Development (LLD) grant: “Development of a Simulation Laboratory for Chemical Engineering Instruction;” period: July 1, 1993 – June 30, 1995; budget: $97,251.

J.M. Nitsche (PI), Procter & Gamble Presidential Young Investigator support program grant: “Fluid Mechanics and Transport Phenomena; Thermodynamics;” period: July 1, 1994 – June 30, 1997; budget: $27,500.

B.J. Nicholson (PI), A.P. Moreno (co-PI) and J.M. Nitsche (co-PI), SUNY-Buffalo Multidisciplinary Research Pilot Project Program grant: “Mechanisms for Molecular Transport and Selectivity in Cellular Gap Junctions;" period: June 1, 1995 – May 31, 1996; budget: $19,800.

L.C. Nitsche (PI) and J.M. Nitsche (PI), NSF conference grant: “Conference: Symposium on Multiphase Flow, Microstructured Media, Diffusion and Biological Transport at the 26th Annual Meeting of the Fine Particle Society;” awarded July 1995; budget: $8,300.

T.J. Mountziaris (PI) and J.M. Nitsche (co-PI), Johnson & Johnson, Inc.: “Reaction and Tranport Modeling of Clinical Analytical Devices;" period: September 1, 1995 – August 31, 1996; budget: $40,693. Renewed for period September 1, 1996 – August 31, 1997; budget: $48,238.

J.M. Nitsche (PI), B.J. Nicholson (co-PI) and A.P. Moreno (co-PI), Whitaker Foundation Biomedical Engineering Research Grant: “Mechanisms for Molecular Transport and Selectivity in Cellular Gap Junctions;” period: September 1, 1996 – August 31, 1999; budget: $209,784 + $25,000 SUNY matching.

T.J. Mountziaris (PI), S.L. Diamond (co-PI), N. Kalogerakis (co-PI), D.A. Kofke (co-PI) and J.M. Nitsche (co-PI), “NSF Engineering Research Equipment: High Performance Computing and Visualization Hardware;” award notification summer 1996; budget: $50,000 + $43,000 SUNY matching.

J.M. Nitsche (PI), the Procter & Gamble Company NYI continued support grant; April 18, 1997; budget: $7,500.

J.M. Nitsche (PI), the Procter & Gamble Company NYI continued support grant; June 25, 1998; budget: $7,500.

J.M. Nitsche (PI), NSF GOALI program grant: “GOALI Project: Comprehensive Model of Molecular Transport and Delivery Through the Skin;” grant no. BES-9818160; period: January 15, 1999 – December 31, 2001; budget: $193,565.

J.M. Nitsche (PI), The Procter & Gamble Company *International Program for Animal Alternatives* (IPAA) grant: "Predictive Computational Model of Skin Permeability to Reduce the Need for Animal Models;" period: July 1, 1999 – February 1, 2001; budget: $91,355.

G.B. Kasting (PI, University of Cincinnati College of Pharmacy) with co-investigator J.M. Nitsche, NIOSH R01 grant: "Improved Methods for Dermal Exposure Estimation," subcontract to J.M. Nitsche under Aims 1, 2 and 5 of proposed work; period: September 1, 2002 – August 31, 2006; total direct costs: $225,683; total budget: $344,820.

G.B. Kasting (PI, University of Cincinnati College of Pharmacy) with co-investigators J.C. Kissel, M.A. Miller and J.M. Nitsche, NIOSH R01 grant: "Mechanistically-Based in Silico Estimation of Dermal Absorption in the Workplace," subcontract to J.M. Nitsche under Aim 3 of proposed work; period: September 1, 2007 – July 31, 2012; total direct costs: $175,663; total budget: $278,426.

J.M. Nitsche (PI), National Institute for Occupational Safety and Health (NIOSH), grant to support sabbatical leave activities: "Transcellular Pathway in Dermal Risk Assessment;" period: September 30, 2007 – September 29, 2008; total direct costs: $5,000; total budget: $5,000.

G.B. Kasting (PI, University of Cincinnati College of Pharmacy) and G.F. Gerberick (PI, The Procter & Gamble Company) with co-investigators M.A. Miller, P.S. Kern and J.M. Nitsche, grant from European Cosmetic, Toiletry and Perfumery Association (COLIPA) A.I.B.S., "Prediction of Epidermal Bioavailability of Contact Allergens," subcontract to J.M. Nitsche under Aim 1 of proposed work; period: April 1, 2008 – May 31, 2011; total direct costs: $40,008; total budget: $63,413.

