

Charlie Fehl, PhD

Chemical biology tools for glycoproteins
Machine-learning actionable target pathways
Medicinal chem.—cancer, diabetes, Alzheimer's

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August 2018 Assistant Professor in Chemistry Wayne State University; Detroit; USA
October 2014 – Postdoctoral research associate University of Oxford; Oxford; UK
September 2014 PhD in medicinal chemistry University of Kansas; Lawrence; USA
May 2009 BS in biochemistry University of Michigan; Ann Arbor; USA

Research

- Wayne State University Chemistry (Detroit, MI, USA)
- Aug 2018-present
- Characterizing epigenetic signaling pathways of protein glycosylation using chemical biology, -omics (protein/mRNA), and machine learning
 - Identifying and targeting the “readers” of protein glycosylation
- University of Oxford Chemistry (United Kingdom)
- Postdoctoral mentor: Benjamin G. Davis, FRS
- Oct. 2014-2018
- *High-throughput mass spectrometry and bioinformatic/machine learning methodology to functionally characterize, annotate, and predict the enzymatic activities of a full glycosyltransferase superfamily*
- Funded by a UK Catalysis Hub grant (UK EPSRC), Oct. 2014-Nov. 2018**
- Jan. 2016-2018
- *Visible light photoredox-catalyzed protein chemical ligation methods to install pure synthetic post-translational modifications on histone proteins*
- University of Kansas Medicinal Chemistry (USA)
- Graduate mentors: Jeffrey Aubé & Emily E. Scott
- 2011-2014
- *Target-based, rational design of cytochrome P450 17A1 (CYP17A1) inhibitors selective over CYP21A2 as biochemical probes for oncology: synthesis, assay development, structural biology, medicinal chemistry*
- Funded by an ACS Medicinal Chemistry Pre-doctoral Fellowship**
- 2010-2011
- *Overcoming product inhibition to yield a catalytic Schmidt reaction – efficient and green access to amide and lactam bonds*
- 2009
- *Development of conditions for a tandem Prins/Friedel–Crafts reaction*
- Universität Regensburg Chemistry (Germany)
- Mentor: Burkhard König
- Summer 2012
- *Visible-light control of reactivity encoded onto carbohydrate surfaces – organic photochemistry on cellulose sheets for biological applications*
- Funded by a NIH Training Grant in Dynamic Aspects of Chemical Biology**
- University of Michigan Biological Chemistry (USA)
- Undergraduate mentor: Bruce Palfey
- 2007-2009
- *Biochemical mechanism of Campylobacter jejuni Thymidylate Synthase Complementing Protein (ThyX) via steady-state and transient kinetics*
- Mentor: Ruthann Nichols
- 2006-2007
- *Pharmacology of neuroactive peptides on fruit flies (animal studies)*

Publications and Patents

High-throughput mass spectrometry and algorithmic modelling of glycobiology data:

“Functional and informatics analysis enables glycosyltransferase activity prediction.” Min Yang*, Charlie Fehl* [*equal], Karen V. Lees, Eng-Kiat Lim, Wendy Offen, Gideon J. Davies, Dianna J. Bowles, Stephen J. Roberts, and Benjamin G. Davis. *Nature Chemical Biology*, **2018**, *14*, 1109.

Medicinal chemistry toward improved breast and prostate cancer therapeutics:

“Structure-based design of inhibitors with improved selectivity for steroidogenic cytochrome P450 17A1 over cytochrome P450 21A2.” Fehl, Charlie; Vogt, Caleb; Yadav, Rahul; Li, Kelin; Scott, Emily E.; Aubé, Jeffrey. *Journal of Medicinal Chemistry*, **2018**, *61*, 4946.

“Inhibitors of CYP17A1” United States Patent 9,611,270 (April 4, **2017**).

Charlie Fehl, Emily E. Scott, and Jeffrey Aubé.

