BIOL324 Advanced Cell Biology

This Research-Rich Course is Funded in Part by the National Science Foundation

Fall Semester 2004-2005

Shubhik K. DebBurman

FUNDAMENTALS

Library Reference Course Guide: http://www.lib.lfc.edu/resource/bio.html
BIO324 Eukaryon E-Journal: http://www.lakeforest.edu/eukaryon

Class Hours:

Lecture:	8:00 am - 9:20 am	T-Th	Johnson 200 & Johnson 240
Laboratory:	12:00 pm- 3:50 pm	Th	Johnson 214 & Johnson 240

•Because of the course's unusual format, you will likely spend a few hours each week in lab outside of regular lab time

Instructor Office Hours:

10 am-12 noon	MWF	Johnson 201
1:00 – 4:00 pm	W	Johnson 201

•Because of the course's unusual format, I expect to spend an hour a week with each of you on an individual basis on your research project. You are highly encouraged to set up regular weekly appointments at the beginning of the semester.

Dropping in: If I am in the office and free of other duties, I'll be happy to meet with you.
If I am busy in office or in lab, please respect my non-availability and instead schedule an appointment.
Phone: 735-6040 (office), 615-2647 (home); avoid calling home after 9 pm unless emergency
email: debburman@lfc.edu

Peer Research Assistant
Ruja Shrestha'07 *email*: shresr@lfc.edu

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Peer Writing Consultant (Writing Center):
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Chris Prater'05 *email:* pratecw@lfc.edu

GOALS

Mastering Advanced Cell Biology Content

1. Strengthen essential cell biology (BIO221) by a selected focus on subset of cellular issues
2. Develop in-depth theoretical knowledge of one specific cell biology topic (pick your favorite) by delivering a classroom lecture on it
3. Within your chosen cell biology sub-topic, understand the current status of biology for a small number of genes/proteins (2-4 proteins) through synthesis of existing primary and secondary literature
4. Expand understanding of how one gene/protein potentially impacts an important cellular phenomenon (protein misfolding) by conducting actual semester-long original research at LFC

Strengthening Scientific Process

5. Improve abilities to think and work like a biologist by engaging in true scientific practice involving design, conduct, and communication of original research
6. Improve abilities for collaborative and independent research
7. Improve understanding of the scientist's diverse contributions to society
8. Improve understanding of ethical approaches to practicing science

PHILOSOPHY

Advanced Cell Biology 324 is *absolutely not* for everyone, but it is right for you. You elected this one-of-a-kind course because you are highly motivated and have previously enjoyed cell biology BIO221. You also possess an interest in graduate school in cell biology and/or doing summer research/theses in this exciting area of biology. Now, you wish to engage in a more advanced treatment of contemporary cell biology, a field that is alive with fierce scientific controversies and extraordinary ideas. This already well-studied field is experiencing a remarkable informational explosion in the post-genomic era, as we settle into this new millennium. Last year, I was awarded a $140,000 National Science Foundation grant to create this research-rich cell biology course (and similarly enrich three other courses that I teach at LFC) because NSF values your thorough and contemporary scientific training for the 21st century marketplace and for quality post-graduate programs.

In this course you will engage seriously in the art of scientific thought and the process of scientific discovery. This course does not have a prescribed textbook, but you will have access to a library of excellent reference texts. Instead, you will engage in a wide variety scientific reading and writing experiences that enable you to seep cell biology from diverse perspectives. You will learn in-depth the latest science from a variety of primary and secondary literature sources as well as the most recent cell biology text references. With my help, you will pick up a special topic and delve into the state-of-the-art knowledge for each of them taking issues to the point where we can begin to form new hypotheses and testing them through original experiments. Believe it or not: I will rarely lecture in this course: in fact, you will instruct more often than I will. Because by design this course is highly experimental, the emphasis will be on extensive laboratory-based research, you will find yourself becoming more of a true practicing biologist than in any other science course you have taken till date. You need to be prepared to spend time in lab outside class hours—you cannot engage in true cell and molecular biology research in blocks of 4 hour labs. Additionally, you will need to create time to read primary articles, research techniques and protocols and synthesize their meaning, so you can adapt them to your experiments. This endeavor can be highly intellectually stimulating: substantially sharpening your skills in critical analysis, problem solving, and technical scientific skills. One of the highlights is that you will take a model system-based approach to explore a fundamental cell biology problem (protein folding) in budding yeast (which is probably the most powerful model eukaryotic organism in science today). You will use cutting edge molecular genetic, cell biology, and biochemistry techniques to potentially discover novel findings regarding the regulation of protein misfolding.

