

**Timothy A. Whitehead**  
*Curriculum Vitae*

**ADDRESS AND CONTACT DETAILS**

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**APPOINTMENTS**

**University of Colorado**, Boulder, CO  
Associate Professor, Department of Chemical and Biological Engineering  
Aug 2018-

**Michigan State University**, East Lansing, MI  
*Johansen Crosby Endowed Chair Associate Professor*, Department of Chemical  
Engineering and Materials Science, Department of Biosystems and Agricultural Engineering  
July 2017-Dec 2018  
*Assistant Professor*, Department of Chemical Engineering and Materials Science,  
Department of Biosystems and Agricultural Engineering Aug 2011-Jun 2017

**EDUCATION**

**University of Washington**, Seattle, WA  
*Senior Fellow*, Department of Biochemistry, Feb 2009-Aug 2011  
Advisor: David Baker, PhD

**University of California-Berkeley**, Berkeley, CA  
*PhD in Chemical Engineering*, May 2008  
Thesis: Engineering proteins to build nanostructures  
Thesis advisor: Douglas S. Clark, PhD

**Vanderbilt University**, Nashville, TN  
*BE in Chemical Engineering, magna cum laude*, May 2001

**PROFESSIONAL EXPERIENCE**

**University of Washington**, Seattle, WA  
*Senior Fellow*, Department of Biochemistry, Feb 2009-Aug 2011

**University of California-Berkeley**, Berkeley, CA  
*Senior Fellow*, Department of Chemical Engineering, June 2008-Jan 2009

**University of California-Berkeley**, Berkeley, CA  
*Graduate Research Assistant*, Department of Chemical Engineering, Aug 2002-May 2008

Arcadis G&M, Melville, NY  
*Environmental Engineer*, Dec 2001-July 2002

- Designed plants for groundwater remediation

## AWARDS

2017	College of Engineering Nominee, MSU Teacher/Scholar Award
2017	Johansen Crosby Endowed Chair, CHEMS MSU
2017	Young Scientist Keynote, PEGS Meeting
2015	Fellow, Global Academy MSU
2013	NSF CAREER
2007	NIH T32 pre-doctoral Biotechnology Training Fellowship

## RESEARCH INTERESTS

Protein engineering, protein design, biomolecular recognition, renewable energy production, antibody and antibody mimics, antigen design, synthetic biology, biochemical engineering

## SELECTED PUBLICATION LIST (\*Corresponding Author, ^Graduate Student/Postdoc Trainee, &Undergraduate Trainee, +Authors contributed equally)

38. **Whitehead TA\***, (2017) “A peptide mimic of an antibody” *Science*, in press
35. Wrenbeck EE<sup>^</sup>, Azouz LR<sup>&</sup>, **Whitehead TA\*** (2017), “Single-mutation fitness landscapes for an enzyme on multiple substrates reveal specificity is globally encoded”, *Nature Communications in press*
32. Klesmith JR<sup>^</sup>, Bacik JP, Wrenbeck EE<sup>^</sup>, Michalczyk R, **Whitehead TA\*** (2017) “Trade-offs between enzyme fitness and solubility illuminated by deep mutational scanning”, *PNAS* 114:2265-2270 doi: 10.1073/pnas.1614437114
28. Wrenbeck EE<sup>^</sup>, Klesmith JR<sup>^</sup>, Adeniran A, Stapleton JA<sup>^</sup>, Tyo KJ, **Whitehead TA\***, (2016) “Plasmid-based single-pot saturation mutagenesis”, *Nature Methods* 13(11): 928-930 doi:10.1038/nmeth.4029
14. **Whitehead TA**<sup>+</sup>, Chevalier A<sup>+</sup>, Song Y et al. (2012) “Optimization of affinity, specificity, and function of designed Influenza inhibitors using deep sequencing”, *Nature Biotechnology* 30(6):543-8. doi: 10.1038/nbt.2214

## COMPLETE PUBLICATION LIST (h-index 18; i-10 index 21; 1525 total citations – Google Scholar, Aug 07 2018)

40. Medina-Cucurella A<sup>^</sup>, Zhu Y, Bowen SJ, Bergeron LM, **Whitehead TA\*** (2018) “Pro region engineering of nerve growth factor by deep mutational scanning enables a yeast

platform for conformational epitope mapping of anti-NGF monoclonal antibodies”, *Biotechnology & Bioengineering*, in press DOI: 10.1002/bit.26706

39. Acquaye-Seedah E, Reczek E, Russell H, Sandman SO<sup>&</sup>, Collins JH<sup>&</sup>, Stein CA<sup>^</sup>, DiVenere A, **Whitehead TA**, Maynard JA (2018) “Plasmablast derived monoclonal antibody response to pertussis toxin after adult acellular pertussis booster immunization”, *Infection & Immunity*, in press DOI: 10.1128/IAI.00004-18

38. Medina-Cucurella A<sup>^</sup>, **Whitehead TA\*** (2018) “Characterizing Protein-Protein Interactions Using Deep Sequencing Coupled to Yeast Surface Display”, *Methods in Molecular Biology in Protein Complex Assembly*, 101-121

