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a. Professional Preparation

Universite Rene Descartes, Paris V, France	Life Sciences	B.S.	1996
Universite de Technologie Compiegne, France	Biological Engineering	M.S.	2000
North Carolina State University, Raleigh, NC	Food Science	M.S.	2000
North Carolina State University, Raleigh, NC	Functional Genomics	Ph.D.	2004
University of Wisconsin, Madison, WI	Business Administration	M.B.A.	2011

b. Appointments

2018-	Professor of Food Science, North Carolina State University, NC
2016-	Todd R. Klaenhammer Distinguished Professor in Probiotics Research, NC State University Scholar, NC State University
2016-	University Scholar, NC State University
2013-2018	Associate Professor of Food Science, North Carolina State University, NC
2010-2018	Adjunct Professor of Food Science, Pennsylvania State University, PA
2011-2013	R&D Director, Genomics, DuPont, WI
2007-2011	Group Manager, Genomics DuPont, WI
2006-2007	Sr. Scientist, Cultures Development, DuPont (Danisco), WI
2005-2006	Scientist, Cultures Development, DuPont (Danisco), WI

NC State University affiliations

- Food, Bioprocessing and Nutrition Sciences (home Department)
- Microbiology graduate program
- Biotechnology graduate program
- Functional Genomics graduate program
- Genetics graduate program
- Comparative Medicine Institute
- Genetic Engineering and Society Center
- Southeast Dairy Foods Research Center
- Plant Sciences Initiative
- Global One Health Academy
- Genetics and Genomics Academy
- Bezos Center on Sustainable Proteins

Shareholdings and financial COIs: Caribou Biosciences CRBU, Felix Biotechnologies, Locus Biosciences, Ancilia Biosciences, CRISPR QC, CRISPR Biotechnologies, Eligo Biosciences, Hoofprint Biome, Inari Ag, Intellia Therapeutics NTLA, Invaio, KiTua Fund, KromaTiD, Provaxus, Raleigh Biosciences, TreeCo, Tune Therapeutics, Wallife

c. Professional Scholarly Activities

2023- KiTua Fund Board of Directors and Investment Committee

2023- National Academies Board on Medicine Health and Medicine Division
 2023- Scientific Advisory Board, Raleigh BioSciences
 2023- Scientific Advisory Board, CRISPR QC
 2023- Board of Directors, HoofPrint Biome
 2021- Editorial Board member, Microbiome Research Reports
 2020-2023 Co-Founder and Chief Executive Officer, CRISPR Biotechnologies
 2020- Scientific Advisory Board, Innovative Genomics Institute, UC Berkeley
 2020- Scientific Advisory Board, Provaxus
 2020- National Academies Food Forum
 2020- Editorial Board member, *BioDesign Research*
 2020-2023 Scientific Advisory Board, Felix Biotechnology
 2019- Co-Founder and Chief Scientific Officer, Ancilia Biosciences
 2019- National Academies Food and Nutrition Board
 2019- Co-Founder, President and Chief Executive Officer, TreeCo
 2019- Scientific Advisory Board, Invaio
 2018- Scientific Advisory Board, Inari Ag
 2017- Editor in Chief, *The CRISPR Journal*
 2017-2022 Editorial Board member *Annual Reviews in Food Science and Technology*
 2017-2019 NC Biolabs Advisory Board
 2017- Editorial Board member, *Genome Biology*
 2016-2018 Co-Founder, Chief Scientific Officer and SAB Chairman, Locus Biosciences
 2016- NC Ag Foundation Board of Directors
 2015- Editorial Board Member *Applied and Environmental Microbiology*
 2014- Co-Founder and member of the Scientific Advisory Board, Intellia Therapeutics
 2013-2016 Board of Directors and Chairman of the Board, Caribou Biosciences

d. Honors and awards

2023 National Inventors Hall of Fame
 2021 LABIP Senior Researcher Award
 2019 Elected Fellow of the US National Academy of Inventors
 2019 Elected into the US National Academy of Engineering
 2019 Triangle Business Journal Research Innovator
 2018 Elected into the US National Academy of Sciences
 2018 National Academy of Sciences Prize in Food and Agriculture Sciences
 2018 Fellow of the American Academy of Microbiology
 2017 National Academy of Sciences Award in Molecular Biology
 2017 (since) Clarivate (former Thomson Reuters) Highly Cited Researcher (I-2878-2014)
 2016 Canada Gairdner International Award
 2016 Warren Alpert Foundation Prize
 2016 Todd R. Klaenhammer Distinguished Scholar in Probiotics Research
 2016 NC State University John S. Risley Entrepreneur of the year Award
 2015 NC State University Faculty Scholar
 2015 NC State University Alumni Association Outstanding Research Award
 2014 (since) Thomson Reuters Highly Cited Researcher (I-2878-2014)
 2014 Inducted into Phi Tau Sigma, the Honor Society for Food Science

2011 NC State Food Science Outstanding Young Alumni award recipient
2011 Distinguished Lecture in Microbiology, UW-Madison
2010 Sixth Annual Leo W. Parks Distinguished Lecture, NCSU
2009 Danisco Project Management Program
2008 Danisco Innovation Award Recipient
2008 Danisco Americas Management Program
2003 National Science Foundation IGERT Fellow

e. Publications (55,755 citations, 87 h-index, 192 i10-index)

249. Roberts A, Spang D, Sanozky-Dawes R, Nethery MA, **Barrangou R.** (2024) Characterization of *Ligilactobacillus salivarius* CRISPR-Cas systems. *mSphere*. 11:e0017124. doi: 10.1128/msphere.00171-24.
248. **Barrangou R** (2024) Surveying the State of CRISPR and Gene Editing. *CRISPR J.* 7:133-134. doi: 10.1089/crispr.2024.0045.
247. **Barrangou R** (2024) CRISPR Pigs Portend a New Era of Xenotransplantation. *CRISPR J.* 7:71. doi: 10.1089/crispr.2024.29173.editorial.
246. **Barrangou R**, Davies K (2024) CRISPR Momentum in the Clinic and the Field. *CRISPR J.* 7:1-2. doi: 10.1089/crispr.2024.29172.editorial.
245. Gilfillan D, Vilander AC, Pan M, Goh YJ, O'Flaherty S, Feng N, Fox BE, Lang C, Greenberg HB, Abdo Z, **Barrangou R**, Dean GA. (2023) *Lactobacillus acidophilus* Expressing Murine Rotavirus VP8 and Mucosal Adjuvants Induce Virus-Specific Immune Responses. *Vaccines* 11:1774. doi: 10.3390/vaccines11121774.
244. **Barrangou R.** (2024) First Drug Approval Rises the CRISPR Tide. *CRISPR J* 6:487. doi: 10.1089/crispr.2023.29168.editorial
243. Pyhtila B, Kasowitz S, Leeson R, **Barrangou R.** (2023) The Expanding Dissemination and Distribution Patterns of Diverse CRISPR Plasmids by Addgene. *CRISPR J* 6:493-501. doi:10.1089/crispr.2023.0059
242. Adler BA, Trinidad MI, Bellieny-Rabelo D, Zhang E, Karp HM, Skopintsev P, Thornton BW, Weissman RF, Yoon PH, Chen L, Hessler T, Eggers AR, Colognori D, Boger R, Doherty EE, Tsuchida CA, Tran RV, Hofman L, Shi H, Wasko KM, Zhou Z, Xia C, Al-Shimary MJ, Patel JR, Thomas VCJX, Pattali R, Kan MJ, Vardapetyan A, Yang A, Lahiri A, Maxwell MF, Murdock AG, Ramit GC, Henderson HR, Calvert RW, Bamert RS, Knott GJ, Lapinaite A, Pausch P, Cofsky JC, Sontheimer EJ, Wiedenheft B, Fineran PC, Brouns SJJ, Sashital DG, Thomas BC, Brown CT, Goltsman DSA, **Barrangou R**, Siksnys V, Banfield JF, Savage DF, Doudna JA. (2023) CasPEDIA Database: a functional classification system for class 2 CRISPR Cas enzymes. *Nucleic Acids Res* 52:D590-D596. doi: 10.1093/nar/gkad890.
241. **Barrangou R.** (2023) The CRISPR Toolbox: The End of the Beginning. *CRISPR J* 6:403. doi: 10.1089/crispr.2023.29167.editorial.
240. **Barrangou R.** (2023) CRISPR Milestones for Sustainable Agriculture and Forestry. *CRISPR J* 6:303-304. doi: 10.1089/crispr.2023.29163.editorial.

239. Tuncel A, Pan C, Sprink T, Wilhelm R, **Barrangou R**, Li L, Shih PM, Varshney RK, Tripathi L, Van Eck J, Mandadi K, Qi Y (2023) Genome-edited foods. *Nat Rev Bioeng* 1: 799–816.
238. Sulis DB, Jiang X, Yang C, Marques BM, Matthews ML, Miller Z, Lan K, Cofre-Vega C, Liu B, Sun R, Sederoff H, Bing RG, Sun X, Williams CM, Jameel H, Phillips R, Chang HM, Peszlen I, Huang YY, Li W, Kelly RM, Sederoff RR, Chiang VL, **Barrangou R**, Wang JP. (2023) Multiplex CRISPR editing of wood for sustainable fiber production. *Science*. 381(6654):216-221. doi: 10.1126/science.add4514.
237. Page CA, Pérez-Díaz IM, Pan M, **Barrangou R**. (2023) Genome-Wide Comparative Analysis of *Lactiplantibacillus pentosus* Isolates Autochthonous to Cucumber Fermentation Reveals Subclades of Divergent Ancestry. *Foods*. 12(13):2455. doi: 10.3390/foods12132455.
236. **Barrangou R**. (2023) CRISPR Conventions in a Polarized Era. *CRISPR J*. 6:183-184. doi: 10.1089/crispr.2023.29160.editorial.
235. Cress B, **Barrangou R**. (2023) Special Issue: Manipulating the Microbiome with CRISPR. *CRISPR J*. 6:86. doi: 10.1089/crispr.2023.0005.cfp.
234. **Barrangou R**. (2023) Amplifying CRISPR: Next-Generation Diagnostics. *CRISPR J* 6:85. doi: 10.1089/crispr.2023.0004.editorial.
233. Foley MH, Walker ME, Stewart AK, O'Flaherty S, Gentry EC, Patel S, Beaty VV, Allen G, Pan M, Simpson JB, Perkins C, Vanhoy ME, Dougherty MK, McGill SK, Gulati AS, Dorrestein PC, Baker ES, Redinbo MR, **Barrangou R**, Theriot CM. (2023) Bile salt hydrolases shape the bile acid landscape and restrict *Clostridioides difficile* growth in the murine gut. *Nat Microbiol*. doi: 10.1038/s41564-023-01337-7
232. **Barrangou R**. (2023) CRISPR Crops and Sustainable Agriculture. *CRISPR J*. 6:1. doi: 10.1089/crispr.2023.0002.editorial.
231. O'Flaherty S, Cobian N, **Barrangou R**. (2023) Impact of Pomegranate on Probiotic Growth, Viability, Transcriptome and Metabolism. *Microorganisms* 11, 404
230. Roberts A, Nethery MA, **Barrangou R**. (2022) Functional characterization of diverse type I-F CRISPR-associated transposons. *Nucleic Acids Res*. doi: 10.1093/nar/gkac985.
229. **Barrangou R**. (2022) Better guidance for CRISPR. *CRISPR J*. 5:741. doi: 10.1089/crispr.2022.29156.editorial.
228. Nethery MA, Hidalgo-Cantabrana C, Roberts A, **Barrangou R**. (2022) CRISPR-based engineering of phages for in situ bacterial base editing. *Proc Natl Acad Sci U S A*. 119(46):e2206744119. doi: 10.1073/pnas.2206744119.
227. Adler BA, Hessler T, Cress BF, Lahiri A, Mutalik VK, **Barrangou R**, Banfield J, Doudna JA. (2022) Broad-spectrum CRISPR-Cas13a enables efficient phage genome editing. *Nat Microbiol*. doi: 10.1038/s41564-022-01258-x.

