

INTRODUCTION

Welcome to the graduate program of the Department of Pharmacology and Toxicology. The Department has prepared the following statement regarding our overall philosophy of graduate training in order to help you understand what our goals are for you. This is followed by some detailed information about all kinds of things that we hope will make our adjustment to Graduate School every easy and pleasant.

This is an exciting time to be starting your graduate training in Pharmacology and Toxicology. Training in these two disciplines will allow you to acquire knowledge that is broadly based on some of the major chemical and biological fields such as biochemistry, medicinal chemistry, molecular biology, cell biology, and behavioral biology. The revolutionary advances in the last few years in the biomedical sciences have had a tremendous impact on the disciplines of Pharmacology and Toxicology. These two disciplines are hybrid disciplines; i.e., knowledge and experimental approaches from all fields of the biological and chemical sciences are used to probe mechanisms of action of therapeutic or toxic agents. The advances in the molecular sciences, including genomes, over the past two decades have opened up great opportunities for understanding the mechanisms of action of chemical agents on biological systems and for designing new drugs that can affect specific cellular processes and the function of specific macromolecules.

Our faculty is committed to providing you with the best training and research opportunities possible. We are also committed to the concept that we are involved in the training of junior colleagues. This concept is very important for you and the faculty. For you it means the following:

1. During your first semester you will participate in three laboratory rotations. The directors of these laboratories are the potential mentors for your dissertation research. Upon entry into the laboratory rotation, you are asked to become involved in the research activities of the laboratory, contribute to the research productivity of the laboratory and to contribute to the training of less experienced students. From the beginning of your career in science you will be interacting closely with a mentor.
2. You are participating in a program that was designed to maximize your training in functionally important aspects of the profession, such as writing of scientific papers and research proposals, and to avoid requirements that represent non-functional experiences.
3. You are included in the "life" of the department as a full participant, e.g. in scientific discussions, in faculty meetings (through a representative), and in the decision-making processes.

Your designation as a junior colleague bears, of course, certain important responsibilities which you have to incorporate in your everyday life while you are a member of our department. The most important among these are the following:

1. Dedication to the science of the discipline. You are here to maximize your learning and acquire the skills to conduct independent research in some of the most modern and important fields of scientific research. You now need to function as an independent thinker and a dedicated scholar. This is a life-time commitment to scholarship which goes far beyond attending class lectures and doing well in examinations.
2. You have to be good “citizen” of the department. You have to assist other students in their training, assist faculty (senior colleagues) in the conduct of their research and teaching mission, and assist the department in the maintenance of all research and instructional facilities.
3. You have to exhibit the highest standards of ethical behavior. Each one of your actions in the classroom or the laboratory has to be governed by absolute adherence to honesty and to consideration of the rights of other faculty, students, staff, or other scientists in general. To be a scientific colleague to all these people, you have to be unquestionably trustworthy. Ethical behavior, not simply intelligence, is at the core of a long-lasting career in science.

In the pages that follow you will find much useful information about how to structure your life in graduate school and how to plan your training and research activities. We encourage you to take the responsibility for structuring your program in consultation with your mentor and the Graduate Program Director of the Department.

ON BEING A GRADUATE STUDENT

Graduate training is designed to help you become a professional, practicing scientist. Thus there are many expectations placed on you which differ from expectations we have of undergraduate students. The following paragraphs highlight those expectations. We hope you will use these guidelines to help you plan your time and set your priorities while you are a graduate student.

Time in the laboratory

You should realize that your laboratory work contributes to the development of two careers, your own and that of your mentor. Furthermore, the more work that gets done, the more quickly you can finish your degree and move to the next level. Minimally then, a student would work a minimum of 7 to 8 hours per weekday in the laboratory and work on least one weekend day for a few hours. Optimally, the student may wish to work significantly harder. During your first year, class time may reduce your lab hours somewhat, but full time in the lab is expected once course work is completed.

Time to study for courses

The Graduate School requires a grade of “B” or better for all required graduate course work and an average GPA of at least 3.0. This usually means that you must devote a significant amount of time and effort to studying for your classes, especially during your first two years. However, we expect that you will accomplish this by **studying at night and on weekends rather than during the weekday hours** when you should be in the laboratory.

Reading the literature

It is impossible to perform good science without a through knowledge of the current literature. Over the course of your graduate career, you are expected to become familiar with the literature regarding your area, and gradually to extend the scope of your reading to other areas. The other areas include those topics that happen to be current in the general literature such as Science or Nature.

In pursuit of this literature familiarity, you should become familiar with the **names** and **accomplishments** of individuals working in your field on interest. You should also become familiar with the names and accomplishments of other prominent scientists. Reading literature somewhat outside your own area as time permits may help you in choosing a postdoctoral position and will certainly contribute to your education.

A reasonable strategy for achieving these goals is to read or skim heavily one article per day from current literature. This is probably only practical if you have passed your exams or if it is the summer. Therefore, students taking a full course load should try for three papers per week during the fall and spring semesters.

Preparation of your written preliminary exams

Qualifying, or cumulative, exams should be researched and written on your own time and not during the 7 – 8 hours you are working in the lab. The timelines for completion of these exams are detailed in the section entitled “Qualifying Exam Guidelines”.

Time off to prepare the NIH proposal for the oral exam

At the beginning of your fourth semester in graduate school you should complete your Oral Comprehensive Exam. It is reasonable to take 4 weeks away from the lab to prepare your NIH proposal which forms the basis of your oral exam. There is a very tight time line that must be followed once your Committee has approved the prospectus for your proposal. Details are described under “Oral Comprehensive Guidelines”.

ROTATIONS, FINANCIAL ASSISTANCE AND ENROLLMENT

Rotations

During your first semester in graduate school, you will participate in laboratory rotations. You will rotate through the laboratories of three different faculty members as potential mentors for your dissertation research. At the end of the rotations, you will inform the Graduate Program Director of your first and second choices for a mentor. The Graduate Program Director together with the departmental faculty, will assist in matching students with a mentor.

Financial Assistance

During the first semester, stipends to all incoming students will be provided by the Department or a Fellowship Award. After the first semester, when a mentor has been chosen, the mentor will then support the students on their grant funds. Because of changes in budgetary appropriations at the federal level, a research grant held by a faculty member may expire. Consequently, a student being supported by the research grant may lose his/her source of financial support. If this occurs, the Department will make every effort to obtain other financial support for the student. Students also will be strongly encouraged to apply for various pre-doctoral fellowships and the faculty will help with this process.

Enrollment

The Graduate School requires that your enrollment in courses and research reflect the amount of faculty time you require and the facilities used for your training. In order to meet this requirement, the following procedure is to be followed:

1. During the regular semester (fall and spring), the standard enrollment is 9 hours. In your terminal semester, you may enroll for only 6 hours of credit per semester (2 seminar + 4 dissertation research).
2. During the summer session, the minimum or standard enrollment will be for 6 hours of credit.
3. After passing the Comprehensive Oral Exam for the doctoral degree, you must be continuously enrolled, including summer sessions, until all requirements for the degree are completed. You must be enrolled at the time of your dissertation defense.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

The course of study leading to the Ph.D. degree usually requires four to five years to complete. Each student is expected to devote the full 12-month year to the pursuit of graduate studies, with some time for holidays and vacation. Students begin lab research training as soon as they enter the program, though a significant amount of time in the first two years is devoted to learning basic concepts through formal course work.

All students take a core of basic courses in pharmacology / toxicology, biochemistry and molecular biology. If a student has successfully completed an equivalent course at another university, it need not be repeated. In addition to the core requirements, in consultation with their mentor, students may choose courses based on their own research interests or courses designed to provide specific research skills as discussed below.

One component of our training program that students appreciate most is the opportunity to learn the art of presenting lectures in undergraduate classes and formal seminars describing their research projects. Careful mentoring and chances to practice using very practical presentation strategies lead to the development of excellent communication skills and self-confidence in our graduates.

The most important part of graduate training is learning how to ask good research questions, design and carry out experiments to answer those questions, and write up the results of the experimental work in a clear and concise manner. For this reason, students begin their lab rotations as soon as they arrive. After a mentor is chosen, each student begins a research project. As their research continues, students develop a dissertation project with the adviser's assistance. Once the course work and exams are completed, students devote full time to their research projects and the preparation of papers describing their work.

A. Ph.D. Course Requirements

Incoming students should have completed 4 semesters of Chemistry and 4 semesters of Biology, including a course in Cell Biology and one in Biochemistry. Prerequisites can be completed during the first year. The core courses in Pharmacology and Toxicology that all students are required to take are listed below. Prerequisite for all courses is graduate standing in the Pharmacology and Toxicology Program.

PTX 700: Professional Issues in the Biomedical Sciences (ML Michaelis)-2 credits

A course designed to assist doctoral students in the biomedical sciences in their professional development by providing presentations, discussions, and practical experiences related to career development. Topics include preparation of vitae/resumes and other elements of a successful job search, writing scientific papers and dealing with editors, preparing an NIH grant application for your Oral Comprehensive Exams, balancing professional and personal obligations, advancing through promotions, and non-academic career opportunities for Ph.D.s in biomedical sciences.

Prerequisite: At least Second-year Graduate standing in the Pharmacology and Toxicology Program.

A student is required to complete **Advanced Pharmacology PTX 730, 731 and 733 plus one additional module of Advanced Pharmacology.**

PTX 730 (I): Advanced Pharmacology I- CNS and ANS (Kim, Fowler)-2 credits

A detailed study of the fundamentals of autonomic nervous system, central nervous system, and their pharmacology. The student will attend PTX 632 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 731(II): Advanced Pharmacology II- Cardiovascular and Renal System (ML Michaelis)-2 credits

A detailed study of the fundamentals of cardiovascular system, renal system and their pharmacology. The student will attend PTX 632 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 732 (III): Advanced Pharmacology III- Hematology and Cancer Biology (ML Michaelis)-2 credits

A detailed study of the fundamentals of hematology, cancer biology and their pharmacology. The student will attend PTX 631 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 733 (IV): Advanced Pharmacology IV- Infectious and Respiratory Diseases (Kim, ML Michaelis)-2 credits

A detailed study of the fundamentals of infectious diseases, respiratory diseases, and their pharmacology. The student will attend PTX 631 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 734 (V): Advanced Pharmacology V- Endocrinology (Dobrowsky and Staudinger)-2 credits

A detailed study of the fundamentals of endocrinology and associated pharmacology. The student will attend PTX 631 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material. **Prerequisite:** Graduate standing in Pharmacology and Toxicology Program.