Review on protein design for new activities:

“Proteins as templates for complex synthetic metalloclusters – progress toward bio-inspired heterometallic systems.” Charlie Fehl and Benjamin G. Davis. *Proceedings of the Royal Society A*, **2016**, *472*, 20160078.

Review on biocatalysis for new chemical reactions:

“Outperforming Nature’s Catalysts: Designing Metalloenzymes for Chemical Synthesis.” Charlie Fehl, Amanda G. Jarvis, Maria Palm-Espling. Benjamin G. Davis, and Paul C.J. Kamer. In *Modern Developments in Catalysis*; World Scientific Press: Singapore, **2016**; 89-122.

Synthetic methodology for rethinking amide bond synthesis:

“Temperature Dependence of Turnover in a Sc(OTf)₃-Catalyzed Intramolecular Schmidt Reaction.” (invited publication in memory of Harry Wasserman) Charlie Fehl, Erin Hirt, Sze-Wan Li, and Jeffrey Aubé. *Tetrahedron Letters*, **2015**, *56*, 3137.

“Overcoming Product Inhibition in Catalysis of the Intramolecular Schmidt Reaction.” Hashim Motiwala, Charlie Fehl, Sze-Wan Li, Erin Hirt, Patrick Porubsky, and Jeffrey Aubé. *Journal of the American Chemical Society*, **2013**, *135*, 9000.

Development of light-controlled surfaces for analytical and biological templates:

“Photocatalytic Surface Patterning of Cellulose using Diazonium Salts and Visible Light.” Peter Schroll, Charlie Fehl, Stephan Dankesreiter, and Burkhard König. *Organic & Biomolecular Chemistry*, **2013**, *11*, 6510.

Review on carbon rearrangement chemistry:

“Hofmann, Curtius, Schmidt, Lossen and Related Reactions.” Charlie Fehl, Ruzhang Liu, Michael McCleod, Hashim Motiwala, and Jeffrey Aubé. In *Comprehensive Organic Synthesis*, 2nd Ed; Elsevier Limited: Amsterdam, **2014**; pp. 598-635.

Construction of a complex anticancer natural product through new chemistry:

“Use of a Tandem Prins/Friedel–Crafts Reaction in the Construction of the Indeno-Tetrahydropyridine Core of the Haouamine Alkaloids: Formal Synthesis of (–)-Haouamine A.” Erik Fenster, Charlie Fehl, and Jeffrey Aubé. *Organic Letters*, **2011**, *13*, 2614-2617.

Funding

March 2019	University Research Grant (Wayne State University). "Tools to target sugar-mediated signaling in metabolic disorders." Award: \$10,000
July 2016	Competitive 2-year renewal of UK Catalysis Hub grant
September 2012	ACS Div. of Medicinal Chemistry predoctoral fellow (1 of 4, in 2012)
August 2011	NIH Training Grant in Dynamic Aspects of Chemical Biology

Mentoring

Graduate students

Class of 2019	Courtney Kondor , graduate student co-mentored with David Crich 'Metabolic labeling tools to study complex human glycoproteins'
Class of 2018	Saheed Ayodeji : 'Informatics to classify epigenetic sugar signaling' Daniel Corey : 'Affinity labeling/enrichment of O-GlcNAc 'readers'' Jessica Groenevelt : 'Pharmacological probes for O-GlcNAc 'readers'' Zachary Nelson : 'Biocatalytic tools for in vivo glycoprotein labeling'

Postdoctoral fellows

Class of 2019	Dr. Jaggaiah Naidu , graduate student co-mentored with David Crich 'Photocaged labeling tools to study O-GlcNAc glycoproteins'
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Undergraduate students

Class of 2018	Anthony Cicalo , Douglas Haslitt** , and Ali Reda** **Mentored candidate for Honors B.S. in Chemistry research
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Teaching

