

Curriculum Vitae

**CAROLE M. LIEDTKE**

**NAME** Carole M. Liedtke

**ADDRESS**

Home	27443 Linwood Circle North Olmsted, Ohio 44070 Phone: (440)-777-0478
Work	Department of Pediatrics Case Western Reserve University Cleveland, OH 44106-4948 Phone: (216)-368-4629 FAX: (216)-368-4223 E-mail: carole.liedtke@case.edu

**EDUCATION**

1966 B.A. (Chemistry and Microbiology), Miami University, Oxford, OH

1980 Ph.D. (Anatomy, Case Western Reserve University  
Predoctoral Advisor: Ulrich Hopfer, M.D., Ph.D.  
Research Area: Membrane Biochemistry and Transport of Chloride in Epithelia

1979-1981 Pulmonary Fellow, Dept. Pediatrics, Case Western Reserve University  
Advisors: Thomas F. Boat, M.D., Dept. of Pediatrics and  
Stephen A. Rudolph, Ph.D., Dept. of Pharmacology  
Research Area: Mechanism of Signal Transduction during Epithelial Chloride  
Secretion

1989 M.B.A., School of Management, Case Western Reserve University  
Areas of Concentration: Accounting and Finance

**PROFESSIONAL APPOINTMENTS**

1981-1983 Instructor, Department of Pediatrics, Case Western Reserve University, Cleveland, OH

1983-1988 Assistant Professor, tenure-track, Departments of Pediatrics and Developmental Genetics and Anatomy, Case Western Reserve University,

1988-1991 Assistant Professor, tenure-track, Departments of Pediatrics and Physiology & Biophysics, Case Western Reserve University

1991-2000 Associate Professor, Departments of Pediatrics and Physiology & Biophysics, Case Western Reserve University

1994 Visiting Professor, James Chair, Department of Biology, St. Francis Xavier University, Antigonish, Nova Scotia

2000- Professor, Departments of Pediatrics and Physiology & Biophysics, Case Western Reserve University

## **PROFESSIONAL DEVELOPMENT**

- 2002 American Society of Nephrology, Postgraduate Educational Course, *Advances in Cell And Molecular Biology: Integration with Renal Medicine*, Philadelphia, PA, October 30-31, 2002.
- 2004 AAMC Faculty Affairs Professional Development Workshop, Tampa, FL  
Grants Writing Workshop, Sponsored Research Office, CWRU
- 2005 Effort Reporting Seminar, Sponsored Research Office, CWRU
- 2006 Electronic Grant Submission, Office of Contracts and Grants, SOM, CWRU
- 2007 ACES Faculty Development. Emotional Intelligence in the Academic Workplace: A Primer for Women Faculty, CWRU
- Responsible Conduct of Research (RCR): What you need to know to train your staff, fellows, and students, Office of Sponsored Research, CWRU
- 2008 High Impact Interviewing, Human Resources, CWRU  
Effort Reporting, CWRU
- 2009 Revised Case Policies on Individual and Institutional Conflicts of Interest, CWRU  
Writing Successful Grants, Robert Porter, CWRU  
Building the NIH Grant Proposal, Robert Porter, CWRU  
Avoiding Retaliation Claims, Colleen Trembl, Office of General Counsel, CWRU  
The Basics of Human Resource Laws, Carolyn Gerick and Kathy Wilsson, CWRU  
Executive Leadership in Academic Medicine, Lunch and Learn program, CWRU  
2D-DIGE User Group Workshop, Mark Chance, CWRU
- 2011 Interrupting Bias in the Faculty Search Process  
Webinar: How to Better Position Yourself as a Scholar, Researcher, and Grant Writer
- 2012 Research Budgets 101, Diane Domanovics, Women Faculty Leadership Development Initiative  
Faculty Fraud Awareness and Grant Management Seminar  
Shameless Self-Promotion: The Art and Style of Interpersonal Communication, Dr. Luanne Thorndyke  
Shameless Self-Promotion: Communicate with Credibility, Christine Zust  
Shameless Self-Promotion: Social Media for Women Faculty, Jill Miller Zimon

## **HONORS AND AWARDS**

- 1963 Culler Award (Chemistry)  
Alpha Lambda Delta (Freshman Women Honorary)
- 1964 Department Award in Chemistry  
Gamma Theta Pi (Chemistry honorary)  
Iota Sigma Pi (National Honorary Chemical Society for Women)
- 1965 Phi Beta Kappa, Phi Sigma (Biology honorary)
- 1966 Graduation honors: Magna Cum Laude, General Honors, Honors in Microbiology  
Phi Sigma Society Undergraduate Award for Research

- 1978 Who's Who Among Students in American Universities and Colleges, Case Western Reserve University
- 1980 Herbert S. Steuer Memorial Award for thesis research, Case Western Reserve University
- 1983 Research Award, Cell and General Physiology Section, American Physiological Society
- 1995 Jefferson Cup for leadership and exceptional service, Case Western Reserve University

**MEMBERSHIP IN PROFESSIONAL SOCIETIES**

- 2002- American Society for Biochemistry and Molecular Biology
- 1999- American Society of Nephrology
- 1984- American Association for the Advancement of Science
- 1984-2007 Society of General Physiologists

**PROFESSIONAL SERVICE**

**Study Section**

**International**

- 1989- Grant Reviewer, Canadian Cystic Fibrosis Foundation
- 1997-2000 Medical/Scientific Advisory Committee, Research Subcommittee  
Canadian Cystic Fibrosis Foundation
- 2010- Natural Sciences and Engineering Research Council of Canada

**National**

- 1986- National Cystic Fibrosis Foundation  
National Science Foundation
- 1987 National Institutes of Health, NHLBI and Specialized Center of Research
- 1990- Veterans Administration, Medical Research
- 1990 National Institutes of Health, NHLBI  
RFA HL-7 Beta-adrenergic regulation of airway function
- 1991 March of Dimes Birth Defects Foundation
- National Institutes of Health, National Center for Research Resources, General Clinical Research Center, Site Visit Team
- 2004, 2007 National Institutes of Health, Lung Cellular, Molecular, and Immunobiology Study Section, ad hoc reviewer
- 2005-2009 National Institutes of Health, Cellular and Molecular Biology of the Kidney Study Section, regular member of review panel
- 2005 American Heart Association, Reviewer, Southern and Ohio Valley Research Consortium, Committee 5A (Molecular Signaling and Basic Cell and Molecular Biology Committee)
- 2005 Wellcome Trust, ad hoc reviewer

- 2009 Special Emphasis Panel/Scientific Review Group 2009/10 ZRG1 CB-J (03) M  
Special Emphasis Panel/Scientific Review Group 2009/10 ZRG1 DKUS A 95 S
- 2010 NIH NIDDK, P30 Cystic Fibrosis Research and Translational Core Centers  
Special Emphasis Panel/Scientific Review Group 2010/05 ZDK1 GRB-W (M2)
- 2011 Special Emphasis Panel-ZRG1 CVRS-H 90, "Getting from Genes to Function in Lung Disease"  
ZHL1 CSR-Q F2 1, "Anchoring Metabolomic Changes to Phenotype"
- 2012 American Heart Association, Basic Cell MSO 1, Spring and Fall committees, Co-Chair for Fall Committee  
Special Emphasis Panel 2012/08 ZHL1 CSR-F, "Early Cystic Fibrosis Lung Disease Studies in Humans"
- 2013- American Heart Association, Basic Cell MSO 1, Chair, 2 review cycles

#### **Editorial Boards**

- 1990-present Member, Editorial Board, **American Journal of Physiology Cell Physiology**
- 1992-1994 Member, Editorial Board, **American Journal of Physiology Lung Cellular and Molecular Physiology**
- 2013 Member, Editorial Board, **American Journal of Physiology Renal Physiology**

#### **Review manuscripts for**

**American Journal of Physical Anthropology**  
**American Journal of Physiology: Cell, GI, Heart and Circulatory, Lung, and Renal**  
**American Journal of Respiratory Cell and Molecular Biology**  
**Archives of Biochemistry and Biophysics**  
**Biochimica et Biophysica Acta**  
**Biophysical Journal**  
**Experimental Eye Research**  
**Experimental Lung Research**  
**Gastroenterology**  
**Hypertension**  
**Investigative Ophthalmology & Visual Science**  
**Journal of Applied Physiology**  
**Journal of Biological Chemistry**  
**Journal of Cellular Physiology**  
**Journal of Clinical Investigation**  
**Journal of Laboratory and Clinical Medicine**  
**Journal of Physiology**  
**Pediatric Research**  
**Pflugers Archiv**  
**PLoS One**  
**Toxicology and Applied Pharmacology**

