

**THE Program IN
Molecular
Biology**

University of Colorado Anschutz Medical Campus



Student Handbook

2017 - 2018



University of Colorado
Anschutz Medical Campus

MOLECULAR BIOLOGY PROGRAM

University of Colorado
Anschutz Medical Campus
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Disclaimer for Student Handbook

This handbook, which includes parts of the Graduate School Rules and the Molecular Biology Program Guidelines, does not constitute a contract with the University of Colorado Denver Graduate School, either expressed or implied. The Molecular Biology Program reserves the right at any time to change, delete, or add to any of the provisions at its sole discretion. Furthermore, the provisions of this document are designed by the Program to serve as firm guidelines rather than absolute rules, and exceptions may be made on the basis of extenuating circumstances.



Graduate School

UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Academic Calendar – Fall 2017

This calendar:

- applies to the Basic Sciences Programs and the Pharmaceutical Sciences and Toxicology Programs on the **Anschutz Medical Campus**.
- only includes deadlines pertaining to coursework or those managed through UCDAccess.

For deadlines pertaining to graduation, please see the Graduation Deadlines document on the Graduate School website.

Month	Day	Deadline	Notes
June	5	First day to submit a new non-degree application for Fall 2017. Click the “Apply” button on the Graduate School website.	All non-students planning to take a Graduate School class in Fall 2017 must submit a non-degree application before the class starts.
	19	First day to apply for Fall 2015 graduation via UCDAccess.	If you intend to graduate in Fall 2017, you must complete this online application. If you do not, you will not be eligible to receive your degree until Spring 2018.
August	1	Registration begins for Fall semester via UCDAccess.	
	21	Last day to submit a new non-degree application .	See June 5 for more info.
	28	First day of Fall semester classes.	
	*	First day faculty/staff may register with a tuition waiver.	Note that faculty/staff must be matriculated in a degree-granting program or as non-degree seeking students in order to register. Non-degree status requires an application with separate, earlier deadlines. You may not be able to register at this time if you have not yet applied to the university for student status. Applies to first year students only.
September		First day of Research Rotation #1	
	4	Labor Day Holiday	No classes. Campus closed.
	8	Last day to add/drop courses via UCDAccess.	After this date, students may use the small Add/Drop Form if they have already registered.
	*	Courses dropped after this date will appear on your transcript with a grade of "W."	
	*	Students will be charged all tuition and fees for any course dropped after this date.	After this date, students who have not yet registered for any classes must use the paper Registration Form.
	*	Students will be charged a \$60 late fee to add courses after this date.	
November		Last day to petition for resident student status. Must be completed by 3 pm.	Graduate students who fail to petition for resident status after their first year may be responsible for the tuition difference.
	11	Last day to apply for graduation in UCDAccess.	If you intend to graduate in Fall 2017, you must complete this online application. If you do not, you will not be eligible to receive your degree until Spring 2018.
		Last day for late course additions/modifications.	After this date, you may not be able to add courses.
	17	Last day of Research Rotation #1	
December	20	First day of Research Rotation #2	Applies to first year students only.
	23-24	Thanksgiving Holiday	Holiday breaks: Nov. 23-24 & Dec. 18-Jan. 1, 2018
	11-15	Final Examination Week	No classes. Campus closed.
	15	End of semester	
December		Fall 2015 degree award date	
	20	Final grades due (noon)	Your degree will be awarded effective this date.

Spring 2018	January 22	Classes begin	
	February 19	Presidents' Day Holiday	No classes. Campus closed.
	March 19-23	Spring Break	No classes. Campus open.
	18	Last day of semester	
	May 25	Commencement & Convocation	
Summer 2018	June 4	Classes begin	
	July 4	Independence Day Holiday	No classes. Campus closed.
	August 17	Last day of semester	



Graduate School

UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Academic Calendar – Spring 2018

This calendar:

- applies to the Basic Sciences Programs and the Pharmaceutical Sciences and Toxicology Programs on the **Anschutz Medical Campus**
- only includes deadlines pertaining to coursework or those managed through UCDAccess.

For deadlines pertaining to graduation, please see the Graduation Deadlines document on the Graduate School website.

Month	Day	Deadline	Notes
October	23	First day to submit a new non-degree application for Spring 2018. Click the "Apply" button on the Graduate School website.	All non-students planning to take a Graduate School class in Spring 2018 must submit a non-degree application before the class starts.
November	6	First day to apply for Spring 2018 graduation via UCDAccess.	If you intend to graduate in Spring 2018, you must complete this online application. If you do not, you will not be eligible to receive your degree until Summer 2018.
	27	Registration begins for Spring semester via UCDAccess.	
January	15	Last day to submit a new non-degree application .	See October 23 for more info.
	22	First day of Spring semester classes. * First day faculty/staff may register with a tuition waiver.	Note that faculty/staff must be matriculated in a degree-granting program or as non-degree seeking students in order to register. Non-degree status requires an application with separate, earlier deadlines. You may not be able to register at this time if you have not yet applied to the university for student status.
February	2	Last day to add/drop courses via UCDAccess. * Courses dropped after this date will appear on your transcript with a grade of "W." * Students will be charged all tuition and fees for any course dropped after this date. * Students will be charged a \$60 late fee to add courses after this date.	After this date, students may use the small Add/Drop Form if they have already registered.
		Last day to petition for resident student status. Must be completed by 3 pm.	After this date, students who have not yet registered for any classes must use the paper Registration Form.
	5	Last day to apply for graduation in UCDAccess.	Graduate students who fail to petition for resident status after their first year may be responsible for the tuition difference.
		Last day for late course additions/modifications.	If you intend to graduate in Spring 2018, you must complete this online application. If you do not, you will not be eligible to receive your degree until Summer 2018.
	19	Presidents' Day Holiday	After this date, you may not be able to add courses.
	23	Last day of Research Rotation #2	No classes. Campus closed.
	26	First day of Research Rotation #3	Applies to first year students only.
March	19-23	Spring Break	Spring Break: March 19-23, 2018 No classes. Campus open.
May	14-18	Final Examination Week	
	18	End of semester Last day of Research Rotation #3 Spring 2018 degree award date	Your degree will be awarded effective this date.
	23	Final grades due (noon)	
	25	Commencement & Graduate School Convocation	Anschutz Medical Campus Graduation Ceremonies

	June 4	Classes begin	
Summer 2018	July 4	Independence Day Holiday	No classes. Campus closed.
	August 17	Last day of semester	
	August 27	Classes begin	
Fall 2018	September 3	Labor Day Holiday	No classes. Campus closed.
(Tentative)	November 22-23	Thanksgiving Day Holiday	No classes. Campus closed.
	December 14	Last day of semester	



Graduate School

UNIVERSITY OF COLORADO
ANSCHUTZ MEDICAL CAMPUS

Academic Calendar – Summer 2018

This calendar:

- applies to the Basic Sciences Programs and the Pharmaceutical Sciences and Toxicology Programs on the **Anschutz Medical Campus**.
- only includes deadlines pertaining to coursework or those managed through UCDAccess.

For deadlines pertaining to graduation, please see the Graduation Deadlines document on the Graduate School website.

Month	Day	Deadline	Notes
January	30	First day to submit a new non-degree application for Summer 2018. Click the "Apply" button on the Graduate School website.	All non-students planning to take a Graduate School class in Summer 2018 must submit a non-degree application before the class starts.
February	5	First day to apply for Summer 2018 graduation via UCDAccess.	If you intend to graduate in Summer 2018, you must complete this online application. If you do not, you will not be eligible to receive your degree until Fall 2018.
May	7	Registration begins for Summer semester via UCDAccess.	
June	30 4	Last day to submit a new non-degree application . First day of Summer semester classes. * First day faculty/staff may register with a tuition waiver.	See January 30 for more info. Note that faculty/staff must be matriculated in a degree-granting program or as non-degree seeking students in order to register. Non-degree status requires an application with separate, earlier deadlines. You may not be able to register at this time if you have not yet applied to the university for student status.
July	8	Last day to add/drop courses via UCDAccess. * Courses dropped after this date will appear on your transcript with a grade of "W." * Students will be charged all tuition and fees for any course dropped after this date. * Students will be charged a \$60 late fee to add courses after this date. Last day to petition for resident student status. Must be completed by 3 pm.	After this date, students may use the small Add/Drop Form if they have already registered. After this date, students who have not yet registered for any classes must use the paper Registration Form. Graduate students who fail to petition for resident status after their first year may be responsible for the tuition difference.
	11	Last day to apply for graduation in UCDAccess.	If you intend to graduate in Summer 2018, you must complete this online application. If you do not, you will not be eligible to receive your degree until Fall 2018.
		Last day for late course additions/modifications.	After this date, you may not be able to add courses.
	4	Independence Day Holiday	No classes; campus closed.
August	13-17	Final Examination Week	
	17	End of semester Summer 2018 degree award date	Your degree will be awarded effective this date.
	22	Final grades due (noon)	

	Aug. 27	Classes begin	
Fall 2018	Sept. 3	Labor Day Holiday	No classes. Campus closed.
(tentative)	Nov. 22-23	Thanksgiving Holiday	No classes. Campus closed.
	Dec. 14	Last day of semester	
	Jan. 21	Classes begin	
Spring 2019	Feb. 18	Presidents' Day Holiday	No classes. Campus closed.
(tentative)	March 18-22	Spring Break	No classes. Campus open.
	May 17	Last day of semester	
	May 24	Commencement & Convocation	

Holiday Schedule Fiscal Year 2017-18

Common Holidays

The following holidays will be observed at both campuses. Offices not designated as essential services will be closed.

Independence Day	Tuesday	July 4, 2017
Labor Day	Monday	September 4, 2017
Thanksgiving	Thursday	November 23, 2017
Christmas	Monday	December 25, 2017
New Year's Day	Monday	January 1, 2018
Memorial Day	Monday	May 28, 2018

Campus-Specific Holidays

Denver Campus

Units specifically serving the Denver Campus and its colleges and schools will observe the following holidays:

Tuesday	December 26, 2017
Wednesday	December 27, 2017
Thursday	December 28, 2017
Friday	December 29, 2017

Anschutz Medical Campus

Units specifically serving the Anschutz Medical Campus and its colleges and schools will observe the following holidays:

Friday	November 24, 2017
Tuesday	December 26, 2017
Monday	January 15, 2018
Monday	February 19, 2018

Consolidated Units

Consolidated units serving both campuses will remain open on the campus-specific holidays and each employee will request either the Denver Campus or Anschutz Medical Campus schedule for the fiscal year.

Holiday Policy

For more information and guidance on administering holiday leave, please see the Holiday Policy:

<http://www.ucdenver.edu/about/departments/HR/FormsTemplatesProcesses/Documents/Holidays.pdf>

TABLE OF CONTENTS

2017 – 2018 Academic Calendar and Holiday Schedule.....	preceding
Welcome to the Molecular Biology PhD Program.....	4
Molecular Biology Program Faculty and Research Interests.....	5 - 10
Molecular Biology Program expectations for a student's thesis career.....	11
Specialty track in Structural Biology and Biochemistry (<i>also appendix 3</i>).....	11
Curriculum for Molecular Biology Students (<i>first two years initially</i>).....	12
Financial Support.....	13
Grant Support.....	14
General Information.....	14
Molecular Biology Program By-Laws.....	15
By-Laws - Student Guidelines.....	20
Policy for Vacation and Leave.....	29
Bolie Scholar and NIH Student Support Awards.....	30 - 31
MOLB Travel Award Resources.....	32
UCD Graduate School.....	33
Directory.....	33
Honor Code.....	34
CU Anschutz Campus Resources.....	35 - 36
Appendix 1: Expectations for Lab Members and Tips for Academic Success.....	37
Appendix 2: Guidelines for Thesis Advisory Committee, Comprehensive Exam, and Thesis Defense.....	39
Appendix 3: Specialty Track in Structural Biology and Biochemistry.....	43
Appendix 4: MolBiol_4th rotation guidelines for Students.....	45
Appendix 5: MolBiol_4th rotation guidelines for Faculty.....	47
Appendix 6: 1718 Molecular Biology Program Committee Membership.....	49
Appendix 7: Guide for PhD students (and post-docs) aiming for a successful career in science...	50

Welcome to the Molecular Biology PhD Program
(www.ucdenver.edu/molecularbiology)

The Molecular Biology Program at the University of Colorado Anschutz Medical Campus is dedicated to providing rigorous training to its students in a supportive environment. The molecular biology faculty are members of fourteen different departments who are applying the techniques of molecular biology to answer questions in diverse areas at the forefront of modern biology. The Program offers a unique opportunity to study a wide variety of research areas in a student-centered environment, all in the inviting setting of Denver, Colorado, just a short distance from the Rocky Mountains.

Molecular biology, the science of how living things work at the molecular level, has spear-headed the recent revolution in our understanding of human disease and led to the birth of a major new industry based on biotechnology. The goal of the Molecular Biology Program at CU is simple: to equip students for careers at the cutting edge of biology. The faculty are committed to providing students with the training they need to carry out the highest quality research using state-of-the-art techniques. The teaching philosophy here is to instill the theoretical knowledge and practical experience that enables our students to identify important questions in science, to design experiments that address those questions and to critically evaluate results. Special emphasis is placed on learning to communicate research results to others effectively. Previous graduates of the program are now working in academic, medical and biotechnology industry positions.

Molecular Biology Program faculty include members of the Departments of Biochemistry and Molecular Genetics, Cell & Developmental Biology, Medicine, Immunology and Microbiology, Pathology, Pharmacology, Pediatrics, Craniofacial Biology, Pharmacy, and Obstetrics/Gynecology and include internationally recognized experts in genetics, genomics, immunology, virology, developmental biology, cancer biology, molecular endocrinology, cell signaling, and structural biology. Their diverse interests provide students with an enormous choice of areas in which to pursue their thesis research.

The Molecular Biology Program provides students with more than classroom and research training. Students learn to present their research by participating as featured speakers in the program's excellent seminar series. Students are encouraged to interact with the seminar series' invited guests during student-centered social hours. An annual retreat to the Rocky Mountains encourages interaction between students and faculty and also familiarizes the students with the research goals and progress of each faculty member. Also, the MOLB program, along with the university, continues in its efforts to increase the number of minority, disabled, and disadvantaged students, with the goal of training all students to become important contributors to the biomedical research field and their communities.

Training of each graduate student is carefully monitored by a committee selected by the student to ensure completion of a top-quality Ph.D. thesis project in a timely fashion (five to six years on average). Because these committees are comprised of faculty from different departments, the committee meetings have always sparked exciting discussions of the student's research.

The Molecular Biology Program has been recognized as a Center of Excellence at the University of Colorado School of Medicine. A \$5 million grant awarded in 1989 by the Lucille P. Markey Charitable Foundation allowed the program to grow and mature. In 1999, the program was awarded a highly competitive NIH pre-doctoral training grant that was renewed in 2004, 2010 and 2015, providing the funding to support and train students for years to come.

In 2001, the Program secured an endowment, the "Bolie Gift Fund", to provide travel funding for MOLB students to participate in national and international conferences and workshops. To date, more than 91 students have attended meetings or workshops with support from the Bolie Fund. The Bolie Fund also supports an annual, student-hosted distinguished Bolie lectureship. In 2011, Dr. Victor Bolie passed away, and left a generous endowment to our program. Starting in 2013, the "Earleen and Victor Bolie Scholarship Fund" supports stipends for 3 students per year (based on anticipated income from this ~\$2 million endowment).

