

Charlie Fehl, PhD

Chemical biology tools for glycoproteins
Machine-learning actionable target pathways
Medicinal chem for sugar-linked disease risks

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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

- Real-time photochemical tools for chemical sugar biology
- Identifying and targeting the “readers” of protein glycosylation
- Treating metabolic diseases via sugar signaling/epigenetics

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

Hyperglycemic O-GlcNAc transferase activity drives cancer stem cell induction in triple-negative breast cancer. Saheed Ayodeji, Bin Bao, Emily A. Teslow, Lisa A. Polin, Greg Dyson, Aliccia Bollig-Fischer, **Charlie Fehl**. Under review at *Cancer Cell International* (2022). Online at *bioRxiv* doi.org/10.1101/2022.03.14.484003

Synthesis and mammalian cell compatibility of light-released glycan precursors. Courtney A. Kondor †, Jaggaiah N. Gorantla † (†equal), Garry D. Leonard, and **Charlie Fehl**. *Bioorganic and Medicinal Chemistry* (2022), 70, 116918. doi.org/10.1016/j.bmc.2022.116918

Spatiotemporal proximity labeling tools to track GlcNAc sugar-modified functional protein hubs during cellular signaling. Yimin Liu, Zachary Nelson, Saheed Ayodeji, Ali Reda, **Charlie Fehl**. *ACS Chem. Biol.*, **2022** in press (published July 12, 2022). doi.org/10.1021/acscchembio.2c00282

Tools, tactics, and objectives to interrogate cellular roles of O-GlcNAc in disease. **Charlie Fehl** and John A. Hanover. *Nature Chemical Biology* **2022** doi: 10.1038/s41589-021-00903-6.

Chemical synthesis and biological applications of O-GlcNAcylated peptides and proteins. Jessica M Groenevelt, Daniel J Corey, **Charlie Fehl**. *ChemBioChem* **2021** doi: 10.1002/cbic.202000843.

Mentored publications:

Light-driven post-translational installation of reactive protein side chains. Josephson B*, **Fehl C***, Iseneggar P* [*equal], Nadal S...Davis BG *et al.* *Nature* **2020**, 585, 530.

Functional and informatics analysis enables glycosyltransferase activity prediction. Yang, M* **Fehl C*** [*equal], Lees KV...Davis BG *et al.* *Nature Chemical Biology*, **2018**, 14, 1109.

Structure-based design of inhibitors with improved selectivity for steroidogenic cytochrome P450 17A1 over cytochrome P450 21A2. **Fehl C**, Vogt C, Yadav R, Li K, Scott EE, Aubé J. *Journal of Medicinal Chemistry*, **2018**, 61, 4946.

“Proteins as templates for complex synthetic metallocusters – progress toward bio-inspired heterometallic systems.” **Fehl C**, Davis BG. *Proc. of the Royal Society A*, **2016**, 472, 20160078.

Outperforming Nature’s Catalysts: Designing Metalloenzymes for Chemical Synthesis. **Fehl C**, Jarvis AG, Palm-Espling M, Davis BG, Kamer PCJ. In *Modern Developments in Catalysis*; World Scientific Press: Singapore, **2016**; 89-122.

“Temperature Dependence of Turnover in a Sc(OTf)₃-Catalyzed Intramolecular Schmidt Reaction.” **Fehl C**, Hirt EE, Li SW, Aubé J. *Tetrahedron Letters*, **2015**, 56, 3137.

“Overcoming Product Inhibition in Catalysis of the Intramolecular Schmidt Reaction.” Motiwala H, **Fehl C**, Li SW, Hirt EE, Porubsky P, and Aubé J. *Journal of the American Chemical Society*, **2013**, 135, 9000.

“Photocatalytic Surface Patterning of Cellulose using Diazonium Salts and Visible Light.” Schroll P, **Fehl C**, Dankesreiter S, König B. *Organic & Biomolecular Chemistry*, **2013**, 11, 6510.

“Hofmann, Curtius, Schmidt, Lossen and Related Reactions.” **Fehl C**, Liu R, McCleod M, Motiwala HM, Aubé J. In *Comprehensive Organic Synthesis*, 2nd Ed; Elsevier Limited: Amsterdam, **2014**; pp. 598-635.

“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.” Fenster E, **Fehl C**, Aubé J. *Organic Letters*, **2011**, *13*, 2614-2617.

Patents

Inhibitors of CYP17A1. **Fehl C**, Scott EE, Aubé J. United States Patent 9,611,270 (2017).

