

Christopher R. Cox, Ph.D.

CURRENT POSITION

2011-Present **Colorado School of Mines, Department of Chemistry**
Assistant Research Professor,
Director, Advanced Biodetection Technologies Laboratory

PERSONAL

Home Address: 708 Elm Circle, Golden, CO 80401

EDUCATION

1995-1999	University of Oklahoma	Norman, OK
B.S. Microbiology and Biochemistry		
2000-2002	University of Oklahoma Health Sciences Center	Oklahoma City, OK
M.S. Microbiology		
2002-2007	Harvard University/ University of Oklahoma HSC	Boston, MA
Ph.D. Microbiology		
2007-2011	Colorado School of Mines Department of Chemistry	Golden, CO
Postdoctoral Fellow		

RESEARCH PROGRAMS

Undergraduate Research Assistant, Microbiology, University of Oklahoma	1998-1999
Studied the effects of heat bleaching on carbon dioxide fixation in the unicellular algae <i>Euglena gracilis</i> . Advisor: Dr. William Ortiz	
Master's Program, Microbiology and Immunology, OUHSC	2000-2002
Studied multi-drug resistant <i>Enterococcus</i> biofilm formation on surgical sutures; designed and applied controlled-fluidics biofilm fermenter. Advisor: Dr. Michael S. Gilmore	
Doctorial Candidate, Schepens Eye Research Institute Harvard Medical School	2002-2006
Developed nucleic acid amplification-based bacterial identification systems for Molecular detection and <i>in vivo</i> visualization of gastrointestinal microflora. Adapted these techniques to study the influence of virulence factors expressed by the nosocomial pathogen <i>Enterococcus faecalis</i> on gastrointestinal colonization in health and disease. Advisor: Dr. Michael S. Gilmore	
Postdoctoral Fellow, Colorado School of Mines	2007-2011
Investigated the use of bacteriophages for bacterial detection by lateral flow immunochromatography and mass spectroscopy, as well as design and	

development of point-of-care devices for rapid detection of bacterial agents of bioterrorism. Advisor: Dr. Kent Voorhees

Assistant Research Professor, Colorado School of Mines 2011-Present
Assistant Director, Advanced Biodetection Technologies Laboratory

Projects include investigation of bacteriophage amplification and genomic/proteomic characterization, lateral flow Immunochromatography, MALDI-TOF MS, Raman spectroscopy, and novel metal oxide laser ionization-based systems for rapid detection, identification and antibiotic resistance determination of bacterial agents of bioterrorism and human disease, as well as the use of phages as decontamination and potential therapeutic agents.

TEACHING

Medical Microbiology, OUHSC College of Dentistry 2000-2001
Medical Microbiology, OUHSC College of Medicine 2001-2003

Biochemistry I CHGN428, Colorado School of Mines 2012
Department of Chemistry and Geochemistry

Biochemistry Field Session CHGN390, Colorado School of Mines 2011-Present
Department of Chemistry and Geochemistry

MEMBERSHIPS

Microbial Sciences Initiative, Harvard University
Microbiology Supergroup, University of Colorado, Boulder.
American Chemical Society
American Society for Microbiology

COMMITTEE AND PROFESSIONAL SERVICE

Student Liaison, Graduate Education Committee, 2002-2004
Oklahoma Center for Neuroscience, OUHSC
Colorado School of Mines Research Council Research Faculty Subcommittee 2012-Present
Colorado School of Mines Biosafety Committee 2014-Present

Peer Journal reviewer:

Editorial Board Member: Nature Scientific Reports 2016-Present
Journal of Analytical and Applied Pyrolysis 2014-Present
FEMS Microbiology 2011-Present
Bacteriophage 2010-Present

HONORS AND RECOGNITION

- Harrison Chance Scholar, University of Oklahoma 1998
- Leo S. and Virginia Kurly Cade Scholar, University of Oklahoma 1998-1999
- George L. Cross Endowed Scholar, University of Oklahoma, Department of Microbiology 1999
- R&D 100 Award 2010
- Colorado School of Mines Outstanding Professor Appreciation Night, Outstanding Professor Award 2012
- NIH Career Development Award, Rocky Mountain Regional Center of Excellence 2012-2014
- NIH Bio-Trac Career Development Training Award, Bethesda, MD 2013
- Association for Mass Spectrometry 2016 Young Investigator Award: Applications to the 2016

Clinical Laboratory. Palm Springs, CA.