PTX 735 (VI): Advanced Pharmacology VI- Metabolism and GI (Moskovitz)-2 credits

A detailed study of the fundamentals of energy metabolism and obesity, gastrointestinal pharmacology and vitamins. The student will attend PTX 633 lectures and meet separately

with the faculty for additional discussion of advanced material on the topics. The student will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 740: Advanced Biotechnology (Dobrowsky, Moskovitz, Staudinger)-3 credits

An examination of basic principles of molecular biology, immunology, and protein chemistry as they apply to the identification, production, stability, delivery, and monitoring of new therapeutic agents provided by the expanding biotechnology industry. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 742: Experimental Pharmacology (ML Michaelis) (Bi yearly)-4 credits

Experimental approaches to understanding mechanism of drug action. Use of drugs as tools to understand functioning of biological systems will also be stressed. Historically important experiments will be discussed along with experiments which are currently used to define drug mechanisms. Topics will include: dose-response, drug receptors, drug metabolism, chemotherapy as well as autonomic CNS, cardiovascular and renal pharmacology.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 747: Molecular Toxicology (Staudinger) (Biyearly)-4 credits

A detailed study of the fundamentals of the experimental methods used in a modern toxicology laboratory. The student will attend PTX 640 lectures and meet separately with the faculty for additional discussions of advanced material on the topics. The students will be examined on the advanced material.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 799: Pharmacology and Toxicology Seminar (Muma, Carrasco)(every semester)-1 or 2 credits

A review of current literature and research in pharmacology and toxicology. Required of all graduate students in the department every fall and spring semester.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

P&TX 800: Pharmacology and Toxicology Teaching Principles-2 Credits

This course is to be used by graduate students fulfilling the teaching requirements for the Ph.D. in pharmacology and toxicology. The student will function as a discussion leader and lecturer in a limited number of class sessions. Each student will meet with the faculty whom he or she is assisting.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 801: Issues in Scientific Integrity (E. Michaelis) (Biyearly)-1 credit

Lectures and discussion on ethical issues in the conduct of a scientific career, with an emphasis on practical topics of special importance in molecular-level research in the chemical, biological, and pharmaceutical sciences. Topics will include the nature of ethics, the scientist in the laboratory, the scientist as an author, grantee, reviewer, employer/employee, teacher, student, and citizen. Discussions will focus on case histories.

PTX 803: Pharmacology Literature Review I (J. Staudinger) (Yearly)-1 credit

This course is to be used by graduate students fulfilling the first written exam requirement for the Ph.D. in pharmacology and Toxicology. The student will research and write a 6 page literature review by choosing a topic provided by the faculty.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

PTX 804: Pharmacology Literature Review II (J. Staudinger) (Yearly)-1 credit

This course is to be used by graduate students fulfilling the second written exam requirement for the Ph.D. in pharmacology and Toxicology. The student will research and write a 12 page literature review by choosing a topic provided by the faculty.

Prerequisite: Graduate standing in Pharmacology and Toxicology Program.

The courses listed below can be repeated during the graduate program based on the advice of each student's mentor.

P&TX 825: Research in Pharmacology and Toxicology (Primary Mentor)-3 credits minimum

Original investigations at an advanced level in the areas of pharmacology or toxicology or related fields. This research will be performed by graduate students in collaboration with a faculty member.

Prerequisite: Graduate standing in Pharmacology and Toxicology program and consent of mentor.

P&TX 899: Master's Thesis (1-11) Hours and credit to be arranged. Independent investigation of a research problem of limited scope, leading to the preparation of a thesis.

P&TX 999: Doctoral Dissertation (1-11). Original laboratory investigations in Pharmacology and Toxicology. Results will be written as components of the dissertation

The courses listed below are electives that a student may decide to take depending on his or her interests and the advice of their mentor.

P&TX 775 (3) Chemistry of the Nervous System. A detailed study of the molecular aspects of neurotransmission will be covered with special emphasis on mechanisms of transmitter release, molecular basis of neuronal signal transduction, gene regulation in the nervous system, and mechanism of neurodegeneration.

P&TX 901 (3) Molecular Pharmacology (2) A study of drug effects at the cellular, subcellular, and molecular levels, and the correlation of such effects with tissue and organ reactions.

B. Advisory and Dissertation Committees

Research Advisory Committee members for Ph. D degree aspirants should be identified by the end of the second year in the program. The committee is composed

of at least three members, and the research director serves as chairman. You should meet with your advisory committee to present your research progress at least once a year, but preferably more often. This Committee can be of great help to you in keeping your research project moving forward in a logical and timely fashion.

Once you have passed the Comprehensive Oral Examination, you become a “candidate” for the Ph.D. Your Research Advisory Committee formally becomes your Dissertation Committee. The final Dissertation Defense Committee should consist of the original Advisory Committee (3 members) plus two (2) other members of the Graduate Faculty. At least one member of the final Dissertation Committee must be from outside the Department.

C. Comprehensive Exam Requirements for Ph. D. Students

Before a student can take the oral comprehensive examination, the Department of Pharmacology and Toxicology requires students to pass BIOL 841 (Biometry I) which is the FLORS requirement. If a student has already taken a minimum of 5 hours of statistics, the student may petition to have this accepted for completion of this requirement. The Graduate Curriculum Committee evaluates petitions to have other statistics courses accepted **prior to the scheduling of the Oral Comprehensive Exam**. The Curriculum committee consists of the Graduate Program Director of the Department and two additional faculty members.

D. Written Comprehensive Examinations.

The Ph.D. aspirant takes the comprehensive examination during the second, third and fourth semesters. The comprehensive examination has three parts:

1. Written Qualifying Examinations- The cumulative exam director serves as the faculty liaison for the cumulative exams and grant proposal. The cumulative exam director will receive all the written exams, solicit reviewers, and prepare correspondence to the student. All questions regarding preparation/completion of the cumulative exams should be directed to her/him. In brief, you have four semesters to complete two written oral examinations and to prepare and defend a grant proposal on an original research topic.

- a) The first two cumulative exams will be completed in the second and third semester.
 - 1) Your first comprehensive exam must be completed by the end of your second semester i.e., the Spring semester.
 - 2) Your second comprehensive exam must be completed by the end of your third semester, i.e., your second Fall semester.

Cumulative Exam 1- First year students will choose one question from a collection of questions that have been posed by individual faculty members and are designated for first year students only. The student should prepare a **6 page mini-review** chosen from

this collection of questions. The cumulative exam should be completed and turned in to the cumulative exam director before the spring break of your second semester. If the review is not of sufficiently high quality, the student has one opportunity to remediate. Remediation should be based on feedback provided by the faculty and must be submitted before the end of the spring semester. If the student does not successfully pass this exam, the faculty will meet to determine if the student will continue in the graduate program.

Cumulative Exam 2- Second year students will choose one question from a collection of questions that have been posed by individual faculty members and are designated for second year students only. The student should prepare a short **12 page review** chosen from this collection of questions. The cumulative exam should be completed and turned in to the cumulative exam director before fall break. As with the first cumulative exam, if the review is not of sufficiently high quality, the student has one opportunity to remediate. Remediation should be based on feedback provided by the faculty and must be submitted before the end of the spring semester. If the student does not successfully pass this exam, the faculty will meet to determine if the student will continue in the graduate program. The student must successfully pass this exam before handing in the grant proposal.

In preparing your written cumulative exam you should include a section entitled **My Analysis** and give a critical analysis of the topic. This analysis should highlight your original and creative ideas and views, not those from a review article. For example, give your perspective on discrepancies in the field and why they may exist, original and creative interpretations of the data, your perspective on the next most critical direction the field should take to significantly advance knowledge and how these issues could be addressed experimentally. Highlight your original ideas and views, not just those from review articles. Adequate discussion in this section is critical to passing the second comprehensive examination. Again, students have one opportunity to remediate as described above.

The cumulative exams are due on the last day of classes. Cumulative exams greater than five days past due will require a personal consultation with the student, his/her advisor, the cumulative exam director and the department chair. A decision about the student's performance and further requirements will be ascertained at this meeting.

b) Preparation of a Research Manuscript- **In lieu of completing the second cumulative written exam a student may substitute a manuscript based upon the student's original research.** The student, should consult the cumulative exam director if he/she thinks they will be able ***to submit*** a manuscript to a peer-reviewed journal by the beginning of the 4th semester of graduate residency. This approach will be reviewed on a case by case basis. The student should inform the cumulative exam director at the beginning of their 3rd semester of graduate residency that they want to substitute a manuscript for their second cumulative exam. The student may be required to present an abstract of his/her work to the faculty followed by an oral presentation of the manuscript data

to the student's advisory committee for evaluation. If accepted, the student will prepare a full manuscript and submit it for review by the faculty; this exercise essentially serves as a pre-review of the manuscript before submission to the actual journal. The faculty will review the manuscript as any ordinary manuscript review would be performed. A review form will be filled out and point by point criticisms provided to the student. If the manuscript is found to be acceptable without major editorial or experimental revisions, this will be considered passing. If the manuscript is identified as acceptable but needing major editorial and/or experimental revisions then the student will be required to revise the manuscript and resubmit for re-evaluation before a pass can be issued. The decision to revise the manuscript is up to the student, keeping in mind that a 12 page review will need to be completed if a revision is not performed. If the manuscript is found to have substantial shortcomings and is declined, the student should prepare a 12 page review and submit it by the end of the semester.

2. Preparation of an NIH-style research proposal. After successful completion of the second written comprehensive exam, the student should begin working on their NIH grant proposal. These serve as the basis for the Oral Comprehensive Exam. ***The written and oral defense of your grant should be completed by the end of your 4th semester of graduate residency.***

Consult with your graduate advisor before you begin to write your proposal. Once you and your advisor have agreed upon your topic, a Research Advisory committee of your graduate advisor and 2 additional faculty members should be chosen and they will initially evaluate your proposal. The student solicits this 3 member committee in consultation with their advisor. The student should then select two additional members may be from outside the department to serve on their full Research Advisory/dissertation committee. (Please note that the 3 members of the Research Advisory committee do not necessarily have to all come from P & TX but that at least 3 members of the full dissertation committee must be P & TX faculty members.)

