Mark R Charbonneau

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Professional Profile

Biotechnology R&D leader with cross-functional expertise in live biotherapeutic drug development, mechanistic modeling, computational biology, and biomarker assay development. Integrates technical acumen and emotional intelligence to build high-functioning teams and foster innovation.

- Leadership experience includes overall strategy and execution for drug development research organization, including program nomination, candidate selection, and IND-enabling studies.
- Highly adept at communicating complex technical information to diverse stakeholders and enabling strategic business decisions.
- Developed innovative R&D capabilities that accelerated drug development timelines.
- Effective people manager with demonstrated experience recruiting talent, establishing a collaborative team culture, and developing direct reports.

Core Competencies

- Excellent written and oral communication
- Building value through innovation
- Project team planning and leadership
- Cross-functional collaboration
- People management and coaching
- Microbiome research
- Germ-free animal models
- Mechanistic model construction
- Biomarker assay development
- Data analysis and statistics
- Next Generation Sequencing
- Python programming

Professional Experience

Synlogic, Inc. I Cambridge, MA

Senior Director, Head of Translational Sciences *Jul 2021 – Present*

- Fulfilled dual roles as alliance director and research project leader for novel IBD therapeutic development program in collaboration with global pharma partner.

Director, Head of Quantitative Biology *Jan 2020 – Jun 2021*

- Served as chair of research leadership team, responsible for setting research goals and budget, allocating resources to align with corporate priorities, and representing research function to executive leadership team.
- Advanced early research projects through key development milestones, including progression of an enteric hyperoxaluria program (SYNB8802) from program nomination through IND-enabling studies in nine months.
- Built mechanistic computational models to predict function of synthetic biotics for the treatment of phenylketonuria (SYNB1618) and enteric hyperoxaluria (SYNB8802) in healthy subjects and patients to drive strategic decisions for clinical development.

Associate Director, Head of Quantitative Biology *Feb 2019 – Dec 2019*

- Led a functional R&D team of eight, responsible for sample bioanalysis, *in vitro* assay development, and mathematical modeling, and managed the efficient delivery of high-quality data to key stakeholders.
- Coordinated development, qualification/validation, and execution of LC-MS/MS based biomarker assays and clinical microbiology protocols to meet aggressive clinical development timelines (SYNB1618 and SYNB1891 programs).
- Established and led a collaboration with the US Air Force Research Laboratory 711th Human Performance Wing to demonstrate blood phenylalanine lowering, using human organ-on-a-chip technology, by a synthetic biotic for the treatment of phenylketonuria.

Senior Scientist *Aug 2017 – Feb 2019*

- Developed *in vitro* gastrointestinal simulation (IVS) assays to elucidate engineered bacterial strain function in the physiological conditions of the human gastrointestinal environment.
- Deployed IVS model to demonstrate activity of lyophilized synthetic biotic drug substance (SYNB1618, SYNB1020) and to identify a novel *in vivo* biomarker of SYNB1618 activity (phenyllactic acid).
- Established a partnership with the Broad Institute of MIT and Harvard to enable RNAseq-based transcriptional profiling of synthetic biotics under simulated gastrointestinal conditions.

Matatu, Inc. I Saint Louis, MO

Senior Scientist *May 2017 – Jul 2017*

Scientist *Jan 2016 – May 2017*

- Designed, implemented, and optimized next generation sequencing (NGS) based computational pipelines to identify and determine engraftment of putative growth-promoting bacterial strains in agricultural swine.
- Developed juvenile gnotobiotic (germ-free) mouse models to define the growth-promoting properties of consortia comprised of primary bacterial isolates.

Washington University in Saint Louis I Saint Louis, MO

PhD Candidate *Jul 2010 – Dec 2015*

- Defined the role of human milk oligosaccharides in promoting healthy growth by interaction with infant gut microbiota by developing gnotobiotic (germ-free) mouse and piglet models of undernutrition.
- Characterized the compositional, transcriptional, and metabolic responses of infant gut bacterial communities to human milk oligosaccharides.

Education

PhD, Computational and Systems Biology I 2010 - 2015

Washington University in Saint Louis, Saint Louis, MO

Thesis: “Characterizing the role of sialylated milk glycans and the infant gut microbiota in growth and metabolism”

Advisor: Jeffrey I. Gordon, MD

BS, Microbiology and Molecular Genetics I 2006 - 2009

Michigan State University, East Lansing, MI

Advisors: James M. Tiedje, PhD and C.A. Reddy, PhD

Professional Training

The Business of Biotechnology: Advanced Concepts, *RA Capital Management* | 2020

Influential Leadership Fundamentals, *Synlogic, Inc.* | 2018

Machine Learning, *Coursera.org* | 2017

Publications

Charbonneau MR, Denney WS, Horvath N, Cantarella P, Castillo MJ, Puurunen MK, and Brennan AM. Modeling the impact of an engineered bacterial therapeutic on plasma phenylalanine in healthy subjects and patients with phenylketonuria. *Commun Biol* **4**, 898. (2021). https://doi.org/10.1038/s42003-021-02183-1