226. **Barrangou R.** (2022) Extreme Genome Editing. *CRISPR J.* 5:629-630. doi: 10.1089/crispr.2022.29155.editorial.
225. **Barrangou R.** (2022) Navigating Viral Space with CRISPR Technologies. *CRISPR J.* 5:487. doi: 10.1089/crispr.2022.29153.editorial.
224. Theriot C, Thanissery R, O’Flaherty S, **Barrangou R.** (2022) Probiotic colonization dynamics after oral consumption of VSL#3 by antibiotic-treated mice. *Microbiome Res Rep* 1:21. doi: 10.20517/mrr.2022.07.
223. Pan M, Morovic W, Hidalgo-Cantabrana C, Roberts A, Walden KKO, Goh YJ, **Barrangou R.** (2022) Genomic and epigenetic landscapes drive CRISPR-based genome editing in *Bifidobacterium*. *Proc Natl Acad Sci U S A.* 2022 Jul 26;119(30):e2205068119. doi: 10.1073/pnas.2205068119.
222. **Barrangou R.** (2022) Celebrating a Decade of CRISPR-Fueled Genome Editing. *CRISPR J.* 5:354-355. doi: 10.1089/crispr.2022.29150.rba
221. Monte DFM, Nethery MA, Berman H, Keelara S, Lincopan, N, Fedorka-Vary PJ, **Barrangou R,** Landgraf M. (2022) Clustered Regularly Interspaced Short Palindromic Repeats Genotyping of Multidrug-Resistant *Salmonella* Heidelberg Strains Isolated From the Poultry Production Chain Across Brazil. *Front Microbiol.* doi: 10.3389/fmicb.2022.867278.
220. Chamberlain M, O’Flaherty S, Cobián N, **Barrangou R.** (2022) Metabolomic Analysis of *Lactobacillus acidophilus*, *L. gasseri*, *L. crispatus*, and *Lactocaseibacillus rhamnosus* Strains in the Presence of Pomegranate Extract. *Front Microbiol.* May 18;13:863228. doi: 10.3389/fmicb.2022.863228. eCollection 2022.
219. Sanozky-Dawes R, **Barrangou R.** (2022) *Lactobacillus*, glycans and drivers of health in the vaginal microbiome. *Microbiome Res Rep* 1:18. doi: 10.20517/mrr.2022.03
218. **Barrangou R.** (2022) CRISPR à la carte. *CRISPR J* 5:170. doi: 10.1089/crispr.2022.29147.rba.
217. **Barrangou R.** (2022) CRISPR Rewrites the Future of Medicine. *CRISPR J* 5:1. doi: 10.1089/crispr.2022.29144.rba.
216. **Barrangou R,** Marraffini LA. (2022) Turning CRISPR on with antibiotics. *Cell Host Microbe* 30:12-14. doi: 10.1016/j.chom.2021.12.013
215. **Barrangou R.** (2021) CRISPR Milestones and Anticipating What Is Next for the Journal. *CRISPR J* 4:771-772. doi: 10.1089/crispr.2021.29139.rba.
214. Ventura M, van Sinderen D, Turrone F, Milani C, Munoz J, Haller D, Ross P, Collado MC, Allen-Vercoe E, Del Rio D, Altermann E, Katayama T, Zoetendal EG, Belzer C, Mena P, Im SH, Gueimonde M, Margolles A, Ruiz L, Lacroix C, Stanton C, Barbara G, Saminen S, Scott KP, **Barrangou R,** Bottacini F, Marco ML. (2021) Editors’ Prelude to Microbiome Research Reports. *Microbiome Res Rep* 1:1 doi: 10.20517/mrr.2021.01
213. Rubin BE, Diamond S, Cress BF, Crits-Christoph A, Lou YC, Borges AL, Shivram H, He

- C, Xu M, Zhou Z, Smith SJ, Rovinsky R, Smock DCJ, Tang K, Owens TK, Krishnappa N, Sachdeva R, **Barrangou R**, Deutschbauer AM, Banfield JF, Doudna JA. (2021) Species- and site-specific genome editing in complex bacterial communities. *Nat Microbiol*. doi: 10.1038/s41564-021-01014-7.
212. Cobian N, Garlet A, Hidalgo-Cantabrana C, **Barrangou R**. (2021) Comparative Genomic Analyses and CRISPR-Cas Characterization of *Cutibacterium acnes* Provide Insights Into Genetic Diversity and Typing Applications. *Front Microbiol* 12:758749. doi: 10.3389/fmicb.2021.758749.
211. Yu H, Xue L, **Barrangou R**, Chen S, Huang Y. (2021) Toward inclusive global governance of human genome editing. *Proc Natl Acad Sci U S A* 18:e2118540118. doi: 10.1073/pnas.2118540118
210. Huang Y, Zhang Y, Wu M, Porter A, **Barrangou R**. (2021) Determination of Factors Driving the Genome Editing Field in the CRISPR Era Using Bibliometrics. *CRISPR J* 4:728-738. doi: 10.1089/crispr.2021.0001.
209. **Barrangou R**. (2021) As CRISPR Technologies Ripen, What Should We Prioritize? *CRISPR J* 4:627. doi: 10.1089/crispr.2021.29138.rba.
208. Nethery MA, Korvink M, Makarova KS, Wolf YI, Koonin EV, **Barrangou R**. (2021) CRISPRclassify: Repeat-Based Classification of CRISPR Loci. *CRISPR J* 4:558-574. doi: 10.1089/crispr.2021.0021.
207. **Barrangou R**. (2021) Clinical Milestone for CRISPR Medicines. *CRISPR J* 4:459. doi: 10.1089/crispr.2021.29135.rba.
206. **Barrangou R**, Hill C. (2021) Todd R. Klaenhammer, an inspirational food microbiologist who leaves a lasting legacy. *Proc Natl Acad Sci U S A*. 118:e2107754118. doi: 10.1073/pnas.2107754118
205. **Barrangou R**. (2021) The CRISPR chronicles and the power of storytelling. *CRISPR J* 4:158-159
204. Saha K, Sontheimer EJ and the SCGE. (2021) The NIH Somatic Cell Genome Editing program. *Nature* 592: 195-204
203. **Barrangou R**. (2021) Political Support Sets the Tone for CRISPR Enthusiasts. *CRISPR J* 4:1-2
202. Kuiken T, **Barrangou R**, Grieger K. (2021) (Broken) Promises of Sustainable Food and Agriculture through New Biotechnologies: The CRISPR Case. *CRISPR J* 4:25-31
201. Foley MH, O'Flaherty S, Allen G, Rivera AJ, Stewart AK, **Barrangou R**, Theriot CM. (2021) *Lactobacillus* bile salt hydrolase substrate specificity governs bacterial fitness and host colonization. *Proc Natl Acad Sci U S A* 118(6):e2017709118. doi: 10.1073/pnas.2017709118.
200. Goh YJ, **Barrangou R**, Klaenhammer TR. (2021) *In Vivo* Transcriptome of *Lactobacillus acidophilus* and Colonization Impact on Murine Host Intestinal Gene Expression. *mBio*

12(1):e03399-20. doi: 10.1128/mBio.03399-20.

199. Goh YJ, **Barrangou R.** (2021) A portable CRISPR-Cas9N system for flexible genome engineering in *Lactobacillus acidophilus*, *Lactobacillus gasseri* and *Lactobacillus paracasei*. *Appl Environ Microbiol*. doi: 10.1128/AEM.02669-20.

198. McClements DJ, **Barrangou R,** Hill C, Kokini JL, Ann Lila M, Meyer AS, Yu L. (2021) Building a Resilient, Sustainable, and Healthier Food Supply through Innovation and Technology. *Annu Rev Food Sci Technol*. doi: 10.1146/annurev-food-092220-030824.

197. **Barrangou R.** (2020) Sharpening the CRISPR Toolbox. *CRISPR J.* 3:421. doi: 10.1089/crispr.2020.29114.rba.

196. Brandt K, **Barrangou R.** (2020) Adaptive response to iterative passages of five *Lactobacillus* species in simulated vaginal fluid. *BMC Microbiol.* 20:339. doi: 10.1186/s12866-020-02027-8.

195. Angrist M, **Barrangou R,** Baylis F, Brokowski C, Burgio G, Caplan A, Chapman CR, Church GM, Cook-Deegan R, Cwik B, Doudna JA, Evans JH, Greely HT, Hercher L, Hurlbut JB, Hynes RO, Ishii T, Kiani S, Lee LH, Levrier G, Liu DR, Lunshof JE, Macintosh KL, Mathews DJH, Meslin EM, Mills PHR, Montoliu L, Musunuru K, Nicol D, O'Neill H, Qiu R, Ranisch R, Sherkow JS, Soni S, Terry S, Topol E, Williamson R, Zhang F, Davies K. (2020) Reactions to the National Academies/Royal Society Report on Heritable Human Genome Editing. *CRISPR J.* 3:332-349. doi: 10.1089/crispr.2020.29106.man.

194. **Barrangou R.** (2020) Nobel Dreams Come True for Doudna and Charpentier. *CRISPR J.* 3:317-318. doi: 10.1089/crispr.2020.29109.rba.

193. **Barrangou R.** (2020) Commissions, Consensus, and CRISPR. *CRISPR J.* 2020 3:316-317. doi: 10.1089/crispr.2020.29107.rba.

192. O'Flaherty S, Foley MH, Rivera AJ, Theriot CM, **Barrangou R.** (2020) Complete Genome Sequence of *Lactobacillus johnsonii* NCK2677, Isolated from Mice. *Microbiol Resour Announc* 9:e00918-20. doi:10.1128/MRA.00918-20

191. Monte DFM, Nethery MA, **Barrangou R,** Landgraf M, Fedorka-Cray PJ. (2020) Whole-genome sequencing analysis and CRISPR genotyping of rare antibiotic-resistant *Salmonella enterica* serovars isolated from food and related sources. *Food Microbiol* 93:103601. Doi: 10.1016/j.fm.2020.103601

190. LaManna CM, Pythila B, **Barrangou R.** (2020) Sharing the CRISPR Toolbox with an Expanding Community. *CRISPR J* 3:248-252. doi: 10.1089/crispr.2020.0075

189. **Barrangou R.** (2020) In times like these, we all need a moment of science. *CRISPR J* 3:223 doi: 10.1089/crispr.2020.29102.rba

188. Klotz C, Goh YJ, O'Flaherty S, **Barrangou R.** (2020) S-layer associated proteins contribute to the adhesive and immunomodulatory properties of *Lactobacillus acidophilus* NCFM. *BMC Microbiol* 20:248. doi: 10.1186/s12866-020-01908-2.