The proposal is based upon the NIH NRSA format and the research topic chosen may be identical to the student's dissertation research. The steps to follow in preparing this proposal are outlined in the Graduate Student Handbook guidelines for the Oral Comprehensive Examination Section. First, prepare a 2-3 page synopsis of the rationale and specific aims of your proposal for consideration by 3 committee members. After these faculty committee members agree that the proposal and specific aims are acceptable, begin writing your grant. You have **1 month** after receiving the approval of your 3 departmental committee members to finish your grant.

E. Oral Comprehensive Exam

After completing your grant, provide the cumulative exam director 3 copies of the grant for submission to the members of the Research Advisory committee. The committee has 2 weeks to read your proposal and to provide you with feedback on the proposal. You then have 2 weeks to rewrite the proposal and submit 3 copies of the revised document to the cumulative exam director for distribution to the full dissertation

committee. You should then arrange a time and room for an oral defense of the proposal giving at least two weeks of time for the committee members to read and evaluate the proposal.

Once the date for your Oral Comprehensive Exam has been scheduled, you should fill out a "Do-All" form. This form can be obtained in the Department office, and it is the mechanism by which the department notifies the Graduate School of the outcome of the Oral exam. You present a 45-50 minute seminar overviewing the proposal. The committee questions you on the grant proposal as well as other topics in pharmacology and toxicology especially those related to your grant proposal.

Following the oral comprehensive examination, the student will be asked to leave the room and the committee will deliberate on the student's performance. The committee will assign an outcome of honors, satisfactory or unsatisfactory based upon a simple majority vote.

The criteria for an honors designation rests solely with the committee but is generally viewed as the student showing an outstanding depth of fundamental knowledge, the ability to rapidly and logically reason through uncertainties with minimal cues from the committee, having written an exceptionally clear research proposal with well rationalized aims and clearly justified experimental approaches and excellence in orally defending the proposal.

The criteria for a satisfactory designation rests solely with the committee but is generally viewed as the student showing an acceptable depth of fundamental knowledge, the ability to logically reason through uncertainties given sufficient cues from the committee, having written a clear research proposal with well rationalized aims and clearly justified experimental and being able to orally defend weaknesses in the experimental rationales.

The criteria for a unsatisfactory designation rests solely with the committee but is generally viewed as the student showing an unacceptable depth of fundamental knowledge, difficulty in being able to logically reason through uncertainties even with cues from the committee and having written a research proposal that although acceptable, did not have clearly justified experimental approaches and whose oral defense of weaknesses in the experimental rationales was poor.

In the event of an honors or satisfactory decision, the student will enter Candidacy for the Ph.D. In the event of an unsatisfactory performance, the student may be given the option to receive an M.S. degree following the write up and defense of a Master's thesis based upon the experimental work performed. Alternatively, the student may submit a brief written petition to the department Chairman requesting a re-examination. This request should be no more than one paragraph and outline any extenuating circumstances or reasons that the student feels may have impacted their performance. This petition should be submitted within 3 days following notification of the outcome of the oral comprehensive examination. In consultation with the student's mentor and departmental members of the examination committee, the Chairman will inform the student within 1 week whether the petition is accepted or denied. If denied, then the student may complete the M.S. degree as outlined above. If accepted, the student will reschedule another committee meeting within 1 month. The second committee should be formed of five new faculty members. The student's advisor will serve *ex officio* and be present during the examination to help clarify any scientific

issues and to inform the committee of the issues that led to the initial decision of unsatisfactory. If following the second examination, the student receives an honors or satisfactory decision, he/she will enter Candidacy for the Ph.D. A second unsatisfactory outcome can not be appealed again and the student may complete the M.S. degree as outlined above.

On passing the Comprehensive Oral Examination, an aspirant for the Ph.D. degree becomes a “candidate”, and a dissertation committee is appointed in accordance with Graduate School regulations. The dissertation committee normally consists of three members who serve as advisors for the completion of your dissertation research.

F. Post-Comprehensive Enrollment

After passing the comprehensive oral examination for a doctoral degree, the candidate must be continuously enrolled, including summer sessions, until all requirements for the degree are completed, and each enrollment must reflect as accurately as possible the candidate’s demands on faculty time and university facilities. During this time, until all requirements for the degree are completed or until 18 post-comprehensive hours have been completed (whichever comes first), the candidate must enroll for a minimum of six hours a semester and three hours a summer session.

G. Dissertation Research

After choosing a research advisor, each student develops a dissertation project in consultation with their advisor.

Conducting research is the most important part of the graduate-training program. It is important for you not only to learn specific methods but also to understand and develop a rationale for experimental design. You should learn which experiments are worth doing and which ones you can predict will not give unequivocal answers. The goal will be accomplished by frequent consultation with your Research Advisor and your Advisory Committee. Following the oral comprehensive examination, the student presents the dissertation research project to a 5-member Advisory Committee. The student also receives periodic advice from this committee throughout the execution of the project.

Note: For one reason or another, a graduate student may wish to change research Advisors. As a matter of policy, this intention should be conveyed to the current Research Advisor first and Graduate Program Director and Department Chairman. The Graduate Program Director and Chairman will then help the student identify and/or arrange for a new advisor to serve as a mentor.

Preparation of the Dissertation

Prior to ceasing your experimental work and writing your dissertation, your Research Advisory Committee must agree that the body of work completed by you is sufficient for a dissertation. You will have already had several meetings with the Advisory Committee so that most of their suggestions will already have been carried out. Instructions regarding the proper form of the dissertation should be obtained from

the Graduate School or the Pharmacy School Graduate Director. Your advisor is responsible providing assistance and critical feedback on drafts of your dissertation as you write them.

Defense of the Dissertation

a) Scheduling the Defense

When the final draft of your dissertation has been tentatively accepted by your research Advisory Committee, you may schedule the final oral defense of your work. In order to provide sufficient time and information for general announcement, the request to schedule dissertation defense must be made at least three weeks before the date of the examination. You must complete the Do-All form and other forms in the packet obtained from the Pharmacy School Graduate Director.

b) Final Dissertation Defense Committee

The committee for your dissertation defense shall consist of at least five members, all of whom are members of the Graduate Faculty. The Committee members must be listed on the Do-All form and approved by the Graduate School prior to announcing your final defense. All members of the Research Advisory Committee (official readers of the dissertation) must be present for your thesis defense. A grade of honors, satisfactory, or unsatisfactory can be assigned.

After the final dissertation defense has been successfully completed, the dissertation is to be signed by the members of the Dissertation Committee. Two unbound copies are to be deposited with the Graduate Director for the School of Pharmacy, one bound copy is given to the Departmental Office, and one bound copy is presented to the Research Advisor and each Committee member. The finalized version of your dissertation must be turned in to the Graduate Director for the School of Pharmacy. The finalized version of your dissertation must be turned in to the Graduate Director for the School of Pharmacy **at least three weeks before the degree is to be conferred**. Degrees are awarded three times a year, in May, August, and December. However, there is only one doctoral hooding ceremony and that takes place on Commencement Day in May.

H. THE MASTER OF SCIENCE DEGREE PROGRAM

Students who wish to terminate with the M. S. degree must satisfactorily complete approximately one third of the courses recommended for the Ph. D. degree, present a thesis based on original research, and pass a final oral examination focused on that research project. The non-thesis M. S. degree is automatically granted after successful completion of the comprehensive oral examination.

EDUCATION: COURSES PLANNED FOR NEXT TOW YEARS

Semester/Year	Course#	Title (& Instr. if appropriate)

3. RESEARCH ACTIVITIES: (Provide a brief summary of your progress in your thesis research and goals for the two academic year.)

1. List the members of your Thesis Advisory Committee:

- 1.
- 2.
- 3.

2. List dates of previous Committee meetings and approximate dates of meetings for the coming year.

7. ADDITIONAL MISCELLANEOUS COMMENTS

If there are activities (past and future) relevant to your program not reported elsewhere, report it here. If you have any relevant comments regarding your progress, also report it here.

8. COMMENTS OF FACULTY ADVISOR/THESIS CHAIRPERSON

NAME OF STUDENT:

NAME OF FACULTY ADVISOR:

This section is to be completed by your faculty advisor after you have completed sections 1-4. (Note to Faculty Advisor: Please discuss the self-evaluation report with your advisee. Is the student making satisfactory progress in the program vis-a vis the School's expectations? Are there any deficiencies in the students' progress? If so, please recommend what actions the student and/or the school should take to remedy it. Please share your evaluation and recommendations with your advisee. After this section is completed, the student will submit the report to the Graduate Studies Director by September _____. The faculty members will meet with each graduate student for ~ 20 min on either September _____ or _____.

Guidelines for Written Cumulative Exams

The following are guidelines for preparing your written answers for cumulative exam questions. These papers will be in the form of a "mini review" with a clear review of relevant literature, discussion of issues raised in the question, and outline of future experimental approaches to resolve issues that are currently not fully addressed. Ideally, the answer should include four main sections.

A. Introduction

This section should introduce the question and the general manner in which you will address it.

B. Review of the current literature relevant to the question

This section is the "meat" and should include facts gleaned from the literature after the literature has been reviewed critically.

Facts should be organized into a format that is logical, progressive, and divided into sections. Each section should make a story and be delineated as such with a heading and a short interim conclusion. Where possible, each section should address a particular facet of the question.

Pay attention to items in the literature that disagree and delineate these in the text of the appropriate section. Try to note which is the minority opinion.

C. Conclusions

Draw appropriate conclusions relevant to the question and be especially critical regarding the literature you have reviewed. Specifically:

1. which facts don't agree
2. which experiments draw interesting conclusions but may not have been done properly [for example, may have omitted appropriate controls].

D. Critical Analysis

In your new capacity as an expert:

1. Try to draw sufficient conclusions to formulate a hypothesis that explains the major facts.
2. Propose experiments for the future, or
3. At least delineate the major questions that need to be addressed experimentally [even if current procedures will not allow specific experiments].

A strict page limitation of either 6 or 12 double-spaced pages (excluding the list of references) written in normal type (compressed print and wide margins are not acceptable) will be enforced. The format to be used for references should include the names of all authors, the year, the title of the article, and the journal title, volume number, and beginning and ending pages.

