BIOGRAPHICAL SKETCH

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NAME: Goller, Carlos

eRA COMMONS USER NAME (credential, e.g., agency login): cgoller

POSITION TITLE: Teaching Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Worcester Polytechnic Institute, Worcester, MA	BS	05/2002	Biology and Biotechnology
Emory University, Atlanta, GA	PHD	09/2008	Microbiology and Molecular Genetics
North Carolina State University, Durham, NC	Postdoctoral Fellow	07/2012	Microbial pathogenesis and high-throughput drug discovery
North Carolina State University, Raleigh, North Carolina	Postdoctoral Fellow	07/2015	Metagenomics and molecular biology education

A. Personal Statement

The complex microbial communities formed in nature and environments around us ("the built environment") can now be dissected using molecular biology tools to understand their behavior, persistence, and, when necessary, eradication. The genetic regulation of biofilm formation was the focus of my graduate work and provided training in bacterial genetics, public health, and microbiology. As a postdoctoral research fellow at Duke University, I explored microbial communities of clinical importance. I used high-throughput screens to discover novel anti-infectives of therapeutic use or useful as 'probes' to learn about the biology of microorganisms. My dissertation and postdoctoral research training prepared me to conduct research in the laboratory, and teaching allowed me to learn the underlying concepts and explain them more effectively to others. My passion for research and teaching has driven me to seek opportunities that combine and share these experiences with students and educators.

I obtained training as a teaching assistant at Emory University and learned from experts in case-based and team-based learning (TBL). I participated in the Preparing Future Faculty (PFF) program at Duke University and learned about Universal Design for Learning (UDL). After completing a postdoctoral research fellowship, I obtained experience as an instructor of record by joining the North Carolina State Biotechnology Program (BIT) as a teaching postdoc. I obtained experience in the classroom and learned how to design a lab-based module to teach participants about metagenomic approaches. Since then, I have helped develop several additional modules (Yeast Metabolic Engineering, Metabolic Modeling of Microbial Communities, High-throughput Discovery, and now Portable Genome Sequencing) and a 200-level Biotechnology & Sustainability semester-long research-based course. As faculty in the BIT Program, I have mentored postdoctoral fellows in developing lab-based courses, including Protein Interactions, Organoids, Comparative Transcriptomics, and Assay Development modules. I have updated a 200-level course with a significant Responsible Conduct in Research (RCR) component (Sjogren et al. 2023). My experience with high-throughput discovery, bioinformatics training, case study-based education, and discipline-based education research has prepared me to contribute to educational initiatives.

I have supported over two dozen graduate student teaching assistants since 2015 and five postdoctoral teaching scholars focusing on molecular biotechnology education. Working with the RIOS, RLOE, NSF RCN HITS, and NSF ASK BIO networks, I have facilitated faculty learning communities to engage and train >120 educators from >50 institutions on the development of case studies, open education, and better

multiple-choice questions. With support from the NC State digital education team (DELTA), we have developed two Quality Matters (QM) certified molecular biology courses. With collaborators at the Allen Institute and the PALM Vision & Change team, we have launched two national educator assessment efforts as part funded by the NSF. With NIH IPERT funding, our network of molecular biotechnology education reform has reached five new partners representing a broad range of institutions.

I have successfully worked with groups in the BIT Program, QUBES/BioQUEST community, and PALM Network to design educational activities to engage students with genomics and determine core bioinformatics competencies in this field. I have worked on updating and assessing courses that aim to train students in Responsible Conduct in Research. Importantly, I am passionate and excited by the opportunity to create new molecular biotechnology laboratory education modules (MBLEMs) and establish a framework to share and implement these at a diverse array of institutions.

1. Prunuske AJ, Evans-Anderson HJ, Furniss KL, Goller CC, Mirowsky JE, Moore ME, Raut SA, Swamy U, Wick S, Wolyniak MJ. Using personas and the ADKAR framework to evaluate a network designed to facilitate sustained change toward active learning in the undergraduate classroom. Discov Educ. 2022;1(1):22. PubMed Central PMCID: PMC9793354.
2. Chen SH. Learning lab skills online: Lessons from implementing video-based instruction for a remote biotechnology lab. Biochem Mol Biol Educ. 2022 Nov;50(6):633-640. PubMed Central PMCID: PMC10557494.
3. Dow E, Wood-Charlson E, Biller S, Paustian T, Schirmer A, Sheik C, Whitham J, Krebs R, Goller C, Allen B, Crockett Z, Arkin A. Bioinformatic Teaching Resources – For Educators, by Educators – Using KBase, a Free, User-Friendly, Open Source Platform. Frontiers in Education. 2021 October 29; 6:-. Available from: https://www.frontiersin.org/articles/10.3389/feduc.2021.711535/full DOI: 10.3389/feduc.2021.711535
4. Goller CC, Srougi MC, Chen SH, Schenkman LR, Kelly RM. Integrating Bioinformatics Tools Into Inquiry-Based Molecular Biology Laboratory Education Modules. Front Educ (Lausanne). 2021 Jul;6 PubMed Central PMCID: PMC8758113.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2024 -	Teaching Professor, North Carolina State University, Department of Biological Sciences, Biotechnology Program (BIT), Raleigh, NC
2020 - 2024	Associate Teaching Professor, North Carolina State University, Department of Biological Sciences, Biotechnology Program (BIT), Raleigh, NC
2015 - 2020	Assistant Teaching Professor, North Carolina State University, Department of Biological Sciences, Biotechnology Program (BIT), Raleigh, NC