37. **Whitehead TA\***, (2017) “A peptide mimic of an antibody” *Science*, in press

36. **Whitehead T\***, Cutler S, Wheeldon I, (2017) “Plant Metabolic Engineering for Chemicals, Fuels, and Precursors”, *Chemical Engineering Progress SBE Supplement (invited)*

35. Wrenbeck EE<sup>^</sup>, Azouz LR<sup>&</sup>, **Whitehead TA\*** (2017), “Single-mutation fitness landscapes for an enzyme on multiple substrates reveal specificity is globally encoded”, *Nature Communications in press*

34. **Whitehead TA\***, Bandi CK, Berger M, Park J, Chundawat S\* (2017) “Negatively supercharging cellulases render them lignin-resistant”, *ACS Sustainable Chemistry & Engineering in press* doi:10.1021/acssuschemeng.7b01202

- Cover of ACS Sustainable Chemistry & Engineering

33. Wang X, Stapleton JA<sup>^</sup>, Klesmith JR<sup>^</sup>, Hewlett E, **Whitehead TA**, Maynard J (2017) “Fine epitope mapping of two antibodies neutralizing the *Bordetella* adenylate cyclase toxin”, *Biochemistry* 56:1324-1336 doi: 10.1021/acs.biochem.6b01163

32. Klesmith JR<sup>^</sup>, Bacik JP, Wrenbeck EE<sup>^</sup>, Michalczyk R, **Whitehead TA\*** (2017) “Trade-offs between enzyme fitness and solubility illuminated by deep mutational scanning”, *PNAS* 114:2265-2270 doi: 10.1073/pnas.1614437114

31. Wrenbeck EE<sup>^</sup>, Faber M<sup>^</sup>, **Whitehead TA\*** (2017) “Deep sequencing methods for protein engineering and design”, *Current Opinion in Structural Biology* 45:36-44

30. Haarmeyer C<sup>^</sup>, Smith MD<sup>&</sup>, Chundawat S, Sammond D, **Whitehead TA\***, (2017) “Insights into cellulase-lignin non-specific binding revealed by computational redesign of the surface of green fluorescent protein”, *Biotechnology & Bioengineering* 114:740-750 doi:10.1002/bit.26201

29. Kowalsky CA<sup>^</sup>, **Whitehead TA\***, (2016) “Determination of binding affinity upon mutation for type I dockerin-cohesin complexes from *Clostridium thermocellum* and

*Clostridium cellulolyticum* using deep sequencing”, *Proteins* 84(12): 1914-1928  
doi:10.1002/prot.25175

28. Wrenbeck EE<sup>^</sup>, Klesmith JR<sup>^</sup>, Adeniran A, Stapleton JA<sup>^</sup>, Tyo KJ, **Whitehead TA\***, (2016) “Plasmid-based single-pot saturation mutagenesis”, *Nature Methods* 13(11): 928-930 doi:10.1038/nmeth.4029

- Documentation at Nature Protocols Exchange (doi:10.1038/protex.2016.061)

27. Klesmith JR<sup>^</sup>, Thorwall S<sup>&</sup>, **Whitehead TA\*** (2016) “Interpreting deep mutational scanning data resulting from plate-based selections”, *bioRxiv* 087072

26. Stapleton JA<sup>^</sup>, Kim J, Hamilton JP, Wu M, Irber LC, Maddamsetti R, Briney B, Newton L, Burton DR, Brown CT, Chan C, Buell CR, **Whitehead TA\*** (2016) “Haplotype-phased synthetic long reads from short-read sequencing”, *PLoS ONE* 11(1):e0147229

25. Khare S\*, **Whitehead TA\*** (2015), “Introduction to RosettaCON Special Collection”, *PLoS ONE* 10(12):e0144326

24. Klesmith JR<sup>^</sup>, **Whitehead TA\*** (2015), “High-throughput evaluation of synthetic metabolic pathways”, *Technology* 4(01):9-14

23. Klesmith JR<sup>^</sup>, Bacik JP, Michalczyk R, **Whitehead TA\*** (2015) “High-resolution sequence function mapping of a levoglucosan utilization pathway in *E. coli*”, *ACS Synthetic Biology* 4 (11), 1235-1243 DOI: 10.1021/acssynbio.5b00131

- Selected for ‘Introducing our Authors’ feature highlight.

22. Bacik JP, Klesmith JR<sup>^</sup>, **Whitehead TA**, Jarboe LR, Unkefer CJ, Mark BL, Michalczyk R (2015) “Structural insights into bioconversion of the biomass pyrolysis product levoglucosan”, *Journal of Biological Chemistry* 290 (44), 26638-26648

21. Kowalsky CA<sup>^</sup>, Faber M<sup>^</sup>, Nath A, Dann H<sup>&</sup>, Kelly VW<sup>&</sup>, Liu L, Shanker P, Wagner EK, Maynard J, Chan C, **Whitehead TA\*** (2015) “Rapid fine conformational epitope mapping using comprehensive mutagenesis and deep sequencing”, *Journal of Biological Chemistry* 290 (44), 26457-26470 doi:10.1074/jbc.M115.676635

- Top 5 accessed article for J. Biol. Chem., Oct. 2015.

