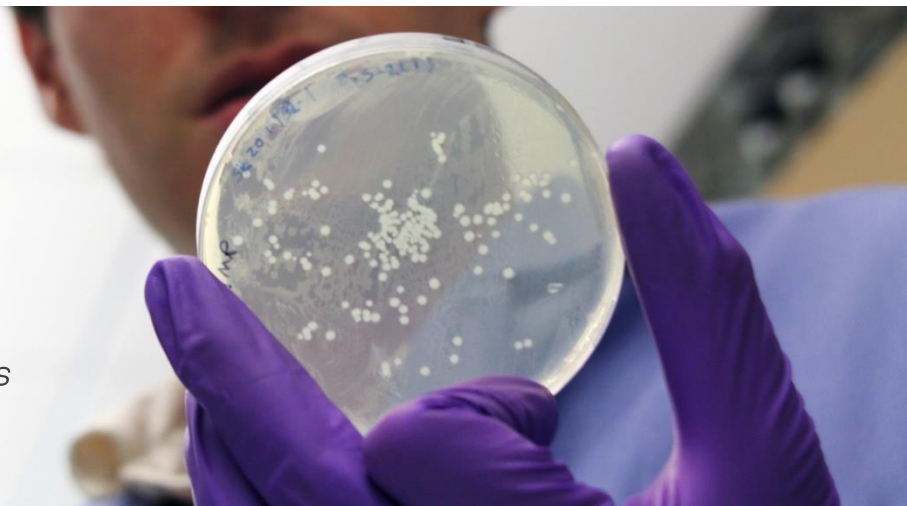


CHEMISTRY OF LIFE PROCESS PREDOCTORAL TRAINING PROGRAM



Handbook for Trainees and Mentors
2021-2022

Trainees gain understanding and experience in transdisciplinary collaboration as an essential component in solving complex problems across the spectrum of health and disease.



Program Features

Dual Mentors

Each Trainee selects two mentors, one with a background in chemistry and the other in the life sciences. The primary mentor fulfills the role of a graduate thesis advisor while also ensuring the trainee is fully participating in program activities and completing requirements. The secondary mentor operates in collaboration with the primary mentor, providing insights and strategies for problem-solving from a different

Immersive 10-Week Experience

Trainees spend 10 weeks total in the research group of their secondary mentor after their graduate program's Qualifying Exams and before the end of their third year. This experience provides Trainees new analytical tools, model systems, and language for applying chemical approaches to research topics in the life sciences.

Seminar Series

Seminars feature topics that deepen Trainees' understanding of research at the interface of chemistry and biology. Up to ten required seminars are selected by program leadership to augment Trainees' graduate programs' seminars.

Additionally, the Trainees select and invite three external speakers annually from academia, and the pharmaceutical and biotech industries to be sponsored by the CLP training program. Students meet with

speakers at lunch and dinner to engage in more in-depth discussions of research approaches and methodologies.

Monthly Research Forum

Trainees present twice each year to their peers and program preceptors at the CLP Research Forum. Presentations not only enable Trainees to gain experience in a public presentation of their work. Presentations also provide a mechanism for gauging trainee progress and for identifying potential obstacles to the trainee's project.

First-in-Class Laboratory Course

The course, CHEM/IBiS 416: Advanced Analytical Methods, covers topics such as high throughput testing, cheminformatics, chemical synthesis and purification, biologics production, in vitro testing, proteomics analysis, light microscopy and preclinical in vivo testing for efficacy and toxicity, plus in vitro and in vivo imaging techniques for targeting drug delivery, visualizing tumors, and documenting drug uptake and localization.

Entrepreneurship Training

Through quarterly meetings with entrepreneurs associated with the Chemistry of Life Processes Institute, Trainees gain insight and training into translation of discoveries with implications for health and treatment of disease into the public realm.

Breakfast with Program Directors

Trainees have the opportunity to meet with the program directors over breakfast each quarter to discuss project progress and career development.