Molecular Biology Faculty Members

(* = non-training/emeritus faculty members)

<u>Members</u>	<u>Dept</u>	<u>Tel</u>	<u>Mail Stop</u>	<u>Room</u>
Anderson, Steve	Path	43742	8104	S-5110
Appel, Bruce	Peds	443465	8108	S-12115
Artinger, Kristin	Craniofacial Bio	44562	8120	S-11112
Asturias, Francisco	BMG		8101	
Barton, David	IMMU/Micro	44215	8333	N-9116
Bates, Emily	Peds	48303	8313	N-4134
Bayer, Ulli	Pharm	43610	8303	N-6105
Bentley, David	BMG	43238	8101	S-10105
Black, Joshua	Pharm	49991	8303	N-6116
Blumenthal, Tom*	BMG	47389	8608	RC 2-4011
Bradford, Andrew*	OB-GYN	43507	8309	N-5100
Catalano, Carlos	Pharm Sci	40011	C238	V20-4118
Churchill, Mair	Pharm	43670	8303	S-6118
Colgan, Sean	Med/Gastro	47235	B146	RC2-10025
D'Alessandro, Angelo	BMG	40096	8101	S-9118
Davis, Richard	BMG	43226	8101	S-10109
DeGregori, James	BMG	43230	8101	S-9103
Eisenmesser, Elan	BMG	43245	8101	S-9117
Ernst, Patricia	Peds/Pharm	48804	8302	N-4117
Evans, Chris	Pul Sciences	46573	8611	RC 2
Evans, Thomas	CDB	43414	8108	S-12104
Fantauzzo, Katherine	Craniofacial Bio	41025	8120	S-11114
Ford, Heide	Pharm	43509	8303	N-6115
Gerber, Anthony (NJH)	Biomed	303-398-1869		NJH
Gutierrez-Hartmann, Arthur	Med/Endo	43960	8106	S-7108
Hagman, James (NJH)	Biomed	303-398-1398	A-004	NJH - K516B
Hesselberth, Jay	BMG	45384	8101	S-10104
Holers, V. Michael	Rheum/IMMU	47605	B115	M20-3201
Hooper, Joan*	CDB	43417	8108	S-12103
Hu, Cheng-Jun	Craniofacial Bio	44576	8120	S-11103
Huang, Mingxia	BMG	43204	8101	S-10112
Hughes, Ethan	CDB	43122	8108	N-7100
Johnson, Aaron	BMG	43224	8101	S-10116
Johnston, Mark	BMG	43203	8101	S-10100
Jones, David	Pharm	43601	8303	S-6116
Jordan, Craig	Hem	48165		RC2 9122
Kieft, Jeffrey	BMG	43257	8101	S-9110
Kutateladze, Tatiana	Pharm	43593	8303	S-6112
Liu, Changwei	BMG	43208	8101	S-9104
Maller, James*	Pharm	41623	8303	S-10122
Martin, Sandy	CDB	43467	8108	S-12104
McManaman, James	OB-GYN	43500	8309	N-5104
McMurray, Michael	CDB	46569	8108	S-12117
Moore, Jeff	CDB	46198	8108	S-12115
Nichols, James	Craniofacial Bio	40157	8120	S-11104
Niswander, Lee	Peds	43790	8133	S-12106
Pearson, Chad	CDB	45742	8108	S-12110
Pietras, Eric	Med/Hem	49657	F754	RC2-10014
Potter, Huntington	Neuro	47385	8608	RC2 - 4009
Prekeris, Rytis	CDB	43411	8108	S-12112
Pyeon, Dohun	IMMU/Micro	47279	8333	N-9120
Reis, Tânia	Med/Endo	43118	8106	S-7122
Reyland, Mary	Craniofacial Bio	44572	8120	S-11113
Richer, Jennifer	Path	43735	8401	N-5127
Rissland, Olivia	BMG/RNA			
Russ, Holger	Peds	48544		Barbara Davis Cntr
Schaack, Jerome*	IMMU/Micro	44220	8333	N-9113
Sclafani, Robert	BMG	43271	8101	S-9100
Sikora, Matt	Path	44301	8104	S-5117
Sussel, Lori	Peds	49119	B140	Barbara Davis Cntr
Thorburn, Andrew	Pharm	43290	8303	S-6100
Tucker, Chandra	Pharm	46337	8303	S-6113
VanDyk, Linda	IMMU/Micro	44207	8333	N-9114
Vasil, Michael	IMMU/Micro	44228	8333	N-9127
Vázquez-Torres, Andrés	IMMU/Micro	44218	8333	N-9131

Voskuil, Martin	IMMU/Micro	44219	8333	N-9115
Wang, Jing	IMMU/Micro	48673	8333	N-
Wang, Xiao-Jing	Path	43001	8104	N-5128
Wefes, Inge*	Graduate School	47368	C296	AO-1503
Williams, Trevor	Craniofacial Bio	44571	8120	S-11111
Zhao, Rui	BMG	43269	8101	S-9108

MOLECULAR BIOLOGY FACULTY - RESEARCH INTERESTS AND CONTACT INFORMATION

(* = non-training/emeritus faculty members)

Steven Anderson, Ph.D. (Dept. of Pathology)

steven.anderson@ucdenver.edu

Signal transduction by cytokine receptors, breast cancer.

Bruce Appel, Ph.D. (Department of Pediatrics)

bruce.appel@ucdenver.edu

Development and repair of the vertebrate nervous system.

Kristin Artinger, Ph.D. (Dept. of Craniofacial Biology)

kristin.arteringer@ucdenver.edu

Molecular, genetic, and developmental mechanisms involved in the patterning of the early spinal cord (neural plate) during vertebrate embryogenesis.

Francisco Asturias, Ph.D., (Biochemistry & Molecular Genetics)

Francisco.asturias@ucdenver.edu

Many essential cellular processes are carried out by "macromolecular machines", large assemblies that often include tens of different proteins, each making a specific contribution to the function of the machine.

David Barton, Ph.D. (Dept. of Immunology and Microbiology)

david.barton@ucdenver.edu

Enterovirus RNA replication.

Emily Bates, Ph.D. (Dept. of Pediatrics)

emily.bates@ucdenver.edu

The use of genetics to determine the molecular mechanisms of pediatric disorders.

Ulli Bayer, Ph.D. (Dept. of Pharmacology)

ulli.bayer@ucdenver.edu

Molecular memory mechanisms in cellular signal transduction and neuronal function: CaMKII and Ca²⁺ signaling.

David Bentley, Ph.D. (Dept. of Biochemistry & Molecular Genetics)

david.bentley@ucdenver.edu

mRNA biogenesis.

Joshua Black, Ph.D. (Dept. of Pharmacology)

joshua.c.black@ucdenver.edu

Regulation of genome stability, cancer cell heterogeneity and chemotherapeutic responses by the chromatin microenvironment.

***Thomas Blumenthal, Ph.D.** (Executive Director, Linda Crnic Institute for Down Syndrome)

Various aspects of gene expression and on the arrangement of genes on chromosomes

***Andrew Bradford, Ph.D.** (Dept. of Obstetrics & Gynecology)

andy.bradford@ucdenver.edu

Hormone/growth factor signaling, and the regulation of gene transcription.

Carlos Catalano, PharmD, Ph.D. (Pharmaceutical Sciences)

carlos.catalano@ucdenver.edu

Seek to understand the molecular mechanisms of virus development in the complex double-stranded DNA (dsDNA) viruses.

Mair E.A. Churchill, Ph.D. (Dept. of Pharmacology) mair.churchill@ucdenver.edu
Structure and mechanism in gene regulation; biophysical and structural studies of protein-nucleic acid and protein-protein complexes in chromatin and bacterial pathogenesis.

Sean Colgan, Ph.D. (Dept. of Medicine/Gastroenterology) sean.colgan@ucdenver.edu
Understanding how epithelial and endothelial cells coordinate inflammatory bowel disease.

Angelo D'Alessandro (Biochemistry & Molecular Genetics) angelo.dalessandro@ucdenver.edu
Omics technologies, especially metabolomics and proteomics, have helped us revealing emerging patterns in systemic responses to acute or chronic hypoxia. By focusing on cancer metabolism and (red) blood cell biology, we are increasingly appreciating shared molecular mechanisms driving systemic responses to trauma/ hemorrhagic shock, I/R injury, sickle cell disease, ageing and inflammation, mammalian hibernation and pulmonary hypertension.

Richard Davis, Ph.D. (Dept. of Biochemistry & Molecular Genetics) richard.davis@ucdenver.edu
Spliced leader RNA trans-splicing and its role in post-transcriptional gene expression. Structure/function of mRNA cap-interacting proteins.

James DeGregori, Ph.D. (Dept. of Biochemistry & Molecular Genetics) james.degregori@ucdenver.edu
Leukemogenesis and leukemia therapeutics.

Elan Eisenmesser, Ph.D. (Dept. of Biochemistry & Molecular Genetics) elan.eisenmesser@ucdenver.edu
Viral protein/host protein interactions, enzyme dynamics, and ligand/receptor interactions involved in cancer progression.

Patricia Ernst, Ph.D. (Dept. of Pediatrics) patricia.ernst@ucdenver.edu
Hematopoietic Stem Cell Development and Maintenance: The Role of the "*Mixed Lineage Leukemia*" Gene in Normal Blood Cell Development, Differentiation and Leukemia

Chris Evans, Ph.D. (Pulmonary Sciences) christopher.evans@ucdenver.edu
Research in the Evans lab focuses on how airway mucins regulate respiratory health and disease.

Thomas Evans, Ph.D. (Dept. of Cell & Developmental Biology) tom.evans@ucdenver.edu
The control of embryonic polarity.

Katherine Fantauzzo, Ph.D. (Craniofacial Biology) Katherine.fantauzzo@ucdenver.edu
Receptor tyrosine kinase signaling in mammalian craniofacial development

Heide Ford, Ph.D. (Dept. of Pharmacology) heide.ford@ucdenver.edu
Parallels between normal development and tumorigenesis, homeoproteins, breast and ovarian cancers, Wilms' tumor, metastasis.

Tony Gerber, Ph.D. (Dept. of Biomedical Research/NJH) gerbera@njhealth.org
The inter-relationship of glucocorticoid receptor signaling, inflammatory response, and lung function.

Arthur Gutierrez-Hartmann, M.D., Ph.D. (Medicine/Endocrinology) a.gutierrez-hartmann@ucdenver.edu
Elucidating the molecular mechanisms governing pituitary-specific gene expression. Determining the role of Ets transcription factors in breast cancer.

James Hagman, Ph.D. (Dept. of Biomedical Research/NJH) hagmanj@njc.org
Molecular regulation of B-cell development; transcription factor structure/function; epigenetic regulation of gene expression; oncogenesis in B-cells.

Jay Hesselberth, Ph.D. (Dept. of Biochemistry & Molecular Genetics) jay.hesselberth@ucdenver.edu
Genomics of gene regulation.

V. Michael Holers, M.D. (Dept. of Medicine/Rheumatology) michael.holers@ucdenver.edu
Structure-function of complement receptors; etiopathogenesis of autoimmune disease.

Cheng-Jun Hu, Ph.D. (Dept. of Craniofacial Biology) cheng-jun.hu@ucdenver.edu
Role of hypoxia response in tumor progression and metastasis.

Mingxia Huang, Ph.D. (Dept. of Dermatology) mingxia.huang@ucdenver.edu
Cell cycle and DNA damage checkpoint.

Ethan Hughes, Ph.D. (Cell and Developmental Biology) ethan.hughes@ucdenver.edu
Oligodendrocytes and their Precursors in the Adult Central Nervous System.

Aaron Johnson, Ph.D. (Dept. of Biochemistry & Molecular Genetics) aaron.m.johnson@ucdenver.edu
Mechanisms of chromatin-mediated gene silencing.

Mark Johnston, Ph.D. (Dept. of Biochemistry & Molecular Genetics) mark.johnston@ucdenver.edu
Functional genomics, glucose sensing and signaling.

David Jones, Ph.D. (Dept. of Pharmacology) david.jones@ucdenver.edu
Molecular mechanism of alcohol and anesthetic actions; structure and function of biomolecules; NMR spectroscopy, x-ray crystallography, biophysics and molecular biology.

Craig Jordan, Ph.D. (Dept. of Medicine/Hematology) craig.jordan@ucdenver.edu
The characterization and targeting of leukemia stem cells.

Jeffrey Kieft, Ph.D. (Dept. of Biochemistry & Molecular Genetics) jeffrey.kieft@ucdenver.edu
RNA structure and function.

Tatiana Kutateladze, Ph.D. (Dept. of Pharmacology) tatiana.kutateladze@ucdenver.edu
Biochemistry and structural biology, NMR and crystal structures of proteins implicated in cancer; structure based drug design.

Changwei Liu, Ph.D. (Dept. of Biochemistry & Molecular Genetics) changwei.liu@ucdenver.edu
The ubiquitin proteasome pathway for protein degradation.

Sandy Martin, Ph.D. (Dept. of Cell & Developmental Biology) sandy.martin@ucdenver.edu
Decoding hibernation: -omics approaches to extreme physiology.

James McManaman, Ph.D. (Dept. of Obstetrics and Gynecology) james.mcmanaman@ucdenver.edu
Lactation, lipid secretion.

Michael McMurray, Ph.D. (Dept. of Cell & Developmental Biology) michael.mcmurray@ucdenver.edu
Mechanisms of assembly and inheritance of dynamic macromolecular structures: higher-order septin assemblies in budding yeast.

Jeff Moore, Ph.D. (Dept. of Cell & Developmental Biology) jeffrey.moore@ucdenver.edu
Molecular regulation of the microtubule network in cell division and disease.

James Nichols, Ph.D. (Craniofacial Biology) james.nichols@ucdenver.edu
Skeletal development and variability.

Lee Niswander, Ph.D. (Dept. of Pediatrics) lee.niswander@ucdenver.edu
Genetics of mouse embryonic development focused on limb and lung development and neural tube closure.

Chad Pearson, Ph.D. (Dept. of Cellular & Developmental Biology) chad.pearson@ucdenver.edu
Centriole assembly and function

Eric Pietras, Ph.D. (Dept. of Medicine – Hematology) eric.pietras@ucdenver.edu
Effects of inflammation on hematopoietic stem cell fate and blood system function.

Huntington Potter, Ph.D. (Dept. of Neurology) Huntington.potter@ucdenver.edu
Current research is devoted to laboratory and clinical investigation of neurodegenerative diseases, particularly Alzheimer's disease (AD) and trisomy 21/Down syndrome (DS), which also induces AD by age 40.

Rytis Prekeris, Ph.D. (Dept. of Cellular & Developmental Biology) rytis.prekeris@ucdenver.edu
Molecular mechanisms regulating the establishment and maintenance of cellular polarity in epithelial cells and neurons.

Dohun Pyeon, Ph.D. (Dept. of Immunology and Microbiology) dohun.pyeon@ucdenver.edu
Understanding how HPV (human papillomaviruses) interacts with the host factors to establish persistent infection and develop invasive cancers.

Tânia Reis, Ph.D. (Dept. of Medicine/Endocrinology) tania.reis@ucdenver.edu
Genetic basis of obesity and neuronal control of energy balance in *Drosophila melanogaster*.

Mary Reyland, Ph.D. (Dept. of Craniofacial Biology) mary.reyland@ucdenver.edu
Regulation of apoptosis in epithelial cells by signal transduction pathways.

Jennifer Richer, Ph.D. (Dept. of Pathology) Jennifer.richer@ucdenver.edu
The action of steroid hormone receptors and non-coding RNAs in women's cancers and rational design of novel therapeutic strategies.

Olivia Rissland, Ph.D. (Biochemistry & Molecular Genetics) Olivia.rissland@ucdenver.edu
RNA post-transcriptional, decay and mechanisms of translational regulation.

Holger Russ, Ph.D. (SOM-Pediatrics) holger.russ@ucdenver.edu
Generation and gene editing of human functional pancreatic and thymic cells to interrogate underlying mechanisms of autoimmune diabetes.

***Jerome Schaack, Ph.D.** (Dept. of Immunology and Microbiology)
Adenovirus vectors.

Robert A. Sclafani, Ph.D. (Dept. of Biochemistry & Molecular Genetics) robert.sclafani@ucdenver.edu
The regulation of the eukaryotic cell cycle; cell cycle regulation in yeast and human cancer cells.

Matthew Sikora, Ph.D. (Dept. of Pathology) matthew.sikora@ucdenver.edu
Understanding mechanisms of response and resistance to steroid hormones and anti-estrogen therapies in breast cancer.

Lori Sussel, PhD (Pediatrics and Cell and Developmental Biology) lori.sussel@ucdenver.edu
Understand the complex transcriptional networks that regulate development, differentiation and function of the pancreas.

Andrew Thorburn, Ph.D. (Dept. of Pharmacology) andrew.thorburn@ucdenver.edu
Understanding the signaling mechanisms that control apoptosis in cancer development and during the response of tumor cells to cancer therapeutics.

Chandra Tucker, Ph.D. (Dept. of Pharmacology) chandra.tucker@ucdenver.edu
 Protein engineering and optogenetics. Developing engineered protein tools to control protein activity, localization, and interactions using light.

Linda van Dyk, Ph.D. (Dept. of Immunology and Microbiology) linda.vandyk@ucdenver.edu
 Virus/host interactions in inflammatory disease and cancer.

Michael L. Vasil, Ph.D. (Dept. of Immunology and Microbiology) mike.vasil@ucdenver.edu
 Molecular mechanisms of bacterial pathogenesis and gene regulation in prokaryotes, including *Mycobacteria tuberculosis* and *Pseudomonas aeruginosa*.

Andrés Vázquez-Torres, D.V.M./Ph.D. (Immunology and Microbiology) andres.vazquez-torres@ucdenver.edu
 Understanding the role that mononuclear phagocytes play in the host response to intracellular pathogenic microorganisms.

Martin Voskuil, Ph.D. (Dept. of Immunology and Microbiology) martin.voskuil@ucdenver.edu
Mycobacterium tuberculosis and *Burkholderia pseudomallei* mechanisms of latency and drug tolerance..

Jing Wang, Ph.D. (Dept. of Immunology and Microbiology) wangj@njhealth.org
 Genomic instability and cancer development; metastasis and genomic instability; molecular mechanisms of somatic hypermutation and class switch recombination.

Xiao-Jing Wang, Ph.D. (Dept. of Pathology) XJ.wang@ucdenver.edu
 Head and neck cancer research

***Inge Wefes, Ph.D.** (Graduate School, Associate Dean) inge.wefes@ucdenver.edu
 Molecular Biology Curriculum Fellow

Trevor Williams, Ph.D. (Dept. of Craniofacial Biology) trevor.williams@ucdenver.edu
 Transcriptional regulation of mouse embryonic development and the role of transcription factors in mammary gland development and breast cancer.

Rui Zhao, Ph.D. (Dept. of Biochemistry & Molecular Genetics) rui.zhao@ucdenver.edu
 Molecular mechanism of pre-mRNA splicing; drug discovery.