20. Stapleton JA<sup>^</sup>, **Whitehead TA**, Nanda V (2015) “Computational redesign of the lipid-facing surface of the outer membrane protein OmpA”, *PNAS* 112(31):9632-9637

19. Kowalsky CA<sup>^</sup>, Klesmith JR<sup>^</sup>, Stapleton JA<sup>^</sup>, Kelly VW<sup>&</sup>, Reichkitzer N<sup>&</sup>, **Whitehead TA\*** (2015) “High-resolution sequence-function mapping of full proteins”, *PLoS ONE*, 10(3): e0118193. doi:10.1371/journal.pone.0118193

18. Tomek KJ<sup>&</sup>, Saldarriaga CRC<sup>&</sup>, Velasquez FPC, Liu T, Hodge DB, **Whitehead TA\***, (2015) “Removal and upgrading of lignocellulosic fermentation inhibitors by in situ

biocatalysis and liquid-liquid extraction”, *Biotechnology & Bioengineering*, 112(3):627-632.

<http://onlinelibrary.wiley.com/doi/10.1002/bit.25473/abstract>

- Selected for B&B video highlight.

17. Gao D, Haarmeyer C<sup>^</sup>, Balan V, **Whitehead TA**, Dale BE, Chundawat SPS (2014) “Lignin triggers irreversible cellulase loss during pretreated lignocellulosic biomass saccharification”, *Biotechnology for Biofuels*, 7:175

16. Bienick MS<sup>&</sup>, Young KW<sup>&</sup>, Klesmith JR<sup>^</sup>, Detwiler EE<sup>^</sup>, Tomek KJ<sup>&</sup>, **Whitehead TA\***, (2014) “The interrelationship between promoter strength, gene expression, and growth rate”, *PLoS ONE*, DOI: 10.1371/journal.pone.0109105

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0109105>

15. **Whitehead TA\***, Baker D, Fleishman SJ\* (2013) “Computational design of novel protein binders and experimental affinity maturation”, *Methods Enzymology*, 523:1-19. doi: 10.1016/B978-0-12-394292-0.00001-1.

14. **Whitehead TA**<sup>+</sup>, Chevalier A<sup>+</sup>, Song Y et al. (2012) “Optimization of affinity, specificity, and function of designed Influenza inhibitors using deep sequencing”, *Nature Biotechnology* 30(6):543-8. doi: 10.1038/nbt.2214

<sup>+</sup> **authors contributed equally**

- Cover of Nature Biotechnology; Featured in numerous popular press articles and radio interviews, including NPR.

13. Fleishman SJ, **Whitehead TA**, Strauch EM et al. (2011) “Community-wide assessment of protein-interface modeling suggests improvements to design methodology”, *J Mol Biol* 414(2):289

12. Fleishman SJ, Corn JE, Strauch EM, **Whitehead TA**, Karanicolas J, Baker D (2011) “Hotspot-centric *de novo* design of protein binders”, *J Mol Biol* 413(5):1047

11. Fleishman SJ<sup>+</sup>, **Whitehead TA**<sup>+</sup>, Ekiert D<sup>+</sup>, Dreyfus C, Corn JE, Strauch EM, Wilson IA, Baker D (2011) “Computational design of proteins targeting the conserved stem region of Influenza hemagglutinin”, *Science* 332(6031):816-21

<sup>+</sup> **authors contributed equally**

- Featured in numerous popular press articles and radio interviews, including NPR.

10. Fleishman SJ, Corn JE, Strauch EM, **Whitehead TA**, Andre I, Thompson J, Havranek JJ, Das R, Bradley P, Baker D (2010), “Rosetta in CAPRI rounds 13-19” *Proteins* 78(15):3212

9. **Whitehead TA**, Bergeron LM, Clark DS (2009), “Tying up the loose ends: circular permutation decreases the proteolytic susceptibility of recombinant proteins” *Protein Eng Des Sel* 22 (10):607-13