This course has no quizzes or exams! Instead, you will further sharpen your skills to critically evaluate the merits of published materials by others and learn how to ask new and interesting questions. I will assess your learning through a series of projects, each more challenging the one before it. **First**, early in the semester, you will have an opportunity to connect with some of the most amazing minds in modern biology, those that forever transformed its face. You will read the scientific biography of one of the 20th century's most well respected Nobel laureates: *Barbara McClintock*. You will also explore in detail *Christian deDuve's* (another Nobel prize-winning biologist) provocative hypotheses and ideas on the origin of cells, life, humans, consciousness, and humanity, in *Life Evolving*! **Second**, you will demonstrate your ability to explain the biology of a defined aspect of cellular biology by giving a lecture on it. **Third**, you will narrow your focus even further and in on a family of proteins by giving a journal club on the latest papers on this family. **Fourth**, based on a published recent genetic screen that identified over 80 genes discovered to regulate the toxicity of a Parkinson's Disease protein (α–synuclein), you will choose one of these 80 proteins and explore new biology by developing a hypothesis on how it influences the misfolding of α–synuclein and write and defend a formal proposal. **Lastly**, you will carry out the actual experiments to test your proposal and convert your data in a primary article that you will present in three formats: 1) as poster at a Parkinson disease workshop on campus (so that it is ready to be presented at the 2005 LFC Student Symposium), 2) as web-based research manuscript for a new peer-reviewed LFC undergraduate research e-journal called EUKARYON, and 3) as print manuscript to a nationally known undergraduate research journal.

Ultimately, your enthusiasm will drive this course. You will have unprecedented latitude in determining where you go with your learning. This course has few boundaries and, yes, high expectations. Therefore, you will have to be extremely responsible, creative, and collaborative, yet independent throughout the semester. *My role will be to constantly fuel your thirst for more and carefully guide your explorations*. I hope you will make the most of this unusual format and fly high with the many creative opportunities with which I will evaluate you. Ultimately, I hope that with this unique exposure, you will become quite excited about postgraduate studies in cell biology or other areas of biology.

READINGS

Required Readings:

1. Life Evolving, by Christian DeDuve
2. A Feeling for an Organism, by
3. Regular Browsing of following journals of these journals during this semester:
   Science, Nature, PNAS and *Cell*. Science Nature and Cell are available in the library and in Dr. DebBurman's lab. As LFC students, you have free web access to PNAS. So you have no excuses not to access them!
4. DebBurman BIO324 Parkinson Disease Folder (kept in Johnson 240)

Available as Reference in the J-240 Teaching Laboratory:

1. Molecular Biology of the Cell, by Alberts *et al*.
2. Neuroscience, by Purves et al.
3. Human Biochemistry, by Orten & Neuhaus.
4. Genes VII, by Lewin.
5. Introduction to Genetic Analysis, by Griffith *et al*.
6. Molecular Biology of S. cerevisiae, by CSHL press (three volumes)
7. Yeast Molecular Genetics Vol II & III, by Guthrie & Fink
8. Methods in Yeast Genetics, by Burke *et al.*
9. Others…

OUT-OF-CLASSROOM PEER SUPPORT

PEER RESEARCH ASSOCIATE

This course has highly technical labs that will require your mastery. Ruja Shrestha'07 will assist me with running all the BIO324 labs. As a research associate in my research lab, Ruja is familiar with most of the techniques used in this course and I am very lucky to have her help me teach this course. She will be a good resource for each of you as you plan, execute and interpret your projects.

PEER WRITING CONSULTANT

Isaac Holmes'05 and Chris Prater'05, senior thesis students in biology and chemistry, will serve as writing tutors in the LFC Writing Center. You are required to have Isaac or Chris read drafts and final versions of all of your writing assignments in this course. As explain in "ASSIGNMENTS IN DETAIL" section, you will receive partial credit for making timely appointments with Isaac.