The success of each student admitted to the Molecular Biology Program is our goal. During the first two years of graduate school, there are clear and tangible milestones every graduate student must meet. In the first year, students must obtain passing grades in their coursework, successfully complete three research rotations, identify a lab for thesis research, and pass the year-end preliminary exam. In the second year, they must begin thesis research and successfully pass the comprehensive exam by the end of the Fall Semester of their third year. In the subsequent years of thesis research, the milestones become much more individualized and success relies on a student's own self-motivation, intellectual drive and hard work. Graduate school is not a job – it is training for a challenging career. A student's success at this stage of his/her training and in subsequent steps will depend on the student's own efforts. The thesis advisor and thesis committee are in place to provide scientific and professional guidance and support. It is the student's responsibility to take the initiative to work with his/her advisor and committee to achieve success in research and in a career. Ultimately, a student's success lies with the student!

The Molecular Biology Program has the following expectations for a student's thesis career:

1. A student must be self-motivated. Motivation should come from within and not determined by the mentor or arbitrary deadlines.
2. A student should work the necessary hours in the lab to complete the experiments. Graduate school is not a five day a week, 9-5 job. The effort each student puts in will be reflected in the level of success and the timetable for graduation.
3. A student should be intellectually engaged in the research project. Initially, the project is often conceived by the mentor; however by the comprehensive exam, the student should be actively participating in experimental decisions and research directions. In subsequent years, the student should take progressively more control in the execution and direction of the research.
4. A student must take initiative for his/her own career and take responsibility for research successes and failures. If things are not working out in the lab or with the advisor, in addition to the advisor's responsibilities, the student should initiate actions to correct the problem. The thesis committee and student advisor exist to help, but the student must seek out that help.

(The first two years of curriculum are covered initially here with additional information for all MOLB students' curriculum located under Molecular Biology Program By-laws – Student Guidelines.)

The Molecular Biology Program curriculum includes didactic courses, laboratory rotations, a seminar series, and selected electives. The heart of the first-year curriculum is a basic core course (IDPT) taken by students in a number of different graduate programs at CU Anschutz during the fall semester. In addition, students rotate through three training laboratories in their first year; at the conclusion of the three rotations, the student chooses a thesis laboratory.

The Graduate School requires at least 30 semester hours in course work pre-comps (rotations and research courses taken prior to the completion of the comprehensive examination) and an additional 30 semester hours of thesis credits for the Ph.D. All work undertaken as a graduate student must be in compliance with the academic Code of Honor (see Graduate School website for details, <http://www.ucdenver.edu/academics/colleges/Graduate-School/Pages/default.aspx>).

Specialty track in “Structural Biology and Biochemistry”: Graduate students entering the Program in Molecular Biology will have the opportunity to train in a specialty track in “Structural Biology and Biochemistry”. This track provides additional course work in advanced protein chemistry and structural analysis of biomolecules and the opportunity to conduct thesis research in laboratories that have expertise in the application of NMR spectroscopy, X-ray crystallography, mass spectrometry, computational biochemistry and biophysical biochemistry to problems of structure/function of biomolecules. Students will receive their Ph.D. degrees from the Molecular Biology Program. The Molecular Biology Program will have the responsibility and complete control of monitoring and administering the progress of students. The minimum requirements established by the Molecular Biology Program will apply; that is, a B or better in the Core course and all required courses. A curriculum will be designed that strikes a balance between meeting requirements of both Programs without overburdening students with having to participate in every course and activity of both Programs (see Appendix 3).

REQUIRED COURSEWORK

First Year

*Foundations in Biomedical Sciences, IDPT 7806, 6 credits (Fall semester)

**Core Topics in Biomedical Sciences A & B, IDPT 7810, 4 credits (Fall semester)

Ethics in Research, PHCL 7605, 1.0 credit (Fall semester)

This course is designed to introduce graduate students to issues around ethics of research, publication, and reviewing of manuscripts and grants. Lectures and class discussions in small groups of the history of scientific fraud, examples from recent cases, examples of ethical dilemmas and consequences of fraud, along with issues of repeatability and reproducibility will be covered.

Research in Molecular Biology, MOLB 7650, 1.0 credit (Sect. 001 and 002 in Fall and Sect. 001 in Spring)

3 laboratory rotations during first year, with choice of thesis lab at end of first year

Advanced Topics in Molecular Biology, MOLB 7800, 4.0 credits (Spring semester)

This course is intended to teach graduate students how to critically evaluate the scientific literature and incorporates a writing component to prepare students for the preliminary examination. A section of the course is specifically designed to prepare students for the preliminary examination at the end of the first year (see below)

Elective of student's choosing from Course Book (Spring semester)

Molecular Biology Seminar (Fall and Spring semesters) *All Molecular Biology students* are required to attend these weekly seminars, but only second year students are required to register for this seminar course.

Summer Semester: No summer course work is required, but MOLB students must register for 1 credit of MOLB 8990, or 3 credits of MOLB 7650 if instructed.

*IDPT 7806 Foundation in Biomedical Sciences, 2.5 weeks each block; M – Th, 8a – 10a, 6 credits, begins 8/28

<u>Session</u>	<u>Subject Area</u>
Block 1	Basic Biochemistry
Block II	Molecular Biology
Block III	Genetics
Block IV	Cell Biology

**IDPT 7810 Core Topics in Biomedical Sciences: Topics A, 2 credits and Topics B, 2 credits = 4 credits total

Students will select one topic in Core Topics A (2 credits) and one/two topics in Core Topics B (minimum of 2 credits)

Core Topics A – 14 two-hour classes, 5 days/week (except for November 22-24 – Thanksgiving break)

Topic - Stem Cell Biology to Regenerative Medicine

Topic - Microbiology in Biomedical Research

Topic - Discovering Protein Structure and Function

Topic – Cancer Biology

Core Topics B – 13 two hour classes, 5 days/week (last day of class is 12/15)

Topic – Introduction to Animal Models and Experiments in Developmental Biology

Topic – Exploratory Data Analysis with R/R Studio

Topic – Evolution/Evolutionary Genetics & Genomics

Topic – Inflammation

Topic – Genetics in Clinical Research

Second Year

Research in Molecular Biology, MOLB 7650, sec. 0V3 (variable credits) (Fall and Spring semesters)

Molecular Biology Seminar, MOLB 7661, 1.0 credit (Fall and Spring semesters)

Seminar series provides a forum for the presentation of scientific experiments and information in molecular biology by faculty, postdoctoral fellows and graduate students.

**All Molecular Biology students* are required to attend these weekly seminars, but only second year students are required to register for this course.

Biostatistics in Research, BIOS 6606, 3.0 hours (Fall semester)

This course provides an overview of fundamental concepts in statistics such as hypothesis testing and estimation, and it provides an overview of statistical methods (for example, regression and analysis of variance) that apply to many areas of science. Restrictions: Enrollment in CU Anschutz graduate program or permission of the instructor.

Rigor and Reproducibility in Biomedical Research MOLB/PHCL 7801 1.0 credit (Spring Semester)

This course combines both “wet” and “dry” lab components focused on teaching the concepts of Rigor and Reproducibility and the appropriate laboratory skills. These topics will be covered:

- Cell line and animal authentication by genotyping
- Quality control of Antibodies
- Rigorous Materials and Methods
- “Big” Data analysis and Statistical Methods (Coordinated with BIOS 6606 and MOLB 7621)

Optional: Electives of student’s choosing - from online Course Catalog and with the input of the MOLB Student Advisor

Summer Semester: No summer course work is required, but MOLB students must register for 1 credit of MOLB 8990 to be considered full-time.

FINANCIAL SUPPORT

According to financial aid, “...In order to avoid retirement withholding from your stipend checks, Financial Aid requires students to be registered for a minimum of 5 credit hours.” The exception to this is in the summer semester, students will only need to register for 1 credit of MOLB 8990 to meet full-time status.

During the first academic year, the Molecular Biology Program will support students with a stipend of \$30,000 per year, paid monthly on the last working day of each month (exception: June 30 check is not deposited until July 1). Monthly checks are automatically deposited into the bank account specified by the student. The Program also pays tuition, fees, and health/dental insurance for the first year, and by the chosen thesis mentor thereafter. Students are responsible for books, housing, etc.

Not registering and paying a tuition bill by the deadlines set by the Registrar and Bursar’s Offices will result in a \$60.00 late fee. Students are personally responsible for paying all late fees and fines.

Student expenses, including stipend, will be paid until graduation contingent on the student meeting the following conditions:

- 1) Satisfactory academic progress.
- 2) Eligibility for in-state tuition after the first year. Students who fail to qualify for in-state residency will be personally responsible for the difference between in-state and out-of-state tuition (international students excepted).
- 3) Preliminary examination is passed at the end of the first year.
- 4) Comprehensive examination completed and passed by end of fall semester of 3rd academic year.
- 5) Chosen research advisor will provide financial support to the student beginning in the second year and continuing to graduation. Support includes stipend, tuition, fees, and health/dental insurance.

GRANT SUPPORT

Students are encouraged to explore the possibility of obtaining grant support whenever possible. Information for federal and non-federal funding is available online through the university's Office of Grants and Contracts and through [the Graduate School's website](#).

GENERAL INFORMATION

In-state Residency Status

New students must immediately obtain documentation to support the petition for State Residency. This is a very important priority for first year students. After the first full year, only in-state tuition will be covered (assuming satisfactory academic progress), which requires that the student qualifies as an in-state resident.* The documents that must be obtained include local checking account, driver's license or State ID, and voter's registration, as well as proof of Colorado domicile. Further information will be provided during the Graduate School Orientation and you may also refer to the Registrar's Office for more information, <http://www.ucdenver.edu/student-services/resources/Registrar-dev/StudentServices/Residency/Pages/default.aspx>

*All US citizens and permanent residents are eligible to become Colorado residents.

International students cannot gain residency and will remain coded at the out-of-state tuition rate; these students are NOT personally responsible for the tuition differential.

Checking Account

It is important to establish a checking account as soon as possible. The University issues all pay checks, including student stipends, as automatic deposits. Students should be sure they have a voided check or savings account deposit slip available when filling out payroll forms. Students are also required to produce a Social Security card for payroll purposes.

UC Identification Card

Everyone on campus must carry a UC picture ID. This ID serves many purposes including enabling students to access the library, obtain parking, gain access to buildings after hours, and attend special University functions.

E-mail Access

Graduate students will have an account in the electronic mail and World Wide Web access system by visiting <https://myaccount.ucdenver.edu>. You will need your student ID # to access this system. If you have questions regarding e-mail access or encounter difficulties, please contact the Student Email Coordinators at [303/724-2171](tel:3037242171) or email student.postmaster@ucdenver.edu.

Molecular Biology Program By-Laws

Mission of Program: To foster excellence in molecular biology at the University of Colorado School of Medicine and at the Graduate School.

Vision Statement for Program: The Molecular Biology Program at the University of Colorado Anschutz Medical Campus is one of the premiere molecular biology training programs nationally. The existence of a strong interactive Center of Excellence in Molecular Biology strengthens the research capabilities of the entire university. This is accomplished through the enhancement of creative, original research as presented in well-recognized journals and at national symposia; by increasing the level of peer-reviewed support; and through the influence of our graduates and their accomplishments. We recognize that achievement of our goals is inseparable from the recruitment and training of the highest quality graduate students; thus, these activities represent our primary vehicle. Since success of the program is dependent upon the dedicated individual efforts of our faculty, the program facilitates their efforts by (i) fostering communication and interaction among all molecular biology researchers, (ii) providing a resource for the dissemination of information regarding the application of molecular biology to all areas of medical research, (iii) helping to increase funding of the program membership, (iv) providing common facilities and shared instrumentation, and (v) enhancing faculty recruitment by individual departments. These achievements are realized through full open participation of all program members as a team in which each member has the opportunity to influence the direction of the program and recognizes their individual responsibility to work in support of the program's activities.

Program Administration: The Director of the Molecular Biology Program is appointed by the Dean of the Graduate School. The Director is responsible for the vision and direction of the Program, funding, budgets, and overall administration. The Director represents the Program on the CU Anschutz Graduate School Executive Committee. The program has a steering committee (five members plus the director and the PI of the T32 training grant) that coordinates the policies and administration of the program. The steering committee is appointed annually by the program director. The steering committee members serve as chairs of the Program subcommittees including seminar, curriculum/symposium, admissions & recruitment, membership and student advisor. A Program Administrator is responsible for maintaining and monitoring the academic records of students, financial records and budgets, and providing administrative support for committees, program-specific activities, and courses.

Admissions and Recruitment Committee: The Admissions and Recruitment Committee is charged with making policy proposals to the faculty and implementing the approved policies to enable recruitment of the top students in the country that seek graduate education in the diverse molecularly-oriented fields represented by our training faculty. The committee is charged with devising strategies for “marketing the program”, for informing prospective applicants and advisors of the advantages of our program, for actively pursuing qualified students who express an interest in molecular biology, for collecting application materials, coordinating student interview visits, informing faculty and students of the purpose of these visits to maximize their recruiting utility, for making admissions decisions, and for conducting post-admissions surveys to allow our recruiting to improve in the future. The committee should coordinate efforts with the Student Advisor so that special conditions, deficiencies, etc. can be recognized and rectified or accommodated.

Student Advisor: The student advisor advises students on and approves their individual curricula, explains program and graduate school regulations and meets with the students regularly to discuss their progress, problems, questions, concerns and suggestions.

Specifically, the student advisor duties are to:

1. Integrate first year students into the program and serve as their main academic advisor until they join a thesis laboratory at the end of the first year.
2. Serve as a liaison between students and the steering committee and faculty.
3. Work with second year students to insure they are appointing their committees and preparing for their comprehensive examination.
4. Prepare an annual report on the students' progress to be presented to the year-end general faculty meeting.
5. Work with the administrator and the program director to monitor the progress of students, making certain that students are meeting program requirements or remediating deficiencies in a timely manner.
6. Establish regulations and guidelines for student performance and oversee documentation of these guidelines consistent with graduate school regulations by working through the steering committee and the faculty.
7. Oversee students receive proper documentation and filing of a signed acknowledgment of the receipt of all regulations and guidelines.
8. Supervise the administration of the preliminary examination at the end of the first year.

Seminar Committee: The Molecular Biology Seminar Series is a key element that bonds the program on a regular basis. It should be organized to maximize participation and be an enjoyable scientifically stimulating experience for the speakers and the audience. This committee is charged with soliciting suggestions from students and training faculty regarding potential seminar speakers, formulating policy recommendations regarding the seminar program, selecting quality outside speakers that will give the audience a balanced interesting seminar series, and for coordinating arrangements for speakers and the maintenance of the seminar schedule. Working together with the Program Administrator, the committee coordinates travel arrangements for invited speakers, and supports the host who made the invitation. The committee should see that seminars are widely advertised so that all faculty and students and academic leadership of the Anschutz Medical Campus that we serve are aware of our seminars. The committee should maximize attendance and participation by Molecular Biology students, faculty and the members of the faculty's laboratories. The committee should see that all participants in the program receive advance notice of their seminar dates, understand their time limitations and the audience they are addressing and understand how to operate the lights and projector in the room that they are using. The committee coordinates seminars involving students with the Student Advisor and the Program Administrator.

Curriculum/Symposium Committee: The curriculum offered to our students should provide them with both a foundation in basic knowledge and the skills to pursue necessary knowledge throughout their careers. Coursework should provide students with basic skills in critically evaluating the literature. With beginning students, these skills will need to be further developed through work in their thesis labs and with their committees, but courses should provide a firm foundation to enable this development. The curriculum committee is charged with making recommendations to the steering committee (and the faculty) regarding course offerings for trainees. The committee should annually evaluate the quality of our current courses, make specific recommendations to the course directors and instructors and evaluate proposals for new courses. The committee should evaluate the curriculum and make recommendations regarding unmet needs. The committee's responsibilities also include planning and organizing the annual Molecular Biology symposium, including coordinating student participation, registration and timely announcements regarding the course. The committee should solicit input from faculty, students and graduates in evaluating our didactic accomplishments and needs.

Faculty Membership Committee: Maintaining a faculty who are committed to graduate education and who effectively conduct imaginative research programs is critical to the success of the program. The membership committee is charged with 1) evaluating new faculty member applications, and 2) reviewing current members' credentials and participation.

1) New Faculty Membership

Application and Evaluation Process. The membership committee is the initial contact for prospective faculty and advises potential applicants of the criteria and Program requirements for membership. The membership committee receives and evaluates written application forms and CVs. Applicants determined to meet the criteria of the Program on paper are invited by the committee to present a research seminar, meet with students, and to interview with the committee. The committee then makes a recommendation to the Steering Committee regarding the suitability of the candidate. To aid in the committee's evaluation, confidential comments from faculty and students are solicited after the research seminar and meeting with students. The Steering Committee considers the recommendation from the Membership Committee and then decides whether to take the candidate's application forward to the general faculty meeting for a vote. Admission to the Program requires a 2/3 affirmative vote by a quorum of the Program faculty. A quorum is defined as 2/3 of the total faculty. Ballots will be sent to all members by email. They can vote Yes, No or ask that the candidate be discussed at the next faculty meeting.

Criteria for Selection of Program Faculty ("Training Faculty). Faculty membership does not require research in a specific area of molecular biology. Individuals will be favored for membership who have an active program of hypothesis-driven or discovery-based research of fundamental regulatory processes at the molecular level. Just using the techniques of molecular biology to study problems at the cellular or organism level may not qualify.