8. Slocik JM, Kim SN, **Whitehead TA**, Clark DS, Naik RR (2009), “Biotemplated metal nanowires using hyperthermophilic protein filaments”, *Small* 5 (18):2038-42
7. Bruns N, Pustelny K, Bergeron LM, **Whitehead TA**, Clark DS (2009), “Mechanical nanosensor based on FRET within a thermosome: damage-reporting polymeric materials”, *Angew Chem Int Ed Engl* 48 (31):5666-9
  - Inside cover of Angew Chem Int Ed Engl; feature story in Chemistry World: <http://www.rsc.org/chemistryworld/News/2009/May/05050901.asp>
6. **Whitehead TA**, Je E, Clark DS (2009), “Rational shape engineering of the filamentous protein gamma prefoldin through incremental gene truncation”, *Biopolymers* 91 (6):496-503
5. Bergeron LM, Gomez L, **Whitehead TA**, Clark DS (2009), “Self-renaturing enzymes: design of an enzyme-chaperone chimera as a new approach to enzyme stabilization”, *Biotechnol Bioeng* 102 (5):1316-22
  - Spotlight article in Biotechnol Bioeng.
4. **Whitehead TA**, Meadows AL, Clark DS (2008), “Controlling the self-assembly of a filamentous hyperthermophilic chaperone by an engineered capping protein”, *Small* 4 (7):956-60
3. **Whitehead TA**, Boonyaratanakornkit BB, Hoellrigl V, Clark DS (2007), “A filamentous molecular chaperone of the prefoldin family from the deep-sea hyperthermophile *Methanocaldococcus jannaschii*”, *Protein Science* 16 (4): 626-634
2. Boonyaratanakornkit BB, Simpson AJ, **Whitehead TA**, Fraser CM, El-Sayed NMA, Clark DS (2005), “Transcriptional profiling of the hyperthermophilic methanarchaeon *Methanococcus jannaschii* in response to lethal heat and non-lethal cold shock”, *Environmental Microbiology* 7 (6): 789-797
1. Laksanalamai P, **Whitehead TA**, Robb FT (2004), “Minimal protein-folding systems in hyperthermophilic archaea”, *Nature Reviews Microbiology* 2 (4): 315-324

## PATENTS

6. Wrenbeck EE, Klesmith JR, Stapleton JA, **Whitehead TA** (2016) “Plasmid-based single-pot saturation mutagenesis”, US Patent Application Number 62/380,717
5. Stapleton JA, **Whitehead T** (2015) “Methods for assembling and reading nucleic acid sequences from mixed populations”, US Patent Application number 14947988
4. Baker D, Fleishman SJ, **Whitehead TA** (2016) “Polypeptides for treating and/or limiting influenza infection”, US Patent 9,388,217
3. Baker D, Fleishman SJ, **Whitehead TA** (2015) “Polypeptides for treating and/or limiting influenza infection”, US Patent 9,181,300

2. Baker D, Fleishman SJ, **Whitehead TA** (2014) “Polypeptides for treating and/or limiting influenza infection”, US Patent 8,765,686

1. **Whitehead TA**, Clark DS (2014) “Heterologous Expression of Extremophile Heat Shock Proteins and Chaperones in Microorganisms to Increase Tolerance to Toxic Compounds”, US Patent 8,685,729

## PROPOSALS

### Funded, active projects (\$ my contribution)

07/2014- 06/2019	<b>Co-PI</b> (lead PI Rob Last) Plant Biotechnology for Health and Sustainability T-32 Training Grant	NIH	\$812,412
06/2013- 05/2019	<b>Lead PI</b> CAREER: Programming Proteins by Deep Sequencing and Design	NSF	\$416,970
11/2018- 06/2020	<b>co-Lead PI</b> Engineering long ssDNA donors for genome editing applications	NIH NIGMS R21	\$220,000
09/2018- 08/2022	<b>co-PI</b> (PI D. Nusinow, Danforth Center) Advanced plant sensing technologies	DARPA APT	\$870,000

### Completed projects

06/2015- 08/2018	<b>Lead PI</b> Research Experience for Undergraduates Supplemental Funding	NSF	\$38,683
05/2016- 12/2017	<b>Lead PI</b> Fine conformational epitope mapping to observe epitope walking	Zoetis	\$110,000
09/2016- 12/2016	<b>Lead PI</b> Paratope affinity maturation for antibodies	Zoetis	\$31,000
06/2016- 05/2017	<b>Lead PI</b> MSU iGEM Synthetic Biology Team	NSF-Beacon	\$12,000
01/2016- 12/2016	<b>Lead PI</b> Development of an optimized fermentative pathway from levoglucosan to isobutanol	USDA	\$35,518
12/2015- 06/2017	<b>Lead PI</b> Deep sequencing of designed operons reveals Pareto optimal growth-associated metabolic pathways	MSU-DFI	\$50,000
8/2012- 12/2016	<b>Lead PI</b> w/ Co-PI S. Chundawat Solving a Sticky Problem: Understanding Enzyme Binding to Lignocellulosic Biomass During Biofuel Production	NSF	\$299,800
4/2013- 7/2015	<b>Co-Lead PI</b> w/ Co-Lead PI K. Chan Deep Sequencing to Screen Functional Antibody Epitopes	NIH	\$356,732

11/2014- 7/2015	<b>Lead PI</b> De Novo Genome Assembly of Polyploids Using a Method for Assembling and Reading Large Contiguous DNA Sequences	M-TRAC	\$48,000
1/2014- 11/2014	<b>Lead PI</b> Method for assembling and reading large contiguous DNA sequences from mixed populations	MIIIE	\$69,820
6/2013- 8/2014	<b>Lead PI</b> Engineering Nanobody Specificity to Outer Membrane Proteins	JHU-APL	\$58,567
8/2012- 7/2014	<b>Lead PI</b> Computational Design of Beta-barrel Membrane Proteins	NIH	\$104,368
<b><u>Pending (\$ is total for my lab)</u></b>			
11/2018- 10/2023	<b>PI</b> The influence of evolutionary landscapes on protective antibody development	NIH NIAID R01	\$2,000,000
01/2019- 12/2022	<b>PI</b> Computational protein design and machine learning to accelerate development of recyclable lignocellulosic biomass deconstruction enzymes	DOE BEEPS	\$840,000