187. **Barrangou R**, Sontheimer EJ. (2020) Shutting down RNA-targeting CRISPR. *Science* 369:31-32. doi: 10.1126/science.abc8243
186. **Barrangou R**. (2020) Finding SECURE Ground: USDA Edits the Biotechnology Regulatory Framework. *CRISPR J* 3:136–137 doi: 10.1089/crispr.2020.29096.rba
185. Roberts A, **Barrangou R**. (2020) Applications of CRISPR-Cas systems in Lactic Acid Bacteria. *FEMS Microbiol Rev* doi: 10.1093/femsre/fuaa016
184. Pan M, Nethery MA, Hidalgo-Cantabrana C, **Barrangou R**. (2020) Comprehensive Mining and Characterization of CRISPR-Cas Systems in *Bifidobacterium*. *Microorganisms* doi: 10.3390/microorganisms8050720
183. Brandt K, Nethery MA, O'Flaherty S, **Barrangou R**. (2020) Genomic characterization of *Lactobacillus fermentum* DSM 20052. *BMC Genomics* 21(1):328. doi: 10.1186/s12864-020-6740-8
182. Davies K, **Barrangou R**. (2020) COVID-19 and the CRISPR Community Response. *CRISPR J* 3:66. doi: 10.1089/crispr.2020.29092.rba
181. Reed AD, Nethery MA, Stewart A, **Barrangou R**, Theriot CM. (2020) Strain-dependent inhibition of *Clostridioides difficile* by commensal Clostridia encoding the bile acid inducible (bai) operon. *J Bacteriol* pii: JB.00039-20. doi: 10.1128/JB.00039-20
180. Klotz C, Goh YJ, O'Flaherty S, Johnson B, **Barrangou R**. (2020) Deletion of S-Layer Associated Ig-Like Domain Protein Disrupts the *Lactobacillus acidophilus* Cell Surface. *Front Microbiol* 11:345. doi: 10.3389/fmicb.2020.00345
179. Selle K, Fletcher JR, Tuson H, Schmitt DS, McMillan L, Vridhambal GS, Rivera AJ, Montgomery SA, Fortier L-C, **Barrangou R**, Theriot CM, Ousterout DG. (2020) *In vivo* targeting of *Clostridioides difficile* using phage delivered CRISPR-Cas3 antimicrobials. *mBio* 11:e00019-20. DOI: 10.1128/mBio.00019-20.
178. **Barrangou R**, Sontheimer EJ. (2020) CRISPR Shields: Fending Off Diverse Cas Nucleases with Nucleus-like Structures. *Mol Cell* 77:934-936. doi: 10.1016/j.molcel.2020.02.015.
177. **Barrangou R**. (2020) Ushering in the next CRISPR decade. *CRISPR J* 3:2 DOI: 10.1089/crispr.2020.29085.rba
176. Pan M, **Barrangou R**. (2020) Combining omics technologies with CRISPR-based genome editing to study food microbes. *Curr Opin Biotechnol* 61:198-208. doi:10.1016/j.copbio.2019.12.027
175. M Pan, C Hidalgo-Cantabrana, **R Barrangou**. (2020) Host and body site-specific adaptation of *Lactobacillus crispatus* genomes. *NAR Genomics & Bioinformatics* 2, lqaa001
174. Pan M, Hidalgo-Cantabrana C, Goh YJ, Sanozky-Dawes R, **Barrangou R**. (2020) Comparative Analysis of *Lactobacillus gasseri* and *Lactobacillus crispatus* Isolated From Human Urogenital and Gastrointestinal Tracts. *Front Microbiol* doi: 10.3389/fmicb.2019.03146

173. Hidalgo-Cantabrana C, **Barrangou R.** (2020) Characterization and applications of Type I CRISPR-Cas systems. *Biochem Soc Trans* doi: 10.1042/BST20190119
172. Makarova KS, Wolf YI, Iranzo J, Shmakov SA, Alkhnbashi OS, Brouns SJJ, Charpentier E, Cheng D, Haft DH, Horvath P, Moineau S, Mojica FJM, Scott D, Shah SA, Siksnyš V, Terns MP, Venclovas Č, White MF, Yakunin AF, Yan W, Zhang F, Garrett RA, Backofen R, van der Oost J, **Barrangou R.**, Koonin EV. (2019) Evolutionary classification of CRISPR-Cas systems: a burst of class 2 and derived variants. *Nat Rev Microbiol* doi:10.1038/s41579-019-0299-x.
171. **Barrangou R.** (2019) Partnering with bioRxiv. *CRISPR J* 2:342 doi:10.1089/crispr.2019.29076.rba
170. **Barrangou R.** (2019) Foresight is 2020: ten bold predictions for the new CRISPR year. *CRISPR J* 2:341-342 DOI: 10.1089/crispr.2019.29075.rba
169. Nethery MA, Henriksen ED, Daughtry KV, Johanningsmeier SD, **Barrangou R.** (2019) Comparative genomics of eight *Lactobacillus buchneri* strains isolated from food spoilage. *BMC Genomics* 20:902. doi: 10.1186/s12864-019-6274-0.
168. Young JK, Gasior SL, Jones S, Wang L, Navarro P, Vickroy B, **Barrangou R.** (2019) The repurposing of type I-E CRISPR-Cascade for gene activation in plants. *Comm Biol* doi: 10.1038/s42003-019-0637-6
167. Huang Y, Porter A, Zhang Y, **Barrangou R.** (2019) Collaborative networks in gene editing. *Nat Biotechnol.* 37:1107-1109. doi: 10.1038/s41587-019-0275-z
166. **Barrangou R.** (2019) Thinking about CRISPR: the ethics of human genome editing. *CRISPR J* 2:247-248 doi: 10.1089/crispr.2019.29072.rba
165. Pickar-Oliver A, Black JB, Lewis MM, Mutchnick KJ, Klann TS, Gilcrest KA, Sitton MJ, Nelson CE, Barrera A, Bartelt LC, Reddy TE, Beisel CL, **Barrangou R.**, Gersbach CA. (2019) Targeted transcriptional modulation with type I CRISPR-Cas systems in human cells. *Nat Biotechnol.* doi: 10.1038/s41587-019-0235-7
164. **Barrangou R.** (2019) Bringing CRISPR to the cinema. *CRISPR J* 2:187 doi: 10.1089/crispr.2019.29070.rba
163. Davis TH. (2019) Profile of **Rodolphe Barrangou.** *Proc Natl Acad Sci U S A* 116:15754-15756. doi: 10.1073/pnas.1911079116.
162. Hidalgo-Cantabrana C, Goh YJ, Pan M, Sanozky-Dawes R, **Barrangou R.** (2019) Genome editing using the endogenous type I CRISPR-Cas system in *Lactobacillus crispatus*. *Proc Natl Acad Sci U S A* 116:15774-15783. doi: 10.1073/pnas.1905421116.
161. Selle K, Andersen JM, **Barrangou R.** (2019) Short communication: Transcriptional response to a large genomic island deletion in the dairy starter culture *Streptococcus thermophilus*. *J Dairy Sci.* 102:7800-7806. doi: 10.3168/jds.2019-16397
160. **Barrangou R.** (2019) Taking CRISPR to New Heights. *CRISPR J* 2:133 doi: 10.1089/crispr.2019.29064.rba.

159. Cañez C, Selle K, Goh YJ, **Barrangou R.** (2019) Outcomes and characterization of Chromosomal Self-Targeting by Native CRISPR-Cas Systems in *Streptococcus thermophilus*. *FEMS Microbiol Lett.* 366 doi: 10.1093/femsle/fnz105
158. **Barrangou R,** Notebaart RA. (2019) CRISPR-Directed Microbiome Manipulation across the Food Supply Chain. *Trends Microbiol* S0966-842X(19)30070-8. doi: 10.1016/j.tim.2019.03.006
157. **Barrangou R.** (2019) Time To Let CRISPR B.E.? *CRISPR J* 2: 67. doi: 10.1089/crispr.2019.29055.rdb
156. Brandt K, **Barrangou R.** (2019) Applications of CRISPR Technologies Across the Food Supply Chain. *Annu Rev Food Sci Technol* 25:10:133-150. doi: 10.1146/annurev-food-032818-121204
155. Varble A, Meaden S, **Barrangou R,** Westra ER, Marraffini LA. (2019) Recombination between phages and CRISPR-cas loci facilitates horizontal gene transfer in staphylococci. *Nat Microbiol* doi: 10.1038/s41564-019-0400-2
154. Foley MH, O’Flaherty S, **Barrangou R,** Theriot CM. (2019) Bile salt hydrolases: Gatekeepers of bile acid metabolism and host-microbiome crosstalk in the gastrointestinal tract. *PLoS Pathogens* doi: 10.1371/journal.ppat.1007581
153. **Barrangou R.** (2019) CRISPR on the move in 2019. *CRISPR J* 2:1-2. doi: 10.1089/CRISPR.2019.29043.rba
152. Nethery MA, **Barrangou R.** (2019) Predicting and visualizing features of CRISPR-Cas systems. *Methods Enzymol* 616:1-25. doi: 10.1016/bs.mie.2018.10.016.
151. Goh YJ, **Barrangou R.** (2019) Harnessing CRISPR-Cas systems for precision engineering of designer probiotic lactobacilli. *Curr Op Biotechnol* 56, 163-171
150. **Barrangou R.** (2018) CRISPR crossroad for genome editing. *CRISPR J* 1:349-350. Doi: 10.1089/crispr.2018.29040.rba
149. **Barrangou R.** (2018) Expanding the CRISPR Landscape on a *cas* by *cas* Basis. *CRISPR J* 1:303-303. doi: 10.1089/crispr.2018.29035.rba
148. Morovic W, Roos P, Zabel B, Hidalgo-Cantabrana C, Kiefer A, **Barrangou R.** (2018) Transcriptional and functional analysis of *Bifidobacterium animalis* subsp. *lactis* exposure to tetracycline. *Appl Environ Microbiol.* pii: AEM.01999-18. doi: 10.1128/AEM.01999-18.
147. Hidalgo-Cantabrana C, Goh YJ, **Barrangou R.** (2018) Characterization and Repurposing of Type I and Type II CRISPR-Cas Systems in Bacteria. *J Mol Biol.* S0022-2836(18)31107-0. doi: 10.1016/j.jmb.2018.09.013
146. Klotz C, **Barrangou R** (2018) Engineering components of the *Lactobacillus* S-layer for biotherapeutic applications. *Frontiers Microbiol* doi: 10.3389/fmicb.2018.02264

145. Bikard D, **Barrangou R** (2018) CRISPR-Cas systems as weapons against pathogenic bacteria. *Biol Aug* 211:265-270. doi: 10.1051/jbio/2018004
144. Hidalgo-Cantabrana C, Sanozky-Dawes R, **Barrangou R**. (2018) Insights into the human virome using CRISPR spacers from microbiomes. *Viruses* 10:479. doi: 10.3390/v10090479
143. Nethery MA, **Barrangou R**. (2018) CRISPR Visualizer: rapid identification and visualization of CRISPR loci via an automated high-throughput processing pipeline. *RNA Biol*. doi: 10.1080/15476286.2018.1493332.
142. Faure G, Shmakov SA, Makarova KS, Wolf YI, Crawley AB, **Barrangou R**, Koonin EV. (2018) Comparative genomics and evolution of trans-activating RNAs in Class 2 CRISPR-Cas systems. *RNA Biol*. doi: 10.1080/15476286.2018.1493331.
141. Curchoe CL, **Barrangou R**. (2018) Pomp and circumstance: making the case for CRISPR. *CRISPR J* 1:252-253. doi: 10.1089/crispr/2018.2930.oxf
140. **Barrangou R**. (2018) CRISPR craziness: a response to the EU court ruling. *CRISPR J* 1:250-251. doi: 10.1089/crispr.2018.29025.edi
139. Crawley AB, **Barrangou R**. (2018) Conserved genome organization and core transcriptome of the *Lactobacillus acidophilus* complex. *Frontiers Microbiol* 9:1834. doi: 10.3389/fmicb.2018.01834
138. Crawley AB, Henriksen ED, Stout E, Brandt K, **Barrangou R**. (2018) Characterizing the activity of abundant, diverse and active CRISPR-Cas systems in lactobacilli. *Sci Rep*. 8:11544. doi: 10.1038/s41598-018-29746-3.
137. Stout EA, Sanozky-Dawes R, Goh YJ, Crawley AB, Klaenhammer TR, **Barrangou R**. (2018) Deletion-based escape of CRISPR-Cas9 targeting in *Lactobacillus gasseri*. *Microbiology*. doi: 10.1099/mic.0.000689
136. Davies K, **Barrangou R**. (2018) MasterChef at Work. *CRISPR J* 1:219-222. doi: 10.1089/crispr.2018.29015.int
135. **Barrangou R**. (2018) The Democratization of CRISPR. *CRISPR J* 1:203-204. doi: 10.1089/crispr.2018.29019.rba
134. LaManna CM, **Barrangou R**. (2018) Enabling the Rise of a CRISPR World. *CRISPR J* 1:105-208. doi: 10.1089/crispr.2018.0022
133. Brandt K, **Barrangou R**. (2018) Using glycolysis enzyme sequences to inform *Lactobacillus* phylogeny. *Microb Genom*. doi: 10.1099/mgen.0.000187
132. O'Flaherty S, Briner Crawley A, Theriot CM, **Barrangou R**. (2018) The *Lactobacillus* Bile Salt Hydrolase Repertoire Reveals Niche-Specific Adaptation. *mSphere* 3: e00140-18. doi: 10.1128/mSphere.00140-18.
131. Daughtry KV, Johanningsmeir SD, Sanozky-Dawes R, Klaenhammer TR, **Barrangou R**

