

**BIO221 CELL & MOLECULAR BIOLOGY**  
**Spring Semester 2004-2005**  
**Shubhik K. DebBurman**

**GENERAL**

**Peer Teachers:** Sara Herrera'05 ([herresk@lfc.edu](mailto:herresk@lfc.edu)) LECTURES ONLY  
Arun Paul'05 ([paulag@lfc.edu](mailto:paulag@lfc.edu)) Tuesday Lab Assistant  
Tammy Hibler'05 ([hibletl@lfc.edu](mailto:hibletl@lfc.edu)) Thursday Lab Assistant

**Writing Consultants:** Christopher Prater'05 ([pratecw@lfc.edu](mailto:pratecw@lfc.edu))  
Isaac Holmes'05 ([holmeif@lfc.edu](mailto:holmeif@lfc.edu))

**Library Research Guide:** <http://www.lib.lfc.edu/resource/bio.html>

**Class Hours:**

Lecture:	8:00-9:20 AM	T-Th	Johnson 200	DebBurman
Lab:	12:00 – 3:50 PM (Section I)	T	Johnson 215	DebBurman
	12:00 – 3:50 PM (Section II)	Th	Johnson 215	DebBurman

**Office Hours:** 8 am – 10 am M-W-F Johnson 201

*Dropping in:* If I am NOT BUSY, I'll gladly meet with you.

If I am busy, please respect my non-availability. E-mail is the easiest way to contact me.

**Ph:** 735-6040 (Office); 615-2647 (Home; please avoid calling after 9 pm).

**Email:** [debburman@lfc.edu](mailto:debburman@lfc.edu)

**LEARNING GOALS**

**SCIENCE CONTENT**

1. Understand why and how cells are the units of life and why you should care about cells
2. Appreciate that cells hold the key to both human health & human disease

**SCIENCE PROCESS**

3. Increase student engagement in the world of contemporary biology research
4. Increase student understanding of the scientific discovery process and how to think scientifically
5. Increase student ability to communicate science effectively both orally and in written form
6. Increase student ability to collaborate with peers and integrate individual talents

**CONTEXT**

Cell & Molecular Biology is one of the most exciting disciplines in life sciences today. For the first time, complete genomes (every single gene and more!) from several simple organisms to humans are known, and new ones are being decoded every other month. The scientific community has forged ahead at breathtaking pace to unravel the functions of hundreds of proteins that these genes encode and how such functions contribute to life and biological diversity. Cell & Molecular Biology has never been more on the edge of an information explosion.

All living organisms are made up of one or more cells. What then makes a cell? How does it propagate life? How and why does it exist in such multiplicity of form and function? How does it make life as simple as bacteria, and as complex as human beings? Importantly, because all diseases likely involve cellular dysfunction, our understanding of normal cell function is central to developing drug therapy and combating disease. Thus, the study of cells at the molecular level is central to all biology.

With such rapid advances, the task of teaching cell & molecular biology is challenging. To teach it in depth in a single course is almost impossible. Therefore, I have intended this course to be a first comprehensive step to your understanding of cell & molecular biology. It is also meant to be your door way for further explorations into other fields: molecular biology, biochemistry, genetics, development, evolution, physiology, immunology, neurobiology, and medicine, just to name a few. Even those of you who are particularly interested in field ecology and environmental studies will gain a new way of understanding about organisms that make up our ecosystem. I hope you will appreciate that cell & molecular biology is still an evolving nascent field. Its progress has been fueled as much by intellectual

biochemistry. In the past 50 years, cell biology has undergone a second, even more remarkable metamorphosis with the coming-of-age of molecular biology, biophysics, and more recently, information technology.

In this course, we will seek to understand the function of cells from each of these perspectives, realizing that boundaries separating them are becoming increasingly blurred. An equally important course goal is to sharpen your skills in recording, interpreting, and communicating scientific observations and becoming familiar and comfortable with reading scientific literature. Special emphasis will be placed on effective writing and oral presentation skills. Ultimately, I hope you will leave this course with some sense of enlightenment about life's processes and with a curiosity about how we (living things) do what we do.