The criteria for the selection of program faculty include all members of CU faculty who (i) are active as a principal investigator on an NIH RO1 or equivalent grant with a stable pattern of funding (with the exception noted below for junior faculty), (ii) are active in the training of graduate students or postdoctoral fellows, (iii) have a history of being participatory in graduate training activities including support for departmental Ph.D. training programs and graduate (Ph.D.) teaching activities, (iv) are actively involved as a major research interest in molecular biological research as defined above, (v) are independently appointed, not subservient to the aims of other investigators, and at the rank of assistant professor or above¹. Full-time faculty at National Jewish Center (NJC) with university-equivalent rank of Assistant Professor and above, with joint appointments in a CU basic sciences department, and who meet all other criteria as stated above, are also eligible for membership. Since the Molecular Biology Program is dependent on active participation, faculty will be favored for admission who are members of only a few other interdepartmental or departmental graduate training program. Faculty are required to have independent programs since they are expected to be able to protect the academic training opportunities for their students. Thus, generally, only faculty in the regular series as defined by the CU School of Medicine criteria will be considered for program admission. Exceptions can be made for faculty in the Research Professor series if they are able to devote significant effort to education.

For exceptionally qualified new assistant professors (M.D. or Ph.D.), the funding criterion is temporarily waived for a period of up to three years provided the candidate's chair writes a letter stating that the department will guarantee the stipend, tuition, insurance, fees and funds to support the student's research until the completion of the Ph.D., if the faculty member fails to obtain grant funding and exhausts

¹Generally defined as a tenure track appointment.

available setup funds. The membership committee must also be provided with the junior faculty candidate's application file including the letter from the candidate's chair, etc., an updated current research plan, and any other materials that are required to assure that the candidate will provide a quality graduate training experience that fulfills the program's goals.

2) Non-training Faculty Members

a. Non-training faculty members have all the rights, privileges, and responsibilities of training faculty members except non-training faculty will not serve as primary mentors for graduate students in the MOLB Program.

Non-training faculty members, like MOLB Program Training Faculty, are expected to regularly:

- i. serve on MOLB graduate student comprehensive & thesis committees,
- ii. teach in MOLB courses,
- iii. attend MOLB Program seminars, retreats and symposium,
- iv. serve on MOLB Program standing committees,
- v. attend and vote at MOLB Program Faculty Meetings.

Non-training faculty membership will be recommended for MOLB Program faculty who wish to participate in the academic aspects of the MOLB Program but are unable to support graduate student thesis research in their labs. Non-training faculty members also need to maintain active graduate school appointments.

b. Curriculum Fellow: In 2013, we created a non-training faculty position of Curriculum Fellow who will oversee curricular issues and spearhead curriculum innovation. This position is held by Dr. Inge Wefes, the Associate Dean in the Graduate School. Dr. Wefes brings incredible enthusiasm for graduate education to this position, and she was already highly instrumental as a member of the committee that reorganized our Core Course. In her previous position at the University of South Florida, she was responsible for the development, directorship and teaching of several graduate programs and courses. In addition to her many efforts in career development described above, she is also responsible for restructuring the orientation for all incoming PhD students into a three-day, six half-day workshop. Here, the new recruits will be exposed early on to hands-on training with respect to the basic requirements of critical and analytical thinking, will learn about proper literature research and the basics of good writing and good presentations and more. Incoming PhD student will also be required to design an IDP (Individual Development Program) that students will discuss regularly with their mentors throughout their training. While Dr. Wefes will of course continue to serve all of the graduate school community (and all programs), we will be her home program, and she will provide regular review of our coursework and training requirements.

With exception of the Curriculum Fellow, only faculty previously appointed as training faculty of the MOLB Program will be eligible for appointment as a non-training faculty member. (Non-training faculty membership will not be considered for new program faculty). Non-training faculty members can return to training faculty status as described below.

3) Review of Current Faculty (Training and Non-training)

Program Membership for both training and non-training faculty members will be reviewed at least every five years. The membership committee will evaluate whether re-appointment of program faculty as a training or non-training member is warranted based on the faculty member's previous involvement in the MOLB Program, their promise of continued contributions, and the criteria described above for new faculty members. Recommendations by the membership committee will be approved or disapproved by the steering committee. If the majority of the steering committee does not support continued

membership, the affected faculty member will be notified by the Program Director. If the faculty member wants to continue membership, the matter will be brought to a vote of the program faculty. A simple majority is required to enable continued membership.

Student Admissions Requirements: A baccalaureate degree in a biological or physical science or in engineering is required. Students will be more favorably viewed for admission if they have a combined Graduate Record Examination score of 350/4.0 or higher. There is no absolute requirement for grade point average above that required by the graduate school, but successful applicants will generally have GPAs above 3.2 (A=4.0). Students seeking admission should have taken Organic Chemistry (2 semesters; 1 semester of laboratory), General Physics, college level mathematics through Calculus or in Probability and Statistics or Computer Science (1 year). Students with deficiencies may be admitted, but these must be rectified during the first year. Courses in Biochemistry, Biophysical Chemistry, and Biology or Genetics are recommended, as is prior substantive research experience either as part of undergraduate training, summer programs, or work responsibilities.

Advisor's Financial Responsibilities: The Graduate School is financially responsible for first-year student stipends at the level determined by the UC Graduate School, plus student tuition and all associated expenses and fees (including health and dental insurance). The Graduate School covers these expenses only until July 1 of the student's first year. The student's thesis advisor is financially responsible for these expenses for the remainder of the training program. The advisor is responsible for making a financial projection for the student's expected tenure and assuring the faculty that they have reasonable expectation of being able to support the student during this entire period. This must be done before a student is given permission to begin their thesis research in the advisor's lab.

Molecular Biology Program By-Laws – Student Guidelines

First Year Requirements:

Colorado Residency: First year students who are U.S. citizens must take proper steps at time of arrival on the UC Anschutz Medical Campus to begin the process of establishing Colorado residency, so that this is completed ***prior to the start*** of the Fall Semester of the student's second year. For more information, <http://www.ucdenver.edu/student-services/resources/Registrar-dev/StudentServices/Residency/Pages/default.aspx>

If residency has not been established by this deadline, the student is responsible for the non-resident portion of tuition that exceeds the resident assessment.

Course Work

Registration for courses in the first year must be approved by the program student advisor.

During the first year, students are required to take the “**Foundations in Biomedical Sciences**”, IDPT 7806, (6 credits) and “**Core Topics in Biomedical Sciences (A and B)**”, IDPT 7810, (at least 2 credits for each A and B blocks), for a total of at least 10 credits in the fall semester. These are required courses for all first year Ph.D. graduate students at UC Anschutz, and cover the fundamentals of biochemistry, cell biology, molecular biology, and genetics. Molecular Biology students must also take **Ethics** in Research, PHCL 7605 (1 credit) during the fall semester.

An additional required course taken in the spring semester is Advanced Topics in Molecular Biology, MOLB 7800 (Spring, 4 credits.) (*see below for more information regarding 7800). This course is intended to teach students how to critically evaluate scientific literature. Papers are chosen by the instructors and formal presentations are made by students. The topics vary somewhat each year, but typically cover nucleic acids, chromatin structure, DNA replication, RNA transcription and processing, cell cycle control and genetics. MSTP students that join the MOLB program are not required to take this course.

One additional elective course is taken in the Spring semester. An extensive list of electives is available in other departments/programs of the University of Colorado Graduate School. Electives should be chosen to meet the research interests of the student and should be made in consultation with the MOLB student advisor. The elective courses most appropriate for molecular biology students are Cancer Biology (CANB 7600), Developmental Biology (CSDV 7605), Immunology (IMMU 7663), Genome Informatics Workshop (MOLB 7620), Molecular Virology (MICB 7627), Receptors and Cell Signaling (PHCL 7606), Protein Chemistry I-II (BMST 7350-7450) and Structural Analysis of Macromolecules I-II (BMST 7354-7454).

First year students must complete three laboratory/research rotations over the first year for 1 credit each (MOLB 7650 Research), *register for both sec 001 and sec 002 in the fall semester, and sec 001 in the spring.*

In some instances, a 4th rotation may be needed. This will be decided upon with input from the MOLB Student Advisor, MOLB Program Director and the Dean of the Graduate School. See Appendices 3 and 4 for more details

***MOLB 7800** (course directors will have some leeway in deciding the exact number of days for different sections):

- 1) The first class of MOLB 7800 will provide an overview (goals, expectations, grading, etc.) by course directors.
- 2) The second class will be an introduction to writing grants, focusing particularly on Specific Aims, as students will be asked to write a one-page Specific Aim for each block of the course.
- 3) Blocks 1-3 of MOLB 7800 will focus on specific areas of Molecular Biology. Each block will consist of 8 classes, including an introductory lecture, 6 paper discussions, and the final class to discuss the Specific Aims provided by the students. Every student will be required to write a one-page Specific Aim based on the papers from that block. Students will send the Specific Aims to the course directors to post on Blackboard, and in the 8th class of the block, 2-4 students will be selected by the Faculty Instructors to present their Specific Aims, followed by critique from other students. Faculty instructors will conclude the discussion with comments/advice for each student's paper.
- 4) Block 4 will focus on grant writing with 16 classes in total. Faculty instructors for this block will cover the information on grant guidelines, fundamentals and strategies of grant writing. Students will be given 2-3 related papers by the faculty instructors and asked to write a 5-page proposal (not including the Specific Aims page), covering a maximum of 2 specific aims. Students will also add a short section on rigor, repeatability and reproducibility in their proposals. Class students will form study sections and critique each student's proposal. This block will count for 2/5 of the final grade, based on the quality of the proposal and participation on the study sections.

Students are required to maintain a 3.0 grade point average throughout the program. Additionally, the Molecular Biology Program requires students to earn a grade of B (3.0) or better in all required courses, regardless of the overall grade point average. If a student receives a B- in any required course, he/she may be allowed, at the discretion of the program faculty, to either retake the course or perform remedial work acceptable to Molecular Biology faculty. Should the student be allowed to retake a required course in which they have received a grade of less than a B (3.0), it must be done by the end of the next academic year. Students are placed on probation by the Graduate School if their grade point average falls below 3.0 and are dismissed from the program if the grade point average is not raised to 3.0 within one semester.

Summer Semester: No summer coursework is required, but MOLB students must register for 1 credit of MOLB 8990, Thesis Research, in order to be considered a full-time student.

Research Rotations: Students are required to take research rotations in the laboratory of three different faculty members of the program. Each rotation lasts for twelve weeks and they are taken over the fall and spring semesters. Selection of laboratories for research rotations should be a decision made mutually by the student and the participating faculty. However, students are encouraged to consult with the program student advisor before making a selection. Factors such as space, number of students in a laboratory and how much time and effort a faculty member can spend should be taken into account. Projects are selected to challenge the student, but are adjusted in scope so that a logical conclusion can be reached within a one-rotation period. These rotations are used to introduce students to the techniques of molecular research, facilitate the development of the logic required for conducting research and give the student an opportunity to view, first-hand, laboratories in which she or he may choose to perform their thesis research.

Students are required to give an oral presentation at the weekly program seminar upon completion of each laboratory rotation. These are brief 10-15 minute talks that cover the work done during the

rotation. Students should consult with the director of the rotation laboratory in putting together and practicing their talks.

Students take research rotations for 1 credit (MOLB 7650, Research). They are evaluated on the basis of their performance by their rotation lab mentor, and this will be used as one criterion for advancement to the second year of the program. Evaluations will be two-fold. The director of the rotation laboratory will not only grade the student for 1 credit of research, but will provide a written critique of the student's understanding of the material, ability to design experiments, bench and organizational skills, and quality of laboratory notebook. Evaluations are completed electronically on the Graduate School website by the faculty, discussed with the student, and placed in the student's file.

Seminar Program: The program holds a weekly seminar in which faculty, postdoctoral fellows, students and invited outside speakers present talks on their research. The seminar series is a major focus for the program in that it draws everyone together weekly, keeps individuals abreast of research in progress as well as scientific techniques and expertise present within the program. This seminar series is beneficial to all participants in the program, both faculty and students. It helps students practice the presentation skills that will be important in their careers, provides examples from faculty presentations, and helps enormously in finding the appropriate colleague to consult when problems arise in individual research efforts. Outside faculty speakers are scheduled to maximize interactions between both students and faculty. Students do not register for this course the first year but are required to attend.

Retreat: The program holds an annual two-day scientific retreat at an off-campus site. Faculty, students and other members of faculty laboratories are asked to give either poster or oral presentations of their research in progress. The program of the retreat is arranged to ensure a vigorous exchange of information and to promote collegiality among participants. All students are required to attend and present a poster or talk at the annual retreat.

Preliminary Examination (See more detailed guidelines in Appendix 2): At the completion of the first year, students must take a preliminary examination which is required by the Graduate School and facilitated by each program for their students. The Preliminary Exam format is in the form of a written mini-proposal, which is defended in a one-hour oral exam, administered in or around the third week of June by a standing committee within the program.

The general format for the Preliminary Exam administered by the Molecular Biology Program is a written research proposal with an oral examination.

- 1) Students will be given a group of papers (3-5) on a single topic.
- 2) The students are to write an NIH/NRSA fellowship style proposal based on the papers provided (1 page Specific Aims plus 6 pages Research Strategy) maximum). Organization into the sections specified for an NIH/NRSA grant is recommended. An additional page addressing rigor, repeatability and reproducibility including a detailed Methods section is required (as of Spring 2017).
- 3) Students will be given 3-4 weeks to write the proposal
- 4) A tutorial will be provided in the spring semester of each year in MOLB7800 (see below) to provide the students with information on guidelines, fundamentals and strategies of grant writing.
- 5) A standing (and rotating) committee consisting of 5 members of the Molecular Biology Program will choose the topic and papers, read the proposals, and administer the oral exam. In

addition, each student will be assigned a mentor from this committee. Typically, a committee member will have no more than 2 students to mentor, reviewing the proposal with the student and offering broad suggestions on content.

- 6) Students will be graded on a Pass or Fail basis.
- 7) If a student fails, they could have one opportunity to re-take the exam in the next 2-3 months. One option for this re-take format might be that the student is told about their deficiencies and asked to revise and rewrite/represent that part of the proposal based on the criticism.

Evaluation and Selection of Thesis Advisor: The program faculty will evaluate the overall performance of the student based on three areas: course work, laboratory rotations and the preliminary examination. This will take place at the general faculty meeting in late June. Upon successful completion of this evaluation, students then select a thesis advisor and a project. Selection of the thesis advisor should be the mutual decision of the student and the program faculty member. **At the completion of the third laboratory rotation (by June 1), students are asked to submit in writing (to the program student advisor), the name of the potential thesis advisor and a brief description of the proposed research project so that this request can be presented at the general faculty meeting in June.** The program faculty will review written requests and make final approvals. Every effort will be made to accommodate a student's first choice. However, factors such as the number of other students in a laboratory, space, and financial resources of the potential thesis advisor must be considered. Therefore, a student may be asked to make an alternate selection. In the event that a student does not match with a thesis advisor by the end of the third rotation, a fourth rotation in the summer can be performed (see Appendices 5 & 6) with the approval of the Student Advisor and the Director, provided the student is otherwise in good standing in the Program (B or better in all required courses and has passed the Preliminary Examination). The Program will make every effort to assist a student in finding a suitable thesis advisor. Nonetheless, matriculation into a thesis lab is required for continuation into the second year in the Molecular Biology Graduate Program.

Graduate Student Advisor: Students in their first year should consult on a regular basis with the program student advisor. This provides a mechanism for continuous rapport to be established between one faculty member and students throughout the critical first year. This permits continuous monitoring of potential problems and a useful way for students to have input into the program. The program student advisor consults regularly with program faculty regarding student questions and concerns.

Second Year Requirements:

Course Work: In consultation with the program student advisor and the thesis advisor, students may choose additional elective courses to round out their expertise in selected areas and to provide general knowledge in others. Students must register for Biostatistics in Research (BIOS 6606, 3 credits) or equivalent in the fall semester. Continued participation in the Research Seminar Program is required and students must now register for this as a course for credit (MOLB 7661, 1 credit). The seminar course will be graded based on participation, and the spring semester grade will in part be based on the student's research seminar presentation (see below). Additionally, students must register for Rigor and Reproducibility in Biomedical Research (MOLB/PHCL7801, 1.0 credit. This course combines both “wet” and “dry” lab components focused on teaching the concepts of Rigor and Reproducibility and the appropriate laboratory skills. Additionally, students must register for MOLB 7650 sec. OV3 (Research in Molecular Biology) (variable credits) each semester during their second year.

Graduate school requirements stipulate that students must accumulate or be registered for 30 credits (not including credits of 8990) prior to taking the comprehensive exam, scheduled no later than the end of fall semester of the third year. Thus, students are urged to transfer credits for any graduate level courses taken from their previous universities.

Summer Semester: No summer course work is required, but MOLB students must register for 1 credit of MOLB 8990 to be considered full-time.

Research Seminar: In the spring, second year students present a seminar on their research in progress. This is given as part of the program's weekly research seminar series. This serves to focus the student's research project and to provide training in oral presentation skills. Students should meet with their thesis advisory committee (see below) immediately following the spring seminar presentation.

Retreat: Students are required to attend and participate in the annual Molecular Biology Program Retreat, fall semester.

Symposium: A novel component of the Molecular Biology Program is the annual Symposium covering seminars on timely topics of interest. The annual topic is selected jointly by faculty and students (2nd years) of the curriculum committee. The symposium seminars are given by prominent visiting scientists and program members, who are experts on the topic of interest. Although the symposium is not taken for a grade, all students are expected to participate, beginning in their second year and throughout the remainder of the program. All 2nd year students are expected to assist in organizing and implementing the symposium which will occur in their third year.