Graduate Program Timeline

First Year:

- Work with Interim Advisor to identify training needs
- Complete at least (2) four-week intra-department (home department) rotations before choosing your thesis advisor
- Graduate program coursework
- Recommended completion of Chem/IBiS 416: Advanced Analytical Methods
- Select primary and secondary mentors, develop your research proposal
- Apply to program by July 1 (applications reviewed July – August)

Second Year:

- Appointment to CLP Training Grant (September 1 start date)
- Complete coursework
- Participate in program activities
- Present dissertation research at CLP Research Forums
- Meet with primary and secondary mentors at least quarterly
- Complete Chem/IBiS 416: Advanced Analytical Methods (depending on when class is offered)

Third Year:

- Complete CLP electives
- Continue dissertation research
- Present dissertation research at CLP Research Forums
- Attend a national research conference
- Continue meeting with mentors quarterly
- Participate in program activities
- 10-Week Immersive Experience (can be spread out)
- Complete Chem/IBiS 416: Advanced Analytical Methods (depending on when class is offered)

Subsequent Years:

- Continue dissertation research
- Engage in career development activities
- Develop grantsmanship
- Present research at national research meetings
- Present research progress at CLP Research Forums
- Continue regular meetings with mentors
- Participate in program activities

Eligibility

Eligibility for NIH training grant support will be determined by the following criteria:

- 1) Candidates must meet NRSA qualifications as US citizens or permanent residents.
- 2) Candidates must meet criteria of departmental programs plus provide tangible evidence of interest in transdisciplinary programs through undergrad coursework, undergrad research or internships.
- 3) Candidates must have taken undergraduate courses in general chemistry and organic chemistry. Additional course work in biology (organismal and cellular) and biochemistry is desirable, but not required.

Outstanding nominees who have not been appointed to the training grant due to lack of space or ineligibility for NRSA support will be considered for support through university fellowships.

Coursework

Given the broad range of degree requirements and variance in the schedules of the graduate programs that enroll CLP Trainees, we have been careful to construct the program's training requirements in such a way as to enable you to stay in sync with your parent graduate program. The course requirements for the CLP training program have been designed with sufficient flexibility to enable you to use CLP-required courses to help fulfill the requirements of your degree-granting programs.

- CHEM/IBIS 416:
Advanced Analytical Methods
- 1 Elective in
complementary field
from the approved
electives
- RCR Training

Approved Electives

<i>Biology Courses</i>		<i>Chemistry Courses</i>	
Course #	Title	Course #	Title
DGP 401	Biochemistry	Chem 402	Principles of Inorganic Chemistry
DGP 405	Cell Biology	Chem 403	Principles of Physical Chemistry
DGP 410	Molecular Biology & Genetics	Chem 408	Design, Synthesis and Applications of Nanomaterials
DGP 420	Introduction to Pharmacology	Chem 410	Physical Organic Chemistry
DGP 422	Introduction to Translational Research	Chem 411	Organic Spectroscopy
DGP 425	Topics in Drug Discovery	Chem 413	Organic Reactions
DGP 435	Receptors and Signaling Mechanisms	Chem 414	Chemical Biology**
DGP 440	Immunology	Chem 415	Medicinal Chemistry: The Organic Chemistry of Drug Design and Action
DGP 442	Microbiology	Chem 432	X-Ray Crystallography
DGP 450	Tumor Cell Biology	Chem 433	Structural Inorganic Chemistry
DGP 462	Eukaryotic Molecular Biology	Chem 434	Inorganic Chemistry
DGP 465	Macromolecular Structure and Function	Chem 445	Advanced Physical Chemistry: Modern Spectroscopy
DGP 466	Structural Basis of Signal Transduction	Chem 448	Computational Chemistry
DGP 475	Virology	Chem 314	Bioinorganic Chemistry
DGP 480	Molecular Mechanisms of Carcinogenesis	Chem 215-3	Advanced Organic Chemistry
DGP 484	Statistics and Data Analysis for Life Scientists	**	Coming Fall 2023
DGP 485	Data Science for Biomedical Researchers		
DGP 486	Advanced Bioinformatics (Genome Informatics)		
IBIS 401	Molecular Biophysics		
IBIS 402	Eukaryotic Molecular Biology		
IBIS 407	Genetics & Epigenetics		
IBIS 409	Biophysical Methods for Macromolecular Analysis		
IBIS 410	Quantitative Biology		
IBIS 432	Statistics for Life Sciences		

Integration with Graduate Programs

Biomedical Engineering Graduate Program

Home Department Rotations: Complete (2) four-week rotations in the research groups of Biomedical Engineering faculty before selecting your thesis advisor. We recommend you rotate in the research groups of CLP training program preceptors.

Selection of Thesis Advisor and Program Mentors: Candidates for CLP traineeships are expected to choose a thesis advisor/ primary mentor from among the CLP Biomedical Engineering preceptors and a secondary mentor from among the CLP Chemistry or Chemical & Biological Engineering preceptors. The secondary mentor also sits on the graduate student's thesis committee.

