CURRICULUM VITAE – Dr. Chase L. Beisel

911 Partners Way, Rm 2026
Raleigh, NC 27695-7905

Email: cbeisel@ncsu.edu
Webpage: http://beisel.wordpress.ncsu.edu

EDUCATION

2009 – 2011 IRTA postdoctoral fellowship, National Institutes of Health (Bethesda, MD)
Section on Environmental Gene Regulation, NICHD

2009 PhD, Chemical Engineering, California Institute of Technology (Pasadena, CA)
Minor: Biology

2004 BS, Chemical Engineering, Iowa State University (Ames, IA)
Minors: Mathematics, Biochemistry

PROFESSIONAL EXPERIENCE

2015 – **Locus Biosciences** (Raleigh, NC)
Co-founder, Member of Scientific Advisory Board

2011 – **North Carolina State University** (Raleigh, NC)
Assistant Professor, Department of Chemical & Biomolecular Engineering
Faculty member, Microbiology Graduate Program

2009 – 2011 **National Institutes of Health** (Bethesda, MD)
IRTA Postdoctoral fellow, NICHD
Postdoctoral advisor: Dr. Gisela Storz

2004 – 2009 **California Institute of Technology** (Pasadena, CA)
Graduate research assistant, Department of Chemical Engineering
Graduate advisor: Prof. Christina Smolke

2002 **Abbott Laboratories** (North Chicago, IL)
Summer intern, validation engineering

AWARDS, HONORS, AND FELLOWSHIPS

2017 Camille Dreyfus Teacher-Scholar Award
2016 NIH Maximizing Investigators' Research Award for New and Early Stage Investigators
2016 Bay Area Lyme Foundation Emerging Leader Award
2016 Sigma Xi Faculty Research Award
2015 2015-16 North Carolina State University Faculty Scholar
2015 NSF CAREER Award
2014 Covenant Companion '40 under 40'
2012 NCSU Faculty Research and Professional Development Award
2010 – 2011 Gordon and Betty Moore Foundation Fellow, Life Sciences Research Foundation
2010 NIH Fellows Award for Research Excellence
2009 National Research Council Research Associateship (declined)
2008 International Genetically Engineered Machines Competition
Caltech team co-mentor, 3rd place out of 84 teams
2008 Biobricks Foundation Synthetic Biology 4.0 Travel Award
2007 Lake Avenue Community Foundation STARS tutor of the year
2006 Constantin G. Economou Memorial Prize, California Institute of Technology

2006 Synthetic Biology 2.0 'Best Part' Award
2005 – 2008 National Defense Science and Engineering Graduate Fellowship
2005 – 2009 National Science Foundation Graduate Research Fellowship
2004 Jeremy Harden Memorial Drumline Leadership Award
2000 – 2004 Iowa State University Full Ride Scholarship
2000 National Merit Finalist

MANUSCRIPTS IN PREPARATION (to be submitted in the next three months)

1. Fagen JR, Singh AK, Maxwell C, Bright CP, Gomaa AA, **Beisel CL**. Exploiting the broad-host P1 bacteriophage for programmable-spectrum CRISPR antimicrobials.
2. Liao C, Denny SR, Ttofali F, Slotkowski RA, Leenay RT, **Beisel CL**. A one-step cloning scheme for multiplexed DNA cleavage and gene regulation with Class II CRISPR nucleases.
3. Waller MC, Palizhati A, Vento J, Grunden AM[#], **Beisel CL**[a]. Efficient DNA transfer in the ligninolytic bacterium *Paenibaccilus glucanolyticus* SLM1.
4. Marshall R, Luo ML, **Beisel CL**[#], Vincent Noireaux[#]. An expansive CRISPRi-based toolbox for cell-free transcription-translation systems.
5. Martino ME**,** Bozonnet L, Leenay RT, Shaw M, **Beisel CL**, Leulier F. Adaptive evolution reveals the role of acetate metabolism in *Drosophila* larval growth promotion by *Lactobacillus plantarum*.
6. Dugar G, Leenay RT, **Beisel CL**, Sharma CM. The Cas9 nuclease in *Campylobacter jejuni* naturally exhibits crRNA-dependent RNA cleavage of endogenous RNAs.
7. Fagen JR, Collias D, Singh AK, **Beisel CL**. Utilizing CRISPR nucleases as programmable antimicrobials. (Invited review for *Curr Opin Biomed Eng*)