- (2018) Phenotypic and genotypic diversity of *Lactobacillus buchneri* strains isolated from spoiled, fermented cucumber. *Int. J. Food Microbiol.* 280:46-56. doi: 10.1016/j.ijfoodmicro.2018.04.044
130. Crawley AB, Henriksen JR, **Barrangou R** (2018) CRISPRdisco: An Automated Pipeline for the Discovery and Analysis of CRISPR-Cas Systems. *CRISPR J* 1:171-181
129. **Barrangou R** (2018) Cultivating CRISPR. *CRISPR J* 1:99-100 doi: 10.1089/crispr.2018.29011.rba
128. **Barrangou R**, van der Oost J (2018) Mining for novel bacterial defence systems. *Nat Microbiol.* doi: 10.1038/s41564-018-0149-z
127. Gersbach CA, **Barrangou R** (2018) Pulling the genome in opposite directions to dissect gene networks. *Genome Biol* 19:42 doi:10.1186/s13059-018-1425-1
126. **Barrangou R** (2018) Keep Calm and CRISPR on. *CRISPR J* 1:1-3. doi:10.1089/crispr.2017.29000.rba
125. Anderson EM, McClelland S, Maksimova E, Strezoska Ž, Basila M, Briner AE, **Barrangou R**, Smith AVB. (2018) *Lactobacillus gasseri* CRISPR-Cas9 characterization *In Vitro* reveals a flexible mode of protospacer-adjacent motif recognition. *PLoS One.* 13(2):e0192181. doi: 10.1371/journal.pone.0192181.
124. Weissman JL, Holmes R, **Barrangou R**, Moineau S, Fagan WF, Levin BR, Johnson PLF (2018). Immune Loss as a Driver of Coexistence During Host-Phage Coevolution. *ISME J* 12:585-597. doi: 10.1038/ismej.2017.194
123. Klotz C, O'Flaherty A, Goh YJ, **Barrangou R** (2017) Investigating the effect of growth phase on the surface-layer associated proteome of *Lactobacillus acidophilus* using quantitative proteomics. *Frontiers in Microbiology* 8:2174. doi: 10.3389/fmicb.2017.02174.
122. Theilmann MC, Goh YJ, Nielsen KF, Klaenhammer TR, **Barrangou R**, Abou Hachem M. (2017). *Lactobacillus acidophilus* metabolizes dietary plant glucosides and externalizes their bioactive phytochemicals. *mBio* 8.pii: e01421-17. doi: 10.1128/mBio.01421-17.
121. Barrangou R, Bikard D. (2017). CRISPR-Cas systems: at the cutting edge of microbiology. *Curr Opin Microbiol* 37:vii-viii. doi: 10.1016/j.mib.2017.09.015
120. Hidalgo Cantabrana C, Crawley AB, Sanchez B, **Barrangou R** (2017) Characterization and exploitation of CRISPR loci in *Bifidobacterium longum*. *Frontiers Microbiol* 8:1851. doi: 10.3389/fmicb.2017.01851. eCollection 2017
119. Toms A, **Barrangou R**. (2017). On the global CRISPR array behavior in Class I systems. *Biol Direct.* 12:20 doi: 10.1186/s13062-017-0193-2
118. Donohue PD, **Barrangou R**, May AP. (2017) Advances in industrial biotechnology using CRISPR-Cas systems. *Trends Biotechnol* S0167-7799(17)30187-7. doi: 10.1016/j.tibtech.2017.07.007

117. Bikard D, **Barrangou R.** (2017) Using CRISPR-Cas systems as antimicrobials. *Curr Opin Microbiol* 37:155-160. doi: 10.1016/j.mib.2017.08.005
116. van Pijkeren JP, **Barrangou R.** (2017). Genome editing of food-grade lactobacilli to develop therapeutic probiotics. *Microbiol Spectr* 5:5. doi:10.1128/microbiolspec.BAD-0013-2016
115. QnAs with Rodolphe **Barrangou.** (2017). *Proc Natl Acad Sci U S A* 114:7183-7184. doi: 10.1073/pnas.1710348114
114. Hidalgo-Cantabrana C, O'Flaherty S, **Barrangou R.** (2017) CRISPR-based engineering of next-generation lactic acid bacteria. *Curr Opin Microbiol.* 37:79-87. doi: 10.1016/j.mib.2017.05.015
113. Johnson BR, O'Flaherty SJ, Goh YJ, Carroll I, **Barrangou R,** Klaenhammer TR. (2017) The S-layer associated serine protease homolog PrtX impacts cell surface-mediated microbe-host interactions of *Lactobacillus acidophilus* NCFM. *Front. Microbiol.* doi:10.3389/fmicb.2017.01185
112. **Barrangou R,** Horvath P. (2017) A decade of discovery: CRISPR functions and applications. *Nat Microbiol.* 2:17092. doi: 10.1038/nmicrobiol.2017.92
111. **Barrangou R,** Ousterout DG. (2017) Repurposing CRISPR-Cas systems as DNA-based smart antimicrobials. *Cell & Gene Therapy Insights.* 3:63-72 doi:10.18609/cg .2017.008
110. Selle K, Goh YJ, Johnson BR, O'Flaherty S, Andersen JM, **Barrangou R,** Klaenhammer TR. (2017) Deletion of Lipoteichoic Acid Synthase Impacts Expression of Genes Encoding Cell Surface Proteins in *Lactobacillus acidophilus*. *Front Microbiol.* 8:553. doi: 10.3389/fmicb.2017.00553.
109. **Barrangou R,** Gersbach CA. (2017) Expanding the CRISPR Toolbox: Targeting RNA with Cas13b. *Mol Cell.* 65:582-584. doi: 10.1016/j.molcel.2017.02.002
108. Stout E, Klaenhammer T, **Barrangou R.** (2017) CRISPR-Cas Technologies and Applications in Food Bacteria. *Annu Rev Food Sci Technol.* 8:413-437. doi: 10.1146/annurev-food-072816-024723.
107. Morovic W, Hibberd AA, Zabel B, **Barrangou R,** Stahl B. (2016) Genotyping by PCR and High-Throughput Sequencing of Commercial Probiotic Products Reveals Composition Biases. *Front. Microbiol.* dx.doi.org/10.3389/fmicb.2016.01747
106. **Barrangou R,** Doudna JA. (2016) Applications of CRISPR technologies in research and beyond. *Nature Biotechnology* 34:933-941 doi:10.1038/nbt.3659
105. Andersen JM, Shoup M, Robinson C, Britton R, Olsen KEP, **Barrangou R.** (2016) CRISPR diversity and microevolution in *Clostridium difficile*. *Genome Biology and Evolution.* doi: 10.1093/gbe/evw203
104. Briner AE, **Barrangou R.** (2016) Guide RNAs: A Glimpse at the Sequences that Drive CRISPR–Cas Systems. *CRISPR-Cas a laboratory manual.* CSHL Protocols. 17-23

103. Briner AE, Henriksen ED, **Barrangou R**. (2016) Prediction and validation of native and engineered Cas9 guide sequences. *CRISPR-Cas a laboratory manual*. CSHL Protocols. 24-30
102. Brandt K, **Barrangou R**. (2016) Phylogenetic Analysis of the *Bifidobacterium* Genus Using Glycolysis Enzyme Sequences. *Front Microbiol*. 7:657. doi: 10.3389/fmicb.2016.00657.
101. 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*. 62:137-47. doi: 10.1016/j.molcel.2016.02.031
100. Briner AE, **Barrangou R**. (2016) Deciphering and shaping bacterial diversity through CRISPR. *Current Op Microbiol*. 31:101-108. doi: 10.1016/j.mib.2016.03.006
99. Sun CL, Thomas BC, **Barrangou R**, Banfield JF. (2016) Metagenomic reconstructions of bacterial CRISPR loci constrain population histories. *ISME J* 10:858-70. doi: 10.1038/ismej.2015.162.
98. Hymes J, Johnson B, **Barrangou R**, Klaenhammer TR. (2016) Functional analysis of an S-layer associated fibronectin binding protein in *Lactobacillus acidophilus*. *App Environ Microbiol pii: AEM.00024-16*
97. **Barrangou R**, Dudley EG. (2016) CRISPR-based typing and next-generation tracking technologies. *Ann Rev Food Sci Technol* 7:395-411. doi: 10.1146/annurev-food-022814-015729
96. **Barrangou R**, van Pijkeren JP. (2015) Exploiting CRISPR-Cas immune systems for genome editing in bacteria. *Curr Op Biotechnol* 37:61-68. doi: 10.1016/j.copbio.2015.10.003
95. **Barrangou R**. (2015) Diversity of CRISPR-Cas immune systems and molecular machines. *Genome Biol* 16:247. doi: 10.1186/s13059-015-0816-9
94. Johnson BR, Hymes J, Sanozky-Dawes R, Henriksen EE, **Barrangou R**, Klaenhammer TR. (2015) Exoproteome analysis of S-layer forming lactobacilli reveals conserved S-layer associated proteins (SLAPs). *App Environ Microbiol* 82:134-45. doi: 10.1128/AEM.01968-15
93. Selle KM, **Barrangou R**. (2015) CRISPR-based technologies and the future of food science. *J Food Sci* 80:R2367-72. doi: 10.1111/1750-3841.13094
92. Sun Z, Harris HMB, McCann A, Yang X, Argimon S, Zhang W, Guo C, Jeffery IB, Cooney JC, Kagawa TF, Liu W, Song Y, Salvetti E, Wrobel A, Rasinkangas P, Parkhill J, Rea MC, O'Sullivan O, Ritari J, Douillard FP, Ross RP, Yang R, Briner A, Felis G, de Vos WM, **Barrangou R**, Klaenhammer TR, Caufield PW, Cui Y, Zhang H, O'Toole PW. (2015) Expanding the biotechnology potential of lactobacilli through comparative genomics. *Nature Comm* 6:8322. doi: 10.1038/ncomms9322.
91. Makarova KS, Wolf YI, Alkhnbashi O, Costa F, Shah S, Saunders SJ, **Barrangou R**, Brouns SJJ, Charpentier E, Haft DH, Horvath P, Moineau S, Mojica FJM, Terns RM, Terns MA, White MF, Yakunin AF, Garrett RA, van der Oost J, Backofen R, Koonin EV. (2015) An updated evolutionary classification scheme for CRISPR-Cas systems. *Nature Rev Microbiol* 13:722-36. doi:10.1038/nrmicro3569

90. Sanozky-Dawes R, Selle K, O’Flaherty SO, Klaenhammer TR, **Barrangou R**. (2015) Occurrence and activity of a type II CRISPR-Cas system in *Lactobacillus gasseri*. *Microbiology*. 161:1752-61 doi: 10.1099/mic.0.000129
89. Briner AE, Lugli GA, Milani C, Duranti S, Turrone F, Gueimonde M, Margolles A, van Sinderen D, Ventura M, **Barrangou R** (2015) Occurrence and Diversity of CRISPR-Cas Systems in the Genus *Bifidobacterium*. *PLoS One* 10:e0133661
88. Sontheimer EJ, **Barrangou R** (2015) The Bacterial Origins of the CRISPR Genome-Editing Revolution. *Hum Gene Ther* 26:413-24
87. Selle K, Klaenhammer TR, **Barrangou R** (2015) CRISPR-based screening of genomic island excision events in bacteria. *Proc Natl Acad Sci U S A* 112:8076-81
86. Dupuis MÈ, **Barrangou R**, Moineau S (2015) Procedures for Generating CRISPR Mutants with Novel Spacers Acquired from Viruses or Plasmids. *Methods Mol Biol*. 1311:195-222
85. Paez-Espino D, Sharon I, Morovic W, Stahl B, Thomas BC, **Barrangou R**, Banfield JF (2015) CRISPR immunity drives rapid phage genome evolution in *Streptococcus thermophilus*. *MBio*. 6:e00262-15
84. Kyung KH, Medina Pradas E, Kim SG, Lee YJ, Kim KH, Choi JJ, Cho JH, Chung CH, **Barrangou R**, Breidt F (2015) Microbial ecology of watery kimchi. *J Food Sci*. 80:M1031-8
83. **Barrangou R**, Birmingham A, Wiemann S, Beijersbergen RL, Hornung V, Smith A (2015) Advances in CRISPR-Cas9 genome engineering: lessons learned from RNA interference. *Nucleic Acids Res*. 43:3407-19
82. Selle K, **Barrangou R** (2015) Harnessing CRISPR-Cas systems for bacterial genome editing. *Trends Microbiol*. 23:225-32
81. **Barrangou R** (2015) The roles of CRISPR-Cas systems in adaptive immunity and beyond. *Curr Opin Immunol*. 32:36-41
80. **Barrangou R**, van der Oost J. (2015) Bacteriophage exclusion, a new defense system. *EMBO J*. 34:134-135
79. **Barrangou R**, May AP (2015) Unraveling the potential of CRISPR-Cas9 for gene therapy. *Expert Opin Biol Ther* 15:311-4
78. Shariat N, Timme RE, Pettengill JB, **Barrangou R**, Dudley E. (2015) Characterization and Evolution of *Salmonella* CRISPR-Cas Systems. *Microbiology* 161:374-386.
77. **Barrangou R**, Horvath P. (2014) Functions and applications of RNA-guided CRISPR-Cas immune systems. *Enc Mol Cell Biol Mol Med* DOI: 10.1002/3527600906.mcb.20130001
76. Beisel CL, Gomaa AA, **Barrangou R**. (2014) A CRISPR design for next-generation antimicrobials. *Genome Biol* 15:516