THE ORAL COMPREHENSIVE EXAMINATION

Admission to candidacy for a Ph.D. degree is based on successful completion of the required course work and acceptable performance in an Oral Comprehensive Examination. The Oral Comprehensive Exam is based on a National Institutes of Health grant application which you must prepare and submit to your Committee Members. The questions which your Committee may ask during the exam will grow out of the proposal but can be very broadly interpreted to be based on the proposal. The steps you need to take to prepare for this exam and to arrange for it to take place are outlined below. This outline is followed by a series of guidelines that may be helpful to you in the preparation of the NIH grant proposal which you must discuss at the oral examination.

1. After you have completed the Biometry course requirement and most of the other required courses for your degree, you should select two or three research areas that interest you as possible topics for your proposal. Read some of the most current literature in each area so you will have some idea of the issues that are not yet resolved. Consider some experimental approaches that might be followed in designing a project to address some of those issues.
2. Meet with your advisor to discuss the possible topics, select one for your proposal, and set a date for convening with your Comprehensive Exam Committee. Your Committee should have the three members of your Advisory Committee plus two others, including someone from outside the Department, to represent the Graduate School.
3. Obtain a copy of the NIH grant application form PHS 398 from the Department Office and use its format to plan your overview to be presented to your Committee.
4. Develop a 2-3 page overview of your planned NIH proposal and present it to 3 members of your Committee. Once they approve the planned proposal, you may have up to 4 weeks to write the full proposal.
5. Read the instructions for completing the NIH application very carefully and prepare your proposed draft (see guidelines below). At the end of 4 weeks, give the proposal to 3 Committee members who will function as your initial readers. They have 2 weeks to give you feedback for revising the proposal. You then have 2 weeks to complete the revisions and get the final proposal to all Committee members. Your exam should be scheduled for about 2 weeks from the time your entire Committee receives the proposal.
6. Once the 3 initial readers indicate that your proposal is nearly ready to hand out to the rest of the Committee, you need to obtain a "Do All" form from the Department office and have it filled out to notify the Graduate School of your upcoming Orals. Completion of the form should be done in consultation with the department chair. The "Do All" form must be sent to the Graduate School at least two weeks prior to the date set for your exam. All the members of your Committee must be listed on that form, including the faculty member from outside the Department.
7. During the first part of your Oral Comprehensive Examination you will present and defend your research proposal. The second part of your exam will consist of questions about fundamental aspects of pharmacology, toxicology, and related areas that touch upon the work in your proposal.

GUIDELINES FOR PREPARING YOUR NIH RESEARCH PROPOSAL

1. Before you begin to write

Gather together the items you will need to help in your writing--a dictionary, thesaurus, a style manual, plus the references, books, etc. After you have read the instructions for the grant application which can be found online at <http://era.nih.gov/ElectronicReceipt/process.htm>, you may want to look at some NIH proposals submitted by faculty members. These are available from the department chair.

2. Essentials of a good proposal

There really are only two essentials--a *good* idea and *well written* development of that idea.

A. A Good Idea

(1) Identify a well-defined, important problem--a problem whose solution would be of scientific and/or clinical significance. Trivial problems or reinventions of the wheel do not lead to interesting proposals.

(2) The problem must also lend itself to one or more experimental approaches, and the technology required to solve it should be available. Do not propose strategies for which methods have not yet been developed.

(3) The problem should be original, i.e., not just a different approach to a question that has already been addressed by others.

(4) Your approach to the problem should be logical, innovative, and 'state-of-the-art'. Demonstrate that you have a very clear plan for attacking the problem and that you are very familiar with the best methodological tools available. Be sure the experiments address the problem you identified.

(5) It is important to show that you have a realistic grasp of how much can be accomplished in the time allotted. Do not propose to do ten years worth of work in three, nor draw one year worth of work out to three years.

B. Written Development of the Good Idea (The Proposal)

The comprehensive evaluation of your proposal and the general impression it makes on the reviewers will be due to many different factors which must come together in the final document you present. The overall significance of the problem and the originality, logic, and feasibility of your planned approach to the problem will form the basis for the final evaluation. Each section of the proposal is designed to provide the reader with specific information that feeds into the total picture. Thus a brief discussion of the most critical elements in each section follows. These are discussed in the order in which they occur in the application form, not necessarily in the order in which you will write the sections.

(1) *Title*. The title should accurately reflect the content of your proposal as the title plays a role in the determination of reviewers for your application, if it were being sent to NIH.

- (2) *Abstract of Research Plan*. The abstract is a very brief statement of the most important components of the total proposal, namely, the significant problem you plan to study and the specific strategy you are going to follow. It is important to clearly and succinctly indicate what is the overall expected outcome of your studies and how these results are relevant to improving human health, the goal of the NIH.

This will be your readers' first contact with your "good idea", and it is important that you use this space to state the problem clearly and succinctly. This is the point at which you must begin to persuade the readers that this is a significant problem and that you have developed a sound approach to solving it--and you must do this in a limited number of carefully chosen words! If your abstract does not make sense to the reviewer, his or her initial approach to the rest of the document will be colored by this sense of confusion.

(3) *Budget and Budget Justification*. Even though you may not have had much experience with keeping track of the costs of running a laboratory at the time you take your Orals, it will be a good experience for you to prepare a budget and justify it in the context of the proposal. You cannot actually prepare the budget until you have written the bulk of the proposal as you need to know how much work is being proposed. Assess the entire body of work and try to make some honest, realistic evaluation of the personnel that would be required to see the work to completion. Specify the credentials or experience you would be looking for in a candidate to fill each position listed. Be sure to propose a salary commensurate with the required qualifications and the Institutional salary scale. You might wish to ask a professor who does work in the same field how much supply money to request and a rough break-down. If you project any increases in salaries and/or the cost of supplies in the second or subsequent years of the project due to inflation, be sure to explain these in the Budget Justification. Any equipment requests need to be fully justified in terms of their necessity for specific experiments.

(4) *Specific Aims*. Once you have developed specific ideas about how to approach the problem you have identified, you can prepare a draft of this part of the proposal. However, once you have completed a draft of the entire proposal, you will undoubtedly need to go back and modify this section to make sure it is totally consistent with the rest of your Research Plan. The "Specific Aims" should outline your concrete goals for each step of the project. The project should be made up of discrete components that need to be undertaken in some prescribed sequence in order to achieve your overall objective. These "Specific Aims" should be presented in an outline form, usually with each one numbered, and they must occupy no more than one page.

(5) *Significance*. This is the section in which you are expected to build the case for the problem you wish to study. This component requires that you make use of the

literature which exists to show precisely what gaps exist in our knowledge regarding the problem. You are setting the stage for the studies you plan to do, and thus you must use the literature to frame the issues and thereby *persuade* your readers these specific issues need to be addressed. The readers must also be persuaded that the resolution of the issues is important. The basis on which you need to build the case for the significance of the problem will be determined to some extent by the nature of the problem you wish to pursue. Finding the answers to some questions may have dramatic clinical implications for a specific disease, while finding the answers to other questions may lead to greatly enhanced understanding of a particular biological mechanism, and so on. The principle for you to keep in mind is that you must provide the readers with pertinent background information and then develop your arguments about the problem in such a way that they will be compelled to agree with you. **Be sure to cite the appropriate literature to document your major arguments and all statements of factual information.** If you cite work that has produced results somewhat similar to the expected results of your projects, you must be very careful to describe exactly what new information will be contributed by your studies and why your studies need to be done.

(6) *Preliminary Studies.* The requirement that you have preliminary data to support the feasibility of what you are proposing to do is theoretically “optional” for a new grant application. However, in practice this is generally not the case, and investigators are virtually always expected to have such data. However, you will probably not be able to provide some for this occasion.

(7) *Experimental Design and Methods.* This section provides you with the opportunity to tell your readers exactly how you are going to do what you are proposing to accomplish. This component is the heart of your proposal and must clearly grow out of the ground work you have laid in the earlier sections. Your Specific Aims should guide the organization of this section, but now you must provide a substantial amount of detail. Regardless of how you decide to organize this section, it is important that your discussion of the Experimental Design and Methods includes the following information:

- (a) A clear and thorough description of the approach you are going to take for each phase of the problem and exactly what methods you plan to use. The more specialized or obscure the method, the more detail you will need to provide.
- (b) Careful justification of your choice of a particular approach. Why is your approach better than other alternatives?
- (c) A summary of the kinds of results you expect to obtain, and the methods you will use to analyze and interpret them, including mathematical, graphical, and statistical handling of your data.
- (d) A discussion of alternative strategies you have thought of in case your results do not come out as expected. It is important here to show the readers that you have considered the possibility that some things may not fall into place

perfectly, and that you have already thought of alternatives that might be pursued.

The manner in which you present your Experimental Design and Methods section either convinces or fails to convince the reviewers that you have the ability to plan a sound method for attacking a problem, that you can anticipate potential difficulties and think of alternative strategies, and that you thoroughly understand the methodology you propose to use. Your written proposal must reveal this, and you must also be prepared to defend your thinking at the time of your exam.

(8) *Human Subjects.* If your studies involve any human subjects or even the use of blood or tissues from humans, you must have the approval of your institutional committee responsible for monitoring human experimentation. If this proposal were going to NIH, the required Form HHS 596 would have to be completed, approved by the committee, and submitted with the application. You should also be aware that some journals now require proof of such approval for any studies involving human subjects.

(9) *Vertebrate Animals.* The use of animals in research is becoming increasingly subject to question and requirements for justification. If your proposal involves the use of vertebrate animals you should follow the instructions for part F of the NIH application form.

(10) *Literature Cited.* Follow the instructions in the application packet. The reviewers will check to make sure your literature citations are relatively recent. It is assumed you will be utilizing the most recent work in an area both to build your case and to plan your methodological approaches.

Once you have a good draft of your proposal together, it would be wise to have at least one, two, or even three fellow students read it over before you give it to the initial readers on your Committee. Ask your colleagues to read it primarily for clarity. The clarity and precision of your writing is considered a reflection of the clarity and precision of your thinking. Even if your colleagues are not familiar with the area, they should be able to give you valuable feedback on the organization of the information, the presentation of the arguments, the clarity of the writing, and also on accuracy of grammar, punctuation, etc. You should get in the habit of asking colleagues to read proposals for you before you send them out, as constructive local feedback can spare you many problems.

The accessibility of word processing should eliminate any excuses for multiple typographical errors and other types of carelessness that can detract significantly from the overall proposal. Furthermore, there is an old adage about writing that is as true today as it ever was: "There is no such thing as good writing; there is only good rewriting." Computers have dramatically reduced the burden of re-writing. Consequently, it is not unreasonable for readers to expect to receive documents that are clear, concise, polished, and error-free. The good draft of the proposal which you submit to the initial readers from your Committee should be well on its way to meeting those criteria.