- Bruker's Best Mass Spectrometry Research of 2015. European Society of Clinical Microbiology and Infectious Diseases, Amsterdam, Netherlands. 2016
Poster: "Bacterial Antibiotic Resistance Determination by Metal Oxide-Catalyzed MALDI MS Fatty Acid Profiling".
- Colorado School of Mines Inventor of the Year. 2016
- Association for Mass Spectrometry 2016 Young Investigator Award: Applications to the Clinical Laboratory. Salzburg, Austria. 2016

PUBLICATIONS

1. Saichek, N.R., Kim, S., **Cox, C.R.** and Voorhees, K.J. Strain-level Identification and Differentiation of *Staphylococcus* by Cerium oxide catalyzed MALDI-TOF MS. 2016. BMC Microbiol. 16:72.
2. **Cox, C.R.**,* Jensen, K.R., Saichek, N.R., and Voorhees, K.J. Strain-level Bacterial Identification and Differentiation by Fatty Acid-based Metal Oxide Laser Ionization Mass Spectrometry. 2015. Nature Sci. Reports. 5:10470.
3. **Cox, C.R.**,* Jensen, K.R., Mondesire, R.R. and Voorhees, K.J. Rapid detection of *Bacillus anthracis* by gamma phage amplification and lateral flow immunochromatography. 2015. J. Microbiol. Meth. 118:51-56.
4. Stambach, N.R., Carr, S.A., **Cox, C.R.** and Voorhees, K.J. Rapid Detection of *Listeria* by Bacteriophage Amplification and SERS-Enhanced Lateral Flow Immunochromatography. 2015. Viruses. 7(12):6631-6641.
5. Cody, R.B., McAlpin, **C.R.**, **Cox, C.R.**, Jensen, K.R. and Voorhees, K.J. Identification of Bacteria by Fatty Acid Profiling with Direct Analysis in Real Time Mass Spectrometry. 2015. Rapid. Commun. Mass Spectrom. 29(21):2007-2012.
6. Voorhees, K.J., Saichek, N.R., Jensen, K.R., Harrington, P.B., and **Cox, C.R.** Comparison of Metal Oxide Catalysts for Pyrolytic MALDI-TOF MS Bacterial Identification. 2014. J. Anal. Appl. Pyrol. DOI: 10.1016/j.jaap.2014.10.016.
7. **Cox, C.R.**,* Saichek, N., Schweizer, H.P. and Voorhees, K.J. Rapid *Burkholderia pseudomallei/mallei* Identification and Antibiotic Resistance Determination by Bacteriophage Amplification and MALDI-TOF MS. 2014. Bacteriophage. 4(3):e29011.
8. **Cox, C.R.*** and Voorhees, K.J. Detection of Chemical, Biological, Radiological and Nuclear Agents for the Prevention of Terrorism: Bacterial Identification by Mass Spectrometry. NATO Science for Peace and Security-Chemistry and Biology: Banoub, J.H. Ed. Springer Science and Business Media and IOS Press. 2014.
9. Kvitko, B., **Cox, C.R.**, DeShazer, D., and Schweizer, H. ϕ X126, P2-like bacteriophage of *Burkholderia pseudomallei* and *B. mallei* with broad strain infectivity. 2012. BMC Microbiology. 12:289-298.
10. **Cox, C.R.**, Rees, J.C., and Voorhees, K.J. Modeling Bacteriophage Amplification as a Predictive Tool for Optimized MALDI-TOF MS-based Bacterial Detection. 2012. J. Mass Spec. 47(11):1435-41.
11. **Cox, C.R.*** Bacteriophage-based methods of Bacterial Detection and Identification. In Bacteriophages in Health and Disease: Abedon, S. and Hyman, P. Eds. 2012. CABI press.
12. **Cox, C.R.**,* and Voorhees, K.J. Bacteriophage amplification-coupled detection and Identification of bacterial pathogens. In Detection of Biological Agents For the Prevention of Bioterrorism. NATO Science for Peace and Security-Chemistry and Biology: Banoub, J.H. Ed. Springer Science and Business Media and IOS Press. 2010.
13. Voorhees, K.J., McAlpin, C.R., and **Cox, C.R.** Lipid profiling using catalytic pyrolysis/metal oxide laser ionization-mass spectrometry. 2012. J. Anal. Appl. Pyrolysis. 98:201-206.