Puurunen MK, Vockley J, Searle S, Sacharow S, Phillips J, Denney WS, Goodlett B, Wagner DA, Blankstein L, Castillo MJ, **Charbonneau MR**, Isabella VM, Sethuraman V, Riese R, Kurtz CB, and Brennan AM. Safety and pharmacodynamics of an engineered *E. coli* Nissle for the treatment of phenylketonuria: a first-in-human study. *Nat Metab.* (2021). https://doi.org/10.1038/s42255-021-00430-7

Nelson MT*, **Charbonneau MR***, Coia HG, Castillo MJ, Holt C, Greenwood ES, Robinson PJ, Merrill EA, Lubkowicz D, Mauzy CA. Characterization of an engineered live bacterial therapeutic for the treatment of phenylketonuria in a human gut-on-a-chip. *Nat. Comms.* **12**, 2805. (2021).

Charbonneau MR, Isabella VM, Li N, and Kurtz CB. Developing a new class of engineered live bacterial therapeutics to treat human diseases. *Nat. Comms.* **11**,1738. (2020).

Kurtz CB, Millet YA, Puurunen MK, Perreault M, **Charbonneau MR**, Isabella VM, Kotula JW, Antipov E, Dagon Y, Denney WS, Wagner DA, West KA, Degar AJ, Brennan AM, and Miller PF. An engineered *E. coli* Nissle improves hyperammonemia and survival in mice and shows dose-dependent exposure in healthy humans. *Sci. Transl. Med*. **11**(475), eaau7975. (2019).

Charbonneau MR, Blanton LV, DiGiulio DB, Relman DA, Lebrilla CB, Mills DA, and Gordon JI. A microbial perspective of human developmental biology. *Nature* **535**, 48-55. (2016).

Blanton LV, Barratt MJ, **Charbonneau MR**, Ahmed T, and Gordon JI. Childhood undernutrition, the gut microbiota, and microbiota-directed therapeutics. *Science* **352**(6293), 1533. (2016).

Charbonneau MR, O'Donnell D, Blanton LV, Totten SM, Davis, JCC, Barratt MJ, Cheng J, Guruge J, Talcott M, Bain JR, Muehlbauer MJ, Ilkayeva O, Wu C, Struckmeyer T, Barile D, Mangani C, Jorgensen J, Fan Y-M, Maleta K, Dewey KG, Ashorn P, Newgard CB, Lebrilla C, Mills DA, and Gordon JI. Sialylated milk glycans promote growth in gnotobiotic mice and pigs with a stunted Malawian infant gut microbiota. *Cell* **164**(5), 859–871 (2016).

Blanton LV, **Charbonneau MR**, Salih T, Barratt MJ, Venkatesh S, Ilkayeva O, Subramanian S, Manary MJ, Trehan I, Jorgensen JM, Fan Y-M, Henrissat B, Leyn SA, Rodionov DA, Osterman AL, Maleta KM, Newgard CB, Ashorn P, Dewey KG, and Gordon JI. Gut bacteria that prevent growth impairments transmitted by microbiota from malnourished children. *Science* **351**(6275), aad3311. (2016).

Faith JJ, Guruge JL, **Charbonneau MR**, Subramanian S, Seedorf H, Goodman AL, Clemente JC, Knight R, Heath AC, Leibel RL, Rosenbaum M, and Gordon JI. The long-term stability of the human gut microbiota. *Science* **341**(6141),1237439 (2013).

Invited Presentations

Microbiome Movement: Drug Development Summit I 2021
Development of a Synthetic Biotic for the Treatment of Enteric Hyperoxaluria

Keystone Symposium: Harnessing the Microbiome for Disease Prevention and Therapy I 2021
Development of a Synthetic Biotic for the Treatment of Enteric Hyperoxaluria

International Conference on Microbiome Engineering I 2020
Development of a Synthetic Biotic for the Treatment of Enteric Hyperoxaluria

International Conference on Microbiome Engineering I 2019
Development of an Engineered Therapeutic E. coli Nissle for the Treatment of Phenylketonuria.

Keystone Symposium on Manipulation of the Gut Microbiota for Metabolic Health I 2018
A Genetically Engineered E. coli Nissle to Prevent Hyperammonemia in Urea Cycle Disorders (UCDs).

Joint Meeting of the German and Japanese Societies of Developmental Biologists I 2017
Childhood undernutrition: a microbial view of human postnatal development.

Professional Honors

Synlogic CEO Award, *Synlogic, Inc.* I 2018, 2019

'Jedi Master' Award for Trust and Respect, *Synlogic, Inc.* I 2018, 2019