#### **Professional Societies**

**American Physiological Society**

- Awarded Research Award, Cell and General Physiology Section, 1983
- Mentored APS-NIH Minority Fellows (NIH sponsored Program), 1989-present
- Selected to serve on Steering Committee, Epithelial Transport Section, 1989-1992
- Organized Epithelial Transport Section Seminar, Spring FASEB/APS meeting, Washington, D.C., 1990
- Chair, APS Symposium, , *Segmental Electrolyte Transport in the Pulmonary Airwayswith Relevance to Cystic Fibrosis*, FASEB/APS Meeting, Atlanta, GA, 1991
- Chair, Experimental Biology Meeting, Transporters session, New Orleans, LA, 1993
- Volunteered as host/guide for Life Sciences Teacher/Student Workshop, Experimental Biology meeting, CA, 1998
- Appointed to Women in Physiology Committee, Jan., 1999 to Dec., 2002  
Appointed Chair, Jan1, 2002-April 21, 2004
- Co-Chair, Women In Physiology and Women in Pharmacology mentoring workshop, EB2003
- Elected to Steering Committee, Epithelial Transport Section, 1999-2001
- Selected to serve on Congressional Liason Committee
- Elected Vice-Chair, Cell and Molecular Physiology Steering Committee, 2002-2006
- Elected Chair, Cell and Molecular Physiology Steering Committee, 2004-2007  
(resigned 2004 due to election to APS Council)
- Selected to serve on Task Force on Development of Professional Skills document, 2003
- Co-Chair, Women In Physiology and Women in Pharmacology mentoring workshop, EB2004
- Elected to APS Council, 2004-2007
- Advisory Board, Professional Skills for Minority Students in Biomedicine, NIGMS funded, 2005-2007
- Appointed to Strategic Planning Committee, 2005
- Selected as Instructor, APS Professional Skill Training Short Course, *Making Scientific Presentations: Critical First Skills*, January, 2007-2010, Orlando, FL
- Selected for Working Group to develop APS Postdoctoral Fellowship Program, 2007
- Elected to Joint Program Committee, Cell and Molecular Physiology Section, 2007-2011
- Selected as Instructor, APS Professional Skill Training Short Course, *Writing and Reviewing Papers*, January 2009, Orlando, FL
- Selected as Instructor, APS Professional Skill Training Short Course, *Writing and Reviewing Papers*, January 2011, Orlando, FL
- Appointed to Finance Committee, 1/2011 to 12/2013

2002- American Society for Biochemistry and Molecular Biology  
 1999- American Society of Nephrology  
 1984- American Association for the Advancement of Science

#### **Advisory Groups**

1994-1996 Judge, Michelson Morley Research Competition in the Biological Sciences

1997-2000 Medical/Scientific Advisory Committee, Research Subcommittee,  
 Canadian Cystic Fibrosis Foundation

2003- Judge, Research ShowCASE, CWRU

- 2003 Judge, Intel International Science and Engineering Fair, Cleveland, OH
- 2005-2007 Advisory Board, Professional Skills for Minority Students in Biomedicine, American Physiological Society, NIGMS funded
- 2007-present Judge, SOURCE (Support of Undergraduate Research & Creative Endeavors) Intersections symposium and poster session.

**National Activities**

- 1982 Discussant, GAP Conference, Cystic Fibrosis Foundation, *Fluid and Electrolyte Transport in Exocrine Glands in Cystic Fibrosis*, San Diego, CA
- 1984 Recorder, GAP Conference Committee, Cystic Fibrosis Foundation, *Endogenous Regulation in Cystic Fibrosis*, Sandpiper Bay, FL
- 1987 Discussant, GAP Conference, Cystic Fibrosis Foundation, *Ion Channel Regulation in Cystic Fibrosis*, Florida
- 1989 Roundtable Moderator, Third Annual North American Cystic Fibrosis Conference, *Intracellular Second Messengers*, Tarpon Springs, FL
- 1991 Discussant, Frontiers in Basic Science Symposium, *Molecular and Cellular Biology of Cystic Fibrosis: Basic Concepts and Strategies for New Therapies*. Sponsored by NIH-NHLBI and the Cystic Fibrosis Foundation, Bethesda, MD
- 1995 Invited discussant, Williamsburg Conference, Cystic Fibrosis Foundation, Williamsburg, VA
- 1997-2011 Federal Demonstration Partnership, Faculty Representative  
 Cost sharing/Effort reporting Task Force, 1998-2000  
 Faculty Task Force on Presidential Review Directive-4, 1999-2000  
 Membership Committee, 2007-2011  
 Faculty Standing Committee, 2001-2011  
 Elected as Co-Chair 2003-2004  
 FDP Faculty representative, Call To Action Workshop, July 17, 2007  
 FDP Faculty liaison, Finance Committee, Sept., 2008-2011  
 ARRA committee, 2009-2011
- 2002 Invited Roundtable Moderator, 16<sup>th</sup> Annual North American Cystic Fibrosis Conference, *Role of Protein Kinase C in CFTR Activation*, New Orleans, LA
- 2003 Invited panelist, regional meeting on *Common Practices Among Agencies*, Research Business Models Subcommittee of Committee of Science, NSTC, Minneapolis, MN
- 2004 Invited panelist, NCURA Region V meeting, Indianapolis, IN
- 2005-2007 Member, Advisory Board, Professional Skills for Minority Students in Biomedicine (NIGMS funded)
- 2007-2011 Election as liaison from Federal Demonstration Partnership to National Academies, Government-University-Industry Roundtable, Board on Emerging Research

## Institutions

2009-2010 Election as President, Ohio Physiological Society

**COMMITTEE SERVICE****University Committee Service**

1988-1996 Radiation Safety Committee  
Chair, Jan. 1, 1992- Dec. 31, 1995

1987- Faculty Senate  
Committee on Graduate Studies and Research, 1987-1990  
Personnel Committee, 1990-1993  
Chair, 1992-1993  
Senator, 1991-1994, Executive Committee, 1992-1994  
Nominating Committee, 1991-1992 and 1994-1997  
Chair, 1995-1997  
Research Committee, 1995-2000  
Chair, 1997-2000  
Committee on Faculty Compensation, 2009-2012

1993 National Science Board/Research Roundtable Discussion Project

1995-1997 Panel for Hearing Procedures

1997-2011 Faculty Representative: National Academies, Government- University- Industry-  
Research Roundtable, Federal Demonstration Partnership

1998 Research Misconduct Symposium, organizing committee

2009-2012 University Committee on Fringe Benefits

**Medical School Committee Service**

1983-1993 Phase II Reproductive Biology Subject Committee, administrative representative of  
Department of Developmental Genetics and Anatomy  
Women Faculty, School of Medicine, Steering Committee and Treasurer  
•Organized three Women in Research programs  
Faculty Council, At-Large Preclinical Representative  
Biomedical Research Building Safety and Security Task Force

1996-2000 Research Committee, *ad hoc* member

1998 21st Century Research Planning Committee

1997-2012 Admissions Committee  
•2003, Appointment as liaison to the Cleveland Clinic Lerner College of Medicine  
Admissions Committee  
•Appointment as Chair, 2005-2012

2004- Director, Professional Skills Program, Office of Graduate Education

**Department Committee Service**

1982-1995 Department of Pediatrics: Ph.D. Task Force, Immunology Search Committee,  
Hematology-Oncology Search Committee, Data Storage and Authorship  
Committee, Laboratory Space Subcommittee  
Research Equipment Committee, Chairperson, 1990-1995

1989-1995 Department of Physiology & Biophysics: Committee on Medical Education,  
Committee on Seminars, Lectures, and Symposia, Safety Committee, Student  
Admissions Committee

2000-2003	Department of Pediatrics: Research Committee
2003-2004	Department of Physiology & Biophysics: Director, Postdoctoral Mentoring Program (co-sponsor Dept. Genetics)
2005- 2010-	Department of Pediatrics: Interview Fellow applicants Department of Physiology & Biophysics: Committee on Appointments, Promotion and Tenure Department of Physiology & Biophysics: Steering Committee for the MS in Medical Physiology program
2011-	Department of Pediatrics, Faculty Affairs Committee