Questions for first year students preparing 6 page mini-review

G. Carrasco

1. The serotonin 2A (5-HT_{2A}) receptor exhibits particular regulation properties. Sustained treatment with either agonists or antagonists induce its desensitization and down-regulation. However, several drugs of abuse such as cocaine, MDMA and metamphetamine will increase its activity. Discuss the atypical regulation of 5-HT_{2A} receptors by drugs of abuse and the molecular mechanisms involved.

2. Marijuana (*cannabis sativa*) exerts its effects via its primary psychoactive component, Δ^9 -Tetrahydrocannabinol (Δ^9 -THC). A number of recent studies suggest that administration Δ^9 -THC or its synthetic analogs can regulate the activity of serotonin (5-HT) receptors, and more specifically serotonin 1A (5-HT_{1A}) receptors. Describe the molecular mechanism by which Δ^9 -THC regulates 5-HT receptors and how this may be beneficial for the treatment of mood disorders.

R. Dobrowsky

1. Protein binding domains are critical in protein-protein interactions which regulate cell survival and death. Discuss the salient features of src homology domains, phosphotyrosine binding domains, pleckstrin homology domains, PDZ domains. Discuss how many of these domains are involved in regulating insulin signaling through the insulin receptor substrate-1. Present a brief critical discussion on whether you think approaches to either increase or decrease these interactions may be beneficial in the treatment of diabetes. Provide data to support your view.

2. Quantitative proteomics provides a powerful mechanism to understand the effects of disease on multiple proteins and metabolic pathways. Stable isotope labeling of cells in culture (SILAC) provides one strategy for performing quantitative proteomics. Describe the process of SILAC, its historical development and some of its current uses. Discuss some of caveats and limitations of SILAC relative extrapolating the results to those obtained in tissue

S. Fowler

1. The role of dopaminergic pathways in modulating behavior is becoming more and more defined. Discuss each of the dopaminergic pathways (mesolimbic, mesocortical, and nigrostriatal), their interconnections and how each pathway may differently affect behavior. In particular, describe the research on the importance of dopamine in reinforcement theory and the dopamine hypothesis of motor deficits in diseases such as Parkinsons and Lesch Nyhan.

2. Describe the differences between the D1 and D2 dopamine families of receptors at the molecular, electrophysiological, anatomical, pharmacological and behavioral levels of analysis (or combinations of these levels). What evidence suggests a role

for these two types of dopamine receptors in learning, memory, motor function, and psychopathology? What are the therapeutic implications of these findings?

E. Michaelis

Deleted:

1. Review the evidence that increased oxidative stress leads to neurodegeneration in the brain and is responsible for some of the neurodegeneration during aging and Alzheimer's Disease. You may use information obtained from studies of exposure of neurons to oxidants, to excitotoxic agents, such as glutamate or NMDA, or to deprivation from neurotrophic factors.
2. Briefly explain the processes involved in early brain development including neuronal proliferation and migration, synaptogenesis, myelination and synapse elimination. Be sure to discuss which of these processes are controlled by genetic and neuronal growth factors and which processes appear to be regulated by the external environment. Describe studies concerning the biochemical mechanisms by which a drug (for example, methylazoxymethanol) can interrupt one of these processes and can cause a disorganization of neuronal connections.

M.L. Michaelis

1. The 'statins' have been found to have beneficial effects in a number of diverse diseases, at least epidemiologically. Briefly summarize what is known about their major target protein and the potential mechanisms that might underlie their actions in at least two other disease states.
2. Free radical damage or increasing levels of "oxidative stress" are believed to be fundamental to the aging process and many age-related diseases. Explain what 'oxidative stress' is with regard to biological systems. Then, briefly discuss some of the most widely-recommended 'anti-oxidants' and the quality of the experimental evidence supporting their potential value for helping maintain good health as aging progresses.

J. Moskovitz

1. Methionine (Met) and cysteine (Cys) are sulfur containing amino-acids that are among the first protein residues to be oxidized following exposure to reactive oxygen species (ROS). Oxidation of either of these amino-acids may lead to structural and functional alteration of the harboring proteins, thereby causing cellular mal-function. Review the literature with respect to the known proteins that are affected by these posttranslational modification and try to classify them into functional categories either by the type of the modification (oxidation of Met or Cys.) or their cellular role (Like signal transduction, immune response, apoptosis, basal metabolic pathways, antioxidant defense etc.). Give examples for diseases that may be associated with the accumulation of such modified proteins.
2. The posttranslational modification of methionine to methionine sulfoxide (MetO) is readily reversed by the thioredoxin-mediated methionine sulfoxide reductase system (Msr). Describe the Msr gene family, its evolutionary development,

function, and its importance in antioxidant defense and cell survival. Review the use of the current Msr-knock-out organism models for oxidative-stress related research.

N. Muma

1. Serotonin signaling is mediated by a variety of G-protein linked receptors. Discuss those that have been implicated in anxiety and depression. Which receptors do you think are the most important targets for therapeutic intervention in anxiety and depression and give evidence to support your conclusions.
2. Progressive supranuclear palsy is a movement disorder which begins clinically similar to Parkinson's disease. Describe the mechanisms that have been associated with the pathophysiology of the disease. Choose one mechanism that you think is important in the disease process, justify why that mechanism is important and describe a potential therapeutic agent that could be used to mitigate that process.

J. Staudinger

1. The nuclear receptor superfamily of ligand activated transcription factors are implicated in processes as diverse as reproduction, development and general metabolism. Review the literature that links PPARs, LXRs, FXR, PXR, and CAR to the feed-forward regulation of metabolic cascades that mediate lipid metabolism, transport, storage and elimination. Present a brief critical discussion of the implication of these discoveries for the development of novel therapeutic agents in the treatment of diabetes, high cholesterol, and cholestasis. Provide data to support your view.
2. The nuclear receptor superfamily of ligand activated transcription factors interact with multiple "co-factors" in both a ligand-dependent and ligand-independent manner. Review the literature and discuss the role of each of these co-factors in regulating transcription. Provide data to support your view.
3. The PDZ domain occurs alone (as single units or as multiple units) in proteins or in association with other domains (i.e. phosphatase, kinase, SH2, SH3, etc...). More than 200 individual PDZ domains have been identified in the human genome and one of the central themes of this field of research involves the identification of the protein partners for each of these individual domains. Briefly review and classify the proteins that contain the PDZ domain with respect to their primary and secondary, and tertiary structure and then discuss the different approaches that investigators have used to identify and characterize these domains with respect to their binding specificity and binding affinity

Questions for second year students preparing the 12 page mini-review.

G. Carrasco

1. Brain-derived neurotrophic factor (BDNF) and serotonin (5-HT) are two distinct signaling systems that play regulatory roles in many neuronal functions including synaptic plasticity. A common feature of these two systems is their ability to regulate development and plasticity of neuronal circuits involved in mood disorders such as depression and anxiety. Review the literature that links BDNF and 5-HT receptors and: (1) discuss the mechanisms that might underlie their actions in mood disorders (2) propose a novel therapeutic approach that may be useful in treating mood disorders.

2. Recent reports have demonstrated that serotonin 2A (5-HT_{2A}) and 2C (5-HT_{2C}) receptors exert opposite effects in regulating dopamine release in several brain areas. Discuss the mechanisms by which 5-HT_{2A} and 5-HT_{2C} receptors regulate dopamine release. In particular describe the brain areas involved. Discuss how this research may be beneficial in the treatment of schizophrenia and substance abuse.

R. Dobrowsky

1. Diabetic neuropathy has a very complex etiology. Discuss the competing hypotheses that have been put forth to explain how diabetes induces neuropathy. Identify the role of superoxide as a focal candidate molecule that may be a central biochemical link to induction of the various biochemical abnormalities associated with diabetic neuropathy. In your critical analysis, discuss the benefits and limitations of anti-oxidant therapy in treating diabetic neuropathy and using data to support your arguments, propose some novel therapeutic approaches that may be of benefit in treating diabetic neuropathy.

2. Caveolin is proposed as a novel tumor suppressor protein. Review the literature describing the role of caveolin in regulating cell growth and differentiation. Discuss what data supports or negates a role of this protein as a tumor suppressor. In your critical analysis, address the issue as to whether the data supports that gene therapy approaches using caveolin may be advantageous in treating specific disease states.

S. Fowler

1. Repeated treatment with some CNS stimulants results in progressively greater behavioral response after each treatment, despite the fact that dose of the drug is held constant. What is this phenomenon called and what drugs produce it in rodents? In this context, describe how behavior is quantified for detecting changes in drug response, and assess the strengths and weaknesses of these methods. Identify cellular mechanisms and brain neurotransmitter systems that may participate in the development and expression of this heightened behavioral response. What is the translational significance (i.e., relation to health problems) of this basic laboratory work?

2. Discuss dopamine-glutamate interactions in the basal ganglia as these are related to current neurochemical theories of Parkinson's disease and schizophrenia."

E. Michaelis

1. Some of the theories about the toxicity of neurons produced by the excitatory amino acids L-glutamate, L-aspartate, and quinolinate suggest the involvement of reactive oxygen species (ROS) as intermediate steps in the expression of toxicity. Review the literature that supports such hypotheses and indicate which are the critical reactions that lead to the formation of the ROS and which ROS are the most likely candidates for excitatory amino acid-induced toxicity. Outline how you think ROS formation leads to neuronal degeneration and death and what type of cell death are the neurons undergoing. Indicate what are the existing ambiguities in this area of research and what are some of the future issues that need to be explored.
2. Calcium functions as an intracellular signaling ion capable of activating several signal transduction cascades. Using neurons from the central nervous system as the model, outline the steps in different intracellular signal transduction events that may be activated by calcium and provide cogent mechanisms for possible gene transcription events. Outline some areas in which you think further experimental work is necessary in order to define the signaling pathways activated by elevations in intracellular calcium.
3. Transgenic and "gene knockout" mice have been introduced in biological and medical research as a means to determine the function of specific genes or to model human diseases. Using the genes for the NMDA receptor proteins NR1 and NR2 as models, review (briefly) the literature supporting the role of these proteins as receptor proteins and the development of transgenic or gene knockout animals for the genes of NR1 and NR2. Describe, in general, the procedures used to generate transgenic and gene knockout animals, the methods for evaluating the activity of the gene products in the nervous system, and the complications that might arise from the over- or under-expression of a gene or from existing differences in mice of different strains.

