

Trevor W. Siggers, PhD

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Education

Columbia University, New York, NY 09/1999 – 02/2006

Degree: Ph.D. (with Distinction) Biochemistry & Molecular Biophysics

Thesis: Aligning and Modeling Protein-DNA Interfaces: Towards an understanding of Protein-DNA binding specificity.

Advisor: Barry Honig, Ph.D., Columbia University, HHMI

Simon Fraser University, Vancouver, BC, Canada 09/1993 – 05/1999

Degree: B.Sc. (with Honors) Mathematical Physics

Post-doctoral Training

Brigham & Women's Hospital/ Harvard Medical School, Boston, MA 01/2006 – 06/2012

Advisor: Martha L. Bulyk, Ph.D

Appointments

Associate Professor, Biology Dept., Boston University, Boston, MA 06/2019 – present

Assistant Professor, Biology Dept., Boston University, Boston, MA 07/2012 – 05/2019

Programmatic Appointments

Director Masters's Studies Program, BU, Biology Dept. 09/2019 – present

Member BU MCBB Graduate Program 2012 – present

Member BU Bioinformatics Graduate Program 2012 – present

Member BU Biological Design Center (BDC) 2017 – present

Member BUMC Immunology Training Program (ITP) 2018 – present

Honors & Awards

Dean's Award for Excellence in Graduate Education (Boston University) 2018

(*Finalist*) Metcalf Award (Boston University) 2018

NIH/NIAID K22 Research Scholar Development Award 2012

Peer Mentor Award (Brigham & Women's Hosp., Harvard Med. School) 2012

NSF Postdoctoral Research Fellowship in Biological Informatics 2006

Grants (*pending*)

January 2020 **NIH (RM1 GM139740)**

Title: Deciphering the microbiome-host interaction code at the molecular level

Agency: NIH

PIs: D. Segre, A. Emili, T. Siggers, G. Menichetti, S. Rakoffhahoum, K. Dmytro

Total costs requested: (\$6,863,564 dir. + \$2,418,040) = \$9,281,604 (5 years)

Grants

- 2021-2026 **NIH (R01 HL151650)**
Title: Exploring mechanisms of cardiac pacemaker cell fate determination
Agency: NIH
PIs: N. Munshi (U. Texas, Southwestern)
Role: Co-investigator
Total costs requested (to T. Siggers): (\$70,493 dir. + 45,820) = \$116,313 (5 years)
- 2020-2022 **NIH (R21 HG011289)**
Title: CASCADE: A high-throughput assay to characterize gene-regulatory complexes affected by single-nucleotide polymorphisms
Agency: NIH
PIs: T. Siggers
Total costs requested: (\$275,000 dir. + \$178,750) = \$453,750 (2 years)
- 2020-2025 **NIH (R01 AI51051)**
Title: Biophysical and functional characterization of immune-related regulatory elements and noncoding variants
Agency: NIH
PIs: T. Siggers
Co-investigators: A. Emili (BU), R. Tewhey (Jackson Labs)
Total costs requested: (\$2,194,409 direct + \$670,090 ind.) = \$2,864,499 (5 years)
- 2020-2021 **NSF (IOS 2031624)**
Title: Transcription Factor Profiling for SARS-CoV2 Tolerance/Symbiosis Regulation
Agency: NSF
PIs: T. Gilmore, T. Siggers, A. Emili
Total costs requested: (\$125,151 dir. + \$78,848) = \$199,999 (1 years)
- 2019-2024 **NIH (R01 AR073228)**
Title: Transcription Factor Genetics in Lupus
Agency: NIH
PIs: L. Kottyan, M. Weirauch, S. Waggoner (U. of Cincinnati College of Med)
Role: Sub-Site Investigator
Total costs awarded: \$2,353,770 (5 years)
Total costs awarded (BU subcontract to T. Siggers): \$217,913 (5 years)
- 2016– 2020 **NIH (R01 A116829)**
Title: Gene Regulation in the Immune System
Agency: NIH/NIAID
Role: PI
Total costs awarded: \$1,841,625 (5 years)