**TEACHING ACTIVITIES****School of Medicine**

1974	<u>Phase I, Cell Biology Committee:</u> Histology (12 direct contact hours, 25 hrs. preparation, exam)
1975	Dental School: Histology, Dr. Bernard Tandler, supervisor, (90 direct contact hours, 150 hrs. preparation, exam prep. and grading)
1976	<u>Phase I, Gastrointestinal Committee:</u> Gross Anatomy (20 direct contact hours, 60 hrs. preparation, exam prep. and grading, and grade reporting)
1977-1978	<u>Phase II, Neuroanatomy Committee:</u> Gross Anatomy, Histology and Neurophysiology (45 direct contact hours, 120 hrs. preparation, exam prep. and grading, and grade reporting)
1980-1981	<u>Phase I, Cardiovascular Committee:</u> Pharmacology (12 direct contact hours, 20 hrs. preparation)
1982	<u>Phase II, Musculoskeletal, Reproductive Biology and Neuroanatomy Committees:</u> Gross Anatomy (1 lecture: 60 direct contact hours, 116 hrs. preparation, exam preparation and grading and grade reporting)
1983	<u>Phase II, Musculoskeletal and Reproductive Biology Committees:</u> <u>Gross Anatomy</u> <u>Phase I, Cardiovascular Committee:</u> Gross Anatomy (1 lecture: 45 direct contact hours, 75 hrs. preparation and grading, and grade reporting)
1984	<u>Phase II, Musculoskeletal and Reproductive Biology Committees:</u> Gross Anatomy (45 direct contact hours, 75 hrs. preparation, exam preparation and grading, grade reporting, and administrative responsibilities)
1985-1988	<u>Year 1, Reproductive Biology and Metabolism Sections:</u> Gross Anatomy (25 direct contact hours, 45 hrs. preparation, exam prep. and grading, grade reporting, and administrative responsibilities)
1986-1990	Pediatric Fellowship Training Program, Department of Pediatrics, 1 lecture
1989-1996	<u>Year 1, Homeostasis I Committee:</u> Cell Physiology and Histology (10 direct contact hours; 25 hrs. preparation)
1990-2004	Years 1 and 2, Type A elective: <i>Cystic Fibrosis - Approaches to a Genetic Problem</i>
1999-	<u>Year 1, Homeostasis I Committee:</u> Cell Physiology, Neuromuscular and Musculoskeletal: small group conference (6 direct contact hour, 18 hrs administration and preparation)
1999-2003	<u>Year 1, Renal Physiology:</u> five small groups (9 direct contact hours, 65 hrs administration and preparation)
2006-	<u>Year One, Block 2,</u> Cell Physiology and Cancer Biology, small group (2 direct contact hrs, 10 hrs preparation)
2007-2008	Years 3 and 4, Advanced Elective on Chronic Disease Management – Pediatric Pulmonology in Asthma and Cystic Fibrosis, basic science component (30 hr preparation, 1 hr per month direct contact, 10 hr per month administrative).
2008-	<u>Year One, Block 4,</u> Cardiovascular Cell Physiology, small group (8 direct contact hrs, 20 hrs preparation)



### **Administrative Activities**

- 1984-1988 Organize Gross Anatomy teaching for Musculoskeletal, Reproductive Biology and Metabolism Sections of Phase II curriculum.
- 1990-1994 Comprehensive Exam Committee, Year I
- 2003-2004 Organize Postdoctoral Mentoring Program, Departments of Physiology & Biophysics and of Genetics
- 2004- Organize and direct a Professional Skills Program, Office of Graduate Education, School of Medicine
- 2010- Member, Steering Committee for Masters in Medical Physiology program  
Develop and implement plan to approve MS degree at CASE and Ohio Board of Governors, Evaluate applicants for admission, Organize general schedule, Organize Block 5 Urinary Physiology by recruiting instructors, organize and implement schedule of lectures for PHOL 482 and PHOL 484, develop learning objectives, prepare and collate quizzes and block exams, work with TAs on LOs, Turning Point, quizzes, and examination questions and regarding. Advise students in preparation of medical applications, in particular, developing personal essay.

### **Graduate School Teaching**

#### **Course Teaching**

- 1975 Histology
- 1982-88 Gross Anatomy
- 1988-94 Physiology 480, Physiology of Organ Systems, Department of Physiology & Biophysics
- 1997- Physiology 466, Cell Signalling, Department of Physiology & Biophysics
- 2009-2010 Physiology 432, Cell Structure and Function, Department of Physiology & Biophysics
- 2011- Physiology 482: Medical Physiology, Block organizer, presented 3 lecture
- 2011- Physiology 484: Translational Physiology, Block organizer
- 2013- IBMS 500, Facilitator for 2 sessions: Safe Laboratory Practices and Responsible Authorship and Publication. (5 direct contact hrs, 4 hr preparation and reporting attendance)

#### **Thesis Committees**

- 1988-89 Ph.D.: V. Martindale, Developmental Genetics and Anatomy, graduated 1989  
Advisor: J. Salisbury
- 1988-91 Ph.D.: M. Romero, Physiology & Biophysics, graduated 1991, Advisor: U. Hopfer
- 2006- Ph.D.: B. Kuri, Physiology & Biophysics
- 2008- Ph.D. E. Yego, Physiology & Biophysics

#### **Graduate Training**

- 2006 Barbara Kuri, Physiology & Biophysics, laboratory rotation in Cellular Signalling
- 2007 Quentin Jamieson, Physiology & Biophysics, Qualifying Examination
- 2009 Neal Goldsmith, Physiology & Biophysics, laboratory rotation in Cellular Signalling
- 2011 Danielle Bozack, Physiology & Biophysics, MS research
- 2013 Alex Gilewski, Physiology & Biophysics, MS research

### **Medical Student Research Training**

- 2007 Nicholas Wilson, Medical Student Year 1, Summer Research Project

### **Undergraduate Research Training**

#### **External Reviewer**

2000 Honors thesis: D. Bowles, Kenyon College, advisor: Professor Chris Gillens

#### **Undergraduate Research Trainees**

1986 Patricia Botti, Cystic Fibrosis Foundation Student Trainee  
1987 Lenore Faulhaber, Cystic Fibrosis Foundation Student Trainee  
1989, 1990 Jennifer Furin, Cystic Fibrosis Foundation Student Trainee  
1990 Michelle Wilson, Health Careers Enhancement for Minorities, CWRU  
1991 John Hyun, Cystic Fibrosis Foundation Student Trainee and Summer Undergraduate Research in Physiology, Rensselaer Polytechnic Institute, Troy, NY  
1992 Camille Davis, High School Apprentice Program for Minorities, Summer Research Program  
1997 Peter Wung, Cystic Fibrosis Foundation Student Trainee  
1998 Sean Nagel, Cystic Fibrosis Foundation Student Trainee, Summer Undergraduate Research Program, Department of Physiology & Biophysics  
Komar Bajaj, Undergraduate Summer Research Student, Department of Pediatrics  
1999 Anthony Skalak, Department of Pediatrics Summer Student Program  
Maya Boumitri, Cystic Fibrosis Foundation Student Trainee, Summer Undergraduate Research Program, Department of Physiology & Biophysics  
2000-2001 Christine Boyle, Undergraduate Research in Biochemistry, 3 credit hour  
2003 Melissa Komlosi, Cystic Fibrosis Foundation Student Trainee, Summer Undergraduate Research Student, Department of Physiology & Biophysics  
Caryn Laughlin, Summer Undergraduate Research Student, Department of Pediatrics  
2009-2011 Katie Seymour, CWRU, Pediatrics Undergraduate Summer Research Program Senior Capstone Research Project  
2010 Aaron Lucas, CWRU, Pediatrics Undergraduate Summer Research Program

#### **High School Research Training**

2007-2009 Casey Glassman, Hathaway Brown, Student Research Program, now attending Cornell University  
2009-2011 Margaret Langefeld, Hathaway Brown, Student Research Program, now attending Case Western Reserve University  
2010-2013 Danielle Jones, Hathaway Brown, Student Research Program  
2013- Kate Egan, Hathaway Brown, Student Research Program

#### **National Activities**

2004 Regional Postdoctoral Symposium, Building a Dynamic Postdoctoral Community, University of Pittsburgh, Pittsburgh, PA, October, 2004.

#### **SCIENTIFIC ACTIVITIES**

##### **International**

1. Invited presentation, International Congress *Hydrogen Ion Transport in Epithelium*, Frankfurt, Germany, July, 1980.

2. Invited presentation, International Cystic Fibrosis Conference *Cellular and Molecular Basis of Cystic Fibrosis*, Verona, Italy, June, 1987.
3. North American Cystic Fibrosis Conference, Toronto, Canada, October, 1987.
4. Invited presentation, Royal Netherland Academy of Arts and Science, *Disorders of Chloride Channel Regulation: Cystic Fibrosis and Secretory Diarrhea*, Amsterdam, the Netherlands, May, 1988.
5. Seminar, St. Francis Xavier University, *Alpha-Adrenergic Regulation of NaCl(K) Cotransport in Tracheal Epithelial Cells*, Antigonish, Nova Scotia, Canada, Aug, 1994
6. Seminar, St. Francis Xavier University, *Cystic Fibrosis: Toward New Therapeutic Approaches* Antigonish, Nova Scotia, Canada, Sept., 1994.
7. Invited speaker, Dayton International Symposium on Cell Volume and Signaling, Wright State University, Dayton, OH, Sept., 2003.
8. Invited speaker, Gordon Conference, Salivary Glands and Exocrine Secretion, Ventura, CA, February, 2007.