PEER COURSE WEB MASTER & EUKARYON CO-DESIGNER

Tulaza Vaidya'07 will help me design, create, and maintain a BIO324 website. She will also design, create and maintain an e-journal for undergraduate biology research at Lake Forest College. This new innovative in-house journal called EUKARYON will feature original research in the form of primary articles of LFC students conducted as part of courses taken during the academic year. In the inaugural 2004 issue, projects of BIO324 students will be featured. You will work with Tulaza and me to convert your print primary articles into a web-based article for this issue.

For 2004-2005, Isaac Holmes, Chris Prater, and I will serve as co-editors who will review your papers for publication.

GRADING & ASSESSMENT

1. LESSONS I DREW FROM INSPIRING SCIENTIFIC THINKERS		100
Life Evolving: Discussion & Reflections	50	
Feeling for an Organism: Discussion & Critique	50	
2. ESTABLISHING BASE KNOWLEDGE: ME As A Cell Biology Teacher		100
My Process of Preparation to Be a Teacher	50	
My Instruction Content and Presentation Effectiveness	50	
3. GETTING TO THE FRONTIER: ME As Expert Of Highly Specialized Field		100
In vivo, The BIO324 Journal Club		
4. FORGING NEW CONNECTIONS: ME As a Competitive Innovative Thinker		200
My Written Proposal	100	
My Oral Defense	100	
5. EXPLORING THE FRONTIER: Me As A Careful Experimental Cell Biologist		450
My Experimental Skills & My Research Conduct	75	
My Ability to Maintain Records	75	
My Parkinson Research Symposium/LFC Student Symposium Poster	100	
My First Primary Article		
Print Format for a National Undergraduate Science Journal	100	
Web Format For *EUKARYON*, The New LFC Science E-Journal	100	
6. EXPLORING THE CURRENT: Me as A Conscientious Up-To-Date Scientist		
50	5 In-Class 5-minute Summaries of Cell Biology Articles Published in Fall 2004	
		1000
7. BONUS		
My Overall Process of Advanced Cell Biology Learning		Up to 50

SCALE

A = 90% or more
B = 80-89%
C = 70-79%
D = 60-69%

I reserve the right to introduce a curve at my discretion, but in three years of past teaching I have rarely deviated from the above scale. Importantly, I expect junior and senior students to approach this class from a more altruistic mindset. Use this course as an opportunity to exercise your mind and to learn something new yourself and not get "hung up" on how well your learning relates to a letter grade or the demanding workload.

EXPECTATIONS

Academic Honesty:
I have zero tolerance for abuses. Please consult your student handbook regarding academic honesty and the honor system by which you should conduct yourself. Please check your student handbook for more details.

One Relevant URL: http://www.lakeforest.edu/academics/writing/plag.asp

Attendance:

Philosophy: I will work hard to present to you the most up-to-date and complete information in neurobiology in a lucid and interesting manner. In return, I expect that you will regularly attend my lectures and actively participate in the classroom, lab, and assignments. Invariably, in each lecture, I will present material that textbooks and handouts may not cover. I will assume that you have read your assignments prior to class so that you can best engage in an informed classroom discussion and gain maximum benefit from my lectures. If you skip class, you will miss out both on valuable new information and possibly an interactive dialog.

Punctuality: My pet peeve is when students arrive late to class. Apart from being disruptive to my teaching efforts, it is also disrespectful of the class.

Absences: Unexcused absences from quizzes, exams, and labs will result in an appropriate loss in points. Health-related absences must be confirmed by student health services. Absences due to religious observations must also be made in advance. Family or other personal emergencies will require notification from the Dean of College's office. I will make every effort to reschedule a missed quiz/exam as a result of such excused absences.

Late Assignments: I strongly discourage of assignments being handed in late. AVOID THIS INDULGENCE. Each late day is a 25% deduction in points. No assignment will be accepted after the third day it is due.

Lastly, But Not In The Least:

While advanced cell biology is a new course at LFC, it has been tremendously successful when I taught it twice before at a similar liberal arts college. All its past graduates are pursuing MD or PhD programs. I am delighted that you are taking this course. Because I am always experimenting with new ways of teaching science to advanced undergraduates, I will push you more than you expected. But, I expect that you will push me just as hard! If you encounter problems understanding the material, please do not hesitate to talk with me. My job here is *to help you learn*. Your feedback and participation in class is very important. I welcome suggestions from you regarding every aspect of the course throughout the semester. Of course, at the end of the semester, the college will require you to formally evaluate my performance. I will look forward very much to that because your comments will help me improve in my quest to be the best teacher I can be and to engage you in superior learning. Remember also that I am here to learn from you. I have often found my students to be my most important teachers. So, I hope this course will be a rewarding experience for all.