14. Voorhees, K.J., Jensen, K.R., McAlpin, C.R., Rees, J.C., Cody, R., Ubukata, M., and **Cox, C.R.** Modified MALDI MS Fatty Acid Profiling for Bacterial Identification. 2013. *J. Mass Spectrom.* 48(7):850-855.
15. McAlpin, **Cox, C.R.**, Matyi, S.A., and Voorhees, K.J. Enhanced matrix-assisted laser desorption/ionization time-of-flight mass spectrometric analysis of phage major capsid proteins with β -mercaptoethanol pretreatment. 2009. *Rapid Commun. Mass Spectrom.* 24(1):11-4.
16. **Cox, C.R.** and Gilmore, M.S. Native microbial colonization of *Drosophila melanogaster* and its use as a model of *Enterococcus faecalis* pathogenesis. *Infection and Immunity.* 2007. 75(4):1565-76.
17. **Cox, C.R.**, Coburn, P.S., and Gilmore, M.S. Enterococcal cytolysin: a novel two component peptide system that serves as a bacterial defense against eukaryotic and prokaryotic cells. *Curr Protein Pept Sci.* 2005. 6(1):77-84.

*Corresponding author

PRESENTATIONS AND INVITED SEMINARS (past 5 years)

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| 1. Association for Mass Spectrometry Applications to the Clinical Laboratory. Palm Springs, CA.
2016 Young Investigator Award: Oral Presentation: "Strain-level bacterial identification by CeO ₂ -catalyzed MALDI-TOF MS fatty acid analysis and comparison to commercial protein-based methods". | February 2016 |
| 2. Pacifichem 2015, Honolulu, HI
Oral presentation: "Strain-level Fungal ID by CeO ₂ -catalyzed MALDI-TOF MS Fatty Acid Profiling". | December 2015 |
| 3. Brigham Young University Department of Microbiology and Molecular Biology. Provo, UT.
Invited Speaker, Departmental Seminar: "Rapid Bacterial Identification and Antibiotic Resistance Determination by Next Generation Mass Spectrometry". | November 2015 |
| 4. Biomedical Advanced Research and Development Authority. Washington, D.C.
Oral presentation: "Bacteriophage and MALDI-based Technologies for Rapid Bacterial ID and Antibiotic Resistance Determination". | October 2015 |
| 5. ASM Interscience Conference on Antimicrobial Agents and Chemotherapy. San Diego, CA.
Poster: "Bacterial Antibiotic Resistance Determination by Metal Oxide-Catalyzed MALDI-TOF MS Fatty Acid Profiling". | September 2015 |
| 6. 21 st Evergreen International Phage Meeting. Olympia, WA
Poster presentation: "Rapid detection of <i>Listeria monocytogenes</i> by phage amplification and SERS Lateral Flow Immunochromatography. | August 2015 |
| 7. Biomereix Colorado School of Mines, Golden, CO.
Oral presentation: "Bacterial Identification by Mass Spectrometry." | July 2015 |
| 8. Colorado Office of Economic Development Advanced Industries, Denver, CO
Oral Presentation: "Next generation clinical diagnostics: Simultaneous bacterial ID and antibiotic resistance determination". | April 2015 |
| 9. Bruker Daltonics, Colorado School of Mines, Golden, CO.
Oral Presentations: "Novel Technologies for Bacterial Identification and Antibiotic Resistance Determination by Mass Spectrometry." | November 2014 |
| 10. ASM Interscience Conference on Antimicrobial Agents and | September 2014 |

- Chemotherapy. Washington, D.C.
Poster: "Strain-level Bacterial ID by CeO₂-catalyzed MALDI-TOF MS Lipid Profiling and Comparison to Protein-based Methods".
11. SimulTOF Systems, Sudbury, MA. May 2014
Oral Presentation: "Bacterial Identification by Mass Spectrometry".
 12. NIH RMRCE Annual Meeting. San Diego, CA. October 2013
Oral presentation: "Translational Technologies for Rapid *Burkholderia* Identification and Drug Resistance Determination".
 13. 20th Evergreen International Phage Meeting. Olympia, WA. August 2013
Oral Presentation: "Bacteriophage amplification for rapid *Burkholderia* ID and drug resistance determination."
 14. NATO Conference on Science for Peace and Security: Detection of Chemical, Biological, Radiological and Nuclear Agents for Prevention of Terrorism. Siena, Italy. May 2013
Invited Speaker: "Bacteriophage-based Methods of Bacterial Detection and Identification".
 15. ASM General Meeting. Denver, CO. May 2013
Poster presentation: "Bacteriophage amplification and MALDI-TOF-MS as a means of rapid *Burkholderia pseudomallei* diagnostic identification and antibiotic resistance determination".
 16. NIH RCE National Meeting. Seattle, WA. April 2013
Invited Speaker: "Translational Technologies for Rapid *Burkholderia* identification and drug resistance determination".
 17. NIH RMRCE Annual Meeting. Missoula, MT. October 2012
Invited Speaker: "Bacteriophage-based Bacterial Detection and Identification of *Burkholderia pseudomallei*".
 18. ASM Interscience Conference on Antimicrobial Agents and Chemotherapy. San Francisco, CA. September 2012
Poster: "Species-Specific Bacteriophage Amplification for Enhanced MALDI-TOF MS Bacterial Diagnostics".
 19. Brigham Young University Department of Microbiology and Molecular Biology. Provo, UT. April 2012
Invited Speaker, Departmental Seminar: "Bacteriophage-based Bacterial Detection and Identification".
 20. Defense Threat Reduction Agency, Chemical and Biological Defense Science and Technology Conference. Las Vegas, NV. November 2011
Oral presentation: "Rapid bacterial detection, identification, and antibiotic resistance determination using phage amplification coupled to novel capillary flow and SERS".
 21. 19th Evergreen International Phage Biology Meeting, Olympia, WA August 2011
Poster: "Complete Genomic Characterization of Bacteriophage Y, a T7-related *Yersinia pestis* Phage".