Honors

2021 - 2022	NSF RCN-UBE Ethics Network for Course-based Opportunities in Undergraduate Research (ENCOUR) Fellowship, NSF ENCOUR
2023	Outstanding Teaching Award, NC State University, Office of Faculty Excellence
2023	ASMCUE Poster Review Chairperson, American Society for Microbiology (ASM)
2022	Michael Dickey Outstanding Research Mentor Award, North Carolina State University Office of Undergraduate Research
2022	Impact Scholar, NC State University, Office of Outreach and Engagement
2021	NC State Student Government Open Education Faculty award, North Carolina State University
2020	NC State University Libraries Faculty Fellow, North Carolina State University

C. Contribution to Science

1. **Developing evidence-based molecular biology educational tools to train students to perform experiments and analyze data.** I have designed and helped design lab modules to teach undergraduate and graduate students fundamental molecular biology techniques. Class activities include novel case studies and lessons to teach students about the applications of metagenomics and microbiome data analysis. These activities have been published in peer-reviewed educational journals, contributed to the NIBLSE Core Competencies for Bioinformatics, and are vertically integrated into diverse curricula.

    a. Harris FR, Sikes ML, Bergman M, Goller CC, Hasley AO, Sjogren CA, Ramirez MV, Gordy CL. Hands-on immunology: Engaging learners of all ages through tactile teaching tools. Front Microbiol. 2022;13:966282. PubMed Central PMCID: PMC9453673.
    b. Goller CC, Johnson GT, Casimo K. Does Organelle Shape Matter?: Exploring Patterns in Cell Shape and Structure with High-Throughput (HT) Imaging. CourseSource. 2022;9 PubMed Central PMCID: PMC9385133.
    c. Goller CC, Srougi MC, Chen SH, Schenkman LR, Kelly RM. Integrating Bioinformatics Tools Into Inquiry-Based Molecular Biology Laboratory Education Modules. Front Educ (Lausanne). 2021 Jul;6 PubMed Central PMCID: PMC8758113.
    d. Gordy CL, Goller CC. Using Metabolic Engineering to Connect Molecular Biology Techniques to Societal Challenges. Front Microbiol. 2020;11:577004. PubMed Central PMCID: PMC7701299.

2. **Supporting educator development and improvement of mentoring networks.** I have worked with educators as part of national initiatives, including QUBES/BioQUEST, RIOS, KBase Educators Org, NSF RCN-UBE ASK BIO, the PALM Network, and RLOE.org to learn from and help educators improve the implementation of high-impact practices.

    a. Dow E, Wood-Charlson E, Biller S, Paustian T, Schirmer A, Sheik C, Whitham J, Krebs R, Goller C, Allen B, Crockett Z, Arkin A. Bioinformatic Teaching Resources – For Educators, by Educators – Using KBase, a Free, User-Friendly, Open Source Platform. Frontiers in Education. 2021 October 29; 6:-. Available from: https://www.frontiersin.org/articles/10.3389/feduc.2021.711535/full DOI: 10.3389/feduc.2021.711535
    b. Bixler A, Eslinger M, Kleinschmit AJ, Gaudier-Diaz MM, Sankar U, Marsteller P, Goller CC, Robertson S. Three Steps to Adapt Case Studies for Synchronous and Asynchronous Online Learning. J Microbiol Biol Educ. 2021;22(1) PubMed Central PMCID: PMC8012036.
    c. Moore ME, Naganathan A, Blumer SL, Goller CC, Misra A, Raut SA, Swamy U, Wick S, Wolyniak MJ. Facilitating Long-Term Mentoring To Effectively Implement Active Learning Instruction: Formation of the Promoting Active Learning and Mentoring (PALM) Network. J Microbiol Biol Educ. 2020;21(3) PubMed Central PMCID: PMC7669288.
    d. Chen SH, Goller CC. Shifting Faculty Approaches to Pedagogy through Structured Teaching Postdoc Experiences. J Microbiol Biol Educ. 2019;20(2) PubMed Central PMCID: PMC6713478.