ASSIGNMENTS IN DETAIL

1. LESSONS I DREW FROM GREAT SCIENTIFIC THINKERS 100

Life Evolving: Discussion & Reflections	50
Feeling for an Organism: Discussion & Critique	50

Textbooks are not the only sources of scientific "facts", "theories", and "hypotheses". Science is conveyed to the public via many other formats: popular magazines, essays, nonfiction books, biographies, autobiographies, TV, and the movies. In fact, the public seldom appreciates the undeniable excitement underlying scientific discoveries from textbooks. Some of our deepest thinkers today are scientists and they have led truly extraordinary lives; many are also great writers and storytellers. The two non-fiction books assigned in this course will hopefully engage you in discovering the true essence of great scientists: exciting lives, personal sacrifices, remarkable discoveries, brilliant minds, difficult societal issues.

FEELING FOR AN ORGANISM: This extraordinary biography about an extraordinary scientist is absolutely a treat for any student of science. Only a handful of women have won Nobel Prizes in Science: only one has won this prize solo for physiology and medicine: Barbara McClintock. She proposed and discovered transposable elements (jumping genes) as she sought to understand the genetics behind changing corn kernels. A discovery that was ignored for 20 years and yet one that was later found universal to higher genomes and a remarkable mechanism. Today transposable elements have become one of the most powerful tools in biotechnology. This compelling biography captures the genius and humanity of Barbara McClintock—her courage to stand scientifically firm when few believed her ideas and her exceptional scientific intellect. We will discuss this book from these perspectives: how a scientist contributes to knowledge over a career, how intellectual mysteries are solved through unexpected discoveries and insight, the importance of collaboration, mentoring, interdisciplinary approach, the roles of ambition, ethics, politics, gender in shaping scientific discovery and careers.

Discussion Day: September 2, Thursday, Week 2

To earn your 50 points, bring completed discussion sheet to class and participate actively . Discussion provided to you during syllabus workshop (first day of class).

LIFE EVOLVING: Christian DeDuve is Nobel laureate in Physiology & Medicine in 1974 for seminal discoveries of several intracellular organelles, including the lysosome. This is his latest book and is already being considered a *tour de force* in scientific literature, an extremely imaginative and literate examination of how the cell evolved and how this understanding may be key to our comprehension our life's origin. He also offers explanations on the origin of language, consciousness, and what it means to human. Of course, DeDuve's argument is a hypothesis, albeit, from the commanding perspective of the author. It is important that you note that definitive proof does not exist for many of his ideas. Regardless, I hope that you will find it stimulating to connect with one of the most brilliant and engaging minds in 20th century biology. We will spend two weeks reading this book and I hope you will actively participate in classroom discussions by being prepared.

Discussion Day: Weeks 3 & 4

Week 3	Tuesday	Ch 1-5
	Thursday	Ch 6-9
Week 4	Tuesday	Ch 10-14
	Thursday	Ch 15-18

To earn your 50 points, submit one-page (300 word max) reflections for assigned readings each discussion day and actively participate in discussion. Details about these reflection assignments forthcoming.

IMPORTANT NOTE FOR PROJECTS 2-5

You will work in Pairs, unless Dr.D assigns otherwise. The same pair will conduct all of these projects since they are interrelated and build on each other. All projects are based on the protein you will choose to work with on your experimental research based on the Parkinson Disease journal club Dr.D presents during the second week of class.