#### National

1. Invited presentation, GAP Conference, Cystic Fibrosis Foundation, *Biology of Mucus*, Tempa, AZ, 1981.
2. Invited presentation, Aspen Lung Conference, *Lung Fluids and Secretions*, Aspen, CO, 1981.
3. Invited presentation, Gordon Research Conference, *Non-ventilatory Function of the Lung*, Plymouth, NH, 1982.
4. Invited presentation, ALA of Ohio, Board of Trustees, Columbus, OH, 1985
5. Invited seminar, Department of Medicine, University of Iowa, Iowa City, IA. *Epinephrine Interaction with Isolated Rabbit Tracheal Epithelial Cells*, 1985.
6. Invited presentation, NIH Conference, *Epithelial Cell Culture in the Study of Cystic Fibrosis*, Bethesda, MD, 1985.
7. Invited presentation, GAP Conference, Cystic Fibrosis Foundation, *Research Development Centers - Years of Progress*, Sandpiper Bay, FL. 1986.
8. Invited seminar, Department of Pharmacological and Physiological Science, Cystic Fibrosis Center, University of Chicago, Chicago, IL. *Adrenergic Regulation of NaCl Cotransport in Rabbit and Cystic Fibrosis Airway Epithelial Cells*, 1987.
9. Invited seminar, Department of Physiology & Biophysics, Wright State University, Dayton, OH. *Adrenergic Regulation of Airway Chloride Transport*, 1988.
10. Invited seminar, Department of Physiology, University of Maryland, Baltimore, MD. *Adrenergic Modulation of Airway Na/Cl Cotransport*, 1988.
11. Invited seminar, Department of Zoology, Miami University, Oxford, OH. *Chloride Transport in Tracheal Epithelium: Implications in Cystic Fibrosis*, 1989.
12. Symposium, FASEB/APS, Atlanta, GA, *Alpha-adrenergic Regulation of Airway NaCl (K) Cotransport*, 1991.

13. Invited seminar, Temple University, Department of Medicine, Pulmonary Diseases Section, Philadelphia, PA. *Alpha-adrenergic Regulation of Ion Transport in Airway Epithelium*, 1991.
14. Invited seminar, Department of Physiology, Ohio State University, Columbus, OH 1994.
15. Invited seminar, MetroHealth Medical Center, Cleveland, OH. *Differential Regulation of Na-Cl-K Cotransport by Protein C- Delta*, 1997.
16. Invited seminar, Department of Biomedical Sciences, Ohio University, Athens, OH. *Differential Regulation of Epithelial Salt and Fluid Secretion by PKC*. 1999.
17. Invited seminar, Department of Physiology, Center for Cellular and Molecular Signalling, Emory University, Atlanta, GA. *Protein kinase C Regulation of Epithelial Electrolyte Transport*. 1999.
18. Invited presentation, Cystic Fibrosis Foundation, Williamsburg Conference, Williamsburg, VA. *Regulation of CFTR by Protein Kinase C*. 1999.
19. Invited seminar, Ohio Physiological Society, Miami University, Oxford, OH. *Differential Regulation of Epithelial Chloride Secretion by Protein Kinase C*. 1999.
20. Invited seminar, Department of Physiology & Biophysics, Wright State University, Dayton, OH. *Regulation of Na-K-2Cl Cotransport in Epithelial Cells*. 1999.
21. Invited seminar, Department of Physiology, Northeastern Ohio Universities College of Medicine, Rootstown, OH. *Differential Regulation of Epithelial Salt and Fluid Secretion by Protein Kinase C*. 2000.
22. Invited seminar, Department of Molecular Cardiology, Cleveland Clinic Foundation, Lerner Research Institute, Cleveland, OH. *Protein Kinase C Regulation of CFTR Cl Channel Involves RACK1 Binding Protein*, 2001.
23. Invited speaker, North American Cystic Fibrosis Foundation, Orlando, FL. Workshop on 'Cell Biology and Molecular Interactions of CFTR'. 2001.
24. Invited seminar, Department of Anesthesiology, Vanderbilt University, Nashville, TN. *Regulation of Epithelial Cl Transporters by PKC*. 2002.
25. Invited seminar, Department of Surgery, University of Cincinnati, Cincinnati, OH. *Differential Regulation of Airway Epithelial Cl Transporters by PKC*. 2002.
26. Invited seminar, Department of Physiology & Biophysics, University of Illinois at Chicago, Chicago, IL. *Regulation of Epithelial Cl Transporters by Protein-Protein Interactions*, 2002.
27. Invited seminar, Department of Pediatric Pulmonology, University of Pittsburgh, Pittsburgh, PA. *Airway Epithelial Cl Secretion: Role of Protein-Protein Interactions*, 2004.
28. Invited seminar, Department of Physiology, Emory University, Atlanta, GA. *Regulation of Epithelial Cl Transporters by Protein Complexes*. 2008.
29. Salt and Water Club meeting, University of Pittsburgh, PA, October, 2010.
30. Oral presentation, Salt and Water Club meeting, University of Maryland, MD, October, 2012.

**RESEARCH SUPPORT**

**ACTIVE SUPPORT**

**PENDING APPLICATIONS**

1. NIH-RO1 (not assigned) 04/01/2014 to 03/31/2018. Control of integral membrane proteins by COMMD1. P.I. Carole M. Liedtke, Ph.D. 33% effort. Total annual direct cost \$225,000. Submit 06/05/2013.
2. NIH-R21 (not assigned) 04/01/2014 to 3/31/2016. Development of a PDZ drug that restores  $\Delta F508$ -CFTR function in cystic fibrosis. P.I. Carole M. Liedtke, Ph.D. 30% effort. Total annual direct cost \$125,000.

**PAST SUPPORT**

1. Cystic Fibrosis Foundation, Rainbow Chapter. 7/1/79 to 6/30/80. Electrolyte secretion. P.I. Thomas F. Boat, M.D. 100% effort for Dr. Liedtke. Total annual direct costs \$16,571.
2. Cystic Fibrosis Foundation, Rainbow Chapter. 7/1/80 to 12/31/81. Control of electrolyte transport. P.I. Thomas F. Boat, M.D. 100% effort for Dr. Liedtke. Total annual direct costs \$19,997.
3. NIH-HL 27700. 7/1/81 to 6/30/84. Isolation of tracheocyte plasma membranes. P.I. Carole M. Liedtke, Ph.D. 75% effort for Dr. Liedtke. Total annual direct costs \$35,600.
4. NIH-HL 26759. 1/1/81 to 7/1/82. Modulation of lung mucus secretion. P.I. Thomas F. Boat, M.D.. 15% effort for Dr. Liedtke. Total annual direct costs \$99,246.
5. Cystic Fibrosis Foundation, Rainbow Chapter. 3/1/83 to 2/28/84. Sodium transport in isolated tracheocytes. P.I. Carole M. Liedtke, Ph.D. 50% effort for Dr. Liedtke. Total annual direct costs \$19,500.
6. NIH-AM 27651. 1/1/84 to 12/31/85. CF Core Center Feasibility Study. Project .Director Carole M. Liedtke, Ph.D. 20% effort for Dr. Liedtke. Total annual direct costs \$25,000.
7. Cystic Fibrosis Foundation, Rainbow Chapter. 3/1/84 to 2/28/85. Prostaglandins in rabbit tracheocytes. P.I. Carole M. Liedtke, Ph.D. 30% effort for Dr. Liedtke. Total annual direct costs \$20,000.
8. American Lung Association. 7/1/84 to 6/30/86. Neurohormonal modulation of tracheal sodium transport. P.I. Carole M. Liedtke, Ph.D. 50% effort for Dr. Liedtke. Total annual direct costs \$15,000.
9. Cystic Fibrosis Foundation, Rainbow Chapter. 3/1/85 to 2/28/86. Regulation of tracheal ion transport by prostaglandins. P.I. Carole M. Liedtke, Ph.D. 30% effort for Dr. Liedtke. Total annual direct cost \$20,000.
10. National Cystic Fibrosis Foundation. 11/15/85 to 11/14/87. Pathways for ion transport in the airways. P.I. Carole M. Liedtke, Ph.D. 30% effort for Dr. Liedtke. Total annual direct costs \$35,000.

