

BIO221 CELL & MOLECULAR BIOLOGY