Winter 2018	WSU: CHM 1240 Organic Chemistry I
Fall 2018	WSU: CHM 6270/7270 Advanced Bioorganic Chem. & Drug Design
2015-2018	Oxford teaching: Biological Chemistry, Organic chemistry (undergrad)
2015-2018	Oxford lecturing: "Synthesis for Biology & Medicine" graduate course
2014-2018	Oxford mentoring: six DPhil students and one MSci student
2010-2014	KU mentoring: three PhD students and one BSc student
Fall 2010	KU teaching: GTA for MDCM 602: Medicinal Biochemistry

University Service:

January 2019–	Faculty advisor to WSU Climbs Hard (grad/undergrad climbing club)
January 2019–	Faculty advisor to American Chemical Society Student Affiliates club
September 2018–	Undergraduate Research Advisor (Chemistry Department)

Outreach:

April 23, 2019	Organized WSU Chemistry AP Day program (high school outreach)
April, 15, 2019	Organized Madison Preparatory High School visit to Chemistry
Aug 2015–Aug 2017	Member, American Association of Pharmaceutical Sciences Blog Committee [steered blog readership and policy]
	<ul style="list-style-type: none">• Emphasized outreach, scientific ethics, 'popular glycobiology,' important developments (please see http://aapsblog.aaps.org/2015/04/22/science-and-power-to-the-people/)• Facilitated several Oxford student posts on entrepreneurship, gender issues in science

Selected Invited Conference Presentations

- June 2018
- Carbohydrates Gordon Research Conference (Hong Kong, China)
 - High Throughput Chemistry & Chemical Biology Gordon Res. Conference
Poster: “Chemical Tools to Study O-Sugar Signaling Pathways”
- October 2018
- American Chemical Soc. “Chemistry in the Motor City” (Detroit, MI)
Keynote talk “**Chemical tools to track protein modification signaling**”
- June 2018
- Bioorganic Gordon Research Seminar (Andover, NH)
Talk: “**Metallaphotoredox-catalyzed protein functionalization enables the synthesis of pure epigenetic species for defined biophysical interaction studies**”
- May 2018
- Syngenta Inc. (Jealott’s Hill campus, UK)
Talk: “***In situ* boronate activation for metallaphotoredox-initiated protein functionalization**”
- September 2017
- Oxford Chemical Biology Departmental Seminar (Oxford, UK)
Talk: “**Functional Screening and Chemical-Bioinformatics Enables Family-Wide Prediction of Sugar Biocatalysis Networks**”
- April 2017
- American Chemical Society National Meeting (San Francisco, CA)
Talk: “**Structural insight from activity: Functional screening of the entire *Arabidopsis* GT1 family enables cheminformatic-bioinformatic predictions of glycosyltransferase reactions and protein features**”
- July 2015
- UK Catalysis Hub Summer Conference (Harwell, UK)
Talk: “**Structural Studies on Glycosyltransferases as Advanced Catalysts and Disease Targets**”
- August 2014
- Medicinal Chemistry Gordon Research Conference (New London, NH)
Posters: “**Design and Profile of Chemical Probes for Steroid Biosynthesis**” (*also presented similar results at this GRC in 2013*)
- September 2013
- American Chemical Society National Meeting (Indianapolis, IN)
Talk: “**Structure-based Design of Novel Inhibitors for Sex Steroid Biosynthesis Targeting Metastatic Prostate Cancer**”
- February 2013
- Capitol Research Summit (Topeka, KS) – *presented to state legislators*
Poster: “**Targeting Sex Hormone Production at the Source – Next-Generation Therapeutics for Prostate and Breast Cancers**”

Awards

- March 2018 Best talk: Syngenta Postdoctoral Symposium (Oxford Chemistry Dept.)
- November 2013 1st Place poster award – KU Cancer Center Symposium (\$1000 award)
- November 2012 Les & Betty Mitscher Prize for Excellence in Medicinal Chemistry (KU)
- April 2012 Poster competition winner – MIKI Graduate Research Symposium
- May 2009 Merck Index Award (Undergraduate Research Award)