11. NIH-DK 27651. 4/1/86 to 3/31/87. CF Core Center Feasibility Study. P.D. Carole M. Liedtke. 25% effort for Dr. Liedtke. Total annual direct costs \$30,000.
12. National Cystic Fibrosis Foundation. 1/15/88 to 1/14/90. Second messenger pathways in the regulation of ion transport. P.I. Carole M. Liedtke, Ph.D. 70% effort for Dr. Liedtke. Total annual direct costs \$87,829.
13. National Cystic Fibrosis Foundation. 2/1/89 to 2/1/91. Effects of lipids/fatty acid profiles on iron transport. P.I. Stephen E. Alpert, M.D. 20% effort for Dr. Liedtke. Total annual direct costs \$75,000.
14. NIH-HL 41945. 12/1/88 to 11/30/93. Immortalization of cystic fibrosis airway epithelial cells. P.I. James Jacobberger, Ph.D. 16% salary support for Co-P.I. Dr. Liedtke. Total annual direct costs \$176,274.
15. American Heart Association. 7/1/90 to 6/30/95. Established Investigator Award. Total annual direct costs \$35,000.
16. NIH-HL 1 R01 43907. 12/1/89 to 11/30/94, no cost extension to 12/31/96. Modulation of an airway epithelial cotransporter. P.I. Carole M. Liedtke, Ph.D. 70% effort for Dr. Liedtke. Total annual direct costs \$125,159.
17. Children's Research Foundation, Faculty Fund Grant, Department of Pediatrics, CWRU. 12/1/95 to 11/30/96. Cloning and expression of human NaCl(K) cotransporter. P.I. Carole M. Liedtke, Ph.D. Total annual direct costs \$15,000.
18. NIH-SCOR Project. 9/30/93 to 8/31/98. Project 2: Diglycerides as regulators of ion transport. P.D. Carole M. Liedtke, Ph.D. 50% effort for Dr. Liedtke. Total annual direct costs \$91,156.
19. Cystic Fibrosis Foundation. 5/1/98 to 4/30/00. LIEDTK98G0. Protein Kinase C Regulation of CFTR. P.I. Carole M. Liedtke, Ph.D. 20% Effort. Total annual direct costs \$60,000.
20. Cystic Fibrosis Foundation, 5/1/00 to 4/30/01. LIEDTK00G0. Protein Kinase C Regulation of CFTR. P.I. Carole M. Liedtke, Ph.D. 15% Effort. Total annual direct costs \$60,000.
21. Cystic Fibrosis Foundation, 5/1/01 to 6/10/01. LIEDTK01P0. Protein Kinase C Regulation of CFTR. P.I. Carole M. Liedtke, Ph.D. 15% Effort. Total annual direct costs \$75,000.
22. NIH-HL-67190. 6/10/01 to 5/31/06 (with no cost extension). Regulation of CFTR by protein kinase C. P.I. Carole M. Liedtke, Ph.D. 40% Effort. Total annual direct cost \$175,000.
23. NIH-HL-58598-05. 7/1/02 to 6/30/07 (with no cost extension). Differential Regulation of Na-Cl-K Cotransport in Tracheal Epithelium. P.I. Carole M. Liedtke, Ph.D. 60% Effort. Total annual direct cost \$225,000.
24. NIH-HL-58598-09 02/1/08 to 1/31/12 (with no cost extension). Differential Regulation of Na-Cl-K Cotransport in Tracheal Epithelium. P.I. Carole M. Liedtke, Ph.D. 60% Effort. Total annual direct cost \$250,000.
25. CWRU, School of Medicine, Bridge Funding. 8/1/12 to 4/30/13. P.I. Carole M. Liedtke, Ph.D. 100% effort for Dr. Liedtke (no salary requested). Total annual amount \$100,000.

26. CWRU, School of Medicine, CTSC Core Utilization Project. Protein scaffolds regulate NKCC1 membrane expression and function. P.I. Carole M. Liedtke, Ph.D. 10/5/12 to 3/31/13. Total amount \$10,000.

## **Bibliography**

### **Articles (Peer-reviewed)**

1. Liedtke CM, Hopfer U. Anion transport in brush border membranes isolated from rat small intestine. **Biochem. Biophys. Res. Comm.** **6**:579-585, 1977. PMID: 17408
2. Hopfer U, Liedtke CM. Kinetic features of cotransport mechanisms under isotope exchange conditions. **Membrane Biochem.** **4**:11-29, 1981. PMID: 7012543
3. Liedtke CM, Hopfer U. Mechanism of Cl<sup>-</sup> translocation across the small intestinal brush border membrane. I. Absence of Na<sup>+</sup>-Cl<sup>-</sup> cotransport. **Am. J. Physiol. Gastrointest. Liver Physiol.** **242**:G263-G271, 1982. PMID: 7065188
4. Liedtke CM, Hopfer U. Mechanism of Cl<sup>-</sup> translocation across the small intestinal brush border membrane. II. Demonstration of Cl<sup>-</sup>/OH<sup>-</sup> exchange and Cl<sup>-</sup> conductance. **Am. J. Physiol. Gastrointest. Liver Physiol.** **242**:G272-G280, 1982. PMID: 7065189
5. Boat T, Liedtke CM, Rudolph S. Mucin secretion and cyclic nucleotide levels are disassociated in rabbit trachea. **Chest** **81S**:29S-31S, 1982. PMID:
6. Liedtke CM, Boat TF, Rudolph SA.  $\beta$ -Adrenergic agonists increase cAMP levels and stimulate mucous glycoprotein secretion in cat tracheal explants. **Chest** **81S**:20S-21S, 1982.
7. Liedtke CM, Boat TF, Rudolph SA. Neurohormonal receptors and cAMP binding proteins in rabbit tracheal mucosa-submucosa. **Biochim. Biophys. Acta** **71**:169-177, 1982. PMID: 612899
8. Liedtke CM, Rudolph SA, Boat TF.  $\beta$ -Adrenergic modulation of mucin secretion in cat trachea. **Am. J. Physiol. Cell Physiol.** **244**:C391-C398, 1983. PMID: 6133450
9. Liedtke CM, Tandler B. Physiological responsiveness of isolated rabbit tracheal epithelial cells. **Am. J. Physiol. Cell Physiol.** **247**:C441-C449, 1984. PMID: 6149692
10. Klinger J, Liedtke CM, Tandler B, Boat TF. Proteinases of *Pseudomonas aeruginosa* evoke mucin release by tracheal epithelium. **J. Clin. Invest.** **74**:1669-1678, 1984. PMID: 6568227
11. Liedtke CM. Interaction of (-)-epinephrine with isolated rabbit tracheal epithelial cells. **Am. J. Physiol. Cell Physiol.** **251**:C209-C215, 1986. PMID: 2874740
12. Welsh MJ, Liedtke CM. Chloride and potassium channels in cystic fibrosis airway epithelia. **Nature** **322**:467-470, 1986. PMID: 2426598
13. Li M, McCann JD, Liedtke CM, Nairn AC, Greengard P, Welsh MJ. Cyclic AMP-dependent protein kinase opens chloride channels in normal but not cystic fibrosis airway epithelium. **Nature** **331**:358-360, 1988. PMID: 2448645
14. Liedtke CM. Differentiated properties of rabbit tracheal epithelial cells in primary culture. **Am. J. Physiol. Cell Physiol.** **225**:C760-C770, 1988. PMID: 2462359

15. Liedtke CM.  $\alpha$ -adrenergic regulation of NaCl cotransport in human airway epithelium. **Am. J. Physiol. Lung Cell Mol. Physiol.** **257**:L125-L129, 1989. PMID: 2548396
16. Li M, McCann JD, Anderson MP, Clancy JP, Liedtke CM, Nairn AC, Greengard P, Welsh MJ. Regulation of chloride channels by protein kinase C in normal and cystic fibrosis airway epithelia. **Science** **244**:1353-1356, 1989. PMID: 2472006
17. Liedtke CM. Calcium and  $\alpha$ -adrenergic regulation of NaCl(K) cotransport in rabbit tracheal epithelial cells. **Am. J. Physiol. Lung Cell Mol. Physiol.** **259**:L66-L72, 1990. PMID: 2166444
18. Davis PB, Silski CL, Liedtke CM. Amiloride antagonizes  $\beta$ -adrenergic stimulation of cAMP synthesis and Cl<sup>-</sup> secretion in human tracheal epithelial cells. **Am. J. Respir. Cell Mol. Biol.** **6**:140-145, 1992. PMID: 1347224
19. Liedtke CM.  $\alpha_1$ -adrenergic signaling in human airway epithelial cells involves inositol lipid and phosphate metabolism. **Am. J. Physiol. Lung Cell. Mol. Physiol.** **262**:L183-L191, 1992. PMID: 1347200
20. Liedtke CM. Bumetanide-sensitive Na<sup>+</sup> and Cl<sup>-</sup> uptake in rabbit tracheal epithelial cells is stimulated by neurohormones and hypertonicity. **Am. J. Physiol. Lung Cell. Mol. Physiol.** **262**:L621-L627, 1992. PMID: 1590411
21. Liedtke CM, Furin J, Ernsberger P.  $\alpha_2$ -adrenergic, but not imidazole, agonists activate NaCl cotransport in rabbit tracheal cells. **Am. J. Physiol. Cell. Physiol.** **264**:C568-C576, 1993. PMID: 8096363
22. Liedtke CM. Activation of phosphatidylinositol-4,5-bisphosphate-sensitive phospholipase C in rabbit tracheal epithelial cells. **Am. J. Physiol. Cell Physiol.** **266**:C397-C405, 1994. PMID: 7908169
23. Liedtke CM. Role of protein kinase C in the regulation of Na(Cl)K cotransport in human airway epithelial cells. **Am. J. Physiol. Lung Cell Mol. Physiol.** **268**:L414-L423, 1995. PMID: 7900823.
24. Liedtke CM, Ernsberger P. Regulation of electrolyte transport in rabbit tracheal epithelial cells by the I<sub>1</sub>-imidazoline agonist moxonodine. **N.Y. Acad. Sci.** **763**:401-404, 1995. PMID: 7677353
25. Liedtke CM, Thomas L. Phorbol ester and okadaic acid activation of Na-Cl-K cotransport in rabbit tracheal epithelial cells. **Am. J. Physiol. Cell Physiol.** **271**:C338-C346, 1996. PMID: 8760063
26. Kester M, Liedtke CM.  $\alpha_1$ -Adrenergic stimulation differentially regulates ester-linked diglycerides in airway epithelial cells from normal and cystic fibrosis patients. **Biochim. Biophys. Acta: Lipids and Lipid Metabolism** **1302**:264-270, 1996. PMID: 8765149
27. Liedtke CM, Cole T, Ikebe M. Differential activation of PKC $\delta$  and PKC $\zeta$  by  $\alpha_1$ -adrenergic stimulation in human airway epithelial cells. **Am. J. Physiol. Cell Physiol.** **273**:C937-C943, 1997. PMID:9316415



