Pre-doctoral Training Plan

*indicates a required course

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laboratory Rotation I</td>
<td>Laboratory Rotation II</td>
<td>Laboratory rotation III</td>
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<tr>
<td></td>
<td>* Foundations I (Biochemistry and Molecular Biology)</td>
<td>Foundations II (Cell Biology and Genetics)</td>
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<td></td>
<td>* Scientific Methods: Survival Techniques</td>
<td>* Pharmacology and Drug Development (or in Spring Yr2)</td>
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<td></td>
<td></td>
<td>* Scientific Integrity &amp; Responsible Conduct of Research</td>
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<tr>
<td>2</td>
<td>Training in pre-doctoral laboratory</td>
<td>Training in pre-doctoral laboratory</td>
<td>Qualifying Exam (must be taken by Dec 31 of 3rd year)</td>
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<tr>
<td></td>
<td>* Biostatistics and Bioinformatics for Biologists (or Fall Yr1)</td>
<td>* Principles of Protein Modifications in Health and Disease</td>
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<td></td>
<td>Seminar in Pharmacology/Work-in-Progress (Pass/Fail)</td>
<td>Elective course</td>
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<td></td>
<td></td>
<td>Seminar in Pharmacology/Work-in-Progress (Pass/Fail)</td>
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<tr>
<td>3</td>
<td>Training in pre-doctoral laboratory</td>
<td>Research in Pharmacology</td>
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<td>Seminar in Pharmacology/Work-in-Progress (Pass/Fail)</td>
<td>Thesis Committee Meetings (twice a year)</td>
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<td></td>
<td>Seminar in Pharmacology/Work-in-Progress (Pass/Fail)</td>
<td>Annual Molecular Pharmacology Training Program Retreat</td>
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Year 3 until graduation

Examples of elective courses:
- Foundations II
- Molecular Oncology
- Stem Cells
- Molecular Mechanisms in Biology
- Cellular Neuroscience

Other opportunities:
- Departmental and institute seminars
- National, international meetings
- Career development seminars
- Skirball Symposium

General requirements:
1. Completion of 72 graduate credits of which at least 32 must be in course work
2. Successful passing of a qualifying examination
3. University acceptance of a dissertation

Molecular Pharmacology Training Program

at the NYU Sackler Institute of Graduate Biomedical Sciences

Erika Bach, PhD, Graduate Director
Gregory David, PhD, Graduate Advisor

The goal of our program is to train a new generation of scientists in molecular and biochemical pharmacology and drug discovery in five major areas:

- Cancer Signaling Pathways and Targets
- Structural Biology, Bioinformatics and Drug Design
- Receptor Pharmacology and Therapeutics
- Development of Therapeutics
- Pharmacology of Neurodegenerative Disorders

* Our program is ranked in the top 10 Molecular Pharmacology Graduate Programs by the Chronicle of Higher Education.
* We have trained >90 PhD & MD/PhD students.
* We are the recipient of a prestigious NIH Training grant.

Contact information: Erika.Bach@nyumc.org
http://biomolpharm.med.nyu.edu/education/molecular-pharmacology-training-program

Confocal image of CHO cells expressing oncogenic Ras (green) stained with mitotracker (red). Researchers in our graduate program use live imaging to investigate the cellular functions of conserved signaling proteins. (Image courtesy of the Philips lab).
Cancer Signaling Pathways and Targets

E. Bach  *Drosophila* models of tumorigenesis
D. Bar-Sagi  Ras signaling in pancreatic and other human tumors
M. Barcellos-Hoff  Role of ionizing radiation in breast cancer
J. Borowiec  Cellular response to genotoxic conditions
P. Cowin  Mammary development and breast cancer
G. David  Chromatin regulation in development and oncogenesis
L. Gardner  Hypoxic gene response on proliferation and tumors
M. Ito  Melanocyte stem cells and melanoma
S. Logan  Androgen receptors and prostate biology
D. Reinberg  Regulation of gene expression in eukaryotes
R. Schneider  Breast cancer genetics; Role of protein synthesis in cancer
T.-T. Sun  Cell biology and biochemistry of epithelial differentiation

Development of Therapeutics

W. Carroll  Mechanisms of drug resistance in childhood leukemia
T. Huang  The role of the ubiquitin cycle in human disease
D. Levy  STAT signaling and the role of Stat3 in tumorigenesis
E. Nudler  Transcription; RNA Sensors and Stress Response
S. Orlow  Drug discovery for the treatment of metastatic melanoma
M. Philips  Pharmacology and biology of Ras related proteins
M. Tahilian  Epigenetic Modifications of DNA
K. Woerpel  Development of cyclic peroxides as anti-cancer agents

Receptor Pharmacology and Therapeutics

W. Coetzee  Pharmacology and electrophysiology of ion channels
M. Costa  Molecular mechanisms of metal carcinogenesis
B. Cronstein  The role of adenosine receptors in inflammation
G. Fishman  Molecular pharmacology of cardiovascular disease
M. Garabedian  Therapeutics for prostate cancer
N. Partridge  Parathyroid hormone regulation of gene expression
H. Samuels  Regulation of tumorigenesis by nuclear hormone receptors

Structural Biology, Bioinformatics and Drug Design

J. Boeke  Functional genomics, histone modification, retrotransposons
T. Cardozo  Protein engineering, cheminformatics, rational drug design
D. Fenyö  Bioinformatics, proteomics, mass spectrometry
S. Hubbard  Crystallographic studies of signaling proteins
X. Kong  Structure-based design in HIV/AIDS vaccine
M. Mohammadi  Structural and functional studies of FGF receptors
T. Neubert  Study of proteins by mass spectrometry
A. Serganov  Metabolite-binding non-coding RNAs; Fragile X syndrome

Pharmacology of Neurodegenerative Disorders

S. Burden  Synapse formation / Neuromuscular disease
K. Carr  Pharmacology/neurobiology of eating behavior/addiction
R. Froemke  Synaptic plasticity, network dynamics, and behavior
E. Klann  Molecular basis of cognitive function
E. Levy  Molecular pathology of cerebral amyloidosis
M. Reith  Neurobiology of dopamine transporters
H. D. Ryoo  Unfolded protein response; ER stress in neurogeneration
M. Sadowski  Alzheimer and prion diseases
G. Suh  Neural circuits mediating innate behaviors
N. Tanese  RNA processing and neurodegeneration

Crystal structure of a small-molecule inhibitor bound to the kinase domain of the insulin-like growth factor-1 receptor. Researchers in our graduate program use state-of-the-art techniques to generate high resolution crystal structures of proteins critical for signal transduction processes in disease states such as diabetes and cancer.

Confocal image of a germ cell tumor caused by upregulation of JAK/STAT pathway activity. Germ line stem cells (red); Somatic stem cells (blue); Chinmo (green). Researchers in our program use genetic approaches in model organisms to study basic aspects of tumorigenesis, stem cell self-renewal and tissue growth, as well as dissect conserved signaling pathways.

(Images courtesy of the lab.)