## INVITED PRESENTATIONS

28. **Whitehead TA** (2018) “Programming enzymes by deep sequencing and design” University of Minnesota Biotechnology Colloquium, Minneapolis, MN

27. **Whitehead TA** (2018) “Programming enzymes by deep sequencing and design” University of Indiana, Bloomington Chemistry Colloquium, Bloomington, IN

26. **Whitehead TA** (2018) “Programming antibodies and antigens using deep sequencing-enabled protein engineering” Eli Lilly Genomics Seminar, La Jolla, CA

25. **Whitehead TA** (2018) “Programming biomolecules by deep sequencing and design” Wayne State University Chemical Engineering and Materials Science Colloquium, Detroit, MI

24. **Whitehead TA** (2018) “Programming biomolecules by deep sequencing and design” Colorado University-Boulder Chemical and Biomolecular Engineering Departmental Colloquium, Boulder, CO

23. **Whitehead TA** (2018) “Programming antibodies and antigens using deep sequencing-enabled protein engineering” Michigan State University Pharmacology and Toxicology Departmental Seminar, East Lansing, MI

22. **Whitehead TA** (2017) “Programming antibodies and antigens using deep sequencing-enabled protein engineering” Antibody Engineering & Therapeutics, San

Diego, CA

- 21. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” Michigan State University Institute for Quantitative Health and Science, East Lansing, MI
- 20. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” Penn State University Chemical Engineering Colloquium, State College, PA
- 19. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” Columbia University Chemical Engineering Colloquium, New York, New York
- 18. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” University of Edinburgh Institute of Genetics & Molecular Medicine, Edinburgh, UK
- 17. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” Young Scientist Keynote, PEGS, Boston, MA
- 16. Whitehead TA** (2017) “Elucidating constraints on biomolecular engineering” Johns Hopkins University Chemical and Biological Engineering Colloquium, Baltimore, MD
- 15. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” Univ. Puerto Rico at Cayey RISE program on computational chemistry, Cayey, PR
- 14. Whitehead TA** (2017) “Programming proteins by deep sequencing and design” UC Riverside Chemical Engineering Colloquium, Riverside, CA
- 13. Whitehead TA** (2016) “Rapid Fine Conformational Epitope Mapping Using Comprehensive Mutagenesis and Deep Sequencing” Cancer Immunology Havana, Cuba
- 12. Whitehead TA** (2016) “Rapid Fine Conformational Epitope Mapping Using Comprehensive Mutagenesis and Deep Sequencing” PEGS, Boston, MA
- 11. Whitehead TA** (2016) “High-throughput conformational epitope mapping for antibody discovery” MSU Innovation Celebration, East Lansing, MI
- 10. Kowalsky CA, Whitehead TA** (2016) “Rapid Fine Conformational Epitope Mapping Using Comprehensive Mutagenesis and Deep Sequencing” PepTalk, San Diego, CA
- 9. Whitehead TA** (2015) “High throughput conformational epitope mapping to guide design of structure-based vaccines” Biochemical and Molecular Engineering Conference XIX, Puerto Vallarta, Mexico
- 8. Whitehead TA** (2015) “Going deep with biomolecular engineering and design” CHEMS annual research forum, East Lansing, MI

7. **Whitehead TA** (2012), “Constructing protein-protein binders by deep sequencing and design”, Defense Threat Reduction Agency, Workshop on “A systems approach to cell-based sensing”, Scottsdale, AZ
6. **Whitehead TA** (2012), “Constructing protein therapeutics by deep sequencing and design”, NSF BEACON Center, Michigan State University
5. **Whitehead TA** (2011), “Leave no amino acid unturned: computational design and exploitation of fitness landscapes leads to broadly neutralizing flu anti-virals”, 2011 RosettaCON, Leavenworth, WA
4. **Whitehead TA** (2010), “Design, validation, and improvement of functional proteins”, Michigan State University Department of Chemical Engineering and Materials Science, East Lansing, MI
3. **Whitehead TA** (2010), “Self-assembling Protein Ovaloids: a New Dimension in Protein Design”, Annual meeting of the American Chemical Society, San Francisco, CA, Nanobiotechnology session
2. **Whitehead TA** (2008), “Engineering extremophilic chaperones for biofuels production and nanobiotechnology”, Rice University Department of Chemical Engineering, Houston, TX
1. **Whitehead TA** [*presenter*], Clark DS (2007), “Engineering hyperthermophilic chaperones for biocatalysis and nanobiotechnology”, Annual meeting of the Society for Industrial Microbiology, Denver, CO

## OTHER PRESENTATIONS

**Whitehead TA**, Wrenbeck EE (2017) “Nicking Mutagenesis” Annual Meeting of the American Chemical Society BIOT Division, San Francisco, CA

**Whitehead TA** (2017) “Improving Synthetic Metabolic Pathway Yields and Productivities Using a Hybrid Computational/Experimental Approach to Increase Enzyme Solubility” International Conference on Biomolecular Engineering San Diego, CA