M.L. Michaelis

1. All major age-dependent neurodegenerative diseases lead to accumulation in of aggregated forms of specific proteins in brain or spinal cord, e.g., the amyloid β peptides in plaques in Alzheimer's brain or α -synuclein in Parkinson's Disease. The shared characteristic has led to the concept that these diseases are due to protein unfolding or de-naturation that allows for aggregation and deposition in the CNS tissues. Recent discoveries about the 'molecular chaperones' that form the cellular protein-folding machinery have led to interest in this system as a potential new therapeutic target for these diseases. Select one example of a neurodegenerative disease, explain the nature of the unfolded protein lesions, and discuss how drugs targeting molecular chaperones have been or might be tested as potential therapeutic agents.

2. RNA silencing techniques have made it possible to suppress expression of a given protein in primary cells in order to assess its possible functional properties before going on to make a 'Knock out' mouse. Describe the steps you would take to use siRNA techniques to help you probe the functional properties of a protein that is of interest to you. Provide the overall strategy, the controls, and the caveats.

3. The tightly regulated balance between Ca^{2+} in the endoplasmic reticulum (ER) and Ca^{2+} in the mitochondria has been proposed to control apoptosis in many types of cells (See R. Rizzuto publications). Evaluate the strength of the evidence in support of this hypothesis and discuss findings that are difficult to explain with this mechanism.

N. Muma

1. Huntington's disease is a neurodegenerative disease caused by a trinucleotide repeat expansion in the gene coding for huntingtin protein. Huntingtin protein aggregates in inclusion bodies in the nucleus and cytoplasm of neurons in selectively vulnerable brain regions in people with the disease. As with most neurodegenerative diseases, the role that the inclusion bodies play in the disease process is unclear. Discuss the evidence that addresses the importance and role of huntingtin protein aggregation in Huntington's disease. Do you think that the aggregation is playing an important role in the disease process or is it an epiphenomena and why?

2. Selective serotonin reuptake inhibitors (SSRI) are antidepressant drugs that take around 3 weeks of treatment to have an antidepressant effect although the therapeutic drug concentration in the plasma is achieved much more rapidly. Discuss the reasons why this delay may occur, which mechanisms are most important to the clinical effectiveness of these drugs and provide evidence to support your conclusions.

J. Moskovitz

1. Aggregation of beta-amyloid (in Alzheimer's disease), alpha-synuclein (in Parkinson's disease), and the infectious form of prion (in Creutzfeldt-Jakob disease) is implicated in the development/progression of their related neurodegenerative diseases. Review the current knowledge about the biological conditions and events that may cause these proteins to aggregate. Discuss the similarities and the differences between the causes leading to the proteins structural changes. Elaborate on the post-translational modifications to these proteins following oxidation. Review the current treatments offered for these diseases that are antioxidant-based therapies. Discuss their advantages and disadvantages and how they may be improved.

2. The basis of the free radical theory of aging is that with time, damage to proteins, DNA, and lipids by reactive oxygen species is increased. Review the evidence for the theory and discuss the parameters that contribute to the complexity of aging research. Describe three model organisms/strains that are the best for aging research, in your opinion. Are metabolic rate and body size/mass of an organism correlated with its expected life span?

J. Staudinger

1. The PDZ domain-containing protein PICK1 has recently been implicated in the regulation of learning and memory (long-term potentiation [LTP], long-term depression [LTD]).
 - A. Describe the current model of the molecular basis of LTP and LTD.
 - B. Discuss the role of each domain in PICK1 (PDZ and coiled-coil domain) in mediating protein-protein interactions.
 - C. Review the evidence that supports a role for PICK1 in learning and memory.
 - D. Review the role of other PDZ proteins in LTP and LTD.
 - E. Describe any other proteins that interact with PICK1 that are not involved in LTP and LTD.
 - F. What are the areas or opportunities for additional research in this field that you feel are important to pursue?

2. Both the multi-drug resistance family of transporter proteins (MDRs) and the multi-drug resistance associated protein (MRPs) family have been implicated in the development of the multi-drug resistance phenotype exhibited by certain types of cancer. Review the literature regarding their substrate specificity and discuss the evidence of their involvement in the development of resistance to anticancer agents. Discuss the current model of the molecular mechanisms of the regulation of transcription and any post-transcriptional regulation of these proteins. What is the importance of these transporter proteins in the field of toxicology? Are there specific opportunities that you feel are important avenues for additional research in this field.

3. The human genome-sequencing project is now complete. Discuss the implications of this fact on current biological research, paying particular attention to the annotation of this information. What is the most current and best information about the number of genes and the classification of these genes into functional groups in the human genome? What challenges lay ahead in putting this information to use in a meaningful way? Are there any shortcomings in the data in its current form? What additional information is necessary to create useful information out of this database? What are the immediate benefits of this knowledge to scientists and to society? Discuss the importance of this knowledge on the ability to profile gene expression patterns and to perform proteomic analysis. Identify any groups of genes (i.e. kinases, ABC transporters...) that you feel deserve additional scrutiny as a result of the information garnered from sequencing the human genome. What is the importance of this information for the field of toxicology? Are there opportunities for additional research represented in the annotated sequence?

STUDENT'S NAME _____
REVIEWER: _____

DATE SENT: _____

Evaluation form for 6 PG Written Cumulative Exams

Rating Scale:

- 1.0 – 1.5 = Outstanding
- 1.6 – 2.0 = Very Good
- 2.1 – 2.5 = Average
- 2.6 – 4.0 = Acceptable, but below expectations
- 4.0 – 5.0 = Unacceptable

Categories

A) Technical Aspects of Writing

- 1. Organization of Information (e.g., logical presentation, organized transitions between topics) _____
- 2. Clarity of Writing Style _____
- 3. Grammar, spelling, punctuation, consistency of form in citations, references _____
- Subtotal Section **A** _____

B) Intellectual/Scientific Content

- 1. Thoroughness of Literature Review, (e.g., depth of review, balanced presentation of opposing interpretations) _____
- 2. Integration of Information and Concepts (e.g., have main points been addressed, integrated and discussed in the broad perspective not as only isolated sections/topics) _____
- 3. Attempt at Critical Analysis (e.g., has student made solid and reasonable attempt to provide a cogent analysis) _____
- 4. Overall Assessment of Depth of Critical Analysis _____
- Subtotal Section **B** _____
- Total _____

Total should be no more than 15 points for acceptance without revisions.

Specific comments are helpful and may be directly on the paper.

STUDENT'S NAME _____

REVIEWER: _____

DATE SENT: _____

Evaluation form for 12 PG Written Cumulative Exams

Rating Scale:

1.0 – 1.5 = Outstanding

1.6 – 2.0 = Excellent

2.1 – 2.5 = Very Good, above average

2.6 – 4.0 = Acceptable, but below expectations

4.0 – 5.0 = Unacceptable

Categories

A) Technical Aspects of Writing

4. Organization of Information (e.g., logical presentation, organized transitions between topics) _____

5. Clarity of Writing Style _____

6. Grammar, spelling, punctuation, consistency of form in citations, references _____

Subtotal Section A _____

B) Intellectual/Scientific Content

5. Thoroughness of Literature Review, (e.g., depth of review, balanced presentation of opposing interpretations) _____

6. Integration of Information and Concepts (e.g., have main points been addressed, integrated and discussed in the broad perspective not as only isolated sections/topics) _____

7. Creativity of Original Conclusions, Future Directions (e.g., has student only reiterated published views, adequacy of attempt to develop novel and testable hypotheses) _____

8. Overall Assessment of Depth of Critical Analysis _____

Subtotal Section B _____

Total _____

Total should be no more than 15 points for acceptance without revisions. Specific comments are helpful and may be directly on the paper.

Journal of the Department of Pharmacology and Toxicology

Manuscript # - *Referee's Report-to be Transmitted to Author*

Date Sent: Please return by:

Referee:

Please, indicate by a check your assessment of the manuscript in the following categories

Scientific Value

___ Outstanding

___ High

___ Medium

___ Low

___ Trivial/Weak/Unsound

___ Insufficient Data

___ Too Speculative

Clarity/Length

___ Concise

___ Acceptable

___ Verbose

___ Over/Under-
Interpreted

___ Text too long

___ Too many
Table/Figures

Recommendation

1) ___ Acceptable as is

2) ___ Acceptable/Minor
editorial revisions

3) ___ Acceptable/Major
editorial revisions

4) ___ Acceptable/Major
editorial revisions, minor
additional experiments

5) ___ Unacceptable/
Major editorial revisions,
major additional
experiments

6) ___ Unacceptable, too
poorly written to judge

Key for checks in Recommendation Column

1-2 - Manuscript acceptable, no revisions required, passed

3-4 - Manuscript acceptable, revisions required and re-review needed before considered passing

5-6 - Manuscript unacceptable; revisions likely too extensive to be completed in timely manner

Please Circle:

Yes No Are the methods sounds and adequately described?

Yes No Are the conclusions and interpretations sound and justified by the data?

Yes	No	Is the abstract correct and informative?
Yes	No	Does the title adequately reflect the contents?
Yes	No	Are the references correctly cited?

Please provide specific comments on the manuscript and continue on a separate sheet if necessary.

GENERAL COMMENTS ABOUT SEMINARS

All student presentations fall into one of two categories, literature review seminars or research seminars. The literature reviews are usually based on two or three very good papers on a particular topic and the work in these papers plus any additional background information are presented during the seminar. Please make the selection of the papers well ahead of time and present them to the seminar director for approval. For research seminars, consult with your advisor to decide on the topic.

Each student should put a copy of the two papers for a literature seminar in a folder titled "P&Tx Seminar Series: _____ Semester, 2---." This folder should be left in the main office of the Department.

Each student will decide on a title for their seminar, with the assistance of their advisor, and should give the title to the Secretary of the Department, Oksana Seitz.

SEMINAR GUIDELINES

The following paragraphs present a set of simple guidelines for your presentations in the departmental seminar course. The guidelines are designed so that you can convey the maximum amount of information to the largest portion of the audience. It is recognized that other styles of presentation may be just as effective when used by some individuals. However, this format is functional for most people. For this reason, please adhere to this format in your presentation. These guidelines contain many things which seem obvious and which you may already have incorporated into your speaking style. Nevertheless, the guidelines serve to bring everyone to the same point and also serve as a framework we use during the critique following each presentation.