- 2014 – 2018 **NSF (IOS 13454935)**
Title: NF-kappaB in Cnidarian Development
Agency: NSF
Role: co-PI (with T. Gilmore and J. Finnerty, BU)
Total costs awarded: \$870,000 (4 years)
- 2015– 2016 **NIH (R56 AI116820)**
Title: Gene Regulation in the Immune System
Agency: NIH/NIAID
Role: PI
Total costs awarded: \$386,636 (1 year)
- 2016 – 2017 **BU-Joslin Diabetes Center Pilot and Feasibility Program (Sub_P30DK036836_P&F)**
Title: Characterizing the Effects of TZDs and Co-factor Recruitment by PPAR γ Using Protein-binding Microarrays and Mass Spectrometry
Agency: NIH/NIDDK; Sponsor: Joslin Diabetes Center
Role: PI
Total costs awarded: \$33,000
- 2015 – 2016 **Genome Sciences Institute (GSI) Seed Grant**
Title: A Method for the Comprehensive Analysis of Changes in Transcription Activity
Agency: Genome Science Institute (GSI), Boston University
Role: Co-PI (with T.D. Gilmore, BU)
Total costs awarded: \$20,000
- 2014 – 2015 **American Cancer Society (ACS) Pilot Project Grant (IRG-72-001-39)**
Title: The Role of LSF DNA Binding in Hepatocellular Carcinoma and Potential Relationship to DNA Binding of p53
Agency: American Cancer Society (ACS)
Role: PI
Total costs awarded: \$30,000
- 2014 – 2015 **BU-Joslin Diabetes Center Pilot and Feasibility Program (Sub_P30DK036836_P&F)**
Title: Characterizing the Effects of TZDs and Endogenous Ligands on PPAR γ Using Protein-binding Microarrays
Agency: NIH/NIDDK; Sponsor: Joslin Diabetes Center
Role: PI
Total costs awarded: \$31,433
- 2013 – 2014 **Genome Sciences Institute (GSI) Seed Grant**
Title: Vaginal Epithelial Response to Endogenous and Synthetic Reproductive Hormones
Agency: Genome Science Institute (GSI), Boston University

Role: Co-PI (with D. Anderson, BUMC)
Total costs awarded: \$20,000

2012 – 2014 **NIH/NIAID K22 Research Scholar Development Award**
Title: The Role of HMGA1 Proteins in NF-kB-dependent Gene Regulation
Agency: NIH/NIAID
Role: PI
Total costs awarded: \$264,594 (2 years)

Student Fellowships

2020 – 2021 **Immunology Training Program (ITP) Fellowship**
Agency: ITP, Boston University
PI: Heather Hook (Ph.D. graduate student)
Total costs awarded: 100% Salary

2019 – 2020 **Kilichand Fellows Program**
Agency: Multicellular Design Program (MDP), Boston University
PI: Heather Hook (Ph.D. graduate student)
Total costs awarded: 100% Salary

2018 – 2019 **Immunology Training Program (ITP) Fellowship**
Agency: ITP, Boston University
PI: Heather Hook (Ph.D. graduate student)
Total costs awarded: 100% Salary

2015 – 2016 **Cross-disciplinary Training in Nanotechnology for Cancer (XTNC) Fellowship**
Agency: Center for Nanoscience, Boston University
PI: Jessica Keenan (Ph.D. graduate student)
Total costs awarded: 50% Salary + \$750

Teaching

CAS BI 560: Systems Biology (*Developed as new course 2013*)

10 students	Spring	2013
8 students	Fall	2014
16 students	Fall	2015
34 students	Fall	2016
23 students	Fall	2017
15 students	Fall	2018
22 students	Fall	2019
17 students	Fall	2020

CAS BI 385: Immunology

69 students	Spring	2014
73 students	Spring	2015
130 students	Spring	2016

131 students	Spring 2017
143 students	Spring 2018
122 students	Spring 2019
126 students	Spring 2020
142 students	Spring 2021

AIM Introduction to Medicine (BU Summer Program)
 Infectious Disease Section (*Developed as new course 2015*)

50 students	Sum. 2015
50 students	Sum. 2016
50 students	Sum. 2017
50 students	Sum. 2018
50 students	Sum. 2019