Round Tables: Beginning in the second year and throughout the remainder of the training program, all students are expected to participate and help organize Round Table Journal Club. Round Table Journal Club is monthly meeting that will be held on last **Tuesday of every month 4pm-5pm (September-May) at RC1S-9105**. The Molecular Biology Program will provide light snacks. Training grant appointed students will serve as coordinators, and decide on a topic and the guests to be invited. The basic format is flexible, but generally one or two students (from any year) will present a paper of their choice to be discussed by all participating students. Alternatively, a student may choose to present his/her research project or an idea about new possibilities. Twice a year (once every semester) students will invite local outside speaker of their choice. Generally, the goal is for students to learn about a new area of interest, including alternative career options. Thus, speakers may be either academic researchers, representatives of industry or other potential alternative career pathways.

Selection of Thesis Advisory Committee (See more detailed guidelines in Appendix 2): Students are expected to form a thesis advisory committee by March of their second year. This should be done in consultation with the program student advisor and the thesis advisor. The committee will have its first meeting with the student ideally on the afternoon following the spring seminar presentation, or as soon thereafter as possible. The first charge of the thesis advisory committee will be to guide and evaluate the student's research progress to this point, to set the guidelines for the upcoming comprehensive examination and to set a tentative date for the comprehensive examination. **This committee (five members) is composed of at least one faculty from outside of the Molecular Biology program, with the balance (a majority) of the committee coming from program faculty; the Chair must be a Molecular Biology faculty member. After the Comprehensive Exam is completed and the student advances to Ph.D. candidacy, the student's mentor may become a member of his/her committee, and one Molecular Biology faculty member may be dropped at that time.** All committee members must have faculty appointments in the Graduate School, and it is the duty of the student to be sure that any faculty member asked to be on his/her committee has a current appointment with the Graduate School. It is the duty of the committee to advise the student and to monitor the student's progress, and

report to the student advisor. Students must meet with their committee at least annually; more frequently is advisable. This committee is also charged with administering the comprehensive examination and guiding the student throughout their thesis project. It is the responsibility of the student to form the committee, submit the names of all members to the Molecular Biology office, arrange annual committee meetings (to take place after the seminar), inform the members and the Molecular Biology office in writing of the date and place of the meetings (at least two weeks in advance), and prepare a written progress report of their research.

Students will meet with their committee in the spring semester of the 2nd year to discuss the format of the comprehensive examination (see below). This “pre-comprehensive exam” meeting is for the student to introduce themselves and their project, and get advice on their project from the committee.

It is the responsibility of the committee chair to complete the on-line evaluation of each committee meeting through the graduate school web site (<https://gs.ucdenver.edu/gaia/pprog/>), which is automatically submitted to the program administrator who then sends a copy to the Student Advisor. This summary should include: 1) the student's progress since the last committee meeting; 2) planned studies for the immediate future; 3) indication of how student's progress relates to the specific aims of the thesis proposal presented in the comprehensive exam; 4) manuscripts published, in press, or in preparation; and 5) number of years in the program as well as anticipated date of completion. Summaries are signed off by committee via the web site and completed within one week following the committee meeting.

Third Year Requirements:

Course Work: In the fall semester of the third year, students register for MOLB 7650 sec. OV3 (Research in Molecular Biology for 5 credits) if they still need research hours to complete the required 30 hours prior to the comprehensive exam. If the student has taken additional electives or has transferred credits from other schools, the 30 hours may already be fulfilled. In such cases, students will register for MOLB 8990 (Doctoral Thesis in Molecular Biology for 5 credits) throughout the remainder of time in the program.

Summer Semester: No summer course work is required, but MOLB students must register for 1 credit of MOLB 8990 to be considered full-time.

Comprehensive Examination (See more detailed guidelines are in Appendix 2): Students are expected to have demonstrated competence in research during their second year and to have generated preliminary data to prepare for the comprehensive examination. This exam requires the written submission of a research proposal that describes the actual thesis project planned by the student. The proposal should be written in an NIH grant format to contain the following sections; specific aims, background and significance, preliminary data, experimental design and approach, and a supporting bibliography. While the overall project goals are formulated in consultation with the mentor, at least one aim should be based on the student's ideas. Students should consult with their committee chair and NIH guidelines for how to format the written portion of the exam. The proposal should be written to be as close as possible to the realistic goals of the thesis project and should not be an overly ambitious proposal for an entire laboratory group. The thesis advisor should read the proposal and provide general comments to the student prior to submission. The student can also seek advice from other colleagues, but again, advice should be limited to general comments so that the proposal is developed by the student. The student defends this proposal orally at the examination. The oral portion of the exam will also test general knowledge through questioning related to the proposal. Starting in Spring 2017, we will require all students to add a section on rigor, repeatability and reproducibility, similar to what is now being required for new NIH R01 grants, <http://grants.nih.gov/reproducibility/index.htm>

To schedule the exam, students must have completed or be registered to have 30 credit hours. A packet of appropriate forms and instructions must be obtained online from the Graduate School website, and returned with all signatures at least two (2) weeks prior to the date of exam. Also, students should submit their completed written portion to committee members at least 2 weeks in advance of the exam date. Students must obtain written approval of the topic of their proposal from the chair of their advisory committee and submit this to the Molecular Biology Office before beginning preparation of the written portion of the exam. This is accomplished sometime after the “pre-comprehensive exam” meeting in the previous spring semester (see above). The format of the oral portion of the exam will be set by the committee chair. During the exam, the student and the mentor will be asked to step outside individually, to allow each to briefly address the committee with any concerns. Students are required to take the exam no later than the end of the fall semester, though earlier in the summer or fall is preferable. Upon successful completion of this exam, the student is advanced to Ph.D. candidacy.

Research Seminar: In the fall semester (if the schedule permits) of the third year, students present a seminar on their research progress at the weekly program seminar series. Students do not register for Research Seminar for credit in the third year or in subsequent years, but attendance at the weekly research seminars is mandatory. Students must meet with their thesis advisory committee immediately following their annual seminar presentation.

Retreat: Students are required to attend and participate at the annual Molecular Biology Program Retreat.

Symposium/Round Tables: As in the second year, students are expected to participate in the symposium and round table.

Fourth Year and Beyond:

Course Work: It is the goal of the program for students to complete their thesis research and to successfully defend their thesis by the end of their fifth year. The fourth years and beyond are devoted almost entirely to research. Students during this period continue to participate in the symposia, the weekly seminar series, Round Table, and the annual retreat (4th year students organize the annual retreat). Students also participate in individual research group meetings during this period. Students are strongly encouraged to make presentations at national meetings during their final two years. The program makes efforts to aid the students in developing independence and leadership skills during this period and to devote considerable thought to their career and postdoctoral research plans. Students are required to continue to meet at least annually with the thesis advisory committee during their final year(s). Again, it is often advisable to meet more frequently than this as the student nears completion of the thesis work.

Students continue to register for MOLB 8990 (Doctoral Thesis in Molecular Biology, 5 credits) during their fourth year and beyond, keeping in mind the necessity to complete 30 hours of thesis credit prior to thesis defense and graduation.

Refresher in Ethics in Research PHCL 7606 - Per NIH guidelines

<http://grants1.nih.gov/grants/guide/notice-files/NOT-OD-10-019.html> “...Frequency of

Instruction: Reflection on responsible conduct of research should recur throughout a scientist’s career: at the undergraduate, post-baccalaureate, predoctoral, postdoctoral, and faculty levels. Institutional training programs and individual fellows/scholars are strongly encouraged to consider how to optimize instruction in responsible conduct of research for the particular career stage(s) of the individual(s) involved. Instruction must be undertaken at least once during each career stage, and at a frequency of no

less than once every four years.” Relevant PHCL 7606 information will be sent out to fourth year and above MOLB students regarding the requirement of a refresher course in Ethics and the options available for the fall semester. It is preferred to complete this refresher no later than your 5th year.

Summer Semester: No summer course work is required, but MOLB students must register for 1 credit of MOLB 8990 to be considered full-time.

**If student will be defending their thesis during the summer semester, then the student needs to register for 5 credits of MOLB 8990.*

Research Seminar: In the fall of the fourth year, students present a seminar on their research progress. This is presented as part of the program's weekly research seminar series. This serves to focus the student's research project and to provide training in oral presentation skills. Students must meet with their committee following seminar presentations or as soon as possible thereafter.

Retreat: Students continue to be required to attend and participate at the annual Molecular Biology Program Retreat.

**Fourth year students are responsible for organizing the annual retreat.*

Symposia/Round Tables: Students are expected to continue participation in the symposia and round tables.

Thesis/Dissertation (See more detailed guidelines in Appendix 2): All doctoral students are required to submit a thesis (or dissertation) to the Graduate School, **at least two weeks** prior to the date of thesis defense, as partial fulfillment of the requirements of the degree, Doctor of Philosophy. To meet this deadline, the thesis must be submitted to the student's thesis committee at least 6 weeks prior to the planned defense date, as detailed below. All forms and applications needed are available online through the Graduate School's website. The form and scope of this thesis is determined by the student, the thesis advisor, the advisory committee, and the Program. The thesis should be based upon original investigation and showing mature scholarship and critical judgment as well as familiarity with tools and methods of research. Starting in Fall 2019, all students are required to add a section on rigor and reproducibility, similar to what is now being required for new NIH R01 grants. In addition, prior to defense of the thesis, a Molecular Biology student must **have, at minimum, one submitted first author original research manuscript**. An exception to this requirement can be granted under extenuating circumstances with approval of the Steering Committee.

Students will be required to have their written dissertation approved in a final form worthy of being defended before they may schedule their public defense. To accomplish this, students will first turn in their dissertation to committee members, and the committee members will then have two weeks to either approve the dissertation or request revisions. The student will address the concerns and criticisms of the committee members (including possible new experimentation), and then resubmit the dissertation to the committee. The committee will again have two weeks to either approve (with or without minor revisions) or disapprove the document, without additional rounds of approval/disapproval. Once the dissertation is approved, the student may schedule his/her public seminar and oral exam (a tentative date can be arranged with committee members at any point). While approval of the dissertation only requires a majority of the committee, it is not in the student's best interest to schedule an exam with disapproving committee members. In order to schedule the oral defense, the committee chair must receive written notification (such as by email) from a majority of committee members, with a majority stating they approve the written dissertation. In addition, the student should seek out the advice of the committee members and faculty mentor early in the writing process, and the committee members and faculty should make themselves available for that purpose.

Approval of the written dissertation by the committee members does not constitute a “Pass” of the defense. The public seminar and oral defense remain important criteria and must be completed to the satisfaction of the committee and mentor. The possible outcomes of the oral defense include Pass, Pass with Conditions, or Fail.

Procedure for changing thesis advisors and dismissal from thesis lab

While it is always the goal that a student who chooses a thesis advisor is able to complete the PhD thesis with this advisor, this relationship does not always work out. While the Molecular Biology Program does not have the authority to dictate whether or not a student continues in a particular thesis lab, the Program does suggest certain guidelines in the interest of fairness to both student and mentor. Still, in the end, it is at the discretion of both the student and advisor as to whether a student continues in the chosen thesis lab.

Guidelines:

- 1) If a student is having trouble in the lab, such as in the form of conflicts with the advisor or lack of mentoring, then the student should consult with the Student Advisor, the Program Director and/or the Chair of the thesis committee. This action should be taken as soon as problems arise. A written summary of the meeting should be issued for documentation and added to the student’s file.
- 2) If an advisor is unhappy with the performance, lab citizenship, work ethic or intellectual engagement of a student (or any other problem), then the advisor should meet with the student expressing these concerns. Consultation with the Student Advisor, the Program Director and/or the Chair of the thesis committee is also recommended. A written summary of the meeting should be issued for documentation and added to the student’s file..
- 3) In either of the cases above, the advisor and the student should then work out a plan of remedy. This plan should be in writing, and it is advised that the plan be forwarded to the Molecular Biology Program Director and the Chair of the student’s thesis committee. Regular meetings between the student and MOLB Advisor should be held, and satisfactory or unsatisfactory improvements documented (copied to the Program Director and Chair of the committee).
- 4) Should a conflict reach the point where either the student or advisor decides that the mentor-student relationship should end, the student has several choices. The student can find another mentor within the Program, choose to leave the Program with a Master’s degree (subject to the rules of the Graduate School and approval by the thesis committee), or transfer to another lab in a different graduate program.

MOLECULAR BIOLOGY PROGRAM POLICY FOR VACATION AND LEAVE

Graduate school is a privilege; obtaining a Ph.D. and working in the biomedical research/academic field is a time-honored and challenging profession that requires a high level of commitment and responsibility. Students in the Molecular Biology Program are required to pursue their training on a full-time basis, devoting each day of the normal work week, plus any additional time required of their research projects and academic courses. MOLB students receive a Graduate Student Assistantship (GSA) (1505) position, which is a full-time student position that also provides for tuition and fee remission per policy. In order to offer tuition remission, students in the program cannot have another position in addition to GSA. In special circumstances, usually involving additional teaching duties or internships, exceptions to this policy may be made that require the permission of both the mentor and the program director. Additionally, for a student to maintain full-time student status, the following guidelines for leave time have been established by the Molecular Biology Program. The Program does not have a formalized system for accounting for vacation and sick leave; this falls under the honor system and is the responsibility of the student.

Vacation and Holidays. Trainees may receive similar vacation days and federal holidays as other training peers at CU Anschutz. Students shall continue to receive stipends during vacations and holidays. In graduate school at CU Anschutz, the times between academic quarters and summers are considered active parts of the training period and are not necessarily free times. However, for first year students, who are expected to attend all classes, vacation days are to be taken only during the Winter break (Mid December – 1st of January), the week between Winter and Spring quarters, and the time between the preliminary examination in mid-June and July 1st when work in the thesis lab begins. For advanced students in the second year and above, vacation time should be arranged with the thesis advisor.

Sick Leave and Other Leave. Trainees may continue to receive stipends for up to 15 calendar days of sick leave per year. Under exceptional circumstances, this period may be extended, but will require a written request and approval from the program director. Sick leave may be used for the medical conditions related to pregnancy and childbirth.

Parental Leave – Trainees may also receive stipends for up to 30 calendar days of parental leave per year for the adoption or the birth of a child when those in comparable training positions at the sponsoring institution have access to paid leave for this purpose. Either parent is eligible for parental leave. For trainees, the use of parental leave must be approved by the program director.

Unpaid Leave – Individuals requiring extended periods of time away from their research training experience, which could include more than 15 calendar days of sick leave or more than 30 calendar days of parental leave, must seek approval from the program for an unpaid leave of absence. Approval for a leave of absence must be requested in advance by the trainee and approved by the program. The leave period and conditions must be documented, both at the time of leave and at the time of re-entry into the program. The program director and student faculty mentor will be responsible for writing and contracting these conditions.

Termination – Upon graduation or termination, a graduate student forfeits all unused annual and sick leave; payment may not be made from grant funds (training grants or research grants) for leave not taken.

*You may also refer to the UC DENVER AMC *GRADUATE SCHOOL* website under *Students: Resources & Policies: Vacation and Leave* at <http://www.ucdenver.edu/academics/colleges/Graduate-School/current/Pages/resources.aspx>

MOLECULAR BIOLOGY PROGRAM BOLIE GRADUATE SCHOLAR and NIH STUDENT SUPPORT AWARDS

Victor W. Bolie and Earleen D. Bolie Graduate Scholarship Fund

(Students in the 4th, 5th and 6th year are eligible to apply for the Bolie Graduate Scholarship award)

Guidelines:

1. Bolie Graduate Scholars will be chosen from students who have completed two years in the lab but not more than four years in the lab (as of August)*. For regular graduate students, these would be students who will be beginning their 4th, 5th, or 6th years as of September. For MSTP students, students entering their 5th, 6th, or 7th years (including 2 medical school years) as of September are eligible. Based on the endowment, there should be three Bolie Graduate Scholars per year. Students currently supported by the MOLB T32 or other fellowships over \$15,000/year are not eligible. (So a student currently supported by the MOLB T32 cannot apply for the Bolie Graduate Scholarship.) Bolie awards are restricted to US citizens (who graduated from US colleges and high schools)**, and previous support by a T32 or other award will not negatively impact award consideration.
2. Each June, the program will issue an invitation for applications from those students who qualify (per stated rules) for the Bolie Scholarship. The application will include: a) the student's biosketch, highlighting achievements of the student in the program, including a paragraph detailing progress in the research project; and b) a letter from the chair of the student's committee (half-page), requested by the student. The current T32 committee will choose three students to receive the award, based on the above application, as well as review of the student's performance and participation in the program.
3. Bolie Graduate Scholars will receive \$18,000 towards their stipend and \$2000 for educational expenses (such as computer, research-relevant software, or travel to conference). The remainder of the stipend and benefits/tuition would come from other sources, i.e. the mentor's grants.
4. The award will be for one year only.
5. Bolie Graduate Scholars will present talks at the Molecular Biology Retreat (same time as allotted for faculty/postdoc speakers).
6. Bolie Graduate Scholars must acknowledge support from the Victor W. Bolie and Earleen D. Bolie Graduate Scholarship Fund in the thesis and in publications.
7. The Molecular Biology Program will provide an annual report to the Bolie Foundation on the students supported (one page, describing projects of students).
8. At the discretion of the Program Director and the Steering Committee, the Program can choose to support an exceptional first year student as a Bolie Scholar. This award would be offered during recruitment of prospective students, as an incentive to capture such an outstanding student.