28. Liedtke CM, Cole T. Antisense oligodeoxynucleotide to PKC- $\delta$  prevents  $\alpha_1$ -adrenergic activation of Na-Cl-K cotransport in human tracheal epithelial cells. **Am. J. Physiol. Cell Physiol.** **273**:C1632-C1640, 1997. PMID: 9374649
29. Marshall WS, Gillis J, Duchesnay R, Bryson SE, Liedtke CM. Neural modulation of salt secretion in teleost opercular epithelium by  $\alpha_2$ -adrenergic receptors and inositol 1,4,5-trisphosphate. **J. Exp. Biol.** **201**:1959-1965, 1998. PMID: 9600877
30. Liedtke CM, Cole TS. Antisense oligonucleotide to PKC- $\epsilon$  alters cAMP-dependent Activation of CFTR in Calu-3 cells. **Am. J. Physiol. Cell Physiol.** **275**:C1357-C1364, 1998. PMID: 9814985
31. Liedtke CM, Cole TS. PKC signalling in CF/T43 cell line: Regulation of NKCC1 by PKC- $\delta$ . **Biochim. Biophys. Acta Molecular Cell Res.** **1495**:24-33, 2000. PMID: 10634929
32. Liedtke CM, Cody, D, Cole TS. Differential regulation of Cl transport proteins in Calu-3 cells. **Am. J. Physiol. Lung Cell. Mole. Physiol.** **280**:L739-L747, 2001. PMID: 11238015.
33. Liedtke, CM, Cole TS. Activation of NKCC1 by hyperosmotic stress in human tracheal epithelial cells involves PKC- $\delta$  and ERK. **Biochim. Biophys. Acta Molecular Cell Res.** **1589**:77-88, 2002. PMID: 11909643
34. Liedtke CM, Papay R., Cole TS. Modulation of Na/K/2Cl cotransport by intracellular Cl<sup>-</sup> and protein kinase C- $\delta$  in Calu-3 cells. **Am. J. Physiol. Lung Cell. Mole. Physiol.** **282**:L1151-1159, 2002. PMID: 11943682
35. Liedtke CM, Yun CHC, Kyle N, Wang D. Protein kinase C- $\epsilon$ -dependent regulation of cystic fibrosis transmembrane regulator involves binding to a receptor for activated C kinase (RACK1) and RACK1 binding to Na<sup>+</sup>/H<sup>+</sup> exchange regulatory factor. **J. Biol. Chem.** **277**:22925-22933, 2002. PMID: 11956211.
36. Liedtke CM, Hubbard M, Wang X. Stability of actin cytoskeleton and PKC- $\delta$  binding to actin regulate NKCC1 function in airway epithelial cells. **Am. J. Physiol. Cell. Physiol.** **284**:C487-C496, 2003. PMID: 12388079
37. Liedtke CM, Raghuram V, Yun CHC, Wang X. Role of a PDZ1 domain of NHERF1 in the binding of airway epithelial RACK1 to NHERF1. **Am. J. Physiol. Cell. Physiol.** **286**:C1037-C1044, 2004. PMID: 15075202.
38. Liedtke CM. Regulation of epithelial electrolyte transporters through protein-protein interactions. **Adv. Exp. Med. Biol.** **559**:349-358, 2004. PMID:17409124.
39. Smallwood N, Hausman BS, Wang X, Liedtke CM. Involvement of N-terminus of PKC $\delta$  in binding of F-actin during hormonal activation of Calu-3 airway epithelial NKCC1. **Am. J. Physiol. Cell. Physiol.** **288**:C906-C912, 2005. PMID: 15590896
40. Liedtke CM, Wang X, Smallwood NS. Role of PP2A in the regulation of Calu-3 epithelial cell NKCC1 function. **J. Biol. Chem.** **280**:25491-25498, 2005. PMID 15899883
41. Liedtke CM, Wang X. The N-terminus of the WD5 repeat of human RACK1 binds to airway epithelial NHERF1. **Biochemistry**, **45**:10270-10277, 2006. PMID: 16922502.

42. Auerbach M, Wang X, Liedtke CM. Role of the scaffold protein RACK1 in apical expression of CFTR. **Am. J. Physiol. Cell. Physiol.** **293**:C294-C304, 2007. PMID: 17409124
  43. Smith L, Smallwood N, Altman A, Liedtke CM. PKC $\delta$  acts upstream of SPAK in the activation of NKCC1 by hyperosmotic stress in human airway epithelial cells. **J. Biol. Chem.** **283**:22147-22156, 2008. PMCID: PMC2494923.
  44. Smith L, Page RC, Xu Z, Kohli E, Litman P, Nix JC, Ithychanda SS, Liu J, Qin J, Misra S, Liedtke CM. Biochemical basis of the interaction between CFTR and immunoglobulin-like repeats of filamin. **J. Biol. Chem.** **285**:17166-17176, 2010. PMID: 20351101.
  45. Torres LM, Berti-Mattera LN, Konopnika B, Liedtke C, Romani A. Defective translocation of PKC $\epsilon$  in ETOH-induced inhibition of Mg<sup>2+</sup> accumulation in rat hepatocytes. **Alcoholism: Clinical and Experimental Research**, 2010 Jun 25. [Epub ahead of print] PMID: 2058674.
  46. Wang Y, Klein JD, Liedtke CM, and Sands JM. Protein kinase C regulates urea permeability in the rat inner medullary collecting duct. **Am J Physiol Renal Physiol.** **299**:F1401-1406, 2010. PMID 2086107.
  47. Smith L, Litman P, and Liedtke CM. COMMD1 interacts with the C-terminus of NKCC1 in Calu-3 airway epithelial cells to regulate NKCC1 ubiquitination. **Am. J. Physiol. Cell Physiol.**, **304**:C133-C146, 2013. PMID: 23515529
- Editorial Focus: McDonald FJ. COMMD1 and ion transport proteins: what is the COMMection? **Am. J. Physiol. Cell Physiol.**, **304**:C129-C113, 2013. PMID: 23677795
48. Smith L, Litman P, Kohli E, Amick J, Page RC, Misra S, and Liedtke CM. RACK1 interacts with filamin-A to regulate plasma membrane levels of Cystic Fibrosis Transmembrane Regulator (CFTR). **Am. J. Physiol. Cell Physiol.** **305**:C111-C120, 2013. PMID: 23636454