Chemistry Graduate Program

Home Department Rotations: Complete (2) four-week rotations in the labs of Chemistry faculty before selecting your thesis advisor. We recommend you rotate in the research groups of CLP training program preceptors.

Selection of Thesis Advisor: Candidates for CLP traineeships are expected to choose a thesis advisor/ primary mentor from among the program's chemistry-affiliated preceptors and a secondary mentor from among the CLP life science preceptors. The secondary mentor also sits on the graduate student's thesis committee.

Chemical & Biological Engineering Graduate Program

Home Department Rotations: The ChBE first year rotations count towards the home department rotations. We recommend you rotate in research groups of CLP training program preceptors.

Selection of Thesis Advisor: Candidates for CLP traineeships are expected to choose a thesis advisor/ primary mentor from among the program's Chemical & Biological Engineering preceptors and a secondary mentor from among the CLP Life Sciences preceptors. The secondary mentor also sits on the graduate student's thesis committee.

Driskill Graduate Program in the Life Sciences

Home Department Rotations: The DGP first year rotations count towards the home department rotations. We recommend you rotate in research groups of CLP training program preceptors.

Selection of Thesis Advisor and Program Mentors: Candidates for CLP traineeships are expected to choose a thesis advisor/ primary mentor from among the program's life sciences-affiliated preceptors and a secondary mentor from among the CLP Chemistry or Chemical & Biological Engineering preceptors. The secondary mentor also sits on the graduate student's thesis committee.

Interdepartmental Biological Sciences Graduate Program

Home Department Rotations: The IBiS first year rotations count towards the home department rotations. We recommend you rotate in research groups of CLP training program preceptors.

Selection of Thesis Advisor: Candidates for CLP traineeships are expected to choose a thesis advisor/ primary mentor from among the program's life sciences-affiliated preceptors and a secondary mentor from among the CLP Chemistry or Chemical & Biological Engineering preceptors. The secondary mentor also sits on the graduate student's thesis committee.

CLP Training Program Preceptors

Biomedical Engineering	Chemistry	Cell & Molecular Biology
Ameer, Guillermo	Gianneschi, Nathan	Huang, Sui
Backman, Vadim	Hoffman, Brian	
Scott, Evan	Meade, Thomas	Molecular Biosciences
Mrksich, Milan	Mirkin, Chad	Bao, Xiaomin
Szleifer, Igal	Nguyen, SonBinh	Carthew, Richard
Zhang, Hao	Odom, Teri	He, Yuan
	Schatz, George	Horvath, Curt
Chemical & Biological Engineering	Scheidt, Karl	Kelleher, Neil
Jewett, Michael	Silverman, Richard	LaBonne, Carole
Leonard, Joshua	Thomson, Regan	Marko, John
Lucks, Julius		Mondragon, Alfonso
Tyo, Keith	Medicine	Morimoto, Richard
Tullman Ercek, Danielle	Gottardi, Cara	Pinkett, Heather
	Zhang, Bin	Radhakrishnan, Ishwar
Materials Science & Engineering		Rosenzweig, Amy
Joester, Derk	Pharmacology	Weiss, Eric
Olvera de la Cruz, Monica	Burridge, Paul	
Stupp, Samuel	George, Alfred	Neurobiology
	Horiuchi, Dai	Allada, Ravi
Neurology	Miller, Richard	Klein, William
Stegh, Alexander	Rocklin, Gabriel	Kozorovitskiy, Yevgenia
Biochemistry & Molecular Genetics		
Foltz, Daniel		

Application

The CLP Predoctoral Training Program traditionally supports up to 8 Trainees annually: 6 funded by NIGMS, 2 funded by university fellowships.

Candidates are asked to submit the following application materials by July 1st at 5:00pm:



The CLP Predoctoral Training Program has had unprecedented success in developing grantsmanship skills of its trainees. For instance, in 2015-16 three of the six graduate students who completed the program applied for and won highly competitive predoctoral fellowships. Former program member **Amanda Bayer** (left) and current member **Jennifer Ferrer** (right) were each awarded individual NIH/NIGMS predoctoral fellowships. In 2015 only 14.7% of fellowship applications were funded by NIGMS.

Now a research associate at Baxter International, Inc., Bayer was a graduate student in Thomas O'Halloran's (Chemistry) lab where she used the tools and perspectives of inorganic chemistry to study the role of zinc in the fertilization process. She was jointly mentored by Teresa Woodruff (Obstetrics-Gynecology).