Community Involvement

BU Master's Program Director	2019 – present
BU Biology Department Graduate Committee	2014–2016, 2020
BU SMED Program Appeals Committee	2015 – present
BU Biology Cell & Molecular (CM) Program Admissions Committee	2013 – 2019
BU BDC Annual Symposium Organizer	2019
BU Biology Department Seminar Series Organizing Committee	2015–2018, 2020-pres
BU Biology Faculty Search Committee (Neurobiology search)	2021
BU Biology Faculty Search Committee (CM search)	2016
BU Bioinformatics Graduate Program Admissions Committee	2014 – 2016
BU Bioinformatics Graduate Program Curriculum Committee	2012 – 2015
BUMC SMED Program Admissions Committee	2014 – 2015
BUMC MMEDIC Program Admission Committee	2015
RCR Training Mentor	2013 – 2014

Mentoring Experience

Nima Mohaghegh (BU, Postdoctoral fellow)	01/2013 – 04/2019
<u>PhD Graduate Students (Boston University)</u>	
Kellen Andrienas (CM)	05/2013 – 08/2019
Ashley Penvose (CM)	05/2013 – 08/2019
Jessica Keenan (Bioinformatics)	05/2013 – 08/2019
David Bray (Bioinformatics)	05/2016 – 08/2020
Heather Hook (CM)	05/2018 – present
Melissa Inge (CM)	05/2020 – present
Rebekah Miller (Bioinformatics)	05/2020 – present

Master's Graduate Students (Boston University)

Evan Wadden	01/2020 – present
Robert Buckshaw	07/2019 – 05/2020

BU Undergraduates

Thierry Edwards	02/2021 – present
Trevor Tamura	02/2021 – present
Kadesh Daniels	01/2020 – present
Matthew Arnold	09/2019 – 05/2020
Rose Zhao	09/2018 – 07/2020
Yemi Osayame	09/2018 – 05/2020
Davis Settipane	09/2018 – 05/2019
Amanda Chaplin	09/2016 – 05/2018
Heather Dennett	01/2017 – 10/2017
Vijendra Ramlall (also as Lab Technician)	10/2012 – 08/2017
Kailyn Doiron	01/2015 – 06/2017
Matthew Caputo	01/2016 – 05/2016
David Mueller	01/2016 – 05/2016
Ryan Webster	09/2013 – 11/2015
Nicole Akramoff	09/2013 – 12/2015
Nanrui Tan	09/2014 – 05/2015
Brandon Leung	09/2014 – 12/2015
Jesse Kurland	01/2013 – 05/2014
Katherine Tooley	07/2013 – 05/2014
Michael Simpson	01/2013 – 05/2014
Kavin Zhu	01/2013 – 09/2013

Other

Bilal Ahmed (HST Program in Bioinformatics and Genomics)	06/2010 – 08/2010
Jessica Reddy (Lab Technician)	06/2008 – 08/2009
Sidra Khan (UROP, MIT Chem. Biological. Eng Senior)	06/2008 – 08/2008
Brian Ho (Rotation Student, Harvard BBS graduate program)	01/2008 – 05/2008
Michael Duyzend (HST Program in Bioinformatics and Genomics)	06/2007 – 08/2007

Journal Reviews

I have reviewed papers for the following peer-review journals: JMB, Bioinformatics, Molecular Systems Biology, Genome Biology, Genomics, Nucleic Acids Research, PLoS ONE, Journal of Inflammation, F1000Research, Science Signaling, Frontiers in Immunology

Conferences Organized

Rules of Protein-DNA recognition: Computational and Experimental Advances 2018
Advances

Role: Co-organizer (w/ Marcus Noyes, NYU)

Organization: Banff International Res. Station (BIRS) / Casa Mathematica Oaxaca (CMO)

Place: Oaxaca, Mexico

Attendees: 42

Publications

Hook H*, Zhao R*, Bray D, Keenan JL, **Siggers T**. High-throughput Analysis of the Cell- and DNA Site-Specific Binding of Native NF- κ B Dimers Using Nuclear Extract Protein-binding Microarrays (NextPBMs) (*accepted*) *Methods in Molecular Biology*