PEER-REVIEWED PUBLICATIONS (* Multiple first authors. [#] Multiple corresponding authors.)

1. Waller MC, Bober JR, Nair N, **Beisel CL**. Modernizing genetic tool development for commensal bacteria. (*under review*)
2. Ye Z, Poplyk M, Trahan AD, Sheikh W, Kelly G, Rodrigiuez D, Luo ML, **Beisel CL**, Lynch MD. MOMENTuM: Microbial Optimization via MEtabolic NeTwork Minimization. (*under review*)
3. Marshall R, Maxwell CS, Collins SP, **Beisel CL**, Noireaux V. Short DNA containing χ sites enhances DNA stability and gene expression in *E. coli* cell-free transcription-translation. *Biotechnol Bioeng* (*in press*)
4. Leenay RT & **Beisel CL**. (2017) Deciphering, communicating, and engineering the CRISPR PAM. *J Mol Biol* 429(2):177-91.
5. Luo ML, Jackson R, Denny SR, Tokmina-Lukaszewska M, Maksimchuk KR, Lin W, Bothner B, Wiedenheft B, **Beisel CL**. (2016) The CRISPR RNA-guided surveillance complex in *Escherichia coli* accommodates extended RNA spacers. *Nucleic Acids Res* 44(15):7385-94.
6. Leenay RT, Maksimchuk KR, Slotkowski RA, Agrawal RN, Gomaa AA, Briner AE, Barrangou R[#], **Beisel CL**[#]. (2016) Identifying and visualizing functional PAM diversity across CRISPR-Cas systems. *Mol Cell* 62(1):137-147.
7. Luo ML, Leenay RT, **Beisel CL**. (2016) Current and future prospects for CRISPR-based tools in bacteria. *Biotechnol Bioeng* 113(5):930-943.
8. **Beisel CL** & Afroz T. (2015) Rethinking the hierarchy of sugar utilization in bacteria. *J Bacteriol* 198(3):374-376.
9. Sun W, Ji W, Hall JM, Hu Q, Wang C, **Beisel CL**[#], Gu Z[#]. (2015) Efficient delivery of CRISPR-Cas9 for genome editing via self-assembled DNA nanoclews. *Agnew Chem Int Ed*

54(41):12029-33. *See comment in Chemical & Engineering News, Genetic Engineering & Biotechnology News, WRAL news*