## READINGS

1. DeBurman Lecture Packets: You will need to buy two lecture packets (PRE-MIDTERM & POST-MIDTERM). These are a collection of my overhead transparencies that I use to engage you in my classroom. Past students have found them invaluable in studying for GREs and MCATs even after this class is over—so they are a good investment of your money.
2. Primary Textbook: “**Essential Cell Biology: An Introduction to the Molecular Biology of The Cell**” by Alberts, *et al.* This relatively new 1998 textbook is designed to serve as a comprehensive introduction to the study of cells. It is meant to be a more manageable and succinct version of a previous Alberts *et al* textbook (which remains the most authoritative cell biology textbook to date and a good reference for your desk and has been placed on the Cell Bio DeBurman Reserve in Johnson 215). As with all new textbooks, this one has its flaws that will be improved in future editions. Nevertheless, it is well designed, contains lucid graphics, and is straightforward to read. It comes with a must-see CD-ROM that has truly excellent images and videos of living cells.
3. Secondary Textbook: “**The Double Helix: A Personal Account of the Discovery of the Structure of DNA**” by James D. Watson. Watson needs no introduction. He happens to be a co-author of your primary textbook. Some of our deepest thinkers today are scientists and they have led truly extraordinary lives. Often, well-known scientists are also great writers and storytellers. This autobiographical account of one of the profound scientific discoveries of all time is infamous as much for historical record as it is for irreverent storytelling of the lives & relationships of scientists, and the politics of science. I hope this delightful read will provide you with an intensely human and scientifically extraordinary landscape surrounding the most celebrated biological milestone of the 20<sup>th</sup> century.
4. BIOL221 Laboratory Manual: You will receive your lab manual on the first day of class.
5. Primary Paper Readings (Johnson 215) This reserve packet is also available to you via the on-line (go to forster BIO221 course site and click on PRIMARY PAPER READINGS). Papers 1-3 are required readings for all. To obtain publication quality PDF copies of all papers, I recommend that you print electronic PDFs. You will do a group journalism project on one of these papers and your group will formally present the paper in a student journal club (see later sections in syllabus) and this will lead you to a disease project as well. Together, these papers serve *at least* three important purposes:  
One, they introduce you to the most important channel by which the scientific community presents its discoveries to the world.  
Two, I focus your attention on some of today's hottest & cutting-edge cell biology topics with these readings.  
Three, the readings supplement topics that are less well covered by the textbooks.
6. Cell Biology books in DeBurman Reserve (Johnson 215)
  - Molecular Biology of the Cell, by Alberts *et al.*
  - Cell & Molecular Biology, by Gerald Karp
  - Molecular Cell Biology, by Lodish *et al.*
  - The World of the Cell, by Becker, Reece & Poenie.
  - How to Write and Publish a Scientific Paper, by Robert Day.
  - Pathological Basis of Disease, by Cotran, Kumar, Robbins.
6. Excellent Cell Biology Scientific Journals Available at our Library
  - Cell ([www.cell.com](http://www.cell.com))
  - Nature ([www.nature.com](http://www.nature.com))
  - Science ([www.sciencemag.org](http://www.sciencemag.org))
  - Journal of Cell Biology ([www.jcb.org](http://www.jcb.org))
  - Proceedings of the National Academy of Sciences USA ([www.pnas.org](http://www.pnas.org))
  - Journal of Biological Chemistry ([www.jbc.org](http://www.jbc.org))

## PHILOSOPHY

**Attendance:** I work very hard to present to you the most up-to-date and complete information in cell biology in a lucid and interesting manner. In return, I expect that you regularly attend my lectures. Invariably, in each classroom session, I present material which textbooks and handout readings do not cover. I will also assume that you will 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. Quizzes and exams will cover information provided via lectures, textbooks, and the required primary readings 1-3.