Notes:

*The reason for choosing upper year students is to assure that the best students can be chosen as Bolie Graduate Scholars, without competing against students being considered for the MOLB T32, i.e. students in their 2nd and 3rd years.

**The conditions of the Bolie Foundation state that "each student sponsored by the fund be a US citizen, a graduate of a U.S. high school and a U.S. undergraduate college.

MOLB T32 NIH training grant

The goal of the Grant Selection Committee is to award NIH training grant slots to the most promising Molecular Biology students. Typically, 4-6 slots will be awarded to students just completing their first or second years and starting their second or third years, respectively, when the award period will begin. For MSTP students, the first year is when they entered the Molecular Biology program.

- 1) In late May, the Grant Selection Committee will request nominations from faculty mentors of training grant eligible Molecular Biology students. The Grant Selection Committee will then meet and review the performance of those training grant-eligible MOLB students nominated by their mentors. Criteria evaluated will include undergraduate GPA, GRE scores, performance in classes during first year of graduate school, preliminary exam scores and performance in their labs (based on grades and both rotation and thesis lab seminars).
 - a. Per NIH guidelines, (nominated) students must be US residents or non-citizens who have permanent resident status.
- 2) In addition, students who have been on the training grant for one year will be re-evaluated. If their performance has been satisfactory and slots are available, they will be interviewed along with other new candidates. If their progress has been unsatisfactory, they will not be interviewed or renewed.
- 3) Promising candidates will be chosen for short interviews. Typically, about twice as many interviews will be conducted as there are available training grant slots.
- 4) The students will be interviewed by the entire Grant Selection Committee for about 15 minutes.
- 5) After all candidates have been interviewed, the Committee will meet in private to decide which students should receive training grant support. If any Committee member has a student in their lab being considered for a training grant slot, then that member will not be present for the discussion of their student.
- 6) An e-mail will be sent to all MOLB faculty and students announcing the new training grant awardees.

MOLECULAR BIOLOGY PROGRAM TRAVEL AWARD RESOURCES

Bolie Travel Award

Awards will be made up to \$1,200 total per student (during their MOLB academic career) to attend a scientific conference or scientific workshop and will be made on a competitive basis. A short application form is available from the Program Administrator. If possible, applications should be turned in at least 60 days in advance of the meeting; and students applying for Bolie funds are also required to apply for any travel awards offered by the sponsoring agency.

Eligibility for travel awards: All full-time Molecular Biology students who are working in a thesis lab are eligible for travel awards. 1st year students, in general, will not be eligible. Preference will be given to students senior enough to have material to present at meetings, either in the form of posters or talks. Attending a workshop will require justification that the technology cannot be learned on campus and will directly impact thesis work. To enable as many students as possible to take advantage of this opportunity, students will generally be eligible to receive a travel award only once during their tenure in the program.

HIRS Travel Fellowship

A major gift to the Graduate School at the Anschutz Medical Campus has allowed the establishment of an endowed award for graduate students in the basic biomedical sciences at the Anschutz Medical Campus. The C. Werner And Kitty Hirs Graduate Student Enrichment Fund Awards may be used for any one of the following three specific purposes:

1. Travel awards to supplement support for Ph.D. students to attend national meetings,
2. Travel awards to facilitate Ph.D. students learning new techniques either through a visit to an out-of state laboratory or by signing up for a hands-on technique course, such as the MBL course, and
3. Merit scholarships to aid in recruiting the “best and the brightest” Ph.D. students into the basic sciences at CU Anschutz.

The travel awards can be made for up to \$500 each. In accordance with Dr. Kitty Hirs’s expressed wishes, the travel award for meeting attendance will be divided into two parts: \$400 to be applied to travel expenses (e.g., registration, lodging, travel) and \$100 directly to the student for personal expenses at the meeting (e.g., making it possible for the student to attend extra-meeting social events in which science is part of the conversation). Up to 20 “meeting” awards will be made each academic year. The travel awards for visiting another laboratory or attending a techniques course are to be applied only to travel expenses (e.g., travel and lodging). Up to 10 “techniques” awards will be made each academic year. Contact 303-724-2911

The Graduate School

Directory

David Engelke, PhD, Dean.....	Academic Office One, Room 1607 david.engelke@ucdenver.edu
Lauren Fields, Executive Asst. to the Dean.....	Academic Office One, Room 1506303 724 2911
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Kristine Sikora, Director of Recruitment.....	Academic Office One, Room 1506 Kristine.sikora@ucdenver.edu303-724-4379

Webpage

<http://www.ucdenver.edu/academics/colleges/Graduate-School/Pages/default.aspx>

Graduate Student Handbook

<http://www.ucdenver.edu/academics/colleges/Graduate-School/current/Pages/resources.aspx>

See Students: Resources & Policies

Graduate School Policies and Procedures

<http://www.ucdenver.edu/academics/colleges/Graduate-School/current/Pages/resources.aspx>

See Students: Resources & Policies

Ph.D. Comprehensive Examination Packet information

<http://www.ucdenver.edu/academics/colleges/Graduate-School/current/Pages/resources.aspx>

See Students: Deadlines & Forms: Admission to Candidacy Application

Per the MOLB Program, this examination must be completed no later than the end of the student's first semester of their third year. (Individual programs may establish an earlier deadline than what is required by the Graduate School which requires that comps be completed by the end of the student's third year.)

Ph.D. Thesis Defense Packet information

<http://www.ucdenver.edu/academics/colleges/Graduate-School/current/Pages/resources.aspx>

See Students: Deadlines & Forms: Graduation Deadlines 2016 -2017 (CU Anschutz)

Once a student has completed his or her dissertation and before the degree is conferred, a final examination on the dissertation and related topics is conducted in two parts, an oral presentation of the dissertation research that is open to the public, and a closed examination conducted by the examining committee. Instructions and deadlines for completion of the forms are provided on the graduate school website.

Honor Code

This campus-wide policy statement on student academic honor and conduct at the Anschutz Medical Campus was developed in consultation with faculty and student representatives from each health sciences school, and representatives of the campus-wide Faculty Council and Student Senate. It provides general policies for all students on campus, in accordance with the Regents' resolution of March 17, 1988, while at the same time it directs the schools to develop specific procedures to implement the policy in accordance with their unique programs and student populations. While the process for resolving honor code violations may vary from school to school, the elements listed below will remain uniform. The health professions are based on a high degree of trust by the individuals they serve. Students entering the health professions have a particular obligation, therefore, to conduct themselves at all times in a manner that reflects honesty, integrity, and respect for others.

A. Academic Honor and Conduct Code: Education at the Anschutz Medical Campus is conducted under the honor system. All students who have entered health professional programs should have developed the qualities of honesty and integrity, and each student should apply these principles to his or her academic and subsequent professional career. All students are also expected to have achieved a level of maturity which is reflected by appropriate conduct at all times.

Although it is not possible to list every situation that violates the Anschutz Medical Campus academic honor and conduct code, the following examples will provide a reference point.

1. Academic Honesty – Students should adhere to the highest standards of academic honesty and integrity. Examples of behavior which violates these standards include: plagiarism (including improper use of web information), cheating, illegitimate possession and/or use of examinations, and falsification of official records.
2. Professional Conduct – As future health professionals, students should also adhere to the highest standards of professionalism. Examples of unprofessional conduct include: misrepresentation of effort, credentials or achievement in either the academic or clinical setting; any action which compromises the quality of patient care; violation of patient confidentiality; and other conduct unbefitting a health professional.
3. Alcohol and Drug Use – Alcohol and/or drug abuse compromises the student's ability to learn and to practice as a health provider and, thus, is considered unprofessional conduct. Students who have a problem with alcohol and/or drugs should seek assistance from services available on campus. The sale of drugs or the possession of non-prescribed narcotics or other controlled substances is against the law. In order to minimize the potential for alcohol abuse at campus functions, Students must work with University and/or their Program administration to ensure compliance with the policies and procedures regarding functions where alcohol may be served.
4. Respect for the Rights and Property of Others – Students should conduct themselves in a manner which recognizes the rights and property of others. Examples of inappropriate behavior include theft, damage to University or personal property of others, disruption of educational or other activities on campus, illegal use of University facilities, harassment or physical assault, and any conduct which threatens the health or safety of others.

The primary responsibility for reporting violations of the student honor and conduct code rests with the individual student who has violated them. However, fellow students and members of the faculty also share in this responsibility.

B. Relationship of Honor and Conduct Code to Local, State, and Federal Laws. The University adheres to all appropriate local, state, and federal laws, and cooperates with law officials in all matters. Any alleged violation of local, state, or federal laws will be referred to the appropriate law enforcement agency, and such laws have precedence over the provisions of this policy.

C. Honor and Conduct Committee. Each school will have a standing Student Honor and Conduct Committee and, as appropriate, individual programs may have standing committees. The composition of the committee will include faculty and student representatives, with the exact composition of the committee to be determined by the dean in consultation with the school's faculty and student governance groups. The primary function of this committee will be to examine alleged violations of the honor and conduct code, and to make recommendations to the dean on these matters as appropriate.

CU Anschutz – Campus Resources

CU Anschutz Bookstore <http://www.ucdenver.edu/AMCbookstore>

Location: Anschutz Medical Campus, Building 500; 1st Floor, 303-724-2665 (4-BOOK)

Financial Aid <http://www.ucdenver.edu/anschutz/studentresources/FASO/Pages/FASO.aspx>

Location: Education II Building, 3rd Floor, 303-556-2886

Information regarding financial assistance is available at the Financial Aid office. You should plan to fill out all forms early. Short-term emergency loans are available.

CU Anschutz Office of Campus Student Services

<http://www.ucdenver.edu/anschutz/studentresources/student-assistance/Pages/default.aspx>

The Office of Campus Student Services' mission is to enhance student life at the CU Anschutz by providing excellence in specific non-academic and academic student services.

- 1718 Student Life Handbook
- Office of Inclusion and Outreach <http://www.ucdenver.edu/DiversityAndInclusion>
- Student Organizations
- Activities and Recreation
- Student Housing
- Academic Resources
 - Disability Resources and Services
 - <http://www.ucdenver.edu/anschutz/studentresources/student-assistance/academic-resources/Pages/Disability-Resources-and-Services.aspx>
- Student Resources
 - **Counseling**
 - Office Hours: Monday – Friday 303-324-4716
 - After Hours: 720-848-0000 : identify yourself as a current CU Anschutz student and ask for the on-call psychiatrist

Health Sciences Library <http://hslibrary.ucdenver.edu/>

Phone: 303-724-2152

Recreation, Health and Wellness

The Anschutz Health and Wellness Center is an innovative, state-of-the art research, education and patient care facility located on the University of Colorado's Anschutz Medical Campus in Aurora, Colorado. The Center's [mission](#) is to transform the lives of individuals and communities through science-based wellness strategies. Our research is translated into customized programs and offerings, delivered through our **Wellness Clinic** and **Fitness Center**. We provide programs, in partnership with schools, worksites and community organizations throughout Colorado. Our vision is a world where wellness is the norm. Visit the full site at AnschutzWellness.com

Parking and Transportation

The parking office is in Building 500 on the 1st Floor (west side of the Food Court seating area). Parking permits are available for; the student rate is \$36/month. They also have maps and information on where to park, bike rack/bike locker locations, maps to get there, and other commuting options <http://www.ucdenver.edu/life/getting-to-campus/Pages/ParkingandMaps.aspx>.

CU Anschutz Student Health Insurance Office <http://www.ucdenver.edu/life/services/student-health>

The University of Colorado provides varied student needs in the area of health. The Student Health Insurance (SHI) Plan is designed to provide students with health care coverage offering a PPO accident and sickness health plan.

All degree and specific approved, certificate-seeking students enrolled in five or more credit hours must take the School of Medicine's Student Health Insurance Plan unless they can prove enrollment in other comparable insurance. Students taking under five credit hours in a degree program are also eligible to purchase the SHI Plan by submitting a selection/waiver form by the September 1, 2011. Forms are located online at http://www.ucdenver.edu/life/services/student-health/Documents/AMC_StudentEnrollWaiver.pdf.

The Student Insurance Office is available to all students at the School of Medicine to assist with selecting or waiving the Student Insurance Plan. The Student Health Insurance Coordinator can help you evaluate your insurance needs so you choose the best plan available. If you are having problems understanding a bill, or you think an error has been made, don't hesitate to contact the Student Insurance Office. One of the functions of the Student Insurance Office is to help you resolve billing issues.

Location:

Student Health Insurance Office | University of Colorado Denver
Mail Stop A035, Education II, North Room #3208
Aurora, CO 80045
Phone: 303-724-7674
E-mail: Laverne.loechel@ucdenver.edu

Hours

Monday through Friday
7:30 a.m. - 3:30 p.m.

Title IX Compliance <http://www.ucdenver.edu/policy/TitleIX/Pages/Know%20Your%20IX.aspx>

Phone number: 1-844-288-4853 or 1-844-CU-TITLE

Contact email: Equity@ucdenver.edu

Emergency Numbers

www.ucdenver.edu/police

911 from a campus phone

911 on campus from cellphone - 303-724-4444

General Campus Contacts

Community Resource Officer	303-724-0739
Emergency Management	303-724-4999
Security Badging Office	303-724-0399
Ombuds Office	303-724-2950
Office of Equity	303-315-2567
CARE Team	303-724-8488
shareaconcern@ucdenver.edu	

APPENDIX 1

Expectations for Lab Members and Tips for Academic Success

These are some questions to review honestly with yourself and with your mentor a few times during your rotation and throughout your career. They are reasonable expectations for skills that you should be developing as you progress through your time in the labs. Some are more or less applicable depending on your position, but at least some are relevant to everyone, whether you are a temporary rotation student, working in your thesis lab, or as a postdoc, technician, or PI in academia or industry.

Scientific/ Career Development.

1. Are experiments well planned with proper controls?
2. Are the technical aspects of the experiments done well?
3. Are the experiments well documented (can someone else repeat what was done from your lab notebook or written protocol)?
4. Are experiments repeated an appropriate number of times?
5. Are results evaluated critically?
6. Are subsequent experiments logical extensions of previous experiments?
7. If problems are encountered, are experiments designed to identify the problem?
8. Take opportunities to present your work and get feedback.

Work habits

1. Are you organized, keep a detailed lab notebook and organize and archive your stuff?
2. Be a good lab citizen, clean up after yourself and help clean general use areas when needed. Follow rules regarding things to double check and sign off on if you are the last person to leave the lab.
3. Is work planned efficiently to optimize the amount that can be done?
4. Are experiments planned ahead, so that experiments aren't lost due to lack of reagents?
5. What use is made of waiting periods in experiments? Please read the literature...do not read novels or surf the internet for non-work related stuff/games.

Keeping up with the literature and other research.

1. Do you routinely search for and read papers in your research area?
2. Do you search for techniques which might allow you to do new types of experiments?
3. Do you read papers provided for journal club or other recommended papers?
4. Do you regularly attend seminars that are in your research area or in other areas?

Creativity and initiative

1. How much input do you have in the routine design, execution and analysis of your experiments?
2. How much input do you have in the medium range goals (months) of your experiments?
3. How often do you suggest new approaches or new lines of experiments on your current project?
4. Do you suggest new lines of research?
5. How much personal responsibility do you take for meeting deadlines, devising experiments, and writing papers or grants?
6. If you see a problem in the lab, what is your response (ignore it, complain, suggest a solution, take the initiative to solve the problem)?

Communication skills

1. How effectively can you put together a draft of a paper or a grant?
2. How much help (and in what areas) do you need to complete the project?

3. Can you plan and prepare good slides?
4. How effectively can you assemble a spoken or poster presentation?
5. How effectively can you give a talk?
6. How well can you critique papers or spoken presentations of others?

Interactions with others

1. Do you leave general lab areas, hoods and equipment clean when you've finished?
2. Do you return reagents, equipment etc. to designated places?
3. Do you cooperate with others to share equipment, space, reagents etc.?
4. Do you share information, techniques etc. when asked?
5. Do you volunteer information and/or help others on your own initiative?
6. How do you handle summer students or others who help with your experiments?
7. Give and take constructive criticism well....it is not personal. The successes of everyone in the lab reflect well on the whole lab and help us towards our ultimate goals of understanding cancer and helping patients. Our other major goal since we are at an academic institution is to develop scientific careers, and a large part of that is learning how to take and give constructive criticism.