2. ESTABLISHING BASE KNOWLEDGE: ME As A Cell Biology Teacher 100

My Process of Preparation	50
Instruction Content and Presentation	50

One of the best ways to learn material in-depth is to have first-hand experience in teaching your peers. I will provide four lecture hours during weeks 5 and 6 for each pair to present a 80 minute instructional experience (lecture, if you will) on a cell biology sub-topic. This topic will be related to your journal club, proposal and original research projects. Your task is to become the expert of your chosen topic. I completely accept that teaching by lecture may not be the best method for you, as there all kinds of ways to effectively teach. You should think hard about how you want to teach your classmates. For inspiration, think of the teachers at LFC whose styles you like most and try and adapt their methods to your plan. Think of what you don't find effective about what your teachers do when they teach, and try other things! I always look for ways to improve my classroom style, and I would be happy to pick some pointers from you. To create your lesson plan in a timely manner, follow the suggested schedule I have developed below. Make sure to include in your lesson plan, the use of multiple sources (including multiple textbooks) and the use of multiple communication styles (for example: chalk and board, overheads, PowerPoint, group discussion, props, others). Also integrate into your lesson the some recent advances (if you are smart, you will double dip into papers you are using for JC and your research proposal). Make as many appointments with me as necessary, if you need my advice. I want you to succeed and feel confident. But, avoid last minute sessions. You must practice your class teaching presentation in front of your instructors at least two days before the presentation. This peer practice is all-important.

Suggested Schedule

Topic selection	Week 2	
Bibliography	Week 3	
Lesson Plan	Week 4	
Practice session	At least two days before actual day and in front of peer instructors to receive 15 points	
Actual instruction	Weeks 5 & 6	Tuesday and Thursday lecture time

3. GETTING TO THE FRONITIER: ME As Expert Of A Highly Specialized Field 100

In vivo, The BIO324 Journal Club

New science is communicated in a variety of ways, all of which are clumped together as "primary literature". At first glance, reading such papers can be daunting and often discouraging, because they are highly technical and require extensive background information. A primary goal of this course is to help you overcome such initial barriers in reading primary papers. As you have already learnt from BIO221 or from other biology courses, a journal club is a presentation format in which primary literature is discussed with an informed audience in an exciting engaging informal manner. The class will be divided into pairs. You must select 2-3 papers that provide the latest insight into the protein family (ideally papers published 2003-) that you wish to delve into for your research proposal/long-term original experiment. Each pair should meet with me on the requested to talk about your selected journal club papers. This meeting is to orient you with the papers and give you sufficient background information on your topic.

Suggested schedule

Topic & paper selection	Week 2	Consult with Dr.D
Supporting Bibliography	Week 3	Consult with Dr.D
Reading & PowerPoint Prep	Week 3-6	One Hour Meeting with Dr,D by Week 4
PowerPoint Practice	At least 2 days before presentation For 25 immediate points	
Actual JC presentations	Weeks 7 & 8	Tuesday and Thursday lecture time

Ask Dr.D for JC grading sheet and samples of excellent JCs from the past

4. MAKING NEW CONNECTIONS: ME As a Competitive Innovative Thinker 200

My Original Written Proposal	100
My Oral Defense	100

I. MY ORIGINAL WRITTEN PROPOSAL

Research is central to scientific exploration and discovery. A research proposal is a formal presentation of ones' ideas for future research. Such proposals are founded on past and present research. Most successful proposals have the following qualities: an exciting original idea, an ability to create new fields or integrate existing fields, logical and exceptional communication of ideas, a plausible experimental plan, and a clear relevance to the human condition. Proposals are usually written to attract funding to sustain one's research; without funding, research is impossible.

In this project, your pair will delve deeper into the biology of the JC protein family by selecting the protein that was on the original genetic screen paper I present for journal club on week 2. I would pick a protein that really strikes your fancy and long-term interest. Ideally, an original proposal would be written individually. But, because of the limited time frame in which you have to accomplish this task and because this will be your first time writing a research proposal, it will be much more productive for you to attempt this in pairs. Having said that, I expect members of each group to contribute fully and equally to each proposal. Your cell biology lecture and your journal club projects will help you to understand the background and significance of your proposal. You already know that absence of your protein can contribute to α-synuclein's toxicity to yeast. But what is not known is why and how. Based on your background reading, propose a testable hypothesis to explain this missing link and develop specific aims to answer the questions that can help test your hypothesis. Your final proposal (due Week 10) should be no more than 10 pages long, single-spaced. It should contain the following sections: Summary, Specific Aims, Background, Experimental Rationale/Methods, Expected Results, Timeline, and References. Reference list should contain between 20-40 referenced papers. You will also be encouraged to provide figures of expected results.

25 points reserved for <u>two</u> consultations with writing consultant on proposal draft and final versions during the recommended weeks. Late consultations will not receive credit.