J.M. Nitsche (PI), U.S. Army Soldier Systems Center, Natick Soldier Research, Development and Engineering Center, research contract: "Essential Computational Model for UGR-E Development;" period: January 1, 2009 – December 31, 2009; total direct costs: $17,171; total budget: $23,248.

Nitsche JM (PI). NSF grant: "Collaborative Research: GOALI: Multiscale Theory and Computer Simulation of Skin Absorption Phenomena;" award no. CBET-1335835; period: September 1, 2013 – August 31, 2017 incl. one-year no-cost extension; total direct costs: $67,970, total indirect costs: $39,763; total budget: $107,733. [Grant is linked to two other NSF awards, nos. CBET- 1335822 and CBET- 1335869; it is both a collaboration with Prof. Gerald B. Kasting (University of Cincinnati) and Prof. Ludwig C. Nitsche (University of Illinois at Chicago), and a GOALI project with industrial partner Dr. Russel H. Devane (The Procter & Gamble Company).]

Nitsche JM (PI). NSF grant, "Collaborative Research: GOALI: High-Impact Multiscale Physicochemical Advancements for the Prediction of Transient Dermal Absorption;" award no. CBET-2124542; period: July 1, 2021 – June 30, 2024; total direct costs: $71,675, total indirect costs: $42,646; total budget: $114,321. [Grant is linked to NSF award no. CBET-2124495 to Gerald B. Kasting (PI) University of Cincinnati and Joanna Jaworska (Co-PI) The Procter & Gamble Company; total budget $294,692.]

Courses taught

CE 212: Fundamental Principles of Chemical Engineering (undergraduate): fall 2008, 2009.

CE 304: Chemical Engineering Thermodynamics (undergraduate): spring 1991, 1992, 1993, 1994, 1995, 2000.

CE 317: Transport Processes I (fluid mechanics, undergraduate): fall 1996.

CE 318: Transport Processes II (heat and mass transfer, undergraduate): spring 2001, 2002, 2003, 2004, 2005, 2006, 2007.

CE 341: Applied Mathematics for Chemical Engineers (undergraduate): fall 2018, 2019.

CE 407: Unit Operations II (separations, undergraduate): fall 1990, 1991, 1992, 1993, 1994, 1995, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2016, 2017 (co-instructor).

CE 408: Chemical Engineering Plant Design (undergraduate): spring 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2019, 2020.

CE 509: Transport Phenomena I (graduate): spring 1996, 1997, 1998, 2005, 2006, 2007, 2009; fall 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

CE 531: Chemical Engineering Analysis I (mathematics, graduate): spring 1992; fall 1992, 1993, 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008; spring 2010, 2011, 2013, 2014; fall 2014, 2020.

CE 531Z: Chemical Engineering Analysis I (mathematics, graduate): spring 1994 (special course for Praxair M.Eng. program).

CE 561: Applied Chemical Kinetics (graduate): fall 2018, 2019, 2020.

Graduate students advised

Doctoral students advised:

- Dr. Ying-Ta Wu, Ph.D. conferred February 1996
- Dr. Partha Roy, Ph.D. conferred September 1996
- Dr. Ganesh Balgi, Ph.D. conferred September 1996
- Dr. Hou-Chien Chang, Ph.D. conferred September 2003
- Dr. Tsuo-Feng Wang, Ph.D. conferred September 2003
- Dr. Kosmas Kretsos, Ph.D. conferred February 2004
- Dr. Anshu Verma, Ph.D. conferred February 2007
- Dr. Yuri Dancik, Ph.D. conferred February 2007

Master's students advised:

- Mr. Satya P. Inampudi, M.S. conferred September 1992
- Mr. Sreenivas Gollapudi, M.S. conferred June 1994
- Mr. Kevin C. Lindquist, M.S. conferred June 1998
- Ms. Yamini Sravanthi Ammoor, M.S. conferred June 2015

Selected curricular activities

CBE Spiral Learning Initiative (spring 2013 – present)

The central idea behind the Spiral Learning Initiative is to use the senior plant design project as a pedagogical focal point for each class of students passing through the undergraduate program. "Spiral problems" are devised for each class and distributed over multiple courses in the sophomore, junior, and senior years. Through these problems, students revisit scientific themes and knowledge areas underlying the design project they will ultimately complete in the capstone design course (CE 408).

This approach has a number of benefits. (i) It makes students more effective in working on their design project. (ii) It helps students appreciate the usefulness of what they learn, and understand connections between elements of knowledge and skills they acquire in different courses. (iii) Students respect the notion that there is a plan behind what they are asked to do.

Implementation involves coordination of other courses in the curriculum with the CE 408 design project, and formulation of specific problems, solutions and lecture materials for the faculty teaching these courses.