1) REACHING THE AUDIENCE

- a. Target your remarks so they are comprehensible to anyone with a solid scientific background. The object is to convey information to the greatest number of people in the audience. While preparing your presentation, never say to yourself: "They ought to know this.". Don't penalize someone for a lack of knowledge.

Example: You are a pharmacologist, address your remarks to scientists from all biological fields. There may be molecular biologists/geneticists in the audience who have only rudimentary knowledge of pharmacology, toxicology, chemistry, neurophysiology and most other fields that are daily currency to you. If you are a molecular biologist, bear in mind that your audience may not be prepared to receive a discourse on such subjects as transcriptional regulation, polymerase chain reaction or restriction enzyme technology without appropriate introduction.

- b. Strive for clarity even if you need more words. Avoid jargon at all costs. In some instances it may be necessary to use terms which a portion of the audience may not understand, or to discuss a particular chemical structure

or DNA sequence which is necessary for the message you wish to deliver. In these cases, a list of such terms or structures should be visible at the corner of the blackboard throughout your talk.

Summary:

- ⇒ Give an adequate introduction.
- ⇒ NEVER USE JARGON
- ⇒ Provide permanent definitions of specialized terms.

2) THE BASIC UNIT OF THE PRESENTATION

Most people are aware that a good presentation consists of three basic elements:

- ❖ Introduction
- ❖ Body
- ❖ Conclusion

Please adhere to this structure for your presentation. However, each of these sections should be divided into the same three basic elements as well. That is, the introduction should not ramble along and grind to a stop. Rather, it should start with an introductory statement, followed by the background information that will be needed to understand the topic, and end with a conclusion and a statement of the problem or issue being investigated. Similarly, both the body and conclusion of the talk should each be divided into the three elements. Finally, the body of the talk consists of descriptions of data and presentation of figures. Each section of the body, and indeed, each figure should be described using the three basic elements of the talk.

Example:

A. ***Introduction to the presentation***

Always begin the presentation with a reiteration of the title followed by an enumeration of the authors and their affiliations. Remember, the work was done by people not simply authors or “them”. Try to acquire a feeling for this that you can convey to your audience throughout the presentation. Think how you would feel if someone was presenting your work in a similar situation. Reflect on how many times you would like to have your name mentioned in association with your work. Also remember that the laboratories from which the work originated and the people who actually did the work are both important. [Example: Joseph Smith in Annie Herkheimer’s Lab] When presenting papers that represent collaborative efforts, or when presenting work containing collaborations be scrupulous in recognizing the work of others as well as their ideas and suggestions. Remember, credit for work and ideas is one of our prime goals.

State the problem

“One of the most perplexing problems in the study of Lunar herbivores is that there exist no plants on the moon, yet numerous sightings of Lunar herbivores exist in the literature.”

2. Body- Describe current literature (pro and con) which outlines the problem.

“Current evidence regarding the problem is as follows. The earliest report of Lunar herbivore activity was by Dr. M. Goose, who described the initial sighting and some follow up experiments. These experiments...”

3. Conclusion of the talk

- 1. Restate the premise of the talk.** *“In this presentation, I have attempted to describe the work of Diddle et al., on the subject of Lunar herbivores. These authors addressed the following questions:*
- 2. Body of the conclusion.**
Re-emphasize the basic conclusions of the talk; describe any additional conclusions by the authors; relate the work described to any other work you think is relevant (supporting, refuting, or elucidating the work you presented).
- 3. Analysis of the Data.**
Restate the quality of the experimental design and the data and suggest alternative procedures or approaches.
- 4. Final conclusion.**
Try to finish with a ‘summing up’ sentence or paragraph that should include future directions the work might take and the impact of the work on the field at large.

SUMMARY

- ❖ Use the three basic elements everywhere.
As Sidney Colowick once said:
“Tell them what you’re gonna tell them,
Tell them,
Them tell them what you told them.”

3) DESCRIPTION OF FIGURES AND TABLES

As mentioned above, each figure or table should be described according to the three basic units. Do not feel compelled to present all the figures and tables in the paper that you are discussing.

Four additional concepts to which you should pay attention are:

1) The transitional sentences; 2) The description of methods; 3) The physical description of figure axes or table columns; and 4) The statement of how many separate experiments the data represent and the statistical analyses used to evaluate the data.

Transitional sentence and introductory statement to Fig. 7:

“Because of the results of the figure I just described, the authors felt it necessary to determine the kinetics of reappearance of herbivores from the backside of the moon. They are able to show that the mean time to traverse the backside of the moon included sufficient time for a stopover.”

Method description for Fig. 7:

“They used the following method to determine how much time elapsed between the disappearance behind the moon and the reappearance of the Lunar herbivore.”

Description of axes for Fig. 7:

Always describe the axes of a figure or the columns of a table before you begin to describe the data. Be certain that the audience has the tools to understand and interpret the data you are presenting before you present it.

“In the figure, the horizontal axis shows time elapsed from when the nose of the animal first passed behind the moon until the nose reappeared on the other side. The vertical axis represents the number of animals which fell into each time period.”

Description of data for Fig. 7:

“The mean time in transit was 256 centons, a time corresponding to 1.83 X the mean orbit time. The authors indicate that this experiment was done three times per month over a period of one year, and that statistical analysis suggests...”

Conclusions regarding Fig. 7:

“Thus, the results of this figure suggest additional time is elapsing while the animals are on the backside of the moon.”

Potential pitfalls of experimental design, data analysis, or conclusions drawn regarding Fig. 7:

“Because the authors could not exclude possible diffraction changes in the images of the noses of herbivores, the exact timing of their disappearance and reappearance may be questioned. Therefore, an alternative procedure for measuring herbivore movements around the moon would be needed to confirm the apparent kinetics of their lunar existence.” Or

“The methods of measurement and the data analyses were excellent and support the idea that movements of herbivores are an important component of their lunar existence.”

SUMMARY

- Be sure one figure flows into the next; do not simply list them.
- State why the experiment was done.
- Describe how they did the experiment.
- Describe how the figure represents the data.
- State what the data shows.
- State how many times each experiment was done.
- Outline their conclusions.
- Describe any experimental ambiguities and suggest any additional experiments.

4) BASIC DO'S

- ❖ Dress appropriately for the presentation of your seminar. Too casual a dress may create the wrong impression about the value you attach to this undertaking.
- ❖ Speak loudly and with confidence so that everyone can hear your presentation.
- ❖ Speak in short declarative sentences. For example, compare the following sentences both written and aloud:

“My finger was injured during a nail driving attempt when an important digit was forced into contact with the business end of the impacting tool resulting in acute discomfort.”

“I was using a hammer. I missed the target. I hit my finger. It hurts.”

- ❖ If you prefer to write the seminar and then memorize and deliver it, remember that spoken language is different from written language. Be sure not to write in passive voice and do not write complex sentences with more than one clause.
- ❖ Use lots of visual aids. Begin with a slide. Always have something for the audience to look at, no matter what you are saying, even if the slide merely lists the points you are making. This tactic keeps people focused on your presentation.
- ❖ Get the laser pointer from the Department office.
- ❖ Prepare your presentation on “PowerPoint” type of format. Load it onto the computer you plan to use for the presentation and check to see that every slide projects appropriately with the equipment in current use in the lecture hall. A few minutes of planning will eliminate surprises or difficult moments during your presentation.
- ❖ Make sure you have extra batteries for the laser pointer.
- ❖ Make sure that you know the appropriate terminology, including singular and plural forms of Latin and Greek terms, e.g., medium vs. media, criterion vs. criteria, phenomenon vs. phenomena.
- ❖ Write very brief, “bullet”, statements or questions on your slides.
- ❖ Make sure figures and tables are readable from the back of the lecture hall.

- ❖ Make eye contact with your audience. Do not speak to the board or projection screen or projector.
- ❖ Please deliver the presentation to the whole audience. Do not elect a particularly attentive member of the audience or a personal friend and present the seminar to that person.
- ❖ Try to talk without notes, or minimize them as much as possible. Give the impression you are conversant with the subject. However, if you must choose between using notes to present the information well, and not using notes, thereby giving a mediocre or bad presentation, by all means use the notes and give a good presentation.
- ❖ When describing figures, always point to what you are describing at the time you are describing it.
- ❖ Schedule at least one practice session with your advisor before the presentation. If you have difficulty arranging an audience, ask the seminar directors or your advisor and they will help you in organizing practice presentations.

5) BASIC DON'TS

- ❖ DO NOT attempt to present a surprise ending, no matter how much fun you think it might be. Rest assured, you will lose your audience during the buildup to the surprise.
- ❖ Avoid shuffling through your notes or looking back through the figures you just showed. If you show it twice, make it twice.
- ❖ Avoid obvious speech mannerisms, such as excessive use of vestigial syllables or words (i.e., “um”, “uh”, “you know”, “like”, “so”, etc.)
- ❖ Avoid making a statement sound like a question because you raise the tone of your voice near the end of the statement (“rising intonation”). This makes you sound less confident about the statement you just made.
- ❖ Do not make up verbs from nouns. For example, there is an uptake process but not “to uptake or uptaken”; there is a flux but not “to flux or it fluxes”; there is an impact of something but not “to impact or impacted”.
- ❖ Do not point the laser pointer toward the audience!
- ❖ Try to avoid mannerisms that might distract the audience and cause them to lose concentration.
- ❖ Don't fidget with clothes, pointer, hair, or anything else on your person or equipment.
- ❖ Don't jingle the change in your pocket.
- ❖ If you must check the time, arrange to do it unobtrusively. If you look at your watch, your audience will do so as well. Since this process usually occurs near the end of the hour, there is a strong likelihood that delivery of a very important concept will be disrupted.
- ❖ DO NOT be flippant or assume the role of a stand-up comedian. Humor can be helpful, but be very careful how you use it. Display the proper respect for the audience you are addressing at all times.

☺ **Most importantly, have fun and enjoy the intellectual challenge of assimilating, presenting, and interpreting information.**

Critical analysis of data

The following comments are presented on order for you to have a working definition of what we mean by the statement of *Critical analysis of data*.

What is critical analysis and how does it differ from gathering and disseminating information?