II. MY ORAL DEFENSE

One week after you have submitted your proposal, each pair will present their proposal formally in front of peers and invited faculty in a public defense. You will use PowerPoint to deliver a 30-minute presentation followed by a 10 minute Q&A session. Your performance will be graded by your peers and by invited faculty. You are expected to "defend" your proposal and explain your rationale, technique, and expected results. You are also expected to come up with alternate experiments and provide the pros and cons of such strategies.

25 points are reserved for practicing in front of peer support at least two days before defense.

•<u>Use Sample Research Proposal, Sample Defense PowerPoint, and Grading Sheets to guide your success</u>

Suggested Schedule:

Topic Selection:	Week2
Bibliography:	Week 3
Specific Aims:	Week 4
Outline:	Week 5
First Draft:	Week 7
Final Draft:	Week 9
Defense:	Week 10

5. EXPLORING THE FRONTIER: Me As A Careful Experimental Cell Biologist 450

My Experimental Skills & My Research Conduct	75
My Ability to Maintain Records	75
My Parkinson Disease Research Symposium Poster	100
My First Primary Article	
-Print Format for a National Undergraduate Science Journal	100
-Web Format For *EUKARYON*, The New LFC Journal	100

This is your capstone project and deliberately and justifiably worth nearly 50% of your grade. The major goal and focus of this course is to provide you a first-rate and real experience as a practicing experimental biologist. As advertised and promised, you will conduct original cutting edge research and attempt to expand the horizon of knowledge and discovery. You will spend at least 50% of your time designing and conducting experiments, recording data, interpreting your results and writing up on your observations for in-house and national publication, and in print, web and poster formats.

Starting from week 1 of this semester, you will begin your journey as a scientist. Initially, the first ten weeks of labs will be designed to introduce you to various techniques that my research lab routinely uses for student projects, each of which is designed to generate original and unpublished data. Minimally, even these 10 weeks of experiments will provide you with several chances to design well-controlled experiments. But, in the four weeks, you have the opportunity to make this an exceptional semester by designing and conducting a second leg of experiments (your own independent project, if you will) based on your research proposal/or as investigation of new hypotheses you propose based on your initial data.

Essentially, your research is an extension and examination of two 2003 Science papers that described the first yeast model for α–synuclein misfolding and the discovery of over 80 genes that regulate its cellular toxicity. α–synuclein causes Parkinson Disease and the ~80 genes discovered to impact it have little to no previously established scientific connection with it. Your experimental research will attempt to provide an explanation for this regulation and establish cellular connection between the 2003 discoveries and what has been known about these 80 genes till date.

Planned Schedule:

Week 1: Prepare control and a-synuclein Plasmid Vectors
Week 2: Confirm that a-synuclein is present in the plasmid vectors
Week 3: Transform control yeast strain and your favorite knock out strain with vectors
Week 4: Confirm that yeast contain these vectors
Week 5: Express proteins and make lysates
Week 6: Electrophoresis of proteins and Transfer to blotting paper
Week 7: Western Blotting
Week 8: Yeast viability: OD-600 & Spotting
Week 9: Green fluorescent protein (GFP) microscopy
Week 10: GFP Microscopy
Week 11: Complete Experiments/Pursue Independent Project
Week 12: Complete Experiments/Pursue Independent Project
Week 13: Complete Experiment/Pursue Independent Project
Week 14: Print-based Primary Article Due
Week 15: Web-based Primary Article Due
Week 16: Poster Due for Parkinson Disease Poster Symposium

Important: Few of these labs above will be completed during the 4-hr Thursday lab. These are simply experiments that need to be done that week. Some steps can be done during the lab time, but you will need to plan each lab one week ahead of time so you can schedule other times for completing lab. Weekly consults with Dr. D and /or Ruja will really help you make this a manageable and successful experience.

My Experimental Skills & My Research Conduct: By completing all experiments with technical competence, using all correct controls, and in an ethical, responsible fashion, you will earn up to 100 points. Also consult lab commandments in lab manual to know what I consider lab conduct. Any student from the DebBurman or Kirk Lab that is taking this course can also help those not in these two

cell/molecular labs with simple tips on establishing proper experimental skills and conduct. Please also see the BONUS section (next section) for other expectations that impact these points.