10. Afroz T, Luo ML, **Beisel CL**. (2015) Impact of residual inducer on titratable expression systems. *PLoS One* 10(9):e0137421.
11. Luo ML, Mullis AS, Leenay RT, **Beisel CL**. (2015) Repurposing endogenous Type I CRISPR-Cas systems for programmable gene repression. *Nucleic Acids Res* 43(1):674-681. *See comment in BD Accuri News*
12. Afroz T, Biliouris K, Boykin KE, Kaznessis Y, **Beisel CL**. (2015) Trade-offs in engineering sugar utilization pathways for titratable control. *ACS Synth Biol* 4(2):141-149.
13. Briner AE*, Donahue PD*, Gomaa AA*, Selle K, Slorach E, Nye C, Haurwitz R, **Beisel CL**[#], May AP[#], Barrangou R[#]. (2014) Guide RNA functional modules direct Cas9 activity and orthogonality. *Mol Cell* 56(2):333-339. *See comment in Genetic Engineering & Biotechnology News*
14. Afroz T*, Biliouris K*, Kaznessis Y, **Beisel CL**. (2014) Bacterial sugar utilization gives rise to distinct single-cell behaviours. *Mol Microbiol* 93(6):1093-1103. *See comment in Mol Microbiol*
15. Gomaa AA, Klumpe HE, Luo ML, Selle K, Barrangou R, **Beisel CL**. (2014) Programmable removal of bacterial strains by use of genome-targeting CRISPR-Cas systems. *mBio* 5(1): e00928-13. *See comment in Nature, New York Times* newspaper*, Wired Magazine, ScienceNews, Faculty of 1000*
16. Afroz T & **Beisel CL**. (2013) Understanding and exploiting feedback in synthetic biology. *Chem Eng Sci* 103:79-90.
17. **Beisel CL**[#], Updegrove TB, Janson BJ, Storz G[#]. (2012) Multiple factors dictate target selection by Hfq-binding small RNAs. *EMBO J* 31(8):1961-1974. *See comment in Faculty of 1000*
18. **Beisel CL** & Storz G. (2011) Discriminating tastes: physiological contributions of the Hfq-binding small RNA Spot 42 to catabolite repression. *RNA Biol* 8(5):766-770.
19. **Beisel CL**[#] & Storz G[#]. (2011) The base-pairing RNA Spot 42 participates in a multi-output feedforward loop to help enact catabolite repression in *Escherichia coli*. *Mol Cell* 41(3):286-297. *See comment in Mol Cell*
20. **Beisel CL**, Chen, YY, Culler SJ, Hoff KG, Smolke CD. (2011) Design of small molecule-responsive microRNAs based on structural requirements for Drosha processing. *Nucleic Acids Res* 39(7):2981-2994. *See comment in Faculty of 1000*
21. **Beisel CL** & Storz G. (2010) Base pairing small RNAs and their roles in global regulatory networks. *FEMS Microbiol Rev* 34(5):866-882. *See comment in FEMS Microbiol Rev*
22. **Beisel CL** & Smolke CD. (2009) Design principles for riboswitch function. *PLoS Comput Biol* 5(4):e1000363.
23. Bayer TS, Hoff KG, **Beisel CL**, Lee JJ, Smolke CD. (2009) Synthetic control of a fitness trade-off in yeast nitrogen metabolism. *J Biol Eng* 3:1.
24. **Beisel CL**, Bayer TS, Hoff KG, Smolke CD. (2008) Model-guided design of ligand-regulated RNAi for programmable control of gene expression. *Mol Syst Biol* 4:224. *See comment in Mol Syst Biol*
25. **Beisel CL**, Dowd MK, Reilly PJ. (2005) Conformational analysis of gossypol and its derivatives by molecular mechanics. *J Mol Struct (Theochem)* 730:51-58.
26. Judice TN, Nelson NC, **Beisel CL**, Delimont DC, Fritzsch B, Beisel KW. (2002) Cochlear whole mount in situ hybridization: identification of longitudinal and radial gradients. *Brain Res Brain Res Protoc* 9(1):65-76.

NON-PEER-REVIEWED PUBLICATIONS (book chapters, commentaries, and perspectives)

1. **Beisel CL.** Invited submission to the Voices series in *Cell Systems* (*accepted*).

2. Luo ML, **Beisel CL**. (2016) SBE Supplement: Synthetic Biology – Engineering Genes with CRISPR-Cas9. *Chemical Engineering Progress* September 2016 issue.
3. **Beisel CL**, Gomaa AA, Barrangou R. (2014) A CRISPR design for next-generation antimicrobials. *Genome Biol* 15:516.
4. **Beisel CL**, Bloom RJ, Smolke CD. (2014) Construction of ligand-responsive microRNAs that operate through inhibition of Drosha processing. *Methods Mol Biol* 1111:259-67.