**Punctuality:** My pet peeve is when students arrive late to class or lab (especially, if such behavior is repetitive). Apart from being disruptive to my 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 must be corroborated by the student health service or your doctor. Absences due to religious observations must be also be made in advance. I will make every effort to reschedule a missed quiz/exam as a result of such excused absences. It is more difficult to make up labs. But when possible, excused lab absences will be rescheduled. If impossible, I will find a way for you to make up your work and receive your points.

**Late Assignments:** I strongly disapprove of assignments being handed 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. This policy will be strictly enforced.

**Academic Honesty:** Zero tolerance for abuses. The Lake Forest College policy for academic honesty can be perused in the college home page @ <http://www.lfc.edu/services/writing/plag.html> or in your student handbook. I strongly encourage you to read this policy. I will be happy to clarify any issue that arises from your understanding of this policy, or lead you to the person who can best do that.

**Lastly, But Not In The Least:** I will likely push you more than you expected in this course. But, my guess is that you will push me just as hard! You will be engaging in many new types of learning and you will feel challenged at times. If you have 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. At the end of the quarter, the college will require you to formally evaluate my performance. I will look forward very much to that because your comments help me tremendously to improve the quality of your learning and effectiveness of my teaching. I am here as much to learn from you as to teach you. So, I hope this course will be a rewarding and enjoying experience for all.

## GRADING

### Basis:

#### Lecture (50%)

Four Take Home Quizzes (30 points each)	120 points
Midterm Exam	200 points
Final Exam	150 points
Watson Discussion	30 points

#### Laboratory (25%)

Laboratory Notebook Assessment 1	50 points
Laboratory Notebook Assessment 2	100 points
Lab Report as a Primary Article	100 points

#### Group Experiential Projects (25%)

Research Journal Club	75 points
Disease Review Article	67.5 points
Disease Symposium Seminar	67.5 points
<b>Resource Use &amp; Collaboration Points</b>	50 points

### **Total**

**1000 points**

+ ***Bonus Points: Up to a Maximum of 25 points! (explained later)***

### Scale:

A	90-100
B	80-89
C	70-79
D	60-69
F	below 60

In the past 4+ years, I have NOT used a curve. In that rare event, a student will not get a grade less than that expected by the above scale.

### **Cell Biology Peer Teachers**

I have taught this course eight times and seen over 200 students succeed; no one has yet failed despite the course being perceived as quite challenging and requiring high work ethic. Seven such times, I have employed peer teachers. Four of these times student participation in peer teacher sessions and workshops was analyzed: the average class performance was significantly higher for those students who attended peer teacher sessions. More importantly, students who attended peer sessions on average did better than those who did not. Peer teacher sessions are not remedial; they are meant for everyone. Students who perceived themselves as stronger were just as active participants and benefited just as much as students who thought themselves to be weaker.

I could not have selected three better-prepared & motivated students than Sara, Arun, and Tammy to be your peer teachers. They have succeeded in my classroom in outstanding fashion. They understand my expectations and have thrived in my approach to teaching. With their strong biology background and genuine enthusiasm in helping you do your best job, it becomes your responsibility to make use of their talents in the classroom, in lab, and in projects, and flourish.

### **Cell Biology Writing Consultant**

This is a writing intensive course. You will write two substantial research-driven papers: one primary article (based on lab experiments) and one research review (literature review of a field). Each paper has its own specific style. I selected your Writing Center Consultants (Chris and Isaac) because of their obvious talents and interest in science writing and in peer editing. You are expected to consult Chris and Isaac (if you are unable to schedule a convenient time, then you may schedule an appointment with any of your peer teachers, who too have excellent writing skills) on each writing assignment and get your papers edited at least once before final submission.