Restructuring of mathematics and computation training for Ph.D. students (spring 2014)

This restructuring, approved by a faculty vote, addressed a perceived decline in mathematics ability of incoming graduate students. It involved: (i) preparation and grading of a math skills assessment exam administered to the fall 2013 incoming class; (ii) a presentation to the CBE Graduate Committee, and participation in discussions of the Committee; (iii) a revamp of CE 531 from a spring semester elective mathematics course to a fall semester required course split evenly between analytical mathematics and computational methods; (iv) a reduction by one in the number of credits in the three chemical engineering core courses to reduce student workload; (v) coordination of CE 531 course content with the three chemical engineering core courses; and (vi) drafting of the justification section of the Program Revision Proposal submitted by the Director of Graduate Studies. The outcome was that required courses for incoming Ph.D. students in the fall 2014 semester changed to CE 509 (Transport Phenomena I, 4 cr.), CE 525 (Advanced Chemical Engineering Thermodynamics, 4 cr.), CE 561 (Applied Chemical Kinetics, 4 cr.) and CE 531 (CE Mathematics and Computation, 4 cr.).

Departmental, school and university service

Director of Graduate Admissions for Chemical Engineering, *March 1993 – March 1997; spring 2001 – spring 2005.*

Member, Chemical Engineering Graduate Committee, *September 1997 – May 1998; spring 2000.*

Member, Chemical Engineering Undergraduate Committee, *fall 1991 – February 1993, spring 2006 – fall 2007, fall 2010 – 15 June 2014.*

Member, Chemical Engineering External Affairs Committee, *fall 2008 – spring 2010.*

Organizer, Chemical Engineering Graduate Informal Seminar Series, *summers 1991–1997*; Organizer, Chemical Engineering Friday Informal Graduate Student Seminar Series, *spring 2009.*

Chair, 1999–2000 Chemical Engineering Faculty Search Committee.

Chair, 2001–2002 Chemical Engineering Faculty Search Committee.

Member, School of Engineering and Applied Sciences Faculty Personnel Committee, academic years 2000–2001, 2003–2004, 2004–2005, 2005–2006.

Member, President's Review Board (PRB), academic years 2010–2011, 2011–2012, 2012–2013.

Director of Undergraduate Studies, Department of Chemical and Biological Engineering, *16 June 2014 – December 2020*.

Proposal review panels

Served on NSF Review Panel for Research Initiation Awards, Division of Chemical and Thermal Systems, April 13, 1993.

Served on NASA Interfacial Phenomena Panel to review proposals in response to NASA Research Announcement 98-HEDS-03, Microgravity Fluid Physics, July 7–9, 1999.

Served on NSF Review Panel for SBIR Phase I Awards, Division of Design, Manufacture and Industrial Innovation, Arlington, VA, September 23, 2003.

Served on NASA Interfacial Phenomena Peer Review Panel to review proposals in response to NASA Research Announcement NRA-01-OBPR-08-D, Research Opportunities in Physical Sciences – Fluid Physics, Washington, DC, March 17–18, 2003.

Served on NSF Review Panel for SBIR Phase II Awards, Division of Design, Manufacture and Industrial Innovation, Arlington, VA, March 10, 2004.

Served on NSF Review Panel for Sensors Interdisciplinary Research Group (Large) Proposals, Division of Chemical and Transport Systems, Arlington, VA, May 3, 2004.

Served on NSF Review Panel for unsolicited proposals submitted to the Particulate and Multiphase Processes Program, Division of Chemical and Transport Systems, Arlington, VA, November 17, 2004.

Served on NSF Review Panel for fiscal year 2006 CAREER proposals in the NSF Particulate and Multiphase Processes program, Division of Chemical and Transport Systems, Arlington, VA, October 19, 2005.

Served on NSF SBIR/STTR Phase I, C4 Fluids I Review Panel, Arlington, VA, February 23, 2006.

Served on NSF SBIR/STTR Phase I, Bio-affinity Based Sensors Review Panel, Arlington, VA, March 29, 2006.

Served on NSF SBIR/STTR Phase I, Sensors for Bioproducts Review Panel, Arlington, VA, March 23, 2007.

Served on NSF Review Panel for unsolicited proposals submitted to the Particulate and Multiphase Processes Program, Division of Chemical, Bioengineering, Environmental and Transport Systems, Arlington, VA, December 13, 2010.

Served on NSF Review Panel for unsolicited proposals submitted to the Interfacial Processes and Thermodynamics (Transport) Program, Division of Chemical, Bioengineering, Environmental and Transport Systems, Arlington, VA, May 26, 2011.