CURRENT AND RECENTLY AWARDED FUNDING

1. **Cox, C.R.** and Voorhees, K.J. 2015-2016. "Pre-commercial proof-of-concept for phage-based MALDI-TOF MS bacterial ID and antibiotic resistance determination". Colorado Office of Economic Development Advanced Industries Accelerator. \$150,000.
2. **Cox, C.R.** and Voorhees, K.J. 2014-2016. "Pre-commercial proof-of-concept and validation of rapid *Listeria* detection and screening technology" Colorado Bioscience Discovery Evaluation Grant Program, \$150,000.

3. **Cox, C.R.** and Voorhees, K.J. "Proof-of-Concept for Lateral Flow Capillary Concentration-based Detection of Serum Cancer Biomarkers". 2013-2015. \$35,000.

PREVIOUS FUNDING

1. **Cox, C.R.** "Rapid *Burkholderia pseudomallei* identification and drug resistance determination". 2012-2014. NIH Career Development Award. Rocky Mountain Regional Center of Excellence. \$388,714.
2. **Cox, C.R.** and Voorhees, K.J. "Rapid detection of *Listeria* using Bacteriophage Amplification and Enhanced Lateral Flow Immunoassays" 2011-2013. Colorado Bioscience Discovery Evaluation Grant Program, \$100,776.
3. Voorhees, K.J., Williams, K., Herring, A., Posewitz, M., Spear, J. 2012. NSF MRI:Acquisition of a High Resolution Tandem MALDI Mass Spectrometer. \$295,000.
4. Voorhees, K.J. and **Cox, C.R.** 2008-2012."Development of Rapid Biodetection Methods" DTRA W81XWH-07-C-0061, \$880,000.
5. **Cox, C.R.** and Voorhees, K.J. 2012. "Novel Lateral Flow Capillary Concentration for Bacterial Detection and Identification". Colorado School of Mines Proof-of-Concept Fund, \$35,000.
6. **Cox, C.R.** and Voorhees, K.J. 2012. "Rapid detection of *Listeria* using bacteriophage amplification and enhanced lateral flow immunoassays". \$100,776.
7. Cox, C.R. and Gilmore, M.S. "*Drosophila* model of antibiotic resistant infection" NIH R21 1RR020596-01A1, \$539,000 (Harvard). 2005-2007.

PENDING FUNDING

1. **Cox, C.R.** and Voorhees, K.J. "Investigation of Metal Oxide Nanoparticle-based systems and Mass Spectrometry for rapid bacterial Identification and Differentiation". 2016. NIH General Medical Sciences Instrument Development for Biomedical Applications R01. \$3,018,876.

PATENTS

1. **Cox, C.R.**, Mondesire, R.R., and Voorhees, K.J. "Detection of Magnetic-Field-Concentrated Analytes in a Lateral Flow Capillary". 2012. U.S. Patent # 61/420,411.
2. Voorhees, K.J., **Cox, C.R.**, and Saichek, N.R. 2014. "Stable Metal Oxide Catalysts for Pyrolytic Matrix-assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry". U.S. Patent # 61985919.
3. Voorhees, K.J. and **Cox, C.R.** 2015. "Detection of Phage Amplification By SERS Nanoparticles". U.S. Patent # 12/351,522.

REFERENCES

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