APPENDIX 2

Guidelines for Thesis Advisory Committees Comprehensive Exam and Thesis Defense Exam

Revised Feb 27, 2017

- 1) **Composition:** The committee (five members) is composed of at least one faculty from outside of the Molecular Biology Program, with a majority of the committee coming from Program faculty; the Chair must be a Molecular Biology faculty member. All committee members must have appointments in the Graduate School; it is the responsibility of the student to ascertain that a proposed committee member has an active appointment in the Graduate School. Additional committee members can be added during the course of the thesis work to provide expertise if needed. After the comprehensive exam is completed and the student has advanced to the Ph.D. candidacy, the student's mentor may become a member of the committee, and one of the former committee members may be dropped. The mentor may be a voting member, but may not be the Chair.
- 2) **Responsibility:** The committee will administer the comprehensive examination, guide the student throughout their thesis project, and conduct the thesis defense examination. Students are expected to form a thesis advisory committee by March 1 of their second year. The committee will have its first meeting ("pre-comprehensive exam") with the student on the afternoon following the spring seminar presentation, or as soon as possible thereafter. The first charge of the committee is to guide and evaluate the student's research progress to this point, and set the guidelines and a tentative date for the comprehensive examination. The comprehensive examination should be completed by December 31 of the third year. Students must meet with their committee at least annually; more frequent meetings are advisable as they move further into their research. It is the responsibility of the student to arrange annual committee meetings, to inform the members and the Molecular Biology office in writing of the date and place of the meetings, at least 2 weeks in advance, and to submit a short written summary of progress to the committee before the meeting.
- 3) **Committee Chair:** It is the responsibility of the committee chair to complete the on-line evaluation (<https://predocprogress.ucdenver.edu/>) of each committee meeting which will automatically be submitted to the program administrator and sends a copy to the Student Advisor. This summary should include: 1) the student's progress since the last committee meeting; 2) planned studies for the immediate future; 3) indication of how student's progress relates to the specific aims of the thesis proposal presented in the comprehensive exam; 4) manuscripts published, in press, or in preparation; and 5) number of years in the program as well as anticipated date of completion. Summaries are signed off on by the student and the committee chair, and completed within one week following the committee meeting.
- 4) **Comprehensive Examination:** This exam requires the written submission of a "major" research proposal that describes the actual thesis project planned by the student. Students must obtain written approval of the topic of their proposal from the chair of their advisory committee and submit this to the Molecular Biology office by September 1 of the third year. The proposal should be written in an R21 NIH style grant format to contain the following sections: specific aims, background and significance, preliminary data, experimental design and approach, and a supporting bibliography. Students should consult with their thesis advisor and NIH guidelines to format the written portion of the exam. The proposal should be written to be as close as possible to the realistic goals of the thesis project and should not be an overly ambitious proposal for an entire laboratory group. **It is the student's responsibility to obtain the packet of forms and**

instructions online from the Graduate School website and return it with the appropriate signatures at least two (2) weeks prior to the exam date. Proposal must also be submitted to committee members at least 2 weeks prior to the exam.

The student defends this proposal orally at the examination. The oral portion of the exam will also test general knowledge through questioning related to the proposal. The student should demonstrate critical and original analyses of his/her own proposal as well as the research from other labs that form the background for the proposal. The student should be prepared to defend his/her ideas against challenges from faculty members of the committee. The format of the oral portion of the exam is set by the committee at the beginning of the examination.

There are three options for evaluation of the exam:

Pass: The student must receive affirmative votes from a majority of the members of the examination committee in order to pass.

Fail: If a majority of the committee votes “fail”, the student may not continue in the Program.

Pass with Conditions: The committee may feel that, although a student has essentially passed the examination, additional work is required. This may be in the form of additional coursework, the rewriting of exam materials, etc. The committee should sign the form as passing, with the conditions stipulated on the bottom. Once the student has completed the conditions to the satisfaction of the committee, the chair should sign approval. The form is returned to the Graduate School after the exam and given to the chair for final approval of conditions upon the chair’s request.

Upon successful completion of this exam, the student is advanced to the Ph.D. candidacy.

Comprehensive exam recommendations:

1. **Form your committee prior to your first Mol Bio seminar and encourage them to attend your seminar.** The committee is made up of 5 faculty, at least one of whom is a non-Mol Bio Faculty. Your thesis advisor is not a member of this committee. You should decide on your committee with the help of your advisor.
2. **Meet with your committee immediately after your seminar (or soon after) to discuss your comprehensive format, tentative dates, and expectations.** Remember – each committee will have slightly different ideas of how a comprehensive exam is conducted.
3. **Contact your committee by e-mail and start picking dates when everyone is in town – this will be the most challenging part of your exam, so start early!** The exam typically lasts for 2-3 hours. Make sure you schedule your exam and book a room for the appropriate amount of time.
4. **Ascertain if your committee members have current appointments in the graduate school, and be sure they are up-to-date.**
5. **Once you have scheduled the exam, make sure you complete the appropriate graduate school forms. The forms with signatures must be returned to the graduate school office at least 2 weeks prior to the exam.**

6. **Proposal**

NIH R21 format (see below)

Based on thesis work

1 page of Specific Aims plus 6 pages of Research Strategy (not including references)

Preliminary data not essential

Understanding of research essential

Must be distributed to your committee **2 weeks prior to your exam.**

7. **Exam (typical format)**

You will be asked to leave the room while they discuss your progress, grades etc.

Give a short presentation (length will be determined by committee)

Questions

You will be asked to leave the room while a decision is made

Advice

Work with your faculty mentor while you are writing your proposal

Get input from your committee members

Look at other students' proposals

Form a "mock comps committee" of more senior students, and practice

DON'T procrastinate!

Rough idea for proposal organization (see NIH guidelines)

Specific aims 1 page

Significance 0.5 page

Innovation 0.5 page

Approach 4.5-4.75 pages

Rigor and Reproducibility 0.25-0.5 page

Total should be no more than 6 pages excluding the Specific Aims page (i.e. 7 total pages including the Specific Aims page).

NIH GUIDELINES

The Research Strategy/Plan is now organized into three sections: Significance, Innovation, and Approach and should answer the following questions: *What do you intend to do? Why is the work important and is it innovative? What has already been done? How are you going to do the work?*

Specific Aims

The purpose of the specific aims is to describe concisely and realistically the goals of the proposed research and summarize the expected outcome(s), including the impact the proposed research will exert on the research fields involved. Content should include broad, long-term goals, the specific objectives and hypotheses to be tested, summarize expected outcomes, and describe impact on the research field. This is the most important page of the entire application since it may be the only section the unassigned reviewers read to understand approach, impact, and innovation. **Recommended Length: 1 page.**

RESEARCH PLAN PART 1: Significance

The Significance section should explain the importance of the problem or describe the critical barrier to progress in the field that is being addressed. Explain how the proposed research project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields. Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved. Content should include the state of existing knowledge, including literature citations and highlights of relevant data; rationale of the proposed

research; explain gaps that the project is intended to fill; and potential contribution of this research to the scientific field(s) and public health. **Recommended Length: 0.5 page**

RESEARCH PLAN PART 2: Innovation

Explain how the application challenges and seeks to shift current research or clinical practice paradigms. Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions. Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions. Focus on innovation in study design and outcomes; and summarize novel findings to be presented as preliminary data in the Approach section. **Recommended Length: 0.5 page.**

RESEARCH PLAN PART 3: Approach

The purpose of the approach section is to describe how the research will be carried out. This section is crucial to how favorably an application is reviewed. Include PI's preliminary studies, data, and experience relevant to the application and the experimental design; the overview of the experimental design; and a description of methods and analyses to be used to accomplish the specific aims of the project. Discuss potential difficulties and limitations, and how these will be overcome or mitigated; expected results, and alternative approaches that will be used if unexpected results are found. Provide a projected sequence or timetable (work plan), and if the project is in early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work. Discuss in detail the way in which the results will be collected, analyzed and interpreted, and include a description of any new methodology used and why it represents an improvement over the existing ones.

Recommended Length: 4.5 pages.

Research Plan Part 4: Rigor and Reproducibility

Starting in the Fall 2017, we will require all students to add a section on rigor and reproducibility, similar to what is now being required for new NIH grants.

(<http://grants.nih.gov/reproducibility/index.htm>)

Training in this area will have occurred in the prior Spring 2017 semester in new MOLB/PHCL7801 course

(see <http://grants.nih.gov/reproducibility/index.htm>)

Recommended Length: 0.25-0.5 pages. Alternatively, you can discuss rigor and reproducibility throughout the document without having a separate section on it.

(you can see sample R21 applications at the NIH site: <https://www.niaid.nih.gov/grants-contracts/sample-applications>).

APPENDIX 3

Molecular Biology Program track in Structural Biology and Biochemistry

Graduate students entering the Program in Molecular Biology will have the opportunity to train in a specialty track in “Structural Biology and Biochemistry”. This track provides additional course work in advanced protein chemistry and structural analysis of biomolecules and the opportunity to conduct thesis research in laboratories that have expertise in the application of NMR spectroscopy, X-ray crystallography, mass spectrometry, computational biochemistry and biophysical biochemistry to problems of structure/function of biomolecules. Students will receive their Ph.D. degrees from the Molecular Biology Program. The Molecular Biology Program will have the responsibility and complete control of monitoring and administering the progress of students. The minimum requirements established by the Molecular Biology Program will apply; that is, a B or better in the Core course and all required courses. A curriculum will be designed that strikes a balance between meeting requirements of both Programs without overburdening students with having to participate in every course and activity of both Programs.

The Molecular Biology and Structural Biology and Biochemistry programs may recruit first-year students jointly or independently who meet the requirements and standards established between the two programs.

Course requirements:

- Ethics Course PHCL 7605 (Fall 1 credit)
- Biomedical Sciences Core Course IDPT 7811-7815 (Fall 10 credits)
- MOLB 7800 Advanced Topics (Spring, 4 credits)
- At least 5 credit hours of the of the 5 courses offered by the Structural Biology & Biochemistry Program:
 - STBB 7608 Molecular Interactions (3 credit hours)
 - STBB 7609 Biophysics and Spectroscopy (3 credit hours)
 - STBB 7631 Molecular Structure A [NMR] (1.5 credit hours)
 - STBB 7632 Molecular Structure B [X-Ray Crystallography] (1.5 credit hours)
 - STBB 7633 Molecular Structure C [Mass Spectrometry] (1.5 credit hours)
- Elective courses to complete credit hours required for Ph.D. candidacy are the choice of the student. Electives may include remaining courses offered by Biomolecular Structure.

Program Activities:

- Students in the first year will do three laboratory rotations for 1 hr of credit each. Faculty in both Molecular Biology and Structural Biology and Biochemistry are eligible to mentor lab rotations.
- Lab rotation seminars will be required and given along with other Molecular Biology Students. Faculty from both Programs will be invited and encouraged to attend rotation seminars.
- Weekly seminars. Students will have the choice of attending the weekly seminar series of either Program, but will not be expected to attend both in any given week. Students will be required to attend at least one of the two seminar series each week.
- Mini-course and Retreat. Students will be required to participate in the annual mini-course and retreat sponsored by the Molecular Biology Program. The Molecular Biology Program will cover the student expense for these annual activities.
- Student seminars. After the first year, students will be required to give an annual research seminar on the progress of their work. This seminar will be given on alternate years in the Molecular Biology and Structural Biology and Biochemistry seminar series. Faculty from both Programs will be invited and encouraged to attend these student seminars.

Thesis laboratory and mentor:

- Students will select and enter a thesis laboratory on July 1st after successful completion of the first year requirements including courses, laboratory rotations and preliminary examination. The criteria established by the Molecular Biology Program will apply for students to pass on to the second year and to enter a thesis laboratory.
- Thesis mentor. A student must select a faculty member from the Program in Structural Biology and Biochemistry as his/her thesis advisor or co-advisor.

Exam/thesis committees:

- Comprehensive examination and thesis committees will have at least 5 faculty members with the majority from Molecular Biology, (at least 3) and the remainder from Structural Biology and Biochemistry. The chair of the committee will be the choice of the student (can be faculty from either Program). Thesis committees will meet at least annually and will file written reports of each meeting according to Molecular Biology guidelines.
- Thesis requirements regarding the written and oral portions of the examination will be according to Molecular Biology guidelines.

Financial responsibilities:

- Graduate School will absorb the cost of funding students in their first year, including recruitment, stipend, tuition, fees and health insurance.
After entering the thesis laboratory on July 1 of the second year, financial responsibility is solely that of the thesis mentor.

APPENDIX 4

Guidelines for graduate student 4th rotation: Guidelines for Students.

MOLB and other graduate students typically do three lab rotations, and consult with rotation advisors to decide on which laboratory to pursue their thesis work. Occasionally, none of the three labs will be suitable for the student for any of a variety of reasons. In this case, the student may do a 4th rotation over the summer, after the preliminary exam. However, the 4th rotation is unique in that it carries several special circumstances:

(1) The 4th rotation lab is usually the only choice a student will have for a thesis lab, with rare exceptions¹.

(2) Graduate school rules stipulate that students who cannot find an acceptable and accepting lab by the beginning of their second year will be dismissed from the program.

¹ Exceptions include: 1. Student has a preferred lab but that lab is waiting on June-August funding decision, and so 4th is alternative if needed. 2. Student has a potential lab but is not sure (or not satisfied) and has strong interest in a 4th lab. 3. Variation of #2, where 4th lab was not available for rotations during the fall-spring period. 4. Other exceptions may apply, but please note that 4th rotations should have strong rationale and require approval of program director and the student advisor (see “Requirements” below).

BEFORE the 4th rotation is established, the student must interview and be interviewed by the prospective fourth rotation advisor, just as they would if they were applying for a job (e.g. a postdoc). It is critical that both the student and the faculty come to a consensus that this is a good lab to pursue PhD thesis work BEFORE starting the rotation. Acceptance of the student for a 4th rotation should be a commitment by the advisor to accept them into the lab, provided that clearly stated expectations are met (see below). If the faculty advisor or student cannot meet these requirements, their lab is not suitable for a 4th rotation.

The student must make sure that the following requirements are met BEFORE undertaking a 4th rotation:

1. The student needs to identify possible 4th rotation labs, make initial inquiries to see if the faculty are interested, and must let the program director and the student advisor know which ones they would like to consider. The program director will then send the faculty their 4th rotation guidelines.

2. The 4th rotation faculty advisor must have the space and interest in training a graduate student for their PhD thesis.

3. The fourth rotation faculty advisor must have secured funds to support the student for their continued thesis work after the rotation period. Usually, the program secures funding from the Graduate School to support the student for the 4th rotation.

4. The student must not be competing for a position with any other personnel (e.g. other student, postdoc candidates, or other lab personnel). For example, if the PI wishes to take on two 4th rotation students (from any program), they must be able, interested, and willing to take both for thesis research.

5. The faculty advisor should agree to accept the student into the lab provided that clearly stated expectations are met during the rotation.

6. The student must receive from the faculty advisor a written document by email stating expectations of the student for the 4th rotation.

7. Once the student and faculty have discussed the rotation, the expectations, these requirements, and have come to an agreement, both need to meet with the program director to ensure that all parties are advised of the rotation's parameters and goals.

8 For special cases in which a 4th rotation is desired but not necessarily essential (see "Exceptions" above¹), prior approval of the program director is required. The student must present in writing the reasons for a 4th rotation, and may need to meet with the program director and the student advisor. Because of variable circumstances for different situations, specific modified requirements and guidelines tailored to those circumstances will be given to the student and 4th rotation faculty.

The following guidelines should be followed by the student:

1. Before beginning serious discussions with any potential 4th rotation advisor, the student should (1) first identify several possible labs of interest, (2) find out if they have money, space, and potential interest, and (3) carefully and fully investigate the science of all potential labs. The student **MUST** have sufficient interest and motivation to pursue their PhD thesis in these labs, before embarking on meeting the pre-rotation requirements listed above. It is strongly advised that the student consider several choices from which they will decide based on more in depth discussions with the faculty and lab personnel. This is very similar to what graduating PhD students do when applying and choosing postdoc labs.

2. Before deciding on the 4th rotation, the student should interview with the faculty advisor to determine if there is sufficient mutual interest in working together.

3. Before deciding on the 4th rotation, the student is strongly advised to meet with other lab personnel, just as they would if they were considering doing a postdoc in the lab. The student is encouraged to talk to former students of the lab as well.

APPENDIX 5

Guidelines for graduate student 4th rotation: Guide for Faculty.

MOLB and other graduate students typically do three lab rotations, and consult with rotation advisors to decide on which laboratory to pursue their thesis work. Occasionally, none of the three labs will be suitable for the student for any of a variety of reasons. In this case, the student may do a 4th rotation over the summer, after the preliminary exam. However, the 4th rotation is unique in that it carries several special circumstances:

- (1) The 4th rotation lab is usually the only choice a student will have for a thesis lab, with rare exceptions¹.
- (2) Graduate school rules stipulate that students who cannot find an acceptable and accepting lab by the beginning of their second year will be dismissed from the program.
- (3) The Graduate school will often fund students for the 4th rotation, but this may depend on circumstances and resources, and requires prior inquiry. It is possible that other funding sources must be found after July 1, typically research or departmental funds of the rotation advisor.

¹ Exceptions include: 1. Student has a preferred lab but that lab is waiting on June-August funding decision, and so 4th is alternative is needed. 2. Student has a potential lab but is not sure (or not satisfied) and has strong interest in a 4th lab. 3. Variation of #2, where 4th lab was not available for rotations during the fall-spring period. 4. Other exceptions may apply, but please note that 4th rotations should have strong rationale and require approval of program director and the student advisor (see “Requirements” below).

Therefore, these special circumstances merit special requirements that must be met and guidelines that should be followed before a 4th rotation is undertaken. These requirements and guidelines are described below. Essentially, the faculty advisor should vet and interview the student, just as they would for a postdoc applicant, BEFORE agreeing to take on the student for the 4th rotation. Acceptance of the student for a 4th rotation should be a commitment by the advisor to accept them into the lab, providing clearly stated expectations are met (see below). If the faculty advisor cannot meet these requirements or does not wish to follow them, he/she should not take on a 4th rotation student.