Served on NSF Review Panel for unsolicited proposals submitted to the Particulate and Multiphase Processes Program, Division of Chemical, Bioengineering, Environmental and Transport Systems, Arlington, VA, April 17–18, 2014.

Served on NSF Review Panel for proposals submitted to the Particulate and Multiphase Processes Program, Division of Chemical, Bioengineering, Environmental and Transport Systems, Alexandria, VA, April 11–12, 2019.

Served on NSF Review Panel for CAREER proposals submitted to the Particulate and Multiphase Processes Program, Division of Chemical, Bioengineering, Environmental and Transport Systems, Arlington, VA, September 25–26, 2019.

Program review

Served as invited reviewer of IIT's programs in the Department of Chemical and Biological Engineering, October 28-30, 2015.

Reviewing of manuscripts

Numerous manuscripts reviewed for the following journals: *Advanced Drug Delivery Reviews, AIChE Journal, Biochimica et Biophisika Acta — Biomembranes and — General Subjects, Biotechnology Progress, Chemical Engineering Communications, Chemical Engineering Education, Chemical Engineering Science, Environmental Health Perspectives, European Journal of Pharmaceutics and Biopharmaceutics, Industrial & Engineering Chemistry Research, International Journal of Multiphase Flow, International Journal of Pharmaceutics, Journal of Controlled Release, Journal of the Electrochemical Society, Journal of Fluid Mechanics, Journal of Investigative Dermatology, Journal of Membrane Science, Journal of Pharmaceutical Sciences, Langmuir, Mathematical Biosciences, Mathematics and Mechanics of Solids, Pharmaceutical Research, Physics of Fluids A, Royal Society of Chemistry Advances, Soft Matter*. Book proposal reviewed for Oxford University Press.

Reviewing of fellowship proposals

Fellowship proposals reviewed for Fulbright Program in Russia 2009, 2010, 2011, 2012, 2013

Organization of technical conferences

Member organizing committee and session co-chair, *Symposium on Multiphase Flow*. 23rd Annual Meeting of the Fine Particle Society, Las Vegas, Nevada, July 13–17, 1992.

Session co-chair (with J.L. Plawsky), *Fundamental Research in Heat and Mass Transfer I: Materials Applications*. Session No. 43, AIChE 1993 Annual Meeting, St. Louis, Missouri, November 7–12, 1993.

Session co-chair (with J.L. Plawsky), *Fundamental Research in Heat and Mass Transfer*. Session No. 110, AIChE 1994 Annual Meeting, San Francisco, California, November 13–18, 1994.

Co-organizer and session co-chair (with L.C. Nitsche), *Symposium on Multiphase Flow, Microstructured Media, Diffusion and Biological Transport.* 26th Annual Meeting of the Fine Particle Society, Chicago, Illinois, August 22–25, 1995.

Session co-chair (with J.L. Plawsky), *Fundamental Research in Transport Phenomena I*. Session No. 160, AIChE 1996 Annual Meeting, Chicago, Illinois, November 10--15, 1996.

Session co-chair (with J.L. Plawsky), *Fundamental Research in Transport Phenomena II*. Session No. 123, AIChE 1997 Annual Meeting, Los Angeles, California, November 16–21, 1997.

Session chair, *Fundamental Research in Transport Processes II*. Session No. 106, AIChE 1998 Annual Meeting, Miami Beach, Florida, November 15–20, 1998.

Co-organizer (with L.C. Nitsche, R.C. Armstrong and A. Benford), *A Symposium to Recognize Professor Howard Brenner for his Research and Educational Contributions in the Felds of Low Reynolds Number Hydrodynamics and Macrotransport Processes on the Occasion of his 70th Birthday*. Cambridge, MA & Providence, RI, September 24 & 25, 1999.

Session co-organizer and co-chair (with L.C. Nitsche), *Fundamental Research in Transport Processes I*. Session No. 105, AIChE 1999 Annual Meeting, Dallas, October 31 – November 5, 1999.

Co-organizer (with L.C. Nitsche), *Interdisciplinary Symposium: Intersections Between Transport Phenomena, Microfluidics, Biological Systems, and Biomed/Pharm Technology*. 2006 International Conference on Bio and Pharmaceutical Science and Technology, sponsored by the Fine Particle Society, San Diego, CA, 18–20 December 2006.

Industrial consulting

Process Technology Optimization, Inc., 2801 Long Road, Grand Island, NY 14072.

Unilever Research & Development, 40 Merritt Boulevard, Trumbull, CT 06611.