Haarmeyer C, Smith M, Chundawat SPS, Sammond DW, **Whitehead TA** (2016) “Using Protein Design to Evaluate the Relationship Between Protein Surface Potential and Protein-Lignin Binding for the Engineering of Low Lignin Binding Cellulases” Annual Meeting of AIChE San Francisco, CA

Wrenbeck EE, Azouz LA, **Whitehead TA** (2016) “Fitness Landscapes for an Enzyme on Multiple Substrates” Annual Meeting of AIChE San Francisco, CA

**Whitehead TA** (2016) “Enzyme Redesign is Unsurprisingly Difficult” RosettaCON Leavenworth, WA

**Whitehead TA** (2016) “Deep Sequencing Methods for Protein Engineering and Design” Protein Society, Baltimore, MD

**Whitehead TA** (2016) “Deep Sequencing Methods for Protein Engineering and Design” Protein Engineering Canada Ottawa, Canada

**Whitehead TA** (2016) “High-throughput conformational epitope mapping by deep sequencing for antibody discovery” Annual Meeting American Chemical Society BIOT Division, San Diego, CA

Klesmith JR, **Whitehead TA** (2016) “Deep sequencing-guided assessment and computational design of synthetic metabolic pathways” Annual Meeting American Chemical Society BIOT Division, San Diego, CA

**Whitehead TA** (2016) “High-Throughput Conformational Epitope Mapping to Guide Design of Structure-Based Vaccines” AIChE Midwest Regional Conference, Chicago, IL

**Whitehead TA**, Stapleton JA (2014), “Long read DNA sequencing technology”, MichBio Annual Conference, Detroit, MI

Stapleton JA, **Whitehead TA** (2014), “Identifying rare combinations of mutations in HIV patients to predict drug resistance”, MSU Board of Trustees, East Lansing, MI

Kowalsky CA, Klesmith JR, Faber M, **Whitehead TA** (2014), “Going Deep with Biomolecular Engineering and Design”, AIChE National Meeting, Atlanta, GA

Kowalsky CA, **Whitehead TA** (2014), “Sequence Function Mapping of Full-Length Protein Sequences”, AIChE National Meeting, Atlanta, GA

Klesmith JR, **Whitehead TA** (2014), “Optimizing physical properties of enzymes using deep mutational scanning”, RosettaCON, Leavenworth, WA

Kowalsky CA, **Whitehead TA** (2014), “High-resolution sequence-function mapping of full proteins”, MSU Engineering Graduate Research Symposium, Lansing MI

- Won graduate student poster award

Haarmeyer C, Chundawat SP, **Whitehead T** (2014), “Correlating surface properties to nonspecific binding: GFP as a tag in lignocellulosic biofuel production”, CHEMS Department Research Forum, Lansing, MI

Haarmeyer C, Chundawat SP, **Whitehead T** (2014), “Correlating surface properties to nonspecific binding: GFP as a tag in lignocellulosic biofuel production”, RosettaCON, Leavenworth, WA

Kowalsky CA, Klesmith JR, **Whitehead TA** (2014), “High Resolution Sequence Function Mapping of Proteins”, MSU Engineering Research Symposium, East Lansing, MI

**Whitehead TA** (2014), “Optimizing pathway flux by simultaneous protein and promoter engineering”, Annual meeting of the American Chemical Society, Dallas, TX, BIOT section

**Whitehead TA** (2013), “Biochemical production of high-value products from pyrolyzed biomass by design of catabolic pathway”, National Meeting of the American Institute of Chemical Engineers, San Francisco, CA

**Whitehead TA** (2013), “Constructing functioning proteins by deep sequencing and design”, 2<sup>nd</sup> Annual Symposium on Plant Biotechnology for Health and Sustainability, Michigan State University

Kowalsky CA, Klesmith JR, **Whitehead TA** (2013), “High Resolution Sequence Function Mapping of Proteins”, MSU CHEMS Research Forum, East Lansing, MI

Kowalsky CA, Klesmith JR, **Whitehead TA** (2013), “High Resolution Sequence Function Mapping of Proteins”, RosettaCON, Leavenworth, WA

Kowalsky CA, Klesmith JR, **Whitehead TA** (2013), “High Resolution Sequence Function Mapping of Proteins”, UM-MSU Blue-Green Seminar, Ann Arbor, MI

**Whitehead TA** (2012), “Constructing protein therapeutics by deep sequencing and design”, Inaugural Symposium on Plant Biotechnology for Health and Sustainability, Michigan State University

**Whitehead TA** (2012), “Leave no amino acid unturned: de novo design, directed evolution, and fitness landscape exploitation leads to potential Influenza therapeutics”, Annual meeting of the American Chemical Society, San Diego, CA, BIOT section

**Whitehead, TA** (2011) “Deep mutational scanning as a new tool for protein sequence/function relationships”, National Meeting of the American Institute of Chemical Engineers, Minneapolis, MN