## COURSE PARTICULARS

### A. EVALUATION BASED ON LECTURE

#### I. Quizzes (120 points)

Four take-home quizzes worth 30 points each will be administered on specific Thursdays covering specified topics. Each quiz is due the following Monday at 8 am. Late quizzes not accepted. While you may consult with each other on quiz questions, you must write your answers individually. Quizzes will comprise of objective questions and/or short answers.

#### II. Exams (350 points)

The midterm and final exams are each worth 200 and 150 points each. They will cover material presented in lecture and in your main textbook. The midterm covers everything up to the lecture before midterm (chapters 1-7 in textbook). The final covers everything from the lecture after midterm (chapters 11-12, 14-18). Each exam will also have a take-home component consisting of problem-solving open book questions and you will get a few days to answer this part.

Samples of one old quiz, one midterm and one final exam will be available on forester pipeline homepage.

#### III. Watson Discussion (30 points)

During week 4 of the course, you will discuss Watson's Double Helix in class within your lab groups. You will prepare for this discussion by completing your discussion prior to class and handing it to the instructor after the discussion. The pre-class discussion sheet is worth 20 points and the quality of your written in-class summary thoughts during and after the discussion is worth 10 points.

### B. EVALUATION BASED ON LABORATORY

#### What you need:

- Cell biology laboratory manual will be provided to you on the first day of the course. This lab manual contains all that you will need for all experiments performed in this course. Additionally, it provides specific guidelines on how to
  - (i) keep a thorough notebook
  - (ii) write a formal lab report in the form of a primary article
- Cell biology laboratory notebook

#### I. Lab Notebook Grading (150 points):

*You have probably never been graded for keeping a biology lab notebook before.* 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.*

Lab Notebook Grading One (based on labs 1-2)	50 points	(see lab schedule for due dates)
Lab Notebook Grading Two (based on labs 3-5)	100 points	(see lab schedule for due dates)

#### II. Primary Research Article (Formal Lab Report) Grading (100 points):

Finally, each pair will be graded on only one combined laboratory report for Lab 2 (which involves three related lab experiences in DNA Technology). Instead of making you write six lab write-ups for the six labs, we will focus on quality and process of writing one professional lab report. You will write this report in the form of a primary research article formatted for the journal CELL. We (your peer teachers, writing consultants and I) will evaluate your initial report, critique it thoroughly and stringently, and give it back to you so you may submit a more thorough final report. You may make up as much 30 points between your initial grade and final grade and we will be happy to award everyone "A" grades, should that be deserved. It behooves you to submit the best possible initial report, so that you can end up doing very well in your final report. *For more details on how to write a lab report, see the lab manual.* For submitting Initial & Final Lab Report, see lab schedule for due dates. See lab manual for instructions to write an outstanding lab report.

## C. EVALUATION BASED ON EXPERIENTIAL LEARNING

This type of learning is something you may not have done as much of. These projects are A LOT OF WORK, BUT THEY CAN BE JUST AS MUCH FUN. The following three projects are group-based. In each group, I expect each member to participate fully and equally. Form groups of preferably 4 (no less than 3 and no more than 5). You will be part of this group for the entire semester and do all three projects described below.

### A. Project I: Research Journal Club (75 points)

Communicating your own science well is just as important as doing it well. A competent and successful scientist not only understands the work of his or her peers, but also effectively retells the significance of their work to others in diverse formats. New science is communicated in a variety of ways, which are often 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. In this first project, your group will role-play a group of graduate students who have to present research papers for a routine research journal club. A journal club is a presentation format in which primary literature is discussed with an informed audience in an exciting informal manner. The underlying goal is to develop skills to grasp one primary article and communicate it orally to a scientifically literate audience. Each group picks one paper from several published in *Cell*, *Science*, and *Nature* that I pre-select. No two groups select the same paper. Each paper elaborates on topics covered in lecture/lab and has clear general relevance.