My Ability to Maintain Records: By keep a thorough, up-to-date and well-detailed lab notebook to earn another 100 points. In this course, your lab notebook will be viewed as your most prized possession in science. Your peers and I should be able to read and understand your notes and be able to repeat your experiment based on just that information. The success of that happening will depend on lucid and complete documentation of your work. You will maintain a lab notebook that you will bring to each lab period and I have high expectations that you will keep an up-to-date, well-indexed lab notebook. Twice during the semester, I will collect notebooks from you and grade them for clarity, record keeping, and completeness. *For more details on keeping a lab notebook, see the lab manual.* Again, any student from the DebBurman or Kirk Lab that is taking this course can also help those not in these two cell/molecular labs with simple tips on establishing proper experimental skills and conduct. Your peer research associate (Ruja) is an outstanding resource as well.

My Parkinson Disease Research Symposium Poster: Your well-designed and scientifically well-communicated poster is worth 100 points. Instead of a Final Exam, we will conduct a research poster symposium on Parkinson Disease during exam time, Finals week. I will provide you detailed instructions on how to present an effective and accurate poster, both visually and orally. You are expected to prepare a 20-minute presentation of your poster. Biology department faculty (Kirk, Houde, Light, Darnell, Gordon, and DebBurman) has displayed several student posters near our research labs. Use these posters as examples to create your work. *If you practice your poster in front of BIO324 peers at least two days before presentation day, you will receive 25 points.*

My First Primary Article: One of the true highlights of this course is that your science scholarship will be submitted for national-level publication (and if you did an exceptional job, you may even receive favorable review and get published!). Your work will be featured in the inaugural issue of a brand new cell biology undergraduate research journal called EUKARYON that we will publish from Lake Forest College this fall. You should take great pride in such professional outcomes associated with your hard work in the classroom. They will add significant growth and stature to your professional development.

Print Format for a National Undergraduate Science Journal: I will assign each pair to write their papers for a specific national undergraduate research journal. We will choose from: BIOS, American Journal of Undergraduate Research, SYNAPSE, and the Journal of Young Investigators. You must understand that you need to start writing this paper much before you complete all experiments. Just about all scientists do this! Strict journal-specific formatting must be followed for drafts.

Suggested Schedule:

Bibliography:	Week 10
Outline:	Week 11
First Draft:	Week 12
Final Draft:	Week 14

If you consult with Isaac or Chris at the Writing Center during first and final drafts, you will automatically receive up to 25 points.

Web Format For *EUKARYON*, The New LFC Undergraduate Research E-Journal: Tulaza Vaidya and I will co-design and create this e-journal during the first half of this semester. We will provide you submission instructions after fall semester break. We will train you to used the web page making program Dreamweaver through a couple of workshops. You will convert your primary article into web-friendly drafts and work with Tulaza to help achieve a professional format.

Suggested Schedule:

Bibliography:	Week 10 (same as for print)
Outline:	Week 11 (same as for print)
First Draft:	Week 13 (language same as for print)

Final Draft: Week 15 (language same as for print)

If you attend Tulaza's initial and consult with her during first and final drafts on web formatting you will automatically receive up to 25 points.

6. EXPLORNG THE CURRENT: Me as A Conscientious Up-To-Date Scientist 50

Five In-Class 5-minute Summaries of Cell Biology Articles Published in Fall 2004

You are expected to browse cell biology articles in each issue of *Nature, Science, PNAS,* and *Cell* this semester. My research lab and the College subscribe to print issues of Nature, Science, and Cell and the College also provides you free online access to PNAS. I expect student to volunteer five In-Class summaries of interesting cell biology articles they find most interesting. These summaries can be made either be during lecture or lab times and any time during the semester. No more than two summaries can be presented on any given day. If you wish to present a summary on a particular day, please give me notice of at least two days so I can schedule you in.

7. *BONUS:* MY PROCESS OF ADVANCED CELL LEARNING (5%)

How you learn is just as important as what you learn. You have been asked to master challenging projects in this course that requires you to develop abilities to work well each other and juggle several projects simultaneously. I have provided several teaching supports that should help you maximize your learning efficiently. If you excel at demonstrating positive learning habits, collaborative ability, and use all the placed resources well, I will be happy to award you up to and all of 50 process points.