75. Briner AE, Donohoue PD, Gomaa AA, Selle K, Slorach EM, Nye CH, Haurwitz RE, Beisel CL, May AP, **Barrangou R**. (2014) Guide RNA functional modules direct Cas9 activity and orthogonality. *Mol Cell* 56:333-9
74. Milani C, Lugli GA, Duranti S, Turrone F, Bottacini F, Mangifesta M, Sanchez B, Viappiani A, Mancabelli L, Taminiau B, Delcenserie V, **Barrangou R**, Margolles A, van Sinderen D, Ventura M. (2014) Genomic encyclopedia of type strains of the genus *Bifidobacterium*. *Appl Environ Microbiol* 80:6290-302
73. Wehnes CA, Rehberger TG, **Barrangou R**, Smith AH. (2014) Determination of *Salmonella* clustered regularly interspaced short palindromic repeats (CRISPR) diversity on dairy farms in Wisconsin and Minnesota. *J Dairy Sci* 97:6370-7
72. **Barrangou R**, Klaenhammer TR. (2014) Bacteria get vaccinated. *Nature* 513:175-6
71. **Barrangou R**. (2014) Cas9 targeting and the CRISPR revolution. *Science* 344:707-8
70. Carte J, Christopher RT, Smith JT, Olson S, **Barrangou R**, Moineau S, Glover CV 3rd, Graveley BR, Terns RM, Terns MP. (2014) The three major types of CRISPR-Cas systems function independently in CRISPR RNA biogenesis in *Streptococcus thermophilus*. *Mol Microbiol* 93:98-112
69. **Barrangou R**, Marraffini LA. (2014) CRISPR-Cas systems: Prokaryotes upgrade to adaptive immunity. *Mol Cell* 54:234-44
68. Pettengill JB, Timme RE, **Barrangou R**, Toro M, Allard MW, Strain E, Musser SM, Brown EW. (2014) The evolutionary history and diagnostic utility of the CRISPR-Cas system within *Salmonella enterica* ssp. *enterica*. *PeerJ* 2:e340
67. 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:e00928-13
66. Toro M, Cao G, Ju W, Allard M, **Barrangou R**, Zhao S, Brown E, Meng J. (2014) Association of clustered regularly interspaced short palindromic repeat (CRISPR) elements with specific serotypes and virulence potential of shiga toxin-producing *Escherichia coli*. *Appl Environ Microbiol* 80:1411-20
65. Briner AE, **Barrangou R**. (2014) *Lactobacillus buchneri* genotyping on the basis of clustered regularly interspaced short palindromic repeat (CRISPR) locus diversity. *Appl Environ Microbiol.* 80:994-1001
64. Abou Hachem M, Møller MS, Andersen JM, Fredslund A, Majumder A, Nakai H, Lo Leggio L, Goh YJ, **Barrangou R**, Klaenhammer TR, Svensson B. (2013) A snapshot into the metabolism of isomalto-oligosaccharides in probiotic bacteria. *J Appl Glycosci* 60:95-100
63. Abou Hachem M, Andersen JM, **Barrangou R**, Møller MS, Fredslund F, Majumder A, Ejby M, Lahtinen SJ, Jacobsen S, Lo Leggio L, Goh YJ, Klaenhammer TR, Svensson B. (2013) Recent insight into oligosaccharide uptake and metabolism in probiotic bacteria. *Biocat Biotransform* 31:226-235

62. **Barrangou R**, Coûté-Monvoisin AC, Stahl B, Chavichvily I, Damange F, Romero DA, Boyaval P, Fremaux C, Horvath P. (2013) Genomic impact of CRISPR immunization against bacteriophages. *Biochem Soc Trans* 41:1383-91.
61. Shariat N, Sandt CH, DiMarzio MJ, **Barrangou R**, Dudley E.G. (2013) CRISPR-MVLST subtyping of *Salmonella enterica* subsp. *enterica* serovars Typhimurium and Heidelberg and application in identifying outbreak isolates. *BMC Microbiol* 13:254.
60. Timme RE, Pettengill JB, Allard MW, Strain E, **Barrangou R**, Wehnes C, Van Kessel JS, Karns JS, Musser SM, Brown EW. (2013) Phylogenetic diversity of the enteric pathogen *Salmonella enterica* subsp. *enterica* inferred from genome-wide reference-free SNP characters. *Genome Biol Evol* 5:2109-23.
59. Loquasto JR, **Barrangou R**, Dudley EG, Stahl B, Chen C, Roberts RF. (2013) *Bifidobacterium animalis* subsp. *lactis* ATCC 27673 is a genomically unique strain within this conserved subspecies. *Appl Environ Microbiol* 79:6903-10
58. Yin S, Jensen MA, Bai J, Debroy C, **Barrangou R**, Dudley EG. (2013) The Evolutionary Divergence of Shiga Toxin-Producing *Escherichia coli* Is Reflected in Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) Spacer Composition. *Appl Environ Microbiol* 79:5710-20
57. Dimarzio M, Shariat N, Kariyawasam S, **Barrangou R**, Dudley EG. (2013) Antibiotic resistance in *Salmonella* Typhimurium associates with CRISPR sequence type. *Antimicrob Agents Chemother* 9:4282-9
56. Shariat N, Kirchner MK, Sandt CH, Trees E, **Barrangou R**, Dudley EG. (2013) Subtyping of *Salmonella enterica* serovar Newport outbreak isolates by CRISPR-MVLST and determination of the relationship between CRISPR-MVLST and PFGE results. *J Clin Microbiol* 51:2328-36
55. Stahl B, **Barrangou R**. (2013) Complete Genome Sequence of Probiotic Strain *Lactobacillus acidophilus* La-14. *Genome Announc* 1:e00376-13
54. Andersen JM, **Barrangou R**, Abou Hachem M, Lahtinen SJ, Goh YJ, Svensson B, Klaenhammer TR. (2013) Transcriptional analysis of oligosaccharide utilization by *Bifidobacterium lactis* Bl-04. *BMC Genomics* 14:312
53. Karvelis T, Gasiunas G, Miksys A, **Barrangou R**, Horvath P, Siksnys V. (2013) crRNA and tracrRNA guide Cas9-mediated DNA interference in *Streptococcus thermophilus*. *RNA Biol* 10:841-51
52. Horvath P, **Barrangou R**. (2013) RNA-guided genome editing à la carte. *Cell Res* 23:733-4.
51. **Barrangou R**. (2013) CRISPR-Cas systems and RNA-guided interference. *Wiley Interdiscip Rev RNA* 4:267-78
50. Shariat N, DiMarzio MJ, Yin S, Dettinger L, Sandt CH, Lute JR, **Barrangou R**, Dudley EG. (2013) The combination of CRISPR-MVLST and PFGE provides increased discriminatory power for differentiating human clinical isolates of *Salmonella enterica* subsp. *enterica* serovar

49. Levin BR, Moineau S, Bushman M, **Barrangou R** (2013) The Population and Evolutionary Dynamics of Phage and Bacteria with CRISPR-Mediated Immunity. PLoS Genet 9:e1003312
48. Paez-Espino D, Morovic W, Sun CL, Thomas BC, Ueda K, Stahl B, **Barrangou R**, Banfield JF. (2013) Strong bias in the bacterial CRISPR elements that confer immunity to phage. Nat Commun 4:1430
47. Sinkunas T, Gasiunas G, Waghmare SP, Dickman MJ, **Barrangou R**, Horvath P, Siksnys V. (2013) In vitro reconstitution of Cascade-mediated CRISPR immunity in *Streptococcus thermophilus*. EMBO J 32:385-94
46. Sun CL, **Barrangou R**, Thomas BC, Horvath P, Fremaux C, Banfield JF. (2013) Phage mutations in response to CRISPR diversification in a bacterial population. Env Microbiol 15:463-70
45. Gasiunas G, **Barrangou R**, Horvath P, Siksnys V. (2012) Cas9-crRNA ribonucleoprotein complex mediates specific DNA cleavage for adaptive immunity in bacteria. Proc Natl Acad Sci U S A 109:E2579-86
44. **Barrangou R**, Horvath P. (2012) CRISPR: New Horizons in Phage Resistance and Strain Identification. Annu Rev Food Sci Technol 3:143-62
43. Weinberger AD, Sun CL, Pluciński MM, Deneff VJ, Thomas BC, Horvath P, **Barrangou R**, Gilmore MS, Getz WM, Banfield JF. (2012) Persisting Viral Sequences Shape Microbial CRISPR-based Immunity. PLoS Comput Biol 8:e1002475.
42. Young JC, Dill BD, Pan C, Hettich RL, Banfield JF, Shah M, Fremaux C, Horvath P, **Barrangou R**, Verberkmoes NC. (2012) Phage-Induced Expression of CRISPR-Associated Proteins Is Revealed by Shotgun Proteomics in *Streptococcus thermophilus*. PLoS One 7:e38077
41. **Barrangou R**. (2012) RNA-mediated programmable DNA cleavage. Nat Biotechnol 30:836-8.
40. Stahl B, **Barrangou R**. (2012) Complete genome sequences of probiotic strains *Bifidobacterium animalis* subsp. *lactis* B420 and Bi-07. J Bacteriol 194:4131-2
39. Broadbent JR, Neeno-Eckwall EC, Stahl B, Tandee K, Cai H, Morovic W, Horvath P, Heidenreich J, Perna NT, **Barrangou R**, Steele JL. (2012) Analysis of the *Lactobacillus casei* supragenome and its influence in species evolution and lifestyle adaptation. BMC Genomics 5:533.
38. Andersen JM, **Barrangou R**, Hachem MA, Lahtinen SJ, Goh YJ, Svensson B, Klaenhammer TR. (2012) Transcriptional analysis of prebiotic uptake and catabolism by *Lactobacillus acidophilus* NCFM. PLoS One 7:e44409.
37. Abou Hachem M, Fredslund F, Andersen JM, Jonsgaard Larsen R, Majumder A, Ejby M, Van Zanten G, Lahtinen SJ, **Barrangou R**, Klaenhammer T, Jacobsen S, Coutinho PM, Lo Leggio L, Svensson B. (2012) Raffinose family oligosaccharide utilisation by probiotic bacteria:

insight into substrate recognition, molecular architecture and diversity of GH36 alpha-galactosidases. *Biocat Biotransform* 30: 316-325