To prepare best for your journal club, follow these recommendations.

#### Guidelines for PowerPoint-based Research Journal Club

- Week 2:** Choose the paper you want to present by Tuesday Class time. You may pick any one of the twelve articles in PRIMARY PAPER READING PACKET marked Papers 4-15. NOTE: No two groups may choose the same paper. \*Schedule group orientation meeting with me.
- Week 3-4:** READ IT FROM THE BEGINNING TO END. Reading science papers is not easy. You will not understand most things at first and that’s normal at this point. Note all the things you do not understand. Identify major ideas in the paper: what is in the abstract, introduction, hypothesis tested, methods used, results obtained, and discussion points. You will have to become familiar with the way articles are organized and written. You will need to look up a variety of terms and phrases. Start acquiring a bibliography (that is, get other articles on the same or related topics or those that provide the scientific background for this study). You may need to get many of these articles from the Finch CMS library or other nearby libraries via Inter-Library Loan. This can take up to two weeks or more! DO NOT POSTPONE THIS—avoid loss of process credit. I expect a working bibliography by Friday, Week 5 (to the bibliography, please attach your Medline abstracts).  
**Attend Peer Teacher Workshop Week 4 (absence will affect your process credit)**  
**What is a Journal Club? How do we grade? See past examples.**
- Week 5-6:** Schedule group meeting with me. We (your group and instructor) will comb the paper together. This meeting with me will only work if you come prepared in your readings. We can easily spot students who have not read papers. The purpose of this meeting is to clarify misconceptions, difficult concepts, and help you understand the techniques that were used in the study and give you guidance for the next step.
- Week 7-10:** Additional Research Time for you. You may need to get more papers. You will need to understand all techniques. Optional additional group meetings with me are always encouraged. Start making PowerPoint.
- Week 10-11:** Week 11 is Journal Club Week and you will present during lab time on March 22-24! Sign up on my door for group practice times for your journal clubs as soon as you return from spring break. It is best to practice a few days before the presentation, so that you can get feedback. Don’t be the first group to not practice your talk at least once before giving your talk. Groups give 45-minute PowerPoint presentations, followed by 15-minute open discussions. The journal clubs are made public so that non-course students and faculty may attend. During the journal club, presenting groups provide a two-page pamphlet that summarizes the main points of the paper and how it connects to cell biology, to further demonstrate your ability to educate peers. Peer teachers evaluate each presentation on both content and process using my grading sheet and recommend a grade. I reserve sole responsibility for final grade.

## **B. Projects II & III: “The Diseased Genome” Student Symposium (125 points)**

**Research Review Paper:** 67.5 points

**Symposium Seminar:** 67.5 points

Now that you know how to read a primary article in cell biology, your group’s next goal is to learn to synthesize material from several primary papers on a certain topic. Choose a human disease that interests you as a group as your research topic (you are encouraged to pursue the same disease or a similar disease on which you learned about in your journalism paper). Your group will represent a team of biomedical research experts invited to present an “up-to-date” seminar and submit an “up-to-date” research review paper on this disease. Although I expect a broad background, your focus should be on the cell/molecular basis of that disease and you will be expected to focus on several recent papers that address the cell/molecular disease mechanism. Your review paper will be published in an in-house reviews journal called “TIDS” (Trends In Diseased Cells). Your seminar will be presented as part of a special public research symposium called “The Diseased Genome” scheduled in Johnson 200 during lab time on week of April 19-21.

### **Disease Symposium Guideline:**

1. **Week 2:** Disease choice due Tuesday (by class time). Discuss your choice and how to get started on research by meeting with me.
2. **Weeks 3-4.** *Research the disease.* Use the Library Research Guide Page to do Medline and targeted journal searches. Acquire print articles from LFC library, Finch CMS library, or by Inter library loan. Remember: print sources are more reliable than Internet. I much prefer peer-reviewed print journals for your references. Avoid web citations as much as possible. Research and acquiring the right articles takes effort and time. *AGAIN, DO NOT SLACK ON THIS or else it will affect your process credit.*

Disease bibliography (a collection of at least 20 references including primary articles, reviews, book chapters) is due class time Friday Week 4. I would like this bibliography arranged alphabetically and with it attach all the Medline abstracts (marked either LFC, Finch, or ILL—depending on source library you will acquire these articles from).