The following requirements must be met BEFORE a 4th rotation begins:

1. The fourth rotation faculty advisor must have the space and interest in training a graduate student for their PhD thesis.
2. The fourth rotation faculty advisor must have secured funds to support the student for their continued thesis work after the rotation period. Usually, the program secures funding from the Graduate School to support the student for the 4th rotation.
3. The student must not be competing for a position with any other personnel (e.g. other student, postdoc candidates, or other lab personnel). For example, if the PI wishes to take on two 4th rotation students (from any program), they must be able, interested, and willing to take both for thesis research.
4. The faculty advisor should agree to accept the student into the lab provided that clearly stated expectations (see #5) are met during the rotation.
5. The student must receive from the faculty advisor a written document by email stating expectations of the student for the 4th rotation. Faculty and student should discuss these expectations. Failure of the student to clearly meet these expectations can justify declining the student a position, but this will likely lead to dismissal from the program.
6. Once the student and faculty have discussed the rotation, the expectations, and come to agreement, the expectations should be emailed to the program director and the student advisor and the student and faculty should meet with them to ensure that all parties are advised of the rotation’s parameters and goals.

7. For special cases in which a 4th rotation is desired but not necessarily essential (see “Exceptions” above¹), prior approval of the program director is required. The student must present in writing the reasons for a 4th rotation, and may need to meet with the program director and the student advisor. Because of variable circumstances for different situations, specific modified requirements and guidelines tailored to those circumstances will be given to the student and 4th rotation faculty.

The following guidelines are strongly recommended for faculty BEFORE agreeing to the 4th rotation:

1. The faculty advisor is advised to review the student’s records (grad school application and grad school performance records; available from the program administrator). The advisor is also strongly encouraged to communicate with the program director and student advisor, previous rotation advisors, course instructors and other references provided by the student, both to evaluate the suitability of the student for the lab and to identify any potential issues that might need to be addressed during the rotation.
2. The faculty advisor should interview the student, just as they would interview a postdoc candidate, to determine if there is sufficient mutual interest in working together. In addition, it would be wise to have the student meet all other lab personnel, again just as a postdoc or other job candidate would.
3. The faculty and student should meet regularly to assess progress and any issues with the rotation as they occur.

APPENDIX 6

Molecular Biology Program Committee Membership

2017-2018 Academic Year

MOLB Program co-Directors

Robert Sclafani

MOLB Student Advisor

Sandy Martin

Rytis Prekeris

MOLB 7800 Course Directors

Aaron Johnson

Michael McMurray

<u>Steering Committee</u>	<u>Admissions & Recruitment Committee</u>	<u>Retreat Committee 2016</u>
Robert Sclafani Rytis Prekeris Sandy Martin Joan Hooper Chad Pearson Marty Voskuil Tania Reis	Tania Reis - chair Patricia Ernst Andres Vazquez-Torres Jing Wang Gabby Li Alexis Zukowski Manny Rosas Bob Sclafani (attends meetings)	Josh Black - chair Ethan Hughes - co-chair <u>2017 Student Committee</u> Tessa Arends Ashley Denney Eric Jaffe Erik Linklater
<u>*Symposium Committee/ **Curriculum Committee</u>	<u>Grant Selection Committee (T32 and Bolie Awards)</u>	<u>Bolie Travel Award Committee</u>
Joan Hooper**Chair Rui Zhao*Chair Dohun Pyeon <u>2018 Student Committee</u> Rachel Ancar, Sara Espinosa Cayla Jewett, Gabby Li Johannes Menzel, Mandy Richer Manny Rosas, Ruth Wang Laura White, Katie Yergert	Robert Sclafani Lee Niswander Bruce Appel Kristin Artinger Arthur Gutierrez-Hartmann Sandy Martin Rytis Prekeris	Robert Sclafani James DeGregori
<u>Seminar Committee</u>	<u>Faculty Membership Committee</u>	
Chad Pearson - chair Jay Hesselberth Lori Sussel Alexis Zukowski Cassi Estrem	Marty Voskuil - chair Tatiana Kutateladze Dick Davis Patrick Cherry Sara Espinosa	
<u>Prelim Committee 2018</u>	<u>Social Committee 1718</u>	
Jeff Moore - chair	Sara Espinosa MOLB student (TBD) MOLB student (TBD)	

APPENDIX 7

Guide for PhD students (and post-docs) aiming for a successful career in science

Roughly in order of importance, and with apologies to those who have worked these things out for themselves!

A full version of this document can be found at Queensland Institute of Medical Research website (<http://www.qimr.edu.au/>).

This is not an official QIMR document and does not represent the views of QIMR or its committees. It does, however, reflect the collective view of some senior QIMR researchers who manage to enjoy very productive and intellectually rewarding careers in medical research, and who wish to pass on some tips to those who are considering a similar career.

Doing a PhD should be fun, rewarding and be seen as a privilege. It's the only time in your life that you can spend 100% of your working time learning to do research, finding out new things, having freedom to pursue new areas and getting paid for it, without any administrative or other responsibilities. Those who stick it out do so because, despite the relatively poor pay, long hours and lack of security, it is all we want to do because of the intellectual satisfaction it brings, the excitement of discovery, the freedom to make your own work schedule, the opportunities for travel, the pleasure of being in an international community of like-minded people and (for some people) the possibility that we might actually help the human condition!

1. **Choose a supervisor whose work you admire** (find out first what work they have done and are doing, and search PubMed to see how productive they are!), located in a department or institute with good infrastructure (equipment, patient samples, seminar series etc), and who has enough grant funding not to limit your project too much.
2. **Get involved and take responsibility for your project.** This is probably the most important transition from the first year. To be successful in research you need to develop strong skills in independent and effective thinking, critical analysis, problem-solving, and time management. The *only* way to develop these skills is to take responsibility for your project. You need to immerse yourself in your research and exercise your mind with every experimental plan and every experimental outcome, including failures. **If you don't get excited by seeing the results of a successful experiment, you are in the wrong profession.** Embrace failures as challenges and training exercises for future successes, rather than looking around for people to blame. If you simply follow directions and close the door behind you at the end of the day you will never progress in research. Tenacity is essential!
3. **Work hard.** Don't think you can get away with a 38-hour week. You will need to work long days all week, and for part of most weekends. That gets you to closer to a 50-60 hour week, which is what you need if you want a successful career in academia (or indeed in any professional career). If research is your passion, this is actually easy to do, and if it isn't your passion, then you are probably in the wrong field. You should be going to work because you want to, not because you have to. Of course, ultimately, the number of hours doesn't matter - the only thing that matters is productivity, but unless you are a genius, *and* very organized, *and* very lucky, you will need to work this hard to get out enough good papers to make a good start in a scientific career. The people who go home with a full briefcase of work to do at home are the ones most likely to succeed. Note

who around you does this – aren't they the ones who have 'made' it? The extra hours are the *cause*, not *consequence* of success!

Play hard. Take some weekends off, and reasonable holidays, so you don't burn out. But if your work is very dependent on people around you, don't plan to work over Christmas and New Year and then take your holidays when your colleagues are all hard at work. On the other hand, if you are totally autonomous and not using equipment that is liable to break down, the holiday season is a great time to work in peace, and without competition for equipment. If you're stuck with a problem in late afternoon or early evening it might be more productive to go home and tackle it fresh the next day.

4. **Read the literature**, both in your immediate area, and around it; both the current and the past. You can't possibly make original contributions to the literature unless you know what is already in there. See it as a challenge to put an interesting paper on your supervisor's desk before they put it on yours! The best time to read papers is between experiments, or in the evenings or weekends. Reading papers at your desk *instead* of doing experiments is a poor use of time. Most people find it challenging to understand some papers when they start out. Don't let this put you off. Instead, go back to the earlier literature or text books, ask questions and discuss the papers with your supervisor or other colleagues. Use this as an opportunity to spark thought-provoking scientific discussions. Your supervisor will be busy, but should always make time for these discussions (if not, find another one!).
5. **Plan your days and weeks very carefully.** If you are in the lab, begin the week, and each day, by carefully dovetailing experiments so that you have the minimum of down time. Make lists of what you have to do tomorrow at the end of each day while today's work is in your mind. This also allows your mind to think about the next day's work while you sleep. Unless you have domestic constraints, be flexible about what time you go home to cope with unexpected changes to this schedule (and remember, this is probably the most flexible part of your life – once you have children, this goes out the window, so make the most of it).
6. **Keep a good lab book, and write it up every day.** It will make thesis writing much easier, and will also help to protect any intellectual property that might one day make you rich. In particular, write up the details of your methods as you go along. They will easily convert to chapters in your thesis, and also to laboratory protocols which is useful for everyone.
7. **Be creative.** Think, think, and think some more about what you are doing, and why, and whether there are better ways to go. Don't just see your PhD as a road map laid out by your supervisor. Talk to your supervisor, and others around you, about alternatives and watch the literature for new discoveries and ideas that are pertinent to your project. Probably the toughest challenge for a successful scientist is to be creative, while keeping a sharp eye on feasibility. It is never too soon to start working on this aspect of your PhD, and at the end of the day probably the single thing that most distinguishes a great scientist from work horse. Ask Big Questions, and be skeptical about 'conventional wisdom', even if it comes from your supervisor. Don't be afraid to argue with your supervisor on scientific grounds – they are not always right and should appreciate the debate.
8. **Be active, not passive, in your approach to research.** Seek information and advice, and don't assume that it will just diffuse into your head. Your supervisor won't know everything (and may be technically less than competent anyway!), so find the right people for advice and don't be afraid to ask for it. Don't go for weeks without talking about your research with your supervisor and other members of the lab. If your supervisor doesn't seek you out regularly, go and talk to him/her. When you are inexperienced it is *very* easy to get off track and waste valuable time and resources.

Those students and post-docs who sit back and wait for the magic to happen, or work in a vacuum, never get anywhere.

9. **Try to keep a three-part portfolio of sub-projects that are ‘safe’, moderately safe, and challenging** (could this be a *Nature* paper if it works out?). That way you are pretty certain to get a PhD, but might hit the jackpot, and have the thrill of a really exciting discovery.
10. **Go to as many seminars as you can and all of them in your general area.** But don’t just sit at the back like a sponge, or fall asleep; sit in the front and ask questions of the speaker in question time, or afterwards, and of your supervisor and others in the lab. Students who speak up in this way gain a much better understanding of their field and are the ones who are really noticed. Remember that at this point in your life it is difficult to make a fool of yourself. Just having the courage to speak up is really applauded!
11. **Make the most of any opportunities to attend a conference or workshop.** If you are lucky enough to do so, don’t treat them like a holiday; they are *work*. Make sure you go to every talk, no matter how relevant you think it is, or isn’t. You will always learn something. Between talks, use every minute to meet new people, find out what they are doing, tell them what you are doing, and remember that this is where you are most likely to find a good post-doc lab. Don’t spend all the time speaking only to people you already know or socializing with your lab; you can do that when you get back. Receptions and dinners are not optional; these are where most networking takes place and you need to be there mixing with new people, not hanging around the ones you already know. Likewise, don’t take your partner with you and spend all the free time with them; they can join you before the meeting starts, or after it finishes, but during the meeting, including the social events, you are at work. If you are hung over from all of the socializing, don’t miss the next morning’s session, just take a bucket in with you. And when you come back, tell your supervisor (who has probably paid for all or some of it out of their hard-won grants), and others in the lab, what you got out of the meeting.
12. **Take a notepad and write down the action items when you meet with your supervisor,** unless you have a perfect memory, and make sure they get done – or go back to explain why they can’t be done.
13. **Practice your writing in any way you can.** Many students enter graduate school with poor writing skills, and this will severely impact your ability to write a satisfactory thesis, get a grant, and get a paper accepted. Do a course in writing (if you can find a good one), *use* the grammar and spell checks on Word, try to learn from people around you who write clearly and concisely, and get feedback on everything you write from colleagues or even friends and family. Plan your project so you can get at least 3-4 good (or 1-2 extremely good) papers out of your PhD. Don’t leave thesis writing until after your scholarship or candidature has expired. Start writing from Day 1, even if nothing you write in the first or second year ends up in your thesis, the experience will be invaluable. It will help to broaden and deepen your knowledge, prioritize experiments, and significantly increase your chances of publishing during, rather than after, your PhD. It will also make writing your thesis much, much easier. In addition, a good literature review is often publishable, so that can be another option that will help to make your name, particularly since reviews get good citation rates.
14. **Buy yourself a lap top if you can possibly afford it,** even if the lab is well supplied with computers. That way you can work easily between work and home, and if the lab gets busier you are still independent.

15. **Make the most of any opportunities to talk about your work.** Use it as an excuse to read additional papers and to think long and hard about what you have (or haven't!) achieved and where your project is going. A shoddy presentation, even at a lab meeting, makes you look bad and is a wasted opportunity. Try your hardest to pre-empt questions that you might get and try to have prepared answers. If you don't know the answer to a question, say so; people will invariably see through a 'bullshit' answer! Talk about your work with family and friends – they sometimes have useful insights (and as tax payers are ultimately your employers).
16. **Appreciate that most biomedical research is *very* expensive and is mostly funded by taxpayers' money or private donations.** You therefore have a responsibility to use these funds carefully and not to waste them on ill-conceived or poorly-performed experiments. Think carefully about *everything* you do and always seek advice if you are uncertain. Be aware that your productivity also has implications for others in the lab. If you take it easy and are unproductive this will affect the productivity of the lab, which in turn will affect the chance of the lab getting grants that support your research and pay the salaries of your colleagues.
17. **Look ahead.** What are you likely to be doing 3, 6 or 12 months from now, and are there any steps you can take now to pave the way (e.g. HREC applications, collection of biospecimens or reagents, learning new techniques)?
18. **Set yourself deadlines and try to keep them** – it is good training for the days when you *have* to adhere to grant application deadlines etc.
19. **Plan to work abroad at some point**, because of all the benefits of working with some real stars (it is a fact that the USA has more Nobel Laureates than any other country), and to get a better perspective of where you fit into world science. If you end up in the lab where the head gets more invitations to speak than he/she can cope with, some might be passed on to you, which is a major advantage for career advancement.
20. **Think very early and very carefully about what you plan to do after your PhD.** If you hope to stay in research you should be aware that you will be judged almost exclusively on your publication record. This judgment includes the *number* of papers, your *position* in the author list and the *quality* of journal in which the work is published. Without a good publication record your chances of getting a fellowship, or even a grant funded position, in research are remote. It is advisable to submit all your work for publication before finishing and not trying to write the papers afterwards during your postdoc or other position. If you wait, the papers may never be submitted or published. Salaries are hard to come by and are therefore *very* competitive. If there is one job and six (or more!) good applicants, the job will always go to the person who has achieved the most.
21. **Start collaborations.** Don't wait for your supervisor to start them for you. It only takes a conversation or an email to someone else who is working on a very similar topic to you, to start the ball rolling. Whether it is the Nobel prize-winning lab head, or a PhD student or anyone in between, you can talk or write to them and see if they are interested in collaborating by sharing samples or ideas. It is probably best to discuss this with your supervisor first, not least because a joint email is more likely to bear fruit, but there may be occasions when you want to at least initiate the discussions alone. In addition to external collaborations, collaborate with your lab colleagues. PhD students who seek collaborations with their lab colleagues often get more publications, and finish their project much earlier than those who work by themselves. We are all very protective about our projects but sometimes we can't do everything. It may be helpful to get someone in the lab (who may be expert in a specific technique) to do an experiment for you which saves lots of time.

22. **Talk to Sales reps.** They can sometimes bother you when you are busy doing something, but if you make appointments to talk to them, you might learn something new, like a new method or a new reagent that will make your life much easier and maybe even make the lab head's budget look much healthier. Conferences are a good place to talk to them, and don't forget to pick up the free pens.
23. **Look for opportunities to write small grants,** such as travel grants, and small society grants as you gain more experience. You will learn a huge amount, and you might even get lucky. Nothing impresses more than your ability to get your own funding (well, except *Science* or *Nature* papers I guess).
24. **Join professional societies.** They all have very cheap student subscriptions, and you will gain something by being involved at any level (cv-building, cheaper registrations at conferences, getting to know who else is working in your field, a society journal, newsletters etc).
25. **Take courses,** in statistics, bioinformatics, English or whatever you think you need extra help in. They take extra time and extra effort, but it is time and effort well spent.
26. **Get involved in institute or department events,** such as organizing student seminar series or conferences, though not at the expense of your project. It is all good experience, and looks good on your cv.
27. **Work out if you are a good collaborator, or more suited to working alone.** Both are perfectly acceptable, but plan your career accordingly. Good collaborators (particularly in large consortia which are all the rage now) need very good communication skills, as well as diplomacy and patience, but if you are naturally rather non-communicative or anti-social (or paranoid or selfish!) it might not be for you.
28. **Ultimately, to be a successful research scientist (e.g. join the NHMRC Fellowship scheme) you need to be at least four of the following:**
- Extremely motivated
 - Creative
 - Very smart
 - Very hard working
 - Very skillful in the lab (or at the computer)
 - Very lucky

Since you can't depend on luck, you'd better focus on the others. If you don't think you can meet most of the expectations above, this is the wrong career path for you, so think again!

This guide was originally compiled by:

- Georgia Chenevix-Trench, Melissa Brown, Nick Martin, Peter Visscher, Emma Whitelaw, James Flanagan and Rajiv Khanna
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