### Book Chapters

1. Liedtke CM, Hopfer U: Electrolyte transport in the small intestine. In: *Proceedings of the International Congress on Hydrogen Ion Transport in Epithelia*, I. Schulz, G. Sachs, J.G. Forte, and K.J. Ullrich (eds.), Elsevier, Amsterdam, pp. 337-344, 1980.
2. Boat TF, Cheng PW, Klinger JD, Tandler B, Liedtke CM. Proteinases release mucin from airways goblet cells. In: *Mucus and Mucosa*, CIBA Symposium 107, A. Silberberg (ed.), London, pp. 72-88, 1984. PMID: 6394245
3. Liedtke CM, Romero M, Hopfer U. Adrenergic control of Na, K, 2 Cl cotransport in airway epithelial cells. In: *Proceedings of the International Congress on the Cellular and Molecular Basis of Cystic Fibrosis*, ed. G. Mastella, P. Quinton (eds.), San Francisco Press, San Francisco, pp 307-313, 1988.
4. Liedtke CM. Chloride channels in Cystic Fibrosis. In: *Ion Channels and Ion Pumps: Metabolic and Endocrine relationships in Biology and Clinical Medicine*, Vol. 7 (Endocrinology and Metabolism series), P.P. Foa and M.F. Walsh (eds.), Springer-Verlag, New York, pp. 500-522, 1994.
5. Liedtke CM. Regulation of epithelial electrolyte transporters through protein-protein interactions. In: *Cell Volume and Signaling*, Advances in Experimental Medicine and Biology,

Vol. 559, PK Lauf and NC Adragna (eds.), Springer, New York, pp.349-358, 2005.  
PMID:18727254

### Invited Articles

1. Liedtke CM, Hopfer U: Proton and bicarbonate transport mechanisms in the intestine. **Ann. Rev. Physiol.** 49:51-67, 1987. PMID: 3032076
2. Liedtke CM. Regulation of chloride transport in epithelia. **Ann. Rev. Physiol.** 51:143-160, 1989. PMID: 2653178
3. Liedtke CM. Electroneutral and electrogenic ion transporters and their regulation in airway epithelium. In *Methods in Enzymology*, Vol. 192. *Biomembranes, Part W, Cellular and Subcellular Transport: Epithelial Cells*. S. Fleischer and B. Fleischer (eds.). Academic Press, Inc., Orlando, FL, pp. 549-565, 1990. PMID: 1706056
4. Liedtke CM. Electrolyte transport in the epithelium of pulmonary segments of normal and cystic fibrosis lung. **FASEB J.** 6:3076-3084, 1992. PMID: 1521739
5. Barman SM, Liedtke CM. Growing Participation of women in physiology: 1987-2002. **The Physiologist** 46:1-7, 2003. PMID:12685276
6. Liedtke CM. Understanding the cellular mechanism for inhaled hyperosmotic saline therapy for patients with cystic fibrosis. **Am. J. Physiol. Cell Physiol.** (August 28, 2013)  
doi:10.1152/ajpcell.00250.2013. PMID: 23986195

### GenBank Sequence Submission

1. Assession Number AY280459. Homo sapiens NaK2Cl cotransprter (SLC12A2) mRNA, complete cds. cDNA sequence of Calu-3 airway epithelial cell Na-K-2Cl cotransporter. May, 2003.

### Abstracts

1. Liedtke CM, Hopfer U: Mechanisms of anion flux across isolated rat intestinal brush border membranes. **Biophys. J.** 17:80a, 1977.
2. Liedtke CM. Inhibition of chloride transport in rat intestinal brush border membranes. **Biophys. J.** 25:94a, 1978.
3. Liedtke CM, Hopfer U: SITS binding to rat enterocyte plasma membranes. XIth International Congress of Biochemistry, 1979.
4. Liedtke CM, Hopfer U: Chloride-sodium symport versus chloride/hydroxide antiport or chloride uniport as mechanisms of chloride transport across the rat intestinal brush border membrane. **Fed. Proc.** 39:2459, 1980.
5. Tandler B, Liedtke CM. Tunnels in the lining epithelium of rabbit trachea. **Anat. Rec.** 199:252A, 1981.
6. Liedtke CM, Rudolph SA, Boat TF. Mechanism of adrenergic modulation of mucous glycoprotein secretion in cat trachea. **Fed. Proc.** 41:1250, 1982.

7. Liedtke CM.  $\beta$ -adrenergic responsiveness of isolated rabbit tracheal epithelial cells. **Fed. Proc.** **42**:459, 1983.
8. Liedtke CM. Epinephrine response in isolated rabbit tracheal epithelial cells. **Physiologist** **27**:277, 1984.
9. Liedtke CM. Fluorescent labeling of the luminal membrane of the tracheal epithelium. **Biophys. J.** **47**:13a, 1985.
10. Liedtke CM.  $\beta$ -adrenergic receptors in *in vitro* cultured rabbit tracheal epithelial cells. **Physiologist** **28**:292, 1985.
11. Welsh MJ, Liedtke CM. Chloride and potassium channels in cystic fibrosis (CF) airway epithelia. **Fed. Proc.** **45**:180, 1986.
12. Liedtke CM. Electroneutral ion uptake processes in rabbit and cystic fibrosis (CF) airway epithelium. **Fed. Proc.** **46**:1272, 1987.
13. McCann JD, Welsh MJ, Liedtke CM. Chloride channel currents in normal and cystic fibrosis airway epithelial cells. **Fed. Proc.** **46**:1272, 1987.
14. Liedtke CM. Sodium-chloride cotransport and its regulation in rabbit and cystic fibrosis airway epithelium. **Pediatr. Pulmonol., Suppl.** **1**:114, 1987.
15. Liedtke CM. NaCl cotransport in cystic fibrosis (CF) airway epithelial cells. **FASEB J.** **2**:A1725, 1988.
16. Li M, McCann JD, Liedtke CM, Nairn AC, Greengard P, Welsh MJ. cAMP-dependent protein kinase opens chloride channels in normal, but not cystic fibrosis airway epithelium. **FASEB J.** **2**:A1724, 1988.
17. Jacobberger JW, Hopfer U, Liedtke CM, Romero MF, Sladek TL. Characterization of cystic fibrosis airway epithelial cells immortalized by transduction of the S V 40 large T antigen gene. **Society for Analytical Cytology**, Sept., 1988.
18. Liedtke CM.  $\alpha$ -adrenergic and calcium modulation of NaCl cotransport in airway epithelial cells. **Pediatr. Pulmonol., Suppl.** **2**:10, 1988.
19. Liedtke CM.  $\alpha$ -adrenergic and calcium regulation of a NaCl cotransporter in airway epithelial cells. Third Annual Symposium of the Ohio Physiological Society, 1988.
20. Liedtke CM. Loop diuretic sensitive NaCl transport and its regulation in rabbit tracheal epithelial cells. **FASEB J.** **3**:A859, 1989.
21. Liedtke CM, Wascovich G. Protein kinase C modulation of airway epithelial NaCl(K) cotransport. **J. Gen. Physiol.** **94**:21a, 1989.
22. Liedtke CM. Calcium, inositol phosphates, and protein kinase C are linked to NaCl cotransport regulation in human airway epithelial cells. **Pediatr. Pulmonol. Suppl.** **4**:122, 1989.

23. Jacobberger JW, Hopfer U, Liedtke CM, Romero MF, Sladek TL. Immortalization of airway epithelial cells by transduction of wild-type and mutant SV-40 large T antigen gene. **Pediatr. Pulmonol. Suppl. 4**:126, 1989.
24. Welsh MJ, Li M, McCann JD, Clancy JP, Anderson MP, Nairn AC, Greengard P, Liedtke CM. Regulation of apical membrane chloride channels from normal and cystic fibrosis airway epithelium. **Pediatr. Pulmonol. Suppl. 4**:105-106, 1989.
25. Liedtke CM. Inositol phosphate signalling mechanism and NaCl(K) cotransport activation in airway epithelial cells (AEC). **Biophys. J. 57**:251a, 1990.
26. Liedtke CM, Wascovich G. Calcium dependent modulation of airway epithelium NaCl(K) cotransport by protein kinase C (PKC). **FASEB J. 4**:A727, 1990.
27. Liedtke CM, Wascovich G.  $\alpha_1$ -Adrenergic metabolism of inositol phosphates is more rapid in CF than in non-CF airway epithelial cells (AEC). **Pediatr. Pulmonol. Suppl. 5**:221, 1990.
28. Liedtke CM, Alpert SE. Ion transport properties and fatty acid (FA) profiles in cultured rabbit airway epithelial cells (AEC). **FASEB J. 5**:A1761, 1991.
29. Liedtke CM.  $\alpha$ -Adrenergic stimulated PI metabolism and NaCl(K) co-transport in airway epithelial cells. Lung Cell Biology Meeting, Woods Hole, MA., October, 1991.
30. Liedtke CM, Furin J, Ernsberger P. Clonidine (CLN) stimulates NaCl cotransport in rabbit tracheocytes through  $\alpha_2$ -adrenergic ( $\alpha_2$ -AR), but not a  $\alpha_1$ -AR or imidazole (I), receptors. **FASEB J. 6**:A1193, 1992.
31. Liedtke CM, P. Vanah. Alpha-adrenergic ( $\alpha$ -AR) mediated-biphasic diacylglycerol (DG) metabolism in airway epithelial cells. **J. Gen. Physiol. 100**:25a 1992.
32. Liedtke CM, Vanah P. Diacylglycerol (DAG) metabolism in airway epithelial cells (AEC) is linked to  $\alpha$ -adrenergic ( $\alpha$ -AR) activation. **Pediatr. Pulmonol., Suppl. 8**: 280, 1992.
33. Thomas L, Liedtke CM. Imidazol(in)e ( $I_1$ )-mediated regulation of sodium transport in rabbit tracheal epithelial cell monolayers. **FASEB J. 7**:A659, 1993.
34. Liedtke CM, Vanah P. Expression of protein kinase C (PKC) isoforms in tracheal and nasal epithelial cells by an immunological approach. **Pediatr. Pulmonol., Suppl. 9**:229, 1993.
35. Liedtke CM, Kester M. Differential generation of diglycerides in human airway epithelial cells. **J. Cellular Physiol. 15 (Suppl. 18D)**:35, 1994.
36. Liedtke CM, Ernsberger P. Regulation of electrolyte transport in rabbit tracheal epithelial cells (AEC) by  $I_1$ -imidazoline ( $I_1$ )-agonist moxonidine. II International Symposium on Imidazoline Receptors. New York, NY 1994.
37. Liedtke CM, Kester M.  $\alpha_1$ -Adrenergic-mediated generation of diglycerides in human airway epithelial cells. **FASEB J. 9**:A309, 1995.
38. Marshall WS, Bryson S.E., Liedtke CM, Gillis J. Neural modulation of chloride cell function:  $\alpha_2$ -adrenoreceptors modulate  $Cl^-$  secretion via  $Ca^{2+}$  and  $IP_3$ . **Soc. Exper. Biol.**, UK, meeting abstract.