3. **Week 5-9.** Identify 3-4 research themes for your disease at the cell/molecular level. Find 3-4 articles on each theme. Get all ILL requests done. I encourage you highly to meet with me as a group to discuss progress in your research in understanding the mechanism underlying your chosen disease and in understanding papers. Come with an outline on how you will write your paper after midterms and let me help you select the primary articles that will form the current research section of your review paper/seminar. I will help extensively you throughout Week 5-10 on your project if you come to me. But, it is your responsibility to seek my guidance as and when you need it.
4. **Week 10.** A group meeting is required with me (the sooner you schedule this meeting the better). Come with all your papers, grouped into those you will use for disease overview and those for current research themes.

**Week 10: Attend Peer Teacher Workshop (absence will affect your process credit)**

**How to Write a Review Paper & Present a Research Seminar? How do we grade your efforts?**

**See past examples.**

Peers will share invaluable tips and walk you through examples highly rated in the past.

5. **Week 11-13.** Begin writing a single review paper (as a group). NOTE: It must have the following sections: Paper title, list of authors, research summary, introduction/history of disease, clinical symptoms, pathology, biology of disease (emphasis on cellular, molecular, genetic basis), current research (focus on three or four recent papers from acceptable peer-reviewed journals), future directions, overall conclusions.
6. **Week 14.** Disease Abstract is due by Monday, 5 pm. Disease Review is due Wednesday, 5 pm. Need you to submit one copy in print form and one as an email Microsoft word attachment. This is the time to get things clarified for both paper and talk- make appointments as and when required.
5. **Week 15:** This is the symposium week. You will present a 45-minute group talk during your lab time on April 19-21. You will be provided ample opportunities to practice your talk before your symposium time. Submit PowerPoint to me by Friday to get process credit.

### **C. PROCESS OF CELL BIOLOGY 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 demonstrate positive learning habits, good collaborative ability, and use the placed resources well, I will be happy to award you up to and all of 50 process points.

#### **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 and exams  
Consulted regularly with peer teacher when you needed advice or help  
Attended peer teacher initiated research skills workshops  
Used Writing Center for feedback on the two papers  
Practiced your two 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 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 other groups by enthusiastic participation in their efforts

#### **You have demonstrated positive intellectual attitude if you**

Were attentive and participated actively in class and lab  
Were prepared ahead in readings and were not routinely absent or late for class, labs, or meetings  
Demonstrated curiosity and creativity in your assignments  
Showed personal initiative and leadership (plenty of scope to do so in this class)

### **D. BONUS POINTS**

Several academically creative opportunities exist that can allow a student to gain up to a maximum of 25 bonus points.

A. Attending cell biology oriented Biology Department Seminars this spring. Already three seminars have been planned. More may be scheduled. Simply attending an event (in its entirety) gains you 5 points. If you ask questions, then an additional 5 points may be accrued (based on the academic quality of the question).

1. Monday, February 7, J200, 6-8 pm: "Biology Alumni Careers Panel: Preparing Future Careers"
2. Tuesday, February 8, J200, 4 pm, Brandon Johnson'03, Stanford University
3. Wednesday, March 16, J200, 4 pm, Dr. Chris Rochet, Purdue University
3. Wednesday, March 23, Meyer Audi, 4 pm, Dr. Neena Schwartz, Northwestern University

B. The two research projects, Cell Biology News & Diseased Genome Symposium will provide, each of you an additional opportunity to show your creative side. Details later.