Funding

July 2022	Faculty competition for postdoctoral research fellow (Wayne State)
July 2021-2026	NIH R35 MIRA, “Spatiotemporal tools to interrogate O-GlcNAc functions in cellular signaling” (\$1,800,000 total award)
August 2021-22	NIH S10 grant: NMR spectrometer (minor contributor, \$600,000 award)
February 2021-22	WSU “Grants Boost” program (\$35,000 total award)
January 2021	Karmanos Cancer Institute “Core Incentive-Proteomics” (\$3,000 award)
August 2020	Faculty competition for postdoctoral research fellow (Wayne State)
April 2020	Ebbing Faculty Development Award. (\$2,400 award)
Jan 2020	Initiative for Maximizing Student Diversity Fellowship-Zackary Nelson
March 2019	University Research Grant (Wayne State University) (\$10,000 award)
July 2016	Competitive 2-year renewal of UK Catalysis Hub grant
September 2012	ACS Div. of Medicinal Chemistry predoctoral fellow
August 2011	NIH Training Grant in Dynamic Aspects of Chemical Biology

Awards

January 2021	Wayne State Grants Writing Workshop Selected Participant – Life Sciences
August 2020	American Chemical Society Outreach Training Program
October 2019	Advisor to WSU Chem. Club as they built “World’s Largest Periodic Table”
March 2018	Best talk: Syngenta Postdoctoral Symposium (Oxford Chemistry Dept.)
November 2013	1 st 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)

Mentoring

Graduate students

Class of 2022 **Courtney Kondor**, successfully defended Ph.D. thesis on May 20, 2022!
 ‘Metabolic labeling tools to study complex human glycoproteins’

Current students (anticipated graduation dates):

Class of 2023	Saheed Ayodeji : ‘Informatics to classify epigenetic sugar signaling’ Daniel Corey : ‘Affinity labeling/enrichment of O-GlcNAc ‘readers’’ Zachary Nelson : ‘Biocatalytic tools for in vivo glycoprotein labeling’
Class of 2025	Garry Leonard : ‘Controllable strategies to manipulate sugars in cells’
Class of 2026	Suendues Noori : ‘Rapid assessment of O-GlcNAc functions in cells’

Postdoctoral fellows

- Jan 2019—Jan 2021 **Dr. Jaggaiah Naidu**, ‘Photocaged tools to study O-GlcNAc proteins’
Currently a research technician at Surnaree Univ. of Tech., Thailand
- Aug 2020—Jun 2022 **Dr. Jess Stachowski**, ‘*In vivo* photoredox glycoprotein labeling’
accepted a tenure-track faculty position at Nazareth College, NY, USA!
- Oct 2022—current Dr. Arunkumar Thangarasu, ‘Chemical control of O-GlcNAc in disease’

Undergraduate students

[underlining indicates student graduated]

- Joined Fall 2018 Anthony Cicalo, Douglas Haslitt*, and Ali Reda* (*honors student)
- Joined Summer 2019 Laura Hanselman**, visiting summer student from Kalamazoo College
**Won a Sherman Fairchild Summer Research Stipend for support
- Fall 2019 Mariam Abdullah, Charlie Trice, Logan Nguyen,* Vince Pallo
- Summer 2020 Sydni Alexis Elebra*** (on a ***ReBUILDetroit fellowship)
- Summer 2021 Mariia Barttelt
- Winter 2022 Austin Agrusa
- Summer 2022- current Tristan Wrong

Teaching

- Winter 2019-2021 WSU: CHM 1240 Organic Chemistry I
- Fall 2018-2020 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

Service:

- August 2021- **Chair**, WSU Chemistry “Diversity, Equity, and Inclusion” Committee
- Jan 2021- American Chemical Society CARB Division virtual webinar organizer.
- September 2019 – WSU Graduate Admissions
- September 2019 – WSU Gopal Symposium Committee
- January 2019 – WSU Paul A. Schaap Endowed Chair Search Committee
- January 2019 – Faculty advisor to WSU Climbs Hard (grad/undergrad climbing club)
- January 2019-21 Faculty advisor to American Chemical Society Student Affiliates club
- September 2018–19 Undergraduate Research Advisor (Chemistry Department)

Outreach:

- October 23, 2019 Built the ‘World’s Largest Periodic Table’ with the WSU Chem Club
<https://www.freep.com/story/news/local/michigan/detroit/2019/10/23/wa-ye-state-university-builds-worlds-largest-periodic-table/4078085002/>
- 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]
- Emphasized outreach, scientific ethics, ‘popular glycobiology,’ important developments
 - Facilitated Oxford student posts on entrepreneurship, gender issues in science

Selected Invited Conference Presentations

- July 2022 • American Soc. of Biochemistry & Molecular Biology: O-GlcNAc Meeting
“Real-time chemical tools to capture and control sugar signaling in cells”
- June 2022 • Bioorganic Gordon Research Conference (Andover, NH)
“Spatiotemporal strategies for tracking glycoprotein functions in cells”
- March 2022 • American Chemical Society National Meeting talk:
“In situ methods for capturing dynamic O-GlcNAc protein glycosylation events”
- December 2021 • Pacificchem “Recent advances in carb. chem. and chemical glycobiology”
Chem tools for tracking O-GlcNAc glycoprotein dynamics in real-time signaling
- November 2021 • Society for Glycobiology “Glyco in Biotechnology” session invitation
“Real-time chemical tools to capture and control sugar signaling in cells”
- July 2021 • Mid-Southern Glycoscience Meeting inaugural conference talk invitation
“Real-time chemical tools to modulate dynamic sugar signaling in cells”
- January 2021 • American Chemical Society CARB: “Young Investigator Symposium” talk
“Real-time chemical tools to assess dynamic O-GlcNAc glycoprotein functions”
- August 2020 • American Chemical Society National Meeting: “Broadcast talk”
“Chemical tools for tracking O-GlcNAc glycosylation dynamics in real time”
- June 2019 • 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”
- 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”