

# Christopher R. Cox, Ph.D.

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Personal research website: [www.advancedbiodetection.com](http://www.advancedbiodetection.com)

## CURRENT POSITION

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

**2017-Present**                      Director, Colorado School of Mines Mass Spectrometry Laboratory

## PERSONAL

Home Address: 708 Elm Circle, Golden, CO 80401

## EDUCATION

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

## RESEARCH PROGRAMS

<b>Undergraduate Research Assistant, Microbiology, University of Oklahoma</b>	1998-1999
Studied the effects of heat bleaching on carbon dioxide fixation in the unicellular algae <i>Euglena gracilis</i> . Advisor: Dr. William Ortiz	
<b>Master's Program, Microbiology and Immunology, OUHSC</b>	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	
<b>Doctorial Candidate, Schepens Eye Research Institute</b>	2002-2006
<b>Harvard Medical School</b>	
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

## 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, OUHSC 2002-2004  
Colorado School of Mines Research Council Research Faculty Subcommittee 2012-Present  
Colorado School of Mines Biosafety Committee 2014-Present  
Colorado School of Mines Research Task Force 2017-Present  
MSACL Scientific Review Board of Directors 2017-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 Clinical Laboratory. Palm Springs, CA. 2016
- 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. Stambach, N.R., **Cox, C.R.**, and Voorhees, K.J. Rapid Detection of *Yersinia pestis* by Bacteriophage Amplification and SERS Lateral Flow Immunochromatography. 2017. J. Med. Microbiol. Submitted.
2. Stambach, N.R., **Cox, C.R.**, and Voorhees, K.J. Detection of *Listeria monocytogenes* in contaminated food by bacteriophage amplification and surface enhanced Raman spectroscopy. 2017. Internat. J. Food Microbiology. Submitted.
3. Saichek, N.R., **Cox, C.R.** and Voorhees, K.J. Simultaneous identification and antimicrobial resistance determination of pathogenic enterococci by phage-based MALDI-TOF MS. 2017. Appl. Environ. Microbiol. In preparation.
4. Stambach, N.R., **Cox, C.R.**, and Voorhees, K.J. Bacteriophage Amplification as a Bacterial Detection Method. 2016. Microbiol. and Mol. Biol. Rev. In preparation.
5. 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.
6. **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.
7. **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.
8. 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.
9. 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.
10. 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.
11. **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.
12. **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.

13. Kvitko, B., **Cox, C.R.**, DeShazer, D., and Schweizer, H.  $\phi$ X126, P2-like bacteriophage of *Burkholderia pseudomallei* and *B. mallei* with broad strain infectivity. 2012. BMC Microbiology. 12:289-298.
14. **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.
15. **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.
16. **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.
17. 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.
18. 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.
19. 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  $\beta$ -mercaptoethanol pretreatment. 2009. Rapid Commun. Mass Spectrom. 24(1):11-4.
20. **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.
21. **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)

1. Association for Mass Spectrometry Applications to the Clinical Laboratory. January 2017  
Palm Springs, CA. 2017 Young Investigator Award: Oral Presentation:  
"Strain-level ID by CeO<sub>2</sub>-catalyzed MOLI MS Fatty Acid Profiling".
2. Association for Mass Spectrometry Applications to the Clinical Laboratory. September 2016  
Salzburg, Austria. 2016 Young Investigator Award: Oral Presentation:  
"Bacterial ID and Antibiotic Resistance Determination by MOLI MS".
3. Association for Mass Spectrometry Applications to the Clinical Laboratory. February 2016  
Palm Springs, CA. 2016 Young Investigator Award: Oral Presentation:  
"Strain-level bacterial identification by CeO<sub>2</sub>-catalyzed MALDI-TOF MS fatty acid analysis and comparison to commercial protein-based methods".
4. Pacifichem 2015, Honolulu, HI December 2015  
Oral presentation: "Strain-level Fungal ID by CeO<sub>2</sub>-catalyzed MALDI-TOF MS Fatty Acid Profiling".
5. Brigham Young University Department of Microbiology and Molecular Biology. Provo, UT. November 2015  
Invited Speaker, Departmental Seminar: "Rapid Bacterial Identification and Antibiotic Resistance Determination by Next Generation Mass Spectrometry".