**Whitehead, TA** (2011) “Computational design of proteins targeting the conserved stem region of influenza hemagglutinin”, National Meeting of the American Institute of Chemical Engineers, Minneapolis, MN

**Whitehead TA** (2011), “Computational design of proteins targeting the conserved stem region of Influenza hemagglutinin”, The 7<sup>th</sup> Annual PEGS Conference, Boston, MA

**Whitehead TA** [poster] (2007), “Engineering molecular chaperones to build controllable structures at the nanoscale”, Annual meeting of the American Institute of Chemical Engineers, Salt Lake City, UT

Chase SD, **Whitehead TA** [presenter], Blanch HW, Clark DS (2007), “Upregulation of a hyperthermophilic chaperone increases the solvent tolerance of *Escherichia coli*”, Annual meeting of the American Institute of Chemical Engineers, Salt Lake City, UT

**Whitehead TA** [presenter], Clark DS (2007), “Protein engineering of extremophilic chaperones for molecular self-assembly”, Annual meeting of the American Chemical Society, Boston, MA

**Whitehead TA** [presenter], Clark DS (2006) “Tunable functionalized filament scaffolds from an engineered hyperthermophilic protein”, Annual meeting of the American Chemical Society, San Francisco, CA

**Whitehead TA** [presenter], Clark DS (2005), “Exploring sequence space of a new biological nanowire”, Annual meeting of the American Institute of Chemical Engineers, Cincinnati, OH

**Whitehead TA** [presenter], Clark DS (2005), “Discovery of a filamentous chaperone from a hyperthermophile”, Annual meeting of the American Institute of Chemical Engineers, Cincinnati, OH

**Whitehead TA**, Hollrigl V, Bergeron LM, Clark DS [poster] (2004), “Characterization of chaperones from *Methanococcus jannaschii* for biotechnology applications”, International Extremophiles Conference, Cambridge, Maryland

## TEACHING

<u>Undergraduate Courses</u>	<u>Date</u>	<u>Students</u>	<u>SIRS (4.0)</u>
CHE201 Material and Energy Balances	FS2018	59	
CHE882 Advanced Biochemical Engineering	SS2018	9	
CHE 481 Biochemical Engineering Laboratory	FS2017	62	
CHE 883 Multidisciplinary Bioprocess Engineering	SS2017	8	
CHE 481 Biochemical Engineering Laboratory	FS2016	47	3.17
CHE 882 Advanced Biochemical Engineering	SS2016	6	N/A
CHE 201 Material and Energy Balances	SS2016	40	3.57
CHE 481 Biochemical Engineering Laboratory	FS2015	42	2.76
CHE 891 Selected Topics – Synthetic Biology	SS2015	7	4.00
CHE 481 Biochemical Engineering Laboratory	FS2014	42	3.48
CHE 201 Material and Energy Balances	FS2013	62	3.49
CHE 201 Material and Energy Balances	FS2013	52	3.76
CHE 201 Material and Energy Balances	FS2012	53	3.69
CHE 201 Material and Energy Balances	FS2012	46	3.72
CHE 201 Material and Energy Balances	SS2012	45	3.50

### Courses Developed

CHE 891: Selected Topics – Synthetic Biology. This course presented an overview of the field of synthetic biology. Lectures were used to establish synthetic biology as a

discipline separate from engineering and discovery biology. Key enabling technologies were described with recourse to primary literature, and applications utilizing synthetic biology were covered. There were two seminar-style lectures per week, with one class period per week involving a journal club.

## ADVISING

### Postdoctoral

Jim Stapleton 2012-2015

### Current Position

Research Professor, University of Oregon

### Ph.D. Students

Angelica Medina 2015-

Matthew Faber 2014-

Emily Wrenbeck 2013-2017

Justin Klesmith 2012-2016

Caitlin Kowalsky 2011-2016

### Current Position

Scientist, Ginkgo Bioworks

Postdoc, Univ. Minnesota (Hackel Lab)

Senior Scientist, AdiMab

### Masters Students

Carolyn Haarmeyer 2012-2016

MaryAnn Laboe 2016-2018

### Current Position

PhD candidate, Michigan State

### Undergraduates

Sarah Caldwell 2017-2018

Noelia Barvo 2017-2018

Raisa Noshin 2017

Justin Hosten 2017

Andrew Dsouza 2016-2017

Ethan Maurer 2016-2018

Jennifer Theland 2016

Sara Sandman 2015

Laura Raef Azouz 2015-2017

Brooke Gunderson 2014-2015

Sarah Thorwall 2014-2016

Matthew Smith 2014-2016

Rachel Schuldt 2013

Manuel Henry 2013

Hailey Dann 2013-2016

Vince Kelly 2013-2016

Nolan Reichkitstizer 2012-2015

Emily Ward 2012-2013

Austin Kennedy 2012-2013

Steven Rausch 2012-2014

Carlos Castillo US2012

Kyle Tomek 2012-2014

Matthew Bienick 2012-2014

Alex Smith 2011-2012

### Current Position

Undergraduate, MSU

Undergraduate, MSU

Undergraduate, UVA

Undergraduate, UMBC

Undergraduate, MSU

Undergraduate, MSU

Undergraduate, Royal Institute Sweden

Unknown

Grad Student, Univ. Texas

HC Undergraduate, MSU

Grad Student, UC Riverside

AdiMab

Undergraduate, MSU

Undergraduate, MSU

GM, Minneapolis, MN

EuriFin Lancaster

Kellogg, Battle Creek, MI

Undergraduate, MSU

Schlumberger

Dow Corning

National University Colombia

Grad Student, NC State

Grad Student, U Arizona

Eli Lilly

Alison Menzias      2011-2012      Undergraduate, MSU

**High School Students**

Rebecca Wang      US2015  
Katherine Erdman      US2014  
Katherine Young      US2013  
Lani Hack      US2012