3. **Developing educational case studies incorporating high-throughput approaches and data management skills.** We developed an NSF-funded RCN network to develop, implement, and assess case studies for undergraduate courses that bring high-throughput approaches to the classroom and lab. We have partnered with companies and institutes developing technologies and created resources that encourage instructors to bring cutting-edge technologies and critical data analysis skills to various courses and institutions.

    a. Bixler A, Eslinger M, Kleinschmit AJ, Gaudier-Diaz MM, Sankar U, Marsteller P, Goller CC, Robertson S. Three Steps to Adapt Case Studies for Synchronous and Asynchronous Online

Learning. J Microbiol Biol Educ. 2021;22(1) PubMed Central PMCID: PMC8012036.

b. Samsa LA, Goller CC. Divide and Conquer: A Simple, Modern Technique for Collaborative Small Group Learning with Reciprocal Peer Teaching. J Microbiol Biol Educ. 2021;22(1) PubMed Central PMCID: PMC7976733.

c. Samsa L, Eslinger M, Kleinschmit A, Solem A, Goller C. Single Cell Insights Into Cancer Transcriptomes: A Five-Part Single-Cell RNAseq Case Study Lesson. CourseSource. 2021; 8:-. Available from: https://qubeshub.org/community/groups/coursesource/publications?id=2753&v=1 DOI: 10.24918/cs.2021.26

d. Samsa L, Andersen L, Groth A, Goller C. A CRISPR/Cas guide RNA design in silico activity. CourseSource. 2020; 7:-. Available from: https://qubeshub.org/community/groups/coursesource/publications?id=2701&v=1 DOI: 10.24918/cs.2020.46

4. **Promoting Responsible Conduct in Research and Bioethics Education.** We redesigned an upper-level undergraduate and graduate bioethics course to include evidence-based pedagogical practices and communication of bioethical dilemmas to the public. Our approach uses a framework of concept mapping and reflective writing to engage students in a deeper analysis of bioethical issues.

a. Chen SH. Learning lab skills online: Lessons from implementing video-based instruction for a remote biotechnology lab. Biochem Mol Biol Educ. 2022 Nov;50(6):633-640. PubMed Central PMCID: PMC10557494.

b. Resnik DB, Smith EM, Chen SH, Goller C. What is Recklessness in Scientific Research? The Frank Sauer Case. Account Res. 2017;24(8):497-502. PubMed Central PMCID: PMC6141194.

c. Sjogren CA, Comstock G, Goller CC. Connecting Ethical Reasoning to Global Challenges through Analysis of Argumentation. J Microbiol Biol Educ. 2023 Apr;24(1) PubMed Central PMCID: PMC10117146.

d. Goller CC. A modern twist on the beaumont and st. Martin case: encouraging analysis and discussion in the bioethics classroom with reflective writing and concept mapping. J Microbiol Biol Educ. 2014 Dec;15(2):229-31. PubMed Central PMCID: PMC4278484.

5. **Exploring high-throughput discovery for novel antimicrobial and anti-biofilm compounds.** My research builds on the classical genetics training obtained as a graduate student and my interest in high-throughput and sequencing-based technologies. Small-molecule libraries allow researchers to investigate how microorganisms respond to chemical treatment. These chemical 'probes' can provide important information about their mechanism of action and the biology of organisms. We currently use this approach to study the phenotypic and genetic responses of *Delftia acidovorans* to novel anti-infectives.

a. Riley NG, Goller CC, Leggett ZH, Lewis DM, Ciccone K, Dunn RR. Catalyzing rapid discovery of gold-precipitating bacterial lineages with university students. PeerJ. 2020;8:e8925. PubMed Central PMCID: PMC7164421.

b. Zambrano MC, Pawlak JJ, Daystar J, Ankeny M, Goller CC, Venditti RA. Aerobic biodegradation in freshwater and marine environments of textile microfibers generated in clothes laundering: Effects of cellulose and polyester-based microfibers on the microbiome. Mar Pollut Bull. 2020 Feb;151:110826. PubMed PMID: 32056618.

c. Goller CC, Arshad M, Noah JW, Ananthan S, Evans CW, Nebane NM, Rasmussen L, Sosa M, Tower NA, White EL, Neuenswander B, Porubsky P, Maki BE, Rogers SA, Schoenen F, Seed PC. Lifting the mask: identification of new small molecule inhibitors of uropathogenic Escherichia coli group 2 capsule biogenesis. PLoS One. 2014;9(7):e96054. PubMed Central PMCID: PMC4077706.

d. Goller CC, Seed PC. High-throughput identification of chemical inhibitors of E. coli Group 2

capsule biogenesis as anti-virulence agents. PLoS One. 2010 Jul 19;5(7):e11642. PubMed Central PMCID: PMC2906519.