39. Liedtke CM, Cole TS. Altered expression and differential  $\alpha_1$ -adrenergic (AR) activation of PKC $\delta$  and  $-\zeta$  in cystic fibrosis (CF) airway epithelial cells (AEC). **FASEB J.** **10**:A91, 1996.
40. Liedtke CM, Cole TS. Differential activation of PKC- $\delta$  and  $-\zeta$  by  $\alpha_1$ -adrenergic (AR) agonist in CF nasal polyp epithelial cells has implications for Na-Cl-K cotransport activation. **Pediatr. Pulmonol., Suppl 13**:241, 1996.
41. Liedtke CM, Cole TS.  $\alpha_1$ -Adrenergic activation of Na-Cl-K cotransport in human tracheal epithelial cells is suppressed by oligodeoxynucleotide to PKC $\delta$ . Poster presentation, Society of General Physiologists, Woods Hole, MA, Sept., 1997.
42. Liedtke CM, Cole TS. Antisense oligodeoxynucleotide to PKC $\delta$  downregulates PKC $\delta$  mass and activity and suppresses  $\alpha_1$ -adrenergic activation of Na-Cl-K cotransport in human tracheal epithelial cells. **Pediatr. Pulmonol., Suppl 14**:243, 1997.
43. Liedtke CM, Cole TS. Downregulation of PKC-epsilon regulates CFTR function in Calu-3 cells. **Pediatr. Pulmonol., Suppl 15**, 1998.
44. Liedtke CM, Cody DG. CFTR and NKCC mRNA levels are unaffected by treatment with antisense oligonucleotides (AS-OGN) to PKC- $\delta$  or PKC- $\epsilon$ . **FASEB J.** **13**:A71, 1999.
45. Baumgarten R, Liedtke CM, Valenti G, van Os CH, Deen PMT. Putative role of protein kinase C zeta in retrieval of aquaporin 2 from the apical membrane in vasopressin-treated stably-transfected MDCK cells. **J. Am. Soc. Nephrol**, **10**:12A, 1999.
46. Liedtke CM, Cole TS, Cody D. PKC- $\epsilon$ -dependent regulation of CFTR in Calu-3 cells. **Pediatr. Pulmonol., Suppl 19**:195, 1999.
47. Liedtke CM, Hornyak H, Cole TS. PKC- $\delta$  and basolateral Na-K-2Cl cotransport (NKCC1) are sensitive to intracellular Cl levels (Cl<sub>i</sub>) in Calu-3 cells. **FASEB J.** **14**:A335, 2000.
48. Liedtke CM, Hatala D, Papay R. Protein interaction between CFTR, RACK1 and PKC-epsilon. **FASEB J.** **15**:A848, 2001.
49. Liedtke CM, Moore R, Papay R. Protein-protein interactions between PKC- $\epsilon$ , CFTR, and RACK1 in a Calu-3 cell line. **Ped. Pulm, Suppl.** **22**:178, 2001.
50. Liedtke, CM, Chaudhuri S, Wang D. Functional interaction of NKCC1, actin and PKC- $\delta$  in Calu-3 cells. **FASEB J** **16**, 2002.
51. Liedtke CM, Raghuram V, Yun CHC, Wang X, Kyle N. Site specific interaction between RACK1 and NHERF1 in Calu-3 airway epithelial cells. **FASEB J** **17**:A1953, 2003.
52. Hausman BS, Liedtke CM. Na-K-2Cl cotransporter (NKCC1/SLC12A2)-binding proteins identified by yeast two-hybrid. **FASEB J** **18**:A 698, 2004.
53. Smallwood ND, Wang X, Hausman BS, Liedtke CM. Determination of binding site of actin on delta C2-like domain of protein kinase C (PKC) delta. **FASEB J** **18**:A321, 2004.

54. Liedtke CM, Smallwood ND, Wang X. Functional role of protein phosphatases in hormone stimulated Na-K-2Cl cotransport (NKCC1) activity in Calu-3 human airway epithelial cells. **FASEB J** 29:A1154, 2005.
55. Liedtke CM, Wang X. Binding of NHERF1 to scaffold protein RACK1 in airway epithelial cells involves the WD5 repeat of RACK1. **J Am Soc Nephrology**, 2005.
56. Liedtke CM, Wang X. The WD5 repeat of RACK1 binds the PDZ1-domain of NHERF1 in Calu-3 airway epithelial cells. **FASEB J** 30:A1440, 2006.
57. Liedtke CM, Auerbach M. Role for airway epithelial RACK1 in the apical expression of CFTR. **FASEB J** 31:A3147, 2007.
58. Liedtke CM, Smith L. PKC $\delta$  - SPAK (Ste20p-related proline alanine-rich kinase) interaction in the regulation of native human NKCC1. **FASEB J**, 22:936.4, 2008.
59. Xu Z; Smith L, Liu J; Misra S, Liedtke CM. Filamin-A modulates CFTR surface expression via Filamin-A Ig repeat 21 and interacts with the scaffold protein RACK1. **Pediatr. Pulmonol, Suppl.** 31:205, 2008.
60. Liedtke CM, Xu Z; Smith L, Kohli E, Misra S. Filamin-A modulates CFTR surface expression via Filamin-A Ig repeat 21 and interacts with the scaffold protein RACK1. **FASEB J.** 23:796.28, 2009.
61. Smith L, Littman P, Liedtke CM. Filamin-A interaction with the scaffold protein RACK1 affects plasma membrane expression of CFTR. Ohio Physiological Society, Columbus, OH, 2010.
62. Littman P, Smith L, Liedtke CM. Role of adaptor protein COMMD1 in functional regulation of Na-K-Cl cotransporter (NKCC1/SLC12A2). Ohio Physiological Society, Columbus, OH. 2010.
63. Littman P, Smith L, Liedtke CM. Functional regulation of epithelial NKCC1 by COMMD1. **FASEB J** 25:829.8. 2011.
64. Smith L, Littman P, Liedtke CM. PP2A interacts with a SPAK-PKC $\delta$ -actin protein complex at human NT-NKCC1 to regulate activity of NKCC1. **FASEB J** 25:833.4, 2011.

### **Scholarships and Training Grants**

- |           |  |
|-----------|--|
| 1962-1966 | General Motors Scholarship, Miami University   |
| 1966      | Kappa Kappa Gamma Scholarship, Miami University  |
| 1965      | National Science Foundation Undergraduate Research Grant in Chemistry,<br>Ohio State University              |
| 1974-1977 | Developmental Biology Training Grant, Case Western Reserve University  |
| 1977-1979 | National Research Service Award (Predoctoral), Case Western Reserve University                               |
| 1980-1981 | National Research Service Award (Pulmonary Fellowship),<br>Dept. Pediatrics, Case Western Reserve University |

**Other Material as Appropriate**

Local Activities

1991-1999 Career Day, Magnificat High School, Rocky River, OH  
2007- Judge, Research Day, Hathaway Brown High School

Commercialization of Intellectual Property

1998 Disclosure, Antisense oligonucleotide to protein kinase C-epsilon.  
2004 Disclosure, Frame shifted vector for yeast two hybrid system.

09.05.2013