PATENTS AND PATENT APPLICATIONS

1. Winter-Sederoff H, **Beisel CL**, Murphree C, Srirangan S. Methods and compositions for modification of plastid genomes. Provisional patent filed 8/27/2016.
2. **Beisel CL**, Barrangou R, Selle K. Methods and compositions for genome editing in bacteria using CRISPR-Cas9 systems. Provisional patent filed 6/17/2015.
3. **Beisel CL**, Gomaa AA. Methods and compositions for efficient delivery of nucleic acids and RNA-based antimicrobials. Provisional patent filed 6/16/2015.
4. **Beisel CL**, Luo ML. Methods and compositions for RNA-directed repression of transcription using CRISPR-associated genes. PCT application filed 4/8/2015.
5. Smolke CD & **Beisel CL**. Integrative, ligand-responsive microRNAs. US Patent # 9,145,555 B2. Issued 9/29/2015.
6. Smolke CD, Win MN, **Beisel CL**. Modular polynucleotides for ligand-controlled regulatory systems. US Patent # 8,367,815. Issued 2/5/2013.

TEACHING EXPERIENCE

North Carolina State University (2011 –)

BIT 495/595: Genome engineering: CRISPR Technologies (S 2015, S 2016)
CHE 205: Chemical Process Principles (F 2011, F 2012, F 2014, F 2015, F 2016)
CHE 225: Chemical Engineering Analysis (S 2013, S 2017)
CHE 551: Biomolecular Engineering (co-taught) (S 2012, S 2013, S 2014, S 2015, S 2016, S 2017)
CHE 596-023: Introduction to Synthetic Biology (F 2013)

National Institutes of Health (2009 – 2011)

Becoming a Successful Scientist (journal club leader) (F 2012)

California Institute of Technology (2004 – 2009)

Bi 23: Bio-inspired Engineering (instructor) (S 2008)
ChE 130: Biomolecular Engineering Laboratory (teaching assistant) (S 2007, S 2008)

CURRENT FUNDING (as faculty member)

(PI) 08/01/2017 – 07/31/2022
Dreyfus Foundation (Camille Dreyfus Teacher-Scholar Award)
Understanding and exploiting the biochemical properties of CRISPR-Cas immune systems
$75,000

HR0011-17-2-0042 (co-PI, PI: JK Joung MGH) 05/01/2017 – 04/30/2021
DARPA (Safe genes program)
Technologies to control, surveil, and counter genome-editing nucleases and gene drives
$11,000,000 ($832,932 to CLB)

HR0011-16-C-0134 (co-PI, PI: V Noireaux U Minn) 09/28/2016 – 04/01/2018
DARPA (Biocontrol program)
Developing an RNA-based PID biological controller using a cell-free testbed
$2,200,000 ($356,722 to CLB)

1R35GM119561-01 (PI) 09/01/2016 – 06/30/2021
National Institutes of Health (NIGMS MIRA program for ESI)
Understanding and exploiting the functional diversity of CRISPR-Cas immune systems
$1,852,891

(PI, co-PI: H Sederoff NCSU) 07/01/2016 – 06/30/2017
North Carolina State University (Chancellor's Innovation Fund)
Editing and engineering the chloroplast genome in plants
$75,000 ($25,000 to CLB)

Gift #3926 (PI) 09/01/2016 – 08/30/2017
Agilent Technologies (Applications and Core Technology University Research)
Probing PAM contributions to CRISPR activity and specificity
$50,000

(Co-PI, PI: G Williams NCSU) 07/01/2016 – 06/30/2017
North Carolina State University (Research and Innovation Seed Funding)
Engineering antibiotic-producing microbes with CRISPR for the affordable production of novel antibiotics
$53,825 ($20,000 to CLB)

(PI) 05/01/2016 – 08/01/2017
Bay Area Lyme Foundation (Emerging Leader Award)
Assessing CRISPR-based antimicrobials against Borrelia burgdorferi
$100,000