William LM, Inge MM, Mansfield KM, Rasmussen A, Afghani J, Agrba M, Albert C, Andersson C, Babaei M, Babaei M, Bagdasaryants A, Bonilla A, Browne A, Carpenter S, Chen T, Christie B, Cyr A, Dam K, Dulock N, Erdene G, Esau L, Esonwune S, Hanchate A, Huang X, Jennings T, Kasabwala A, Kehoe L, Kobayashi R, Lee M, LeVan A, Liu Y, Murphy E, Nambiar A, Olive M, Patel D, Pavesi F, Petty CA, Samofalova Y, Sanchez S, Stejskal C, Tang Y, Yapo A, Cleary JP Jr, Yunes SA, **Siggers T**, Gilmore TD (2020) Transcription factor NF- κ B in a basal metazoan, the sponge, has conserved and unique sequences, activities, and regulation. *Dev Comp Immunol.* 104:103559 (PMID:31751628)

Bruno L, Ramlall V, Studer RA, Bradley D, Dharmalingam G, Carroll T, Ghoneim M, Chopin M, Nutt SL, Elderkin S, Rueda DS, Fisher AG, **Siggers T**, Beltrao P, Merckenschlager M (2019) Selective deployment of transcription factor paralogs with submaximal strength facilitates gene regulation in the immune system. *Nature Immunology.* doi 10.1038/s41590-019-0471-5 (PMID:31451789)

Penvose A*, Keenan J*, Bray D, Ramlall V, **Siggers T** (2019) Comprehensive study of nuclear receptor DNA binding provides a revised framework for understanding receptor specificity. *Nature Communications* 10(1):2514 (PMID:31175293)

Mohaghegh N*, Bray D*, Keenan J, Penvose A, Andrienas KK, Ramlall V, **Siggers T** (2019) NextPBM: a platform to study cell-specific transcription factor binding and cooperativity. *Nucleic Acids Research* doi:10.1093/nar/gkz020 (PMID:30657937)

Andrienas KK, Ramlall V, Kurland J, Leung B, Harbaugh AG, **Siggers T** (2018) DNA-binding landscape of IRF3, IRF5 and IRF7 dimers: implications for dimer-specific gene regulation. *Nucleic Acids Research* 46:2509-2520 (PMID:29361124)

Mansfield KM, Carter NM, Nguyen L, Cleves PA, Alshanbayeva A, Williams LM, Crowder C, Penvose AR, Finnerty JR, Weis VM, **Siggers T**, Gilmore TD (2017) Transcription factor NF- κ B is modulated by symbiotic status in a sea anemone model of cnidarian bleaching. *Scientific Reports* 7:16025 (PMID:29167511)

Kuzu G, Kaye EG, Chery J, **Siggers T**, Yang L, Dobson JR, Boor S, Bliss J, Liu W, Jogi, Rohs R, Singh ND, Bulyk ML, Tolstorukov MY, Larschan E (2016) Expansion of GA Dinucleotide Repeats Increases the Density of CLAMP Binding Sites on the X-Chromosome to Promote Drosophila Dosage Compensation. *PLoS Genetics* 12:e1006120 (PMID:27414415)

Barrera LA, Vedenko A, Kurland JV, Rogers JM, Gisselbrecht SS, Rossin EJ, Woodard J, Mariani L, Kock KH, Inukai S, **Siggers T**, Shokri L, Gordan R, Sahni N, Cotsapas C, Hao T, Yi S, Kellis M, Daly MJ, Vidal M, Hill DE, Bulyk ML (2016) Survey of variation in human

transcription factors reveals prevalent DNA binding changes *Science* 35:1450-1454 (PMID:27013732)

Menke C, Cionni M, **Siggers T**, Bulyk ML, Beier DR, Stottmann RW (2015) Grhl2 is required in nonneural tissue for neural progenitor survival and forebrain development. *Genesis* 53(9):573-582 (PMID:26177923)

Andrilenas K, Penvose A, **Siggers T**. Using protein-binding microarrays to study transcription factor specificity. (2015) *Briefings in Functional Genomics* 14:17-29 (PMID:25431149)

Siggers T, Gilmore T, Barron B, Penvose A. Characterizing the DNA binding sites specificity of NF- κ B with Protein Binding Microarrays (PBM) (2015) *Methods in Molecular Biology* 128:609-630 (PMID:25736775)

Siggers T, Reddy J, Barron B, Bulyk ML. Diversification of transcription factor paralogs via noncanonical modularity in C2H2 zinc finger DNA binding (2014) *Molecular Cell* 55:640-648 (PMID:25042805)