36. Makarova KS, Haft DH, **Barrangou R**, Brouns SJ, Charpentier E, Horvath P, Moineau S, Mojica FJ, Wolf YI, Yakunin AF, van der Oost J, Koonin EV. (2011) Evolution and classification of the CRISPR-Cas systems. *Nat Rev Microbiol* 9:467-77.
35. Bhaya D, Davison M, **Barrangou R**. (2011) CRISPR-Cas systems in bacteria and archaea: versatile small RNAs for adaptive defense and regulation. *Annu Rev Genet* 45:273-97.
34. Sapranaukas R, Gasiunas G, Fremaux C, **Barrangou R**, Horvath P, Siksnys V. (2011) The *Streptococcus thermophilus* CRISPR/Cas system provides immunity in *Escherichia coli*. *Nucleic Acids Res* 39:9275-82
33. Sinkunas T, Gasiunas G, Fremaux C, **Barrangou R**, Horvath P, Siksnys V. (2011) Cas3 is a single-stranded DNA nuclease and ATP-dependent helicase in the CRISPR/Cas immune system. *EMBO J* 30:1335-42
32. Liu F, **Barrangou R**, Gerner-Smidt P, Ribot EM, Knabel SJ, Dudley EG. (2011) Novel virulence gene and clustered regularly interspaced short palindromic repeat (CRISPR) multilocus sequence typing scheme for subtyping of the major serovars of *Salmonella enterica* subsp. *enterica*. *Appl Environ Microbiol* 77:1946-56
31. Liu F, Kariyawasam S, Jayarao BM, **Barrangou R**, Gerner-Smidt P, Ribot EM, Knabel SJ, Dudley EG. (2011) Subtyping *Salmonella* serovar Enteritidis isolates from different sources using sequence typing based on virulence genes and CRISPRs. *Appl Environ Microbiol* 77:4520-6
30. Duong T, Miller MJ, **Barrangou R**, Azcarate-Peril MA, Klaenhammer TR. (2011) Construction of vectors for inducible and constitutive gene expression in *Lactobacillus*. *Microb Biotechnol* 4:357-67
29. Andersen JM, **Barrangou R**, Abou Hachem M, Lahtinen S, Goh YJ, Svensson B, Klaenhammer TR. (2011) Transcriptional and functional analysis of galactooligosaccharide uptake by *lacS* in *Lactobacillus acidophilus*. *Proc Natl Acad Sci USA* 108:17785-90
28. Loquasto JR, **Barrangou R**, Dudley EG, Roberts RF. (2011) The complete genome sequence of *Bifidobacterium animalis* subspecies *animalis* ATCC 25527(T) and comparative analysis of growth in milk with *B. animalis* subspecies *lactis* DSM 10140(T). *J Dairy Sci* 94:5864-70.
27. Horvath P, **Barrangou R**. (2010) CRISPR/Cas, the immune system of bacteria and archaea. *Science* 327:167-170
26. Garneau JE, Dupuis MÈ, Villion M, Romero DA, **Barrangou R**, Boyaval P, Fremaux C, Horvath P, Magadán AH, Moineau S. (2010) The CRISPR/Cas bacterial immune system cleaves bacteriophage and plasmid DNA. *Nature* 468:67-71
25. Putaala H, **Barrangou R**, Leyer GJ, Ouwehand AC, Hansen EB, Romero DA, Rautonen N. (2010) Analysis of the human intestinal epithelial cell transcriptional response to *Lactobacillus acidophilus*, *Lactobacillus salivarius*, *Bifidobacterium lactis* and *Escherichia coli*. *Beneficial*

24. Horvath P, Coûté-Monvoisin AC, Romero DA, Boyaval P, Fremaux C, **Barrangou R**. (2009) Comparative analysis of CRISPR loci in lactic acid bacteria genomes. *Int J Food Microbiol* 131:62-70
23. **Barrangou R**, Briczinski EP, Traeger LL, Loquasto JR, Richards M, Horvath P, Coûté-Monvoisin AC, Leyer G, Rendulic S, Steele JL, Broadbent JR, Oberg T, Dudley EG, Schuster S, Romero DA, Roberts RF. (2009) Comparison of the complete genome sequences of *Bifidobacterium animalis* subsp. *lactis* DSM 10140 and Bl-04. *J Bacteriol* 191:4144-4151
22. Briczinski EP, Loquasto JR, **Barrangou R**, Dudley EG, Roberts AM, Roberts RF. (2009) Strain-specific genotyping of *Bifidobacterium animalis* subsp. *lactis* by using single-nucleotide polymorphisms, insertions, and deletions. *Appl Environ Microbiol* 75:7501-7508
21. Ventura M, Turrone F, Lima-Mendez G, Foroni E, Zomer A, Duranti S, Giubellini V, Bottacini F, Horvath P, **Barrangou R**, Sela DA, Mills DA, van Sinderen D. (2009) Comparative analyses of prophage-like elements present in bifidobacterial genomes. *Appl Environ Microbiol* 75:6929-6936
20. **Barrangou R**, Horvath P. (2009) The CRISPR system protects microbes against phages, plasmids. *Microbe* 4:224-230
19. Deveau H, **Barrangou R**, Garneau JE, Labonté J, Fremaux C, Boyaval P, Romero DA, Horvath P, Moineau S. (2008) Phage response to CRISPR-encoded resistance in *Streptococcus thermophilus*. *J Bacteriol* 190:1390-1400
18. Horvath P, Romero DA, Coûté-Monvoisin AC, Richards M, Deveau H, Moineau S, Boyaval P, Fremaux C, **Barrangou R**. (2008) Diversity, activity and evolution of CRISPR loci in *Streptococcus thermophilus*. *J Bacteriol* 190:1401-1412
17. Azcarate-Peril MA, Altermann E, Goh YJ, Tallon R, Sanozky-Dawes RB, Pfeiler EA, O'Flaherty S, Buck BL, Dobson A, Duong T, Miller MJ, **Barrangou R**, Klaenhammer TR. (2008) Analysis of the genome sequence of *Lactobacillus gasseri* ATCC33323 reveals the molecular basis of an autochthonous intestinal organism. *App Environ Microbiol* 74:4610-4625
16. Klaenhammer TR, Altermann E, Pfeiler E, Buck BL, Goh YJ, O'Flaherty S, **Barrangou R**, Duong T. (2008) Functional genomics of probiotic lactobacilli. *J Clin Gastroenterol* 42:S160-162.
15. **Barrangou R**, Fremaux C, Deveau H, Richards M, Boyaval P, Moineau S, Romero DA, Horvath P. (2007) CRISPR provides acquired resistance against viruses in prokaryotes. *Science* 315:1709-12
14. Klaenhammer TR, Azcarate-Peril MA, Altermann E, **Barrangou R**. (2007) Influence of the dairy environment on gene expression and substrate utilization in lactic acid bacteria. *J Nutr* 137:748S-50S
13. Yoon SS, **Barrangou R**, Breidt Jr F, Fleming HP. (2007) Detection and characterization of a lytic *Pediococcus* bacteriophage from fermenting cucumber brine. *J Microbiol Biotechnol*

12. Makarova K, Slesarev A, Wolf Y, Sorokin A, Mirkin B, Koonin E, Pavlov A, Pavlova N, Karamychev V, Polouchine N, Shakhova V, Grigoriev I, Lou Y, Rohksar D, Lucas S, Huang K, Goodstein DM, Hawkins T, Plengvidhya V, Welker D, Hughes J, Goh Y, Benson A, Baldwin K, Lee JH, Díaz-Muñoz I, Dosti B, Smeianov V, Wechter W, Barabote R, Lorca G, Altermann E, **Barrangou R**, Ganesan B, Xie Y, Rawsthorne H, Tamir D, Parker C, Breidt F, Broadbent J, Hutkins R, O'Sullivan D, Steele J, Unlu G, Saier M, Klaenhammer T, Richardson P, Kozyavkin S, Weimer B, Mills D. (2006) Comparative genomics of the lactic acid bacteria. *Proc Natl Acad Sci USA* 103:15611-15616

11. **Barrangou R**, Azcarate-Peril MA, Duong T, Connors SB, Kelly RM, Klaenhammer TR. (2006) Global analysis of carbohydrate utilization by *Lactobacillus acidophilus* using cDNA microarrays. *Proc Natl Acad Sci USA* 103:3816-3821

10. Ventura M, Canchaya C, Bernini V, Altermann E, **Barrangou R**, McGrath S, Claesson MJ, Li Y, Leahy S, Walker CD, Zink R, Neviani E, Steele J, Broadbent J, Klaenhammer TR, Fitzgerald GF, O'toole PW, van Sinderen D. (2006) Comparative genomics and transcriptional analysis of prophages identified in the genomes of *Lactobacillus gasseri*, *Lactobacillus salivarius* and *Lactobacillus casei*. *Appl Environ Microbiol* 72:3130-3146

9. Duong T, **Barrangou R**, Russell WM, Klaenhammer TR. (2006) Characterization of the *tre* locus and analysis of trehalose cryoprotection in *Lactobacillus acidophilus* NCFM. *Appl Environ Microbiol* 72:1218-1225

8. Altermann E, Russell WM, Azcarate-Peril MA, **Barrangou R**, Buck BL, McAuliffe O, Souther N, Dobson A, Duong T, Callanan M, Lick S, Hamrick A, Cano R, Klaenhammer TR. (2005) Complete genome sequence of the probiotic lactic acid bacterium *Lactobacillus acidophilus* NCFM. *Proc Natl Acad Sci USA* 102:3887-4216

7. Klaenhammer TR, **Barrangou R**, Buck BL, Azcarate-Peril MA, Altermann E. (2005) Genomic features of lactic acid bacteria effecting bioprocessing and health. *FEMS Microbiol Rev* 29:393-409

6. Klaenhammer TR, Azcarate-Peril MA, **Barrangou R**, Duong T, Altermann E. (2005) Genomic perspectives on probiotic lactic acid bacteria. *Biosc Microflora* 24:31-33

5. Pridmore RD, Berger B, Desiere F, Vilanova D, Barretto C, Pittet AC, Zwahlen MC, Rouvet M, Altermann E, **Barrangou R**, Mollet B, Mercenier A, Klaenhammer T, Arigoni F, Schell MA. (2004) The genome sequence of the probiotic intestinal bacterium *Lactobacillus johnsonii* NCC533. *Proc Natl Acad Sci USA* 101:2512-2517

4. **Barrangou R**, Altermann E, Hutkins R, Cano R, Klaenhammer TR. (2003) Functional and comparative genomic analyses of an operon involved in fructooligosaccharide utilization by *Lactobacillus acidophilus*. *Proc Natl Acad Sci USA* 100:8957-8962

3. **Barrangou R**, Yoon SS, Breidt Jr F Jr, Fleming HP, Klaenhammer TR. (2002) Characterization of six *Leuconostoc fallax* bacteriophages isolated from an industrial sauerkraut fermentation. *Appl Environ Microbiol* 68:5452-5458

2. **Barrangou R**, Yoon SS, Breidt F Jr, Fleming HP, Klaenhammer TR. (2002) Identification and characterization of *Leuconostoc fallax* strains isolated from an industrial sauerkraut fermentation. *Appl Environ Microbiol* 68:2877-2884

1. Yoon SS, **Barrangou R**, Breidt Jr F, Klaenhammer TR, Fleming HP. (2002) Isolation and characterization of bacteriophages from fermenting sauerkraut. *Appl Environ Microbiol* 68:973-976

Books, book chapters and Magazine features:

9. **Barrangou R**. (2022) Engineering genomes for sustainable agriculture: opportunities and challenges. *The Bridge, NAE* summer 2022. 17-21.

8. **Barrangou R**. Sontheimer E, Marraffini L. eds. (2022) *CRISPR Biology and Applications*. ASM Press

7. **Barrangou R**. (2021) CRISPR-Cas: From bacterial adaptive immunity to a genome editing revolution. *XBio The Explorer's guide to biology* <https://explorebiology.org/>

6. Foegeding EA, Klaenhammer TR, **Barrangou R** (2019) Unlocking the Genomics of Lactic Acid Bacteria. *Food Technol* 73:72-78.