(Co-PI, PI: E Braswell USDA) 09/01/2016 – 08/31/2018
USDA (Farm Bill Section 10007)
Targeting bacterial pathogens with a CRISPR-targeted antimicrobial system
$622,900 ($622,900 to CLB)

MCB-1452902 (PI) 01/01/2015 – 12/31/2019
National Science Foundation (CAREER award)
CAREER: Harnessing endogenous defense systems as genetic tools for microbial communities
$600,000

MCB-1413044 (Co-PI, PI: G Reeves) 07/01/2014 – 06/30/2017
National Science Foundation
Synthetic gene regulatory networks to study emergent properties in development
$797,991 ($300,000 to CLB)

CBET-1403135 (PI, Co-PI: R Barrangou) 07/01/2014 – 06/30/2017
National Science Foundation
Engineering highly specific and orthogonal CRISPR-Cas systems
$400,000 ($330,000 to CLB)

PRIOR FUNDING (as faculty member)

OPP1140021 (PI) 11/01/2015 – 04/30/2017
Bill and Melinda Gates Foundation (Grand Challenges Explorations)
A bacteriophage platform for programmable killing of bacteria

$100,000

IIP-1549648 (Co-PI, PI: E Brune) 01/01/2016 – 12/31/2016
National Science Foundation
STTR Phase I: Harnessing CRISPR-mediated silencing for the one-step optimization of protein production strains
$225,000 ($105,027 to CLB)

(PI) 01/01/2016 – 12/31/2016
North Carolina Biotechnology Center (Technology Enhancement Grant)
Bacteriophage-based delivery of sequence-specific antimicrobials
$75,000

(PI, Co-PI:B Rao) 07/01/2013 – 06/30/2015
Kenan Institute of Engineering, Technology and Science (Seed grant)
Expanding genome editing with the CRISPR immune system
$44,000

1R56AI103557-01A1 (PI, Co-I A Deiters) 08/01/2013 – 07/31/2014
National Institutes of Health (NIAID)
High-Throughput Assay Development for the Discovery of Small Molecule Inhibitors
$201,491 ($101,491 to CLB)

(PI) 07/01/2012 – 06/31/2013
NC State University (Faculty Research and Professional Development Award)
A novel and targeted approach to treat infections by multidrug-resistant pathogens
$7,000

(PI) 04/01/2012 – 06/01/2012
North Carolina State University (ADVANCE D3 External mentoring mini-grant)
Mentoring interactions with Prof. Yiannis Kaznessis at the University of Minnesota
$1,100

STUDENT MENTORING AND TRAINING

Current group

Fani Ttofali, Laboratory manager (2016 –)

Dr. Janetta Hakovirta (2017 –)

Dr. Chunyu Liao, Postdoctoral fellow (2016 –)
Dr. Colin Maxwell, Postdoctoral fellow (2016 –)
Dr. Jennie Fagen, Postdoctoral fellow (2016 –)
Dr. Atul Singh, Postdoctoral fellow (2016 –)

Daphne Collias, Graduate student (2017 –)
Scott Collins, Graduate student (2017 –)
Thomas Jacobsen, Graduate student (2014 –) GAANN Biotechnology Fellowship
Jointly advised with Dr. Gregory Reeves (NCSU/CBE)
Ryan Leenay, Graduate student (2013 –) NIH Molecular Biotechnology Training Fellow
Justin Vento, Graduate student (2017 –)
Matthew Waller, Graduate student (2014 –)

Perry Currin, Undergraduate student (2016 –)
Steven Denny, Undergraduate student (2014 –)
Cameron Bright, Undergraduate student (2015 –)

Brooke McGirr, Undergraduate student (2015 –)
Aini Palizhati, Undergraduate student (2015 –)
Malay Shah, Undergraduate student (2013 –)
Rebecca Slotkowski, Undergraduate student (2013 –)

Former postdoctoral fellows

Dr. Kenneth Maksimchuk, Postdoctoral fellow (2015 – 2016) Research Scientist I at GSK