Currently a senior manager for alliance management at Tempus Labs, Ferrer worked on a new approach to drug delivery in the treatment of liver fibrosis under the supervision of Chad Mirkin (Chemistry) and Jason Wertheim (Transplant Surgery).

- 1) Completed CLP Training Program online application form.
- 2) A one-page statement from the nominee describing career goals, commitment to and a detailed plan for completing the curricular requirements of the training program.
- 3) A one-page research project description including background and biomedical significance of the research, a list of project goals and specific plans to achieve these objectives. The biological and chemical approaches to problem solving must be emphasized.
- 4) CLP Training Program Candidate Home Department Rotation Form.
- 5) Copies of undergraduate and graduate transcripts. Official transcripts are not required.
- 6) A short CV, including honors, presentations, research experience, publications, etc.
- 7) Two signed letters of recommendation on letterhead:
 - a) One letter should be submitted by the candidate's primary CLP preceptor/mentor. The letter must include a statement from the mentor reaffirming his/her commitment to the training program and agreeing to allow his/her mentees to satisfy all training program requirements.
 - b) The second letter should be obtained from the candidate's secondary CLP preceptor/mentor who is familiar with the applicant's academic accomplishments, research potential, and collaborative research project.

Further application instructions and forms can be found on the website: clp.northwestern.edu

Reappointment Evaluation

Second-year NIGMS-funded trainees' progress is evaluated prior to reappointment to the training grant. Trainees and Primary/Secondary Mentors are required to submit materials to the CLP Program Coordinator for record-keeping and in support of the evaluation.

Trainees are asked to submit the following evaluation materials by **July 1st**:

- 1) Completed CLP Training Program Renewal Form.
- 2) Official Graduate School transcript showing completed coursework.
- 3) One-page summary of trainee's research accomplishments, techniques acquired and plans for the coming year.
- 4) Copies and citations of all published papers, manuscripts submitted, meeting abstracts for talks and poster presentations, and awards received.
- 5) Copy of Individual Development Plan updated from start of appointment.
- 6) Letter from trainee's primary mentor regarding progress in trainee's research and academic standing.
- 7) Letter from trainee's secondary mentor describing trainee's progress in applying transdisciplinary approaches to his/her research and the growth of the trainee's capabilities in applying orthogonal approaches to research problems.

The CLP Evaluation Committee will consider all materials and make the decision to reappoint based on the following criteria: first, that the trainee be in good standing with his/her graduate program; second, that the trainee has completed all CLP program requirements or has presented a feasible plan to do so; and third, that progress in research is clearly demonstrated.

Major changes in the trainee's research project must be reviewed by the Evaluation Committee for applicability within the parameters of the program. Failure to meet program criteria will result in loss of training grant support.

Training Completion

Trainees will be required to provide documentation of their completion of all program requirements for final review by program leadership at the end of their second year of support. Trainees will retain a close affiliation with the program after the termination of their formal appointment. They will continue to be a vital component of the training program and are encouraged to continue participation in all program activities including seminars, Research Forums, and social activities throughout their graduate career. Trainees will continue to receive advice and support from their primary and secondary CLP mentors who will actively monitor the trainee's progress towards his/her degree. Additional oversight will be provided by the trainee's thesis committee, which includes the trainee's secondary mentor.

Program Leadership & Administration

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About the Chemistry of Life Processes Institute

Established by Northwestern University in 2004, the Chemistry of Life Processes Institute (CLP) fosters the transdisciplinary collaborations among physical and life scientists and clinicians that are required to address the complexity of the “big questions” underlying human health and disease. The Institute has created an ecosystem that enables basic and translational research and training that transcends disciplinary boundaries built upon a custom designed physical environment in the Richard and Barbara Silverman Hall for Molecular Therapeutics and Diagnostics. A critical component of the CLP ecosystem is the capacity to move discoveries from the laboratory bench into the hands of society. The Institute provides researchers with the tools needed to translate their discoveries through its entrepreneur-in-residence program. This unique program bridges the academic and commercial environments.

The Institute's 65 tenure-track faculty, while representing ten departments spanning the schools of arts and sciences, engineering, and medicine, are renowned for team-based, multi-disciplinary approaches to biomedical research. PhD-level technical staff maintain and develop cutting edge instrumentation and services, provides training, and collaborates with researchers to advance their research programs.