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|---|----------------|
| 6. Biomedical Advanced Research and Development Authority. Washington, D.C.<br>Oral presentation: "Bacteriophage and MALDI-based Technologies for Rapid Bacterial ID and Antibiotic Resistance Determination".  | October 2015   |
| 7. ASM Interscience Conference on Antimicrobial Agents and Chemotherapy. San Diego, CA.<br>Poster: "Bacterial Antibiotic Resistance Determination by Metal Oxide-Catalyzed MALDI-TOF MS Fatty Acid Profiling".  | September 2015 |
| 8. 21 <sup>st</sup> Evergreen International Phage Meeting. Olympia, WA<br>Poster presentation: "Rapid detection of <i>Listeria monocytogenes</i> by phage amplification and SERS Lateral Flow Immunochromatography.   | August 2015    |
| 9. Biomereix Colorado School of Mines, Golden, CO.<br>Oral presentation: "Bacterial Identification by Mass Spectrometry."   | July 2015      |
| 10. Colorado Office of Economic Development Advanced Industries, Denver, CO<br>Oral Presentation: "Next generation clinical diagnostics: Simultaneous bacterial ID and antibiotic resistance determination".  | April 2015     |
| 11. Bruker Daltonics, Colorado School of Mines, Golden, CO.<br>Oral Presentations: "Novel Technologies for Bacterial Identification and Antibiotic Resistance Determination by Mass Spectrometry."  | November 2014  |
| 12. ASM Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, D.C.<br>Poster: "Strain-level Bacterial ID by CeO <sub>2</sub> -catalyzed MALDI-TOF MS Lipid Profiling and Comparison to Protein-based Methods".                            | September 2014 |
| 13. SimulTOF Systems, Sudbury, MA.<br>Oral Presentation: "Bacterial Identification by Mass Spectrometry".   | May 2014       |
| 14. NIH RMRCE Annual Meeting. San Diego, CA.<br>Oral presentation: "Translational Technologies for Rapid <i>Burkholderia</i> Identification and Drug Resistance Determination".   | October 2013   |
| 15. 20 <sup>th</sup> Evergreen International Phage Meeting. Olympia, WA.<br>Oral Presentation: "Bacteriophage amplification for rapid <i>Burkholderia</i> ID and drug resistance determination."  | August 2013    |
| 16. NATO Conference on Science for Peace and Security: Detection of Chemical, Biological, Radiological and Nuclear Agents for Prevention of Terrorism. Siena, Italy.<br>Invited Speaker: "Bacteriophage-based Methods of Bacterial Detection and Identification". | May 2013       |
| 17. ASM General Meeting. Denver, CO.<br>Poster presentation: "Bacteriophage amplification and MALDI-TOF-MS as a means of rapid <i>Burkholderia pseudomallei</i> diagnostic identification and antibiotic resistance determination".                               | May 2013       |
| 18. NIH RCE National Meeting. Seattle, WA.<br>Invited Speaker: "Translational Technologies for Rapid <i>Burkholderia</i> identification and drug resistance determination".   | April 2013     |
| 19. NIH RMRCE Annual Meeting. Missoula, MT.<br>Invited Speaker: "Bacteriophage-based Bacterial Detection and Identification of <i>Burkholderia pseudomallei</i> ".  | October 2012   |

## 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”. Colorado School of Mines Foundation. 2013-2015. \$40,000.
4. Cox, C.R. “A *Drosophila* model to optimize bacteriophage-based diagnostic technologies for the marketplace.” 2017. Colorado School of Mines Foundation. \$41,000.

## 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.
2. **Cox, C.R.** “Development of a Non-mammalian GI tract Model for Study of Bacteriophage Therapy on the Native Microbiome”. 2016. NIH NIAID R15. \$407,684.
3. **Cox, C.R.** and Voorhees, K.J. 2016. “Bacteriophage Amplification and Novel Lateral Flow Capillary Concentration for Rapid, Simultaneous *Acinetobacter baumannii* Identification and Drug Resistance Determination”. 2016. NIH NIAID R15. \$417,095.
4. **Cox, C.R.** “A *Drosophila* GI tract model of phage therapy directed against antibiotic resistant infection”. 2017. Keck Foundation. \$1,217,506

## 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. 2005-2007.

## 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

Michael S. Gilmore, Ph.D.  
Professor, Department of Ophthalmology  
Massachusetts Eye and Ear Infirmary  
Harvard Medical School  
243 Charles Street  
Boston, MA 02114  
Phone: 617-573-3845  
Email: [Michael\\_gilmore@meei.harvard.edu](mailto:Michael_gilmore@meei.harvard.edu)

Stephen T. Abedon, Ph.D.  
Associate Professor, Department of Microbiology  
The Ohio State University  
297 Bromfield  
1680 University Drive  
Mansfield, OH 44906  
Phone: 419-755-4343  
Email: [abedon1@osu.edu](mailto:abedon1@osu.edu)

Kent J. Voorhees, Ph.D.  
Professor, Department of Chemistry  
Colorado School of Mines  
1012 14<sup>th</sup> Street  
Coolbaugh Hall Room 121  
Golden, CO 80401  
Phone: 303-273-3616  
Email: [kvoorhee@mines.edu](mailto:kvoorhee@mines.edu)

Herbert P. Schweizer, Ph.D.  
Professor  
Department of Molecular Genetics and Microbiology  
Emerging Pathogens Institute  
University of Florida  
2055 Mowry Road  
Gainesville, FL 32610  
Phone: 352-273-9402  
Email: [hschweizer@ufl.edu](mailto:hschweizer@ufl.edu)

Matthew C. Posewitz, Ph.D.  
Associate Professor, Department of Chemistry  
Colorado School of Mines  
1012 14<sup>th</sup> St.  
Golden, CO 80401  
Phone: 303-384-2425  
Email: [mposewit@mines.edu](mailto:mposewit@mines.edu)

John Spear, Ph.D.  
Professor, Department of Environmental Science and  
Engineering  
Associate Vice President for Research  
Colorado School of Mines  
1012 14<sup>th</sup> Street  
Coolbaugh Hall Room 252  
Golden, CO 80401  
Phone: 303-273-3497  
Email: [jspear@mines.edu](mailto:jspear@mines.edu)