5. **Barrangou R**, van der Oost J. eds. (2012) *CRISPR-Cas systems: RNA-mediated adaptive immunity in bacteria and archaea*. Springer Science & Business Media

4. Horvath P, Gasiunas G, Siksnys V, **Barrangou R**. (2012) Applications of the versatile CRISPR-Cas systems. *CRISPR-Cas systems: RNA-mediated adaptive immunity in bacteria and archaea*. Springer Science & Business Media 267-286

3. **Barrangou R**, Lahtinen SJ, Ibrahim F, Ouweland AC. (2012) Genus lactobacillus. *Lactic acid bacteria. Microbiological and functional aspects*, 73

2. **Barrangou R**, Horvath P. (2011) *Lactic Acid Bacteria Defenses Against Phages. Stress Responses of Lactic Acid Bacteria*. Springer US, 459-478

1. **Barrangou R**, Horvath P. (2010) Protection against foreign DNA. *Bacterial stress responses*. American Society for Microbiology Press, 333-348

f. Collaborators & Grants

Collaborators

Jack Wang, NC State University: genome editing of trees and forestry applications

Casey Theriot, NC State University: probiotics & CRISPR-based solutions against *C. difficile*

Charlie Gersbach, Duke University : applications of CRISPR-Cas systems in eukaryotes

Gregg Dean, Colorado State University: engineering of probiotics for viral immunization

Marco Ventura, University of Parma: occurrence and activity of CRISPR in bifidobacteria

Current Research Support

LBNL-DOE (PI) *mCAFEs: Microbial Community Analysis and Functional Evaluation in soils*.

Pairwise Plants (co-PI) *Transgene-free CRISPR-based genome editing in Caneberry*

Intellia Therapeutics (PI) Mining metagenomic data for genome engineering tools
NC Ag Foundation (PI, PINS 1475) *Functional genomics of Lactobacillus acidophilus*
DuPont-IFF (PI, PINS 0495) *Functional Genomics of Probiotic Lactobacillus species and beneficial cultures.*
USDA-AFRI (co-PI) Vaccine against Clostridial dermatitis in turkeys.

Past Research Support

BASF (PI, PINS 88784) *Investigating novel DNA delivery polymers*
DOE (co-PI, PINS 86711) *Microbial community analysis and functional evaluation in soils.*
NIH (R01 co-PI PINS 92135) *Identification and characterization of novel CRISPR-based genome editing systems.*
NIH (R01 co-PI PINS) *Novel recombinant rotavirus vaccine utilizing the probiotic microorganism Lactobacillus acidophilus*
NSF (EAGER co-PI, PINS 91035) *Electrically driving the microbial conversion of nitrogen gas into ammonia.*
North Carolina State University Chancellor Innovation Fund (co-PI, PINS 3078). *Transgene-free CRISPR-based genome editing in forest trees.*
Novozymes (PI, PINS) *CRISPR-based genome editing in Bacillus*
Elysium (PI, PINS 91983) *Selection and formulation of next-generation probiotics in combination with bioactive compounds*
LifeEDIT (PI, PINS 86919, 2017-2018) *Mining novel CRISPR-Cas systems*
NSF BBBE (co-PI). (CBET-1403135, 2014-2017) *Engineering highly specific and orthogonal CRISPR-Cas systems.*
NIH (R21 co-PI, PINS 62045, 2015-2017) *A biotherapeutic CRISPR-delivery platform to eradicate Clostridium difficile.*
DuPont Pioneer (PI, PINS 63352, 2015-2017) *GRAS CRISPR-Cas9 systems for genome editing in plants*
USDA-NIFA (co-PI, PINS 61227), (2015-2016) *Development of Methods for Knockout Chickens: CRISPR-Cas Genome Editing To Understand Foodborne Pathogen-Host Interactions In Poultry*
FNU (Denmark Research council) (co-PI). (2014-2016). *Occurrence and diversity of CRISPR-Cas systems in clostridia.*
Danish Council for Independent Research (PI, PINS 63956) *Prebiotic utilization by probiotic bacteria.*
North Carolina State University Chancellor Innovation Fund (PI, PINS 56415). (2014-2015). *Novel CRISPR Systems for Genome Editing.*
North Carolina Biotechnology Center (PI, PINS 57198). (#558507, 2014-2015). *Novel CRISPR-Cas9 systems for enhanced genome editing.*
North Carolina State University CALS enhancement grant (co-PI, PINS 55185). (2013-2014) *Enhancer Excision based on CRISPR technology: a tool for deciphering gene regulation.*

g. Patents

Patents issued

1. 11,162,114 RNA-guided nucleases, active fragments and variants thereof and methods of use
2. 10,787,654 Methods and compositions for sequence guiding Cas9 targeting
3. 10,711,267 Recombinant type I CRISPR-Cas system
4. 10,662,227 Bifidobacteria CRISPR sequences
5. 10,640,778 Method of modulating cell resistance

6. 10,584,358 Compositions and methods related to a type-II CRISPR-Cas system in *Lactobacillus buchneri*
7. 10,543,239 Lactic acid bacteria and bifidobacteria for treating endotoxemia
8. 10,450,584 Cas9 proteins and guiding features for DNA targeting and genome editing
9. 10,136,649 Methods for screening bacteria, archaea, algae, and yeast using CRISPR nucleic acids
10. 10,066,233 Method of modulating cell resistance
11. 9,951,342 Cultures with improved phage resistance
12. 9,879,269 Method for modulating resistance
13. 9,816,140 Tagged microorganisms and methods of tagging
14. 9,399,801 Tagged microorganisms and methods of tagging
15. 9,259,447 Lactic acid bacteria and bifidobacteria for treating endotoxemia
16. 8,361,725 Detection and typing of bacterial strains
17. 8,178,337 *Lactobacillus acidophilus* nucleic acid sequences encoding carbohydrate utilization-related proteins and uses therefor
18. 7,919,277 Detection and typing of bacterial strains
19. 7,838,276 *Lactobacillus acidophilus* nucleic acid sequences encoding carbohydrate utilization-related proteins and uses therefor
20. 7,824,894 *Lactobacillus acidophilus* nucleic acids encoding fructo-oligosaccharide utilization compounds and uses thereof
21. 7,495,092 Compositions comprising promoter sequences and methods of use
22. 7,459,289 *Lactobacillus acidophilus* nucleic acid sequences encoding carbohydrate utilization-related proteins and uses therefor
23. 7,407,787 *Lactobacillus acidophilus* nucleic acids encoding fructo-oligosaccharide utilization compounds and uses thereof

Patents pending

1. 20190021343 METHODS FOR SCREENING BACTERIA, ARCHAEA, ALGAE, AND YEAST USING CRISPR NUCLEIC ACIDS
2. 20180371405 METHODS AND COMPOSITIONS FOR DELIVERY OF CRISPR BASED ANTIMICROBIALS
3. 20170275648 NOVEL CAS9 PROTEINS AND GUIDING FEATURES FOR DNA TARGETING AND GENOME EDITING
4. 20170037416 Method of Modulating Cell Resistance
5. 20170002339 Methods and Compositions for Sequences Guiding Cas9 Targeting
6. 20160345578 METHODS FOR SCREENING BACTERIA, ARCHAEA, ALGAE, AND YEAST USING CRISPR NUCLEIC ACIDS
7. 20160289700 COMPOSITIONS AND METHODS RELATED TO A TYPE-II CRISPR-CAS SYSTEM IN *LACTOBACILLUS BUCHNERI*
8. 20160113976 LACTIC ACID BACTERIA AND BIFIDOBACTERIA FOR TREATING ENDOTOXEMIA
9. 20150093473 CULTURES WITH IMPROVED PHAGE RESISTANCE
10. 20150056628 DETECTION AND TYPING OF BACTERIAL STRAINS
11. 20140199767 USE (of *cas* genes)
12. 20130158245 Detecting and Typing of Bacterial Strains
13. 20130011828 Use (of *cas* genes)
14. 20120196325 *LACTOBACILLUS ACIDOPHILUS* NUCLEIC ACID SEQUENCES ENCODING CARBOHYDRATE UTILIZATION-RELATED PROTEINS AND USES THEREFOR
15. 20120183516 Lactic acid bacteria and bifidobacteria for treating endotoxemia

16. 20110300541 Detection and typing of bacterial strains
17. 20110300538 BIFIDOBACTERIA CRISPR SEQUENCES
18. 20110081707 *LACTOBACILLUS ACIDOPHILUS* NUCLEIC ACID SEQUENCES ENCODING CARBOHYDRATE UTILIZATION-RELATED PROTEINS AND USES THEREFOR
19. 20110008292 *LACTOBACILLUS ACIDOPHILUS* NUCLEIC ACIDS ENCODING FRUCTO-OLIGOSACCHARIDE UTILIZATION COMPOUNDS AND USES THEREOF
20. 20110002889 Cultures with Improved Phage Resistance
21. 20100104690 Tagged Microorganisms and Methods of Tagging
22. 20100093617 Use (of *cas* genes)
23. 20090155913 COMPOSITIONS COMPRISING PROMOTER SEQUENCES AND METHODS OF USE
24. 20090093021 *LACTOBACILLUS ACIDOPHILUS* NUCLEIC ACID SEQUENCES ENCODING CARBOHYDRATE UTILIZATION-RELATED PROTEINS AND USES THEREFOR
25. 20090005311 *LACTOBACILLUS ACIDOPHILUS* NUCLEIC ACIDS ENCODING FRUCTO-OLIGOSACCHARIDE UTILIZATION COMPOUNDS AND USES THEREOF
26. 20080124725 Tagged microorganisms and methods of tagging
27. 20070003668 *Lactobacillus acidophilus* nucleic acid sequences encoding carbohydrate utilization-related proteins and uses therefor
28. 20060199190 Detection and typing of bacterial strains
29. 20060166323 Compositions comprising promoter sequences and methods of use
30. 20050123941 *Lactobacillus acidophilus* nucleic acids encoding fructo-oligosaccharide utilization compounds and uses thereof

Recent applications:

1. **R. Dewey et al.** “Adaptation of the CRISPR-Cas9 system of *Lactobacillus gasseri* for genome editing in *Nicotiana tabacum*” (IDF 19178)
2. **R. Barrangou et al.** “Use of PDX in combination with CRISPR constructs to edit or alter microbiomes” (IDF 19195)
3. **R. Barrangou et al.** “Development of RNP-based CRISPR-Cas systems for editing in trees” (IDF 19150)
4. **R. Barrangou et al.** “Novel Type I CRISPR-Cas systems for eukaryote genome editing” (IDF 18291)
5. **R. Barrangou et al.** “Use of endogenous Type I CRISPR-Cas systems for editing and screening in bacteria” (IDF 18220)
6. **R. Barrangou et al.** “Catabolism of and adaptation to plant compounds by probiotic lactobacilli” (IDFs 18127, 18224)
7. **M. Nethery and R. Barrangou** “Automated pipeline to detect CRISPR-Cas systems” (IDF 18144)
8. **R. Barrangou et al.** “Engineering a novel *Lactobacillus acidophilus* strains for PKU” (IDF18134)
9. **R. Barrangou et al.** “Compositions and methods for increasing phytochemical bioavailability and bioactivity” (62/536,209; IDF 17229).
10. **R. Barrangou et al.** “Altering guide RNAs for modulating Cas9 activity and methods of use” (62/511,462)

h. Select seminars and conference highlights (select recent presentations)

- Broad Institute – MIT (March 2024)