1. Critical analysis of an experiment involves a systematic dissection of how information was obtained and how evidence was pieced together to support or refute a point of view.
2. Critical thinking about any experiment is not achieved instantaneously nor is it usually taught in classes. It is the result of continuous training and practice and a willingness to be intellectually alert and honest.
3. Critical analysis of data depends on having a large base of information, but it goes beyond that. It depends on being skilled in science, but it goes beyond mere laboratory skills.
4. Critical analysis of experiments requires the use of scientific information and skill in the laboratory to question the premises under which an experiment is performed.
5. Above all, critical analysis of experimental design and data requires a willingness or desire to reject ideas not supported by experimental manipulations.

Criteria for Demonstrating the Critical Analysis of Data

How do we determine if someone is thinking critically about an experiment? In order to do that, we examine whether the following have been accomplished:

1. A hypothesis based on existing, valid, and well-documented facts was formulated.
2. The hypothesis is internally consistent and logical.
3. The hypothesis is testable, i.e. one can design appropriate experiments to test it.
4. A clear and logical experimental approach to test the hypothesis has been chosen.
5. A precise description of all possible experimental outcomes has been presented, both those supporting and those refuting the hypothesis.
6. A clear presentation of the data has been made, including
 - Appropriate controls
 - Number of repetitions
 - Statistical analysis
 - Limits of the precision of the techniques used
 - Reproducibility and internal consistency of the measures used
7. The experimental outcome is compared to outcomes from other experiments reported in the literature.
8. A strong effort is made to provide as many alternative explanations for the experimental outcomes as possible, including explanations that may not fit or support the original hypothesis.
9. A clear description is presented of experimental design to address each of the alternative explanations, or the literature is used to effectively argue against such alternatives.

10. A cautious statement is made to accept or modify the original hypothesis or additional experimental approaches are proposed to test the hypothesis further.
11. An Outline of possible limitations of the study presented.

A Checklist for Critical Analysis and Good Reasoning

1) All reasoning has a PURPOSE.

- State your purpose clearly.
- Distinguish your purpose from related purposes.
- Check periodically to be sure you are still on target.
- Choose significant and realistic purposes.

2) All reasoning is an attempt to FIGURE something out, to settle some QUESTION, solve some PROBLEM.

- State the question at issue clearly and precisely.
- Express the question in several ways to clarify its meaning and scope.
- Break the question into sub-questions.
- Distinguish questions that have definitive answers from those that are a matter of opinion and from those that require consideration of multiple viewpoints.

3) All reasoning is based on ASSUMPTIONS.

- Clearly identify your assumptions and determine whether they are justifiable.
- Consider how your assumptions are shaping your point of view.

4) ALL reasoning is done from some POINT OF VIEW.

- Identify your point of view.
- Seek other points of view and identify their strengths as well as weaknesses.
- Strive to be fair-minded in evaluating all points of view.

5) All reasoning is based on DATA, INFORMATION & EVIDENCE.

- Restrict your claims to those supported by the data you have.
- Search for information that opposes your position as well as information that supports it.
- Make sure that all information used, including data, is clear, accurate, and relevant to the question at issue.
- Make sure you have gathered sufficient information/data.

6) All reasoning is expressed through, and shaped by, CONCEPTS and IDEAS.

- Identify key concepts and explain them clearly.
- Consider alternative concepts or alternative definitions of concepts.
- Make sure you are using concepts with care and precision.

7) All reasoning contains **INFERENCES** or **INTERPRETATIONS** by which we draw **CONCLUSIONS** and give meaning to data.

- Infer only what the evidence implies.
- Check inferences for their consistency with each other.
- Identify assumptions that lead you to your inferences.

8) All reasoning leads somewhere or has **IMPLICATIONS** and **CONSEQUENCES**.

- Trace the implications and consequences that follow from your reasoning.
- Search for negative as well as positive implications.
- Consider all possible consequences.

What You Need to Address in a Presentation or Paper

PURPOSE:	What am I trying to accomplish? What is my central aim? My Purpose?
QUESTIONS:	What question am I raising? What question am I addressing? Am I considering the complexities in the question?
INFORMATION:	What data/information am I using in coming to a conclusion? What experience have I had to support this claim? What information do I need to settle the question?
INFERENCES/ CONCLUSIONS:	How did I reach this conclusion? Is there another way to interpret the information?
CONCEPTS:	What is the main idea here? Can I explain this idea?
ASSUMPTIONS:	What am I taking for granted? What assumption has led me to that conclusion?
IMPLICATIONS/ CONSEQUENCES:	If someone accepted my position, what would be the implications? What am I implying?
POINTS OF VIEW:	From what point of view am I looking at this issue? Is there another point of view I should consider?

Three Kinds of Questions

In approaching a question, it is useful to figure out what type it is. Is it a question with one definitive answer? Is it a question that calls for a subjective choice? Or does the question require you to consider competing points of view?

- 1. One System** → **Requires evidence &** → **A correct answer** →
Knowledge
reasoning within a system
- 2. No System** → **Calls for stating a** → **A subjective opinion** →
Cannot be assessed
subjective preference
- 3. Multi System** → **Requires evidence &** → **Better& worse** →
Judgment
reasoning within
multiple systems
answer

Template for Analyzing the Logic of an Article Chosen for Presentation

1) The main Purpose of this article is

(State as accurately as possible the author's purpose for writing the article.)

2) The key question that the author is addressing is

(Figure out the key question in the mind of the author when she/he wrote the article.)

3) The most important information in this article is

(Figure out the facts, experiences, data the author comes to and present in the article.)

4) The main inferences/conclusions in this article are

(Identify the key conclusions the author comes to and presents in the article.)

5) The key concept(s) or experimental strategies we need to understand in this article is (are)

By these concepts the author means _____

(Figure out the most important ideas or experimental strategies you would have to understand in order to understand the author's line of reasoning and conclusions.)

6) The main assumption(s) underlying the author's thinking is (are)

(Figure out what the author is taking for granted [that might be questioned].)

7a) If we take this line of reasoning seriously, the implications are

(What consequences are likely to follow if people take the author's line of reasoning seriously?)

7b) If we fail to take this line of reasoning seriously, the implications are

(What consequences are likely to follow if people ignore the author's reasoning or accept an alternative reasoning?)

8) The main point(s) of view presented in this article is (are)

(What is the author looking at, and how is she/he seeing it?)

Criteria for Evaluating the Reasoning/Critical Analysis of Information in a Presentation

- 1) **PURPOSE:** What is the purpose of the reasoner? Is the purpose clearly stated or clearly implied? Is it justifiable?
- 2) **QUESTIONS:** Is the question at issue well-stated? Is it clear and unbiased? Does the expression of the question do justice to the complexity of the matter at issue? Are the question and purpose directly relevant to each other?
- 3) **INFORMATION:** Does the presenter cite relevant evidence, experiences, and/or information essential to the issue? Is the information accurate? Does the presenter address the complexities of the issue?
- 4) **CONCEPTS:** Does the presenter clarify key concepts when necessary? Are the concepts used justifiably?
- 5) **ASSUMPTIONS:** Does the presenter show sensitivity to what he or she is taking for granted or assuming? (Insofar as those assumptions might reasonably be questioned?) Does the presenter use questionable assumptions without addressing problems which might be inherent in those assumptions?
- 6) **INFERENCES:** Does the presenter develop a line of reasoning explaining well how she/he is arriving at her/his main conclusions?
- 7) **POINT OF VIEW:** Does the presenter show sensitivity to alternative relevant points of view or lines of reasoning? Does he/she consider and respond to objections framed from other relevant points of view?
- 8) **IMPLICATIONS:** Does the presenter show sensitivity to the implications and consequences of the position she/he is taking?

Points to Remember in Preparing a Seminar or a Paper

CLARITY	Should I elaborate further? Should I give an example? Should I illustrate what I mean?
ACCURACY	How can I check on that? How can I find out if that is true? How can I verify or test that?
PRECISION	Can I be more specific? Can I give more details? Can I be more exact?
RELEVANCE	How does that relate to the problem? How does that bear on the question? How does that help me with the issue?
DEPTH	What factors make this a difficult problem? What are some of the complexities of this question? What are some of the difficulties we need to deal with?
BREADTH	Do I need to look at this from another perspective? Do I need to consider another point of view? Do I need to look at this in other ways?
LOGIC	Does all this make sense together? Does my first statement fit in with my last? Does what I say follow from the evidence?
SIGNIFICANCE	Is this the most important problem to consider? Is this the central idea to focus on? Which of these facts are most important?
FAIRNESS	Is there a vested interest in this issue? Were the view points of others presented fairly?

Name of Student _____

Date: _____

INTRODUCTION (Comments should at least address adequacy of topic introduction. Was the relevance to current work and why the work was performed discussed. Were general approaches of investigation, key investigators in the field and their contributions identified.)

DATA PRESENTATION (Comments should at least address the clarity of the data presentation, student background preparation in explaining data and relevant methodology, visual clarity of figures and tables, adequacy of describing of methods/data. Were transitions between figures smooth and logical? Were interim conclusions used appropriately?)

CRITICAL EVALUATION OF EXPERIMENTAL DESIGN, ANALYSIS OF DATA AND FUTURE DIRECTIONS (Comments should at least address if student presented a discussion of strengths or weakness of experimental design and of the data, presentation of alternative explanations for the results. Were the critical evaluation and future directions intellectually creative, scientifically reasonable but obvious criticisms and next steps, trite and mundane or lacking totally.)

CLOSING STATEMENT (Comments should address the clarity and adequacy of the overall summary of the conclusions)

OVERALL KNOWLEDGE OF THE SUBJECT (Comments should address how you perceived the breadth and depth of knowledge of the presenter. Did he/she understand where this research fits in the broader field. How would you rate the overall intellectual content of the presentation?)

SPEAKING STYLE

Presence Clear and Confident Clear but not Confident Could be Improved

Mannerisms Nothing Distracting Minor Distracting Behaviors Problems

Overall Rating of Seminar _____

5 – Outstanding

Clear and articulate verbal presentation, well designed slides, well prepared, intellectually creative critical analysis

4 – Excellent

Clear and articulate verbal presentation, well designed slides, well prepared, reasonable but not novel critical analysis

3 – Good

Reasonably articulate verbal presentation, some design flaws in slides, more or less prepared, reasonable critical analysis

2 – Poor

Not very articulate verbal presentation, majority of slides poorly designed, not well prepared, mundane critical analysis

1 – Not acceptable,

Poor presentation in all aspects, requires consultation with advisor and Graduate Studies Director