Siggers T, Gordan R. Protein-DNA binding: complexities and multi-protein code (2014) *Nucleic Acids Research*. 42:2099-2111 (PMID:24243859)

Soruco MM, Chery J, Bishop EP, **Siggers T**, Tolstorukov MY, Leydon AR, Sugden AU, Goebel K, Feng J, Xia P, Vedenko A, Bulyk ML, Park PJ, Larschan E. (2013) The CLAMP protein links the MSL complex to the X chromosome during *Drosophila* dosage compensation. *Genes & Development* 27(14):1551-1556 (PMID:23873939)

Siggers T*, Chang AB*, Teixeira A, Wong D, Williams KJ, Ahmed B, Ragoussis J, Udalova IA, Smale ST, Bulyk ML. (2012) Principles of dimer-specific gene regulation revealed by a comprehensive characterization of NF- κ B family DNA binding. *Nature Immunology* 13(1):95-102 (PMID:22101729)

Siggers T, Duyzend MH, Reddy J, Khan S, Bulyk ML. (2011) Non-DNA-binding cofactors enhance DNA-binding specificity of a transcriptional regulatory complex. *Molecular Systems Biology* 7:555 (PMID:22146299)

Wong D, Teixeira A, Oikonomopoulos S, Humburg P, Lone IN, Saliba D, **Siggers T**, Bulyk ML, Angelov D, Dimitrov S, Udalova I, Ragoussis J. (2011) Extensive characterization of NF- κ B binding uncovers non-canonical motifs and advances the interpretation of genetic functional traits *Genome Biol.* 12(7):R70 (PMID:21801342)

Rowan S*, **Siggers T***, Lachke SA, Yue Y, Bulyk ML, Maas RL. (2010) Precise temporal control of the eye regulatory gene Pax6 via enhancer binding site affinity *Genes Dev.* 24(10):980-985. (PMID:20413611)

Giorgetti L, **Siggers T**, Tiana G, Caprara G, Notarbartolo S, Corona T, Pasparakis M, Milani P, Bulyk ML, Natoli G (2010) Noncooperative interactions between transcription factors and

clustered DNA binding sites enable graded transcriptional responses transcriptional responses to environmental inputs. *Mol. Cell.* 37(3):418-428. (PMID:20159650)

Viiri KM, Janis J, **Siggers T**, Heinonen TY, Valjakka J, Bulyk ML, Maki M, Lohi O (2009) DNA-binding and -bending activities of SAP30L and SAP30 are mediated by a zinc-dependent module and monophosphoinositides *Mol. Cell Biol.* 29:342-356.

Siggers T, Honig B (2007) Structure-based prediction of C2H2 zinc-finger binding specificity: sensitivity to docking geometry. *Nucleic Acids Res.* 35(5):1085-1097. (PMID:17264128)

Siggers T, Silkov T, Honig B (2005) Bending in the right direction. *Structure* 13:1400-1401. (PMID:16216570)

Siggers T, Silkov A, Honig B (2005) Structural alignment of protein-DNA interfaces: insights into the determinants of binding specificity. *JMB* 345(5):1027-1045. (PMID:15644202)

*Authors contributed equally

Publications (in review/revision)

Bray D*, Hook H*, Zhao R, Keenan J, Penvose A, Osayame Y, Mohaghegh N, Chen X, Parameswaran S, Kottyan LC, Weirauch M, **Siggers T** (in review *Cell Genomics*) Customizable high-throughput approach to discover and characterize regulatory complex binding altered by non-coding variants (earlier version at BioRxiv <https://doi.org/10.1101/2020.04.21.053710>)

Publications (in preparation)

Mansfield KM, Cleves PA, Van Vlack E, Kriefall NG, Benson BE, Camacho DJ, Hemond O, Pedroza M, **Siggers T**, Pringle JR, Davies SW, Gilmore TD (2019) Varied effects of algal symbionts on transcription factor NF- κ B in a sea anemone and a coral: possible roles in symbiosis and thermotolerance. BioRxiv <https://doi.org/10.1101/640177>

Keenan J, Inge M, Hook H, Zhao R, Osayame Y, Bray D, Mohaghegh N, Li H, Wong W, **Siggers T** (in preparation) CoRec: a microarray-based approach to determine binding specificity for regulatory cofactors. (anticipated submission, April 2021)

*Authors contributed equally