Former graduate students

Dr. Ahmed Gomaa (PhD 2016), Consultant at Emendo
Dr. Michelle Luo (PhD 2016), Scientist at Emmune
Dr. Taliman Afroz (PhD 2014), Scientist I at Great Basin Scientific

Former undergraduate students

Roma Agrawal, Undergraduate student (2014 – 2016)
Kelsey Boykin (2013), Engineer at Hospira
Jordan Hall (2011 – 2015), Graduate student in Chemical Engineering at the University of California, Riverside
Jenna Hunter (2012)
Heidi Klumpe (2011 – 2013), Graduate student, Chemical Engineering, California Institute of Technology
Dillon Love (2012 – 2013), Graduate student, Chemical Engineering, University of Colorado-Boulder
Heather McMahon (2012)
Adam Mullis (2013 – 2014), Graduate student, Chemical Engineering, Iowa State University
Megan Smithmyer (2012), Graduate student, Chemical Engineering University of Delaware
Caleb Wilson (2014), Laboratory Technician, Duke University

UNIVERSITY SERVICE

2016 –	Executive Committee, NCSU Comparative Medicine Institute
2015 –	Co-lead, CFEP Microbiomes cluster hire committee
2014 –	Member, CBE Graduate recruiting and admissions committee
2014 – 2015	Member, CFEP Systems and Synthetic Biology cluster hire committee
2014	Member, Committee evaluating Premium MS in chemical engineering
2013 – 2015	Organizer, CBE departmental seminar series
2013 –	Member, Genomic Sciences Laboratory Faculty Advisory Board
2012 –	Co-organizer, “Biolunch” graduate seminar series

EXTERNAL SERVICE

2017	Organizer, CRISPR Technologies conference (planned for December 2017)
2016 –	Instructor, Cold Spring Harbor Laboratory Synthetic Biology Summer School (Cold Spring Harbor, NY)
2016	Topical A Conference Chair, AIChE annual conference (San Francisco, CA)
2016	Session Chair, “General Topics in Upstream Processes.” American Chemical Society spring meeting (San Diego, CA)
2015	Topical A Conference Co-chair, AIChE annual conference (Salt Lake City, UT)

2015	Session Chair, Annual CRISPR Conference (New York City, NY)
2013	Session Chair, “Synthetic Biology.” Institute of Biological Engineering annual meeting (Raleigh, NC)
2013 –	Science Hour volunteer with non-profit *Score One Up*, Sanderford Road Community Center, Sgt. Courtney T. Johnson Community Center
2012 –	Session Chair or Co-chair for 8 sessions, AIChE annual conference
2012 –	NSF reviewer on 15 panels (CBET, IIP, MCB)
2011 –	Journal peer reviewer for ACS Synthetic Biology, Antimicrobial Agents and Chemotherapy, Applied and Environmental Microbiology, Biophysics Journal, Biotechnology & Bioengineering, Biotechnology & Biofuels, Biotechnology Journal, Chemical Engineering Science, Current Opinions in Microbiology, Frontiers in Life Science, Genes and Development, Genetics, Genomics, Integrative Biology, Journal of Applied Microbiology, Journal of Bacteriology, Journal of Biotechnology Advances, Journal of Industrial Microbiology and Biotechnology, mBio, Metabolic Engineering, Metabolic Engineering Communications, Methods, MicrobiologyOpen, Molecular Cell, Molecular Pharmaceutics, Nature Chemical Biology, Nature Communications, Nature Reviews Microbiology, Nucleic Acids Research, Philosophical Transactions B, Physical Biology, PLoS Computational Biology, PLoS Genetics, Proceedings of the National Academy of Sciences, Scientific Reports

PROFESSIONAL AFFILIATIONS

American Chemical Society
American Institute of Chemical Engineers
American Society for Microbiology
Sigma Xi Research Society
Society for Industrial Microbiology and Biotechnology