- American Heart Association (November 2023)
- American College of Cardiology, New Orleans (March 2023)
- Gairdner Symposium , Toronto (October 2022)
- Annual CRISPR conference, MIT (June 2022)
- Co-host and Organizer, Annual CRISPR conference, Pasteur Institute (June 2021)
- Molecules in the Mountain (May 2021)
- New Frontiers Series (January 2021)
- First international conference on BioDesign Research (December 2020)
- APLU Experimental Station Annual Meeting (September 2020)
- Ontario Genomics Annual Meeting (September 2020)
- NCFAR Annual Meeting (July 2020)
- Pepsi Research Academy Keynote (December 2019)
- Genetics of Industrial Microbes (Keynote speaker, September 2019)
- 5th international conference on microbial diversity (September 2019)
- CPH:DOX international film conference (March 2019)
- Keystone Genome editing conference (co-organizer and speaker, February 2019)
- Rosalind Franklin Society (November 2018)
- ASHG Genome and transcriptome engineering conference, San Diego (October 2018)
- AAAS Science Matters series, Washington D.C. (September 2018)
- Annual CRISPR conference, Vilnius Lithuania (June 2018), speaker and co-organizer
- FASEB genome editing conference, Florence Italy (June 2018)
- RTI symposium, Worcester MA (June 2018)
- Annual CRISPR conference, Bozeman MT (June 2017)
- Alexandria Ag Summit, New York City NY (February 2017)
- Conference Legrain, Paris France (January 2017)
- Warren Alpert Symposium, Harvard Medical School (October 2016)
- Genome editing 4.0, MIT/Broad Institute, Boston (May 2016)
- Seminars presented at: University of Missouri, University of Arizona, Emory University, University of Georgia, North Carolina State University, the Pennsylvania State University, the University of Illinois at Urbana-Champaign, University of Wisconsin-Madison, Duke University, University of Michigan, University of North-Carolina Chapel Hill, The Georgia Institute of Technology, University of Lethbridge, University of Toronto, Guelph University, Waterloo University, Western University, University Laval, Colorado State University, University of British Columbia, University of Quebec at Montreal, NIEHS, FDA, USDA, USPTO, Michigan State University, University of Maryland
- Invited CRISPR seminars presented at commercial and industrial stakeholders: DuPont, Caribou Biosciences, Pioneer, AgBiome, Intellia Therapeutics, Dharmacon, GE Healthcare, GSK, Raleigh Science Museum, Syngenta, Syngenta Ventures, Biogemma/Limagrain, Precision Biosciences, STI Ag, Novozymes, Chr Hansen, Locus Biosciences, AgriMetis, AmpliPhi, BASF, Altria, Elysium, Bayer, ChemChina, Nestle, RTI, AgTech Accelerator, Pioneer, Ontario Genomics, Genome Canada, Burrows Wellcome Fund, Epibiome, Alltech, Inari, Invaio, BRI, Illumina, NCREN, NC Biolabs, Pepsi, Bayer, Pairwise Plants, APLU, Wacker, Soredab, Mammoth Biosciences, CSL, Schreiber, Pfizer, Eli Lilly, CurieCo, Empresas COPEC, P&G, Promega, PPD, Lesaffre, Fonterra and others.

i. Student advising

Graduated, chair or co-chair

Briner,Alexandra E	FBNS	MS ‘Spring 2015
Daughtry,Katheryne V	FBNS	MS ‘Spring2016
Dekam,Emily Ae-Hui	FBNS	MS ‘Summer 2016
Hymes,Jeffrey	FBNS	MS ‘Spring 2016
Johnson,Brant R	Micro	PhD ‘Spring 2016
Selle,Kurt M	Genomics	PhD ‘Spring 2016
Canez,Casie Lynn	Genomics	MS ‘Spring 2018
Briner,Alexandra E	Genomics	PhD ‘Spring2018
Brandt,Katelyn	Genomics	PhD ‘Spring 2019
Klotz,Courtney	Genomics	PhD ‘Spring 2019
Pan, Meichen	Food Science	MS ‘Spring 2019
Andersen, Stefanie	Bioinformatics	MR ‘Spring 2020
Fideler-Moore, Jennifer	FBNS	PhD ‘Spring 2021
Chamberlain, MaryClaire	Food Science	MS ‘Summer 2021
Nethery, Matthew	Genomics	PhD ‘Spring2022
Pan, Meichen	Genomics	PhD ‘Fall 2023
Avery Roberts	Genomics	PhD ‘Spring 2024

In progress, chair or co-chair

Kalani Gast	Microbiology	PhD advisor
Ourania Raftopoulou	Microbiology	PhD advisor
John Beckley	Microbiology	PhD advisor
Emma Jager	Microbiology	PhD advisor
Grace Fuller	Genomics	PhD advisor
Tim Shin	Microbiology	PhD advisor
Sydney Baker	Microbiology	PhD advisor

Graduated, Committee Member

Manuel,Clyde Simmons	FBNS	PhD ‘Spring2016
Mahmoud Gomaa,Ahmed	ChemE	PhD ‘Summer 2016
Almand,Erin Ahmo	FBNS	PhD ‘Spring 2017
Cauley,Sarah M	FBNS	PhD ‘Spring 2017
Parsons,Cameron T	FBNS	PhD ‘Spring 2017
Luo,Michelle Lynn	ChemE	PhD ‘Spring 2017
Palatini, Kimberly	FBNS	PhD ‘Spring 2017
Leenay, Ryan T	ChemE	PhD ‘Spring 2018
Toms, Alice	Genomics	PhD ‘Spring 2020
Zang, Zhontian	Microbiology	PhD ‘Spring 2021

In progress, Committee Member

Fan,Sicun	FBNS	PhD Committee member
Zeldes,Benjamin	ChemE	PhD Committee member
Straub, Christopher T	ChemE	PhD Committee member
Collias, Daphne	ChemE	PhD Committee member
Yang, Sophia	Biochem	PhD Committee member

Visiting scholars and post docs

Matthew Foley	FBNS	visiting scholar Sep’19-now
Claudio Hidalgo-Cantabrana	FBNS	visiting scholar Dec’16-20
Joakim Andersen	FBNS	visiting scholar May’14-16

At Penn State University, Committee Member

Zhaoyong, Ba	Food Science PhD 2015
Shuang, Yin	Food Science PhD 2014
Joseph Loquasto	Food Science PhD 2013
Liu, Fenyun	Food Science MS 2010

i. Instruction

2022 Spring Term

BBS 201-001 Introduction to Biopharmaceutical Sciences, 16 enrolled

FS 893-001 DR Supervised Research, 5 enrolled

2021 Spring Term

BBS 201-001 (Class 1342) Introduction to Biopharmaceutical Sciences, 14 enrolled

FS 695-001 (Class 2967) MR Thesis Research, 1 enrolled

FS 893-001 (Class 2975) DR Supervised Research, 4 enrolled

2020 Spring Term

BBS 201-001 (Class 1342) Introduction to Biopharmaceutical Sciences, 23 enrolled

FS 695-001 (Class 2967) MR Thesis Research, 1 enrolled

FS 725-001 (Class 5368) Fermentation Microbiology, 10 enrolled

FS 893-001 (Class 2975) DR Supervised Research, 4 enrolled

MB 725-001 (Class 12272) Fermentation Microbiology, 2 enrolled

2019 Spring Term

BBS 201-001 (Class) Introduction to Biopharmaceutical Sciences, 23 enrolled

FS 695-001 (Class) MR Thesis Research, 1 enrolled

FS 893-001 (Class 2975) DR Supervised Research, 4 enrolled

MB 725-001 (Class 12272) Fermentation Microbiology, 2 enrolled

2018 Spring Term

BBS 201-001 (Class 1342) Introduction to Biopharmaceutical Sciences, 23 enrolled

FS 695-001 (Class 2967) MR Thesis Research, 1 enrolled

FS 725-001 (Class 5368) Fermentation Microbiology, 10 enrolled

FS 893-001 (Class 2975) DR Supervised Research, 4 enrolled

MB 725-001 (Class 12272) Fermentation Microbiology, 2 enrolled

2017 Fall Term

FS 693-001 (Class3834) MR Supervised Research, 1 enrolled

FS 893-001 (Class3845) DR Supervised Research, 3 enrolled

FS 895-001 (Class1846) DR Dissertation Research, 1 enrolled

2017 Spring Term

BBS 201-001 (Class1359) Introduction to Biopharmaceutical Science, 24 enrolled

FS 693-001 (Class3048) MR Supervised Research, 1 enrolled

FS 893-001 (Class3057) DR Supervised Research, 2 enrolled

FS 895-001 (Class3059) DR Dissertation Research, 1 enrolled

2016 Fall Term

FS 693-001 (Class3953) MR Supervised Research, 1 enrolled

FS 893-001 (Class3965) DR Supervised Research, 3 enrolled

2016 Spring Term

BBS 201-001 (Class 1391) Introduction to Biopharmaceutical Sciences, 22 enrolled

FS 693-001 (Class 3506) MR Supervised Research, 1 enrolled

FS 725-001 (Class6686) Fermentation Microbiology, 14 enrolled

FS 893-001 DR Supervised Research, 3 enrolled

MB 725-001 Fermentation Microbiology, 3 enrolled

2015 Fall Term

FS 693-001 (Class 4147) MR Supervised Research, 1 enrolled

FS 893-001 (Class 4159) DR Supervised Research, 3 enrolled

MB 695-001 (Class 12154) MR Thesis Research, 1 enrolled

2015 Spring Term

BBS 201-001 (Class1411) Introduction to Biopharmaceutical Sciences, 15 enrolled

FS 693-001 (Class 3630) MR Supervised Research, 1 enrolled

FS 699-001 (Class 3632) MR Thesis Preparation, 1 enrolled

2014 Fall Term

FS 693-001 (Class 4622) MR Supervised Research, 1 enrolled

2014 Spring Term

BBS 201-001 (class#1532) Introduction to Biopharmaceutical Sciences, 24 enrolled

FS 693-001 (class#4386) MR Supervised Research, 1 enrolled

2013 Fall Term

FS 693-001 (class#5306) MR Supervised Research, 1 enrolled

k. Committees and service

A. FBNS Department

- Food Science Club Advisor and Executive Board Member 2013-2014
- FBNS Preliminary examination, committee member 2013-now
- FBNS Strategic Planning, committee chair, 2013-2014; 2014-2015
- FBNS Undergraduate Curriculum Committee, member 2015-2016
- FBNS Graduate Curriculum Committee, Member 2016-2018
- FBNS Microbiome position hiring committee (PHHI), Member, 2017-2018
- FBNS Graduate Curriculum Committee, Chair 2017-2018
- FBNS Food Chemistry faculty hiring committee 2018-2019
- FBNS Dairy Enterprise Director committee, Chair, 2020

B. CALS

- CALS Dean Search (2022, 2023)
- CALS Big Ideas Committee (2014)

- CALS Efficiency and Innovation Committee (2015)
- CALS Stewart of the Future Committee Chair (2015-2016)
- CALS Plant Sciences Initiative (2016-2017)
- Plant Pathology Department, open position hiring committee (2016-2017)
- NC Ag Foundation member of the Board of Directors (since 2015)

C. University

- Provost Task Force on Brand and Reputation (2020)
- PSI Director hire committee (2019-2021)
- Microbiome cluster hire committee (2015-2017)
- Microbiology interdisciplinary program faculty member
- Biotechnology interdisciplinary program faculty member
- Genomic Sciences interdisciplinary program faculty member
- Comparative Medicine Institute faculty member
- Genome Engineering and Society Center faculty member
- Genetics Department Associate Faculty member

D. Professional Associations

- US Inventors Hall of Fame (since 2023)
- US National Academy of Inventors (since 2020)
- US National Academy of Engineering (since 2019)
- US National Academy of Sciences (since 2018)
- ASM General Membership (since 2013)
- AEM Editorial Board member (since 2015)
- Genome Biology, Editorial Board member (since 2017)
- Current Opinion in Microbiology special issue guest editor (2017)
- PLoS Genetics guest editor (2017)
- CRISPR Journal, Editor in Chief (since 2018)
- Center for Food Integrity, Gene Editing Responsible Use Guidelines working group (2017-2018)
- 2017-2021 Co-Editor, ASM book on CRISPR Microbiology, ASM Press

E. Peer reviewing

Ad hoc reviewer and referee for Science, Nature, Cell, Nature Biotechnology, Molecular Cell, PLoS Genetics, Nature Communications, Nature Methods, Nature Microbiology, PNAS, Genome Biology, CRISPRj, Molecular Biology, EMBO J, Nucleic Acids Research, BMC Genomics, BMC Microbiology, mBio, Journal of Virology, PLoS ONE, Journal of Bacteriology, ISME Journal and others. A total of 435 manuscripts (29 in 2013, 35 in 2014, 48 in 2015, 44 in 2016, 46 in 2017, 40 in 2018, 40 in 2019, 44 in 2020, 41 in 2021, 38 in 2022, 42 in 2023) have been reviewed since joining NC State in 2013.