**Current Position**

High School, TX  
High School, MD  
Undergraduate, MIT  
Undergraduate, UC Berkeley

**Committee Member Ph.D. Students**

Paul Sharpe, Eric Young, Bradley Paasch, Derek Fedeson, Kevin W Hall, Philip Angart, Daniel Lybrand, Qian Qin, Kanchan Chavan

**Committee Member Masters Students**

Erica Earl

**Highlights for Integrating Undergraduates in Research**

- Founder and faculty advisor of 1<sup>st</sup> MSU synthetic biology iGEM team. Won Bronze medal at 2016 iGEM world competition and have been invited to submit a research article on photochemostats to *Journal of Visualized Experiments*. Won Silver medal at 2017 iGEM.
- 9 undergraduates/high school students have been co-authors on submitted or published peer-reviewed journal articles.
- 3 undergraduates/high school students have been 1<sup>st</sup> authors on peer-reviewed journal articles.
- 5 former undergraduates currently enrolled in PhD programs.
- Laura Azouz (current student) was 2015 Goldwater nominee for MSU, won honorable mention in national competition, and won 1<sup>st</sup> place in Gulf Coast Undergraduate Research Symposium at Rice University (2016).

**Peer Recognition of Graduate and Postdoctoral Students**

- Jim Stapleton (postdoc) won an NIH postdoctoral fellowship.
- Caitlin Kowalsky won best poster award at international conference PepTalk (San Diego, CA Jan 2016).
- Caitlin Kowalsky was 2016 Fitch Beach CHEMS nominee and won 3<sup>rd</sup> prize graduate student in the College of Engineering
- Justin Klesmith won a 2015 USDA NIFA predoctoral fellowship.
- Emily Wrenbeck and Angelica Medina both won NIH T32 Plant Biotechnology Training Fellowships.
- Emily Wrenbeck won 2017 Outstanding Graduate Student Award, MSU Dept. Chemical Engineering
- Matthew Faber won best poster award at Protein Engineering Canada (Ottawa, CA July 2016).
- Carolyn Haarmeyer won DOE graduate student fellowship (2015)

- Emily Wrenbeck won the *Biochemical Engineering Journal* poster award for the 2016 AIChE Food, Pharmaceutical, and Bioengineering Division (2016).
- Angelica Medina won best poster award at *MSU-UM Blue Green Seminar* (2017) and is University representative for HHMI Gilliam fellowship.

## SERVICE

### *External Service.*

- Panel reviewer for National Science Foundation CBET Division (2013-present; 4 times)
- Panel reviewer for National Science Foundation EPSCoR (2017, 2018)
- Panel reviewer for National Institutes of Health Special Emphasis Panel on Zika Complications (2016)
- Ad hoc reviewer for Israeli Science Foundation (2014-current), Rosetta Licensing Funds (2015-current), National Science Foundation MCB Division (2017), and Department of Defense (2016-current)
- Reviewer for over a dozen journals (*Science, eLife, PNAS, Biotechnology & Bioengineering, Genome Biology, Bioresource Technology, PROTEINS, PEDS, ChemBioChem, Scientific Reports, Current Opinion Biotechnology, PLOS Pathogens, Oncotarget*)
- Session chair, AIChE (2013-2015,2017), ACS BIOT Division (2015-present)
- Rosetta Commons Executive Committee (2016-present)

### *Conference organization.*

- Co-organizer, *2014 RosettaCON* Leavenworth WA. International conference with 200 attendees from over a dozen countries.
- Co-organizer of 1<sup>st</sup>, 2<sup>nd</sup>, and 5<sup>th</sup> annual *Symposium of Plant Biotechnology for Health and Sustainability*, East Lansing, MI (2012, 2013, 2016)

### *University Service.*

- *Engineering Research Advisory Panel (2013-2017)*
- *NIH T32 Training Grant Executive Committee (2014-present)*
- *Review Panel Member, Institutionally Limited Dec 2014*
- *Faculty Adviser, OXE Chemical Engineering Undergraduate Society (2012-2017)*
- *Faculty Volunteer, High School Engineering Institute (2012-present)*
- *Faculty Volunteer, Engineering Connect (2012-present)*
- *Faculty founder and co-advisor, MSU iGEM Synthetic Biology team (2016-present)*
- *MSU Strategic Partnership Grant Review Panel Member (2017-present)*
- *Member, MSU Departmental Graduate Studies Committee (2017-present)*