You have demonstrated positive intellectual attitude if you
Were attentive and participated actively in class and lab and pushed me to be even more effective
Were prepared ahead in readings and were not absent or late for class, labs, or meetings
Demonstrated curiosity and creativity in your assignments: stepped "out-of-the-box"
Showed personal initiative and leadership (plenty of scope to do so in this class)
You have used resources effectively if you
Did not miss appointments with me and did not wait till the last minute to work on assignments
Consulted regularly with your peer instructional support when you needed advice or help
Used Writing Center for feedback on all papers
Practiced your talks in front of peers
You have collaborated well if you
Contribute equally to developing each project from beginning till end
Participate equally in writing papers and in presenting each talk
Provided support for your group/pair members if they needed it
Did not complain about each other and tried to solve conflicts by talking to each other
Maintained healthy collegiality and supported class students by enthusiastic participation in their efforts

BIOL324 Advanced Cell Biology

This Research-Rich Course is Funded in Part by the National Science Foundation

Fall Semester 2004-2005

Shubhik K. DebBurman

COURSE SCHEDULE

WEEK	DATE		LECTURE TOPIC	LAB TOPIC	MEETINGS/DEADLINES
1	8/26	Th	**Syllabus Workshop**		Individual Meeting by FRI
	LAB this week			Plasmid Preparation Making Plates, Media, Solutions	Make pairs for projects
2	8/31	T	Parkinson Disease Journal Club: Dr.D		Pairs Meeting To Discuss
	9/2	Th	*Feeling For Organism* Book Discussion		BIO324 Project Topics (By WEI
	LAB this week			Plasmid & Whole cell PCR Making Plates, Media, Solutions	
3	9/7	T	*Life Evolving* Discussion Ch 1-5		Bibliography for JC &
	9/9	Th	*Life Evolving* Discussion Ch 6-9		Research Proposal FRI
	LAB this week			Transform Plasmids into Yeast	
4	9/14	T	*Life Evolving* Discussion Ch 10-14		Read JC papers with Dr.D
	9/16	Th	*Life Evolving* Discussion Ch 15-18		
	LAB this week			Screen & Whole Cell PCR	
5	9/21	T	**Student Lecture I**		Proposal Outline FRI
	9/23	Th	**Student Lecture II**		
	LAB this week			Protein Expression & Lysis Preparation	
6	9/28	T	**Student Lecture III**		Proposal Outline return
	9/30	Th	**Student Lecture IV** (optional)		
	LAB this week			Protein Electrophoresis & Transfer	
7	10/5	T	***In Vivo* Journal Club 1**		Research Proposal Draft Due FR
	10/7	Th	***In Vivo* Journal Club II**		
	LAB this week			Western Blot II	
8	10/12	T	***In Vivo* Journal Club III**		Proposal draft return
	10/14	Th	***In Vivo* Journal Club IV** (optional)		**Lab Note Book Grading 1**
	LAB this week			Spotting & OD-600	

F A L L B R E A K

9	10/19	T	F A L L B R E A K		
	10/21	Th	Lab Prep Hour		
	LAB this week			GFP microscopy	**Proposal Final Due** FRI
10	10/26	T	**Defense I & II**		
	10/28	Th	**Defense III & IV** (IV is optional)		
	LAB this week			GFP microscopy	Primary Article Biblio Due FRI Web Workshop (Tulaza)
11	11/2	T	Flex Time		P Article Outline Due FRI
	11/4	Th	Flex Time		Begin Web Training w/Tulaza
	LAB this week			Complete Experiments/Pursue independent projects	
12	11/9	T	Flex Time		P Article- Print Draft Due FRI
	11/11	Th	Flex Time		
	LAB this week			Complete Experiments/Pursue independent projects	
13	11/16	T	Flex Time		P Article-Web Draft Due FRI
	11/18	Th	Flex Time		
	LAB this week			Complete Experiments/Pursue independent projects	
14	11/23	T	Flex Time		**P Article-Print Final Due FRI**
	11/25	Th	Flex Time		
	LAB this week			Complete Experiments/Pursue independent projects	
15	11/30	T	Flex Time		**P Article-Web Final Due FRI**
	10/2	Th	Flex Time		**Lab Note Book Grading 1I**
	LAB this week			Complete Experiments/Pursue independent project	
16	**FINAL EXAM TIME**			**PARKINSON DISEASE RESEARCH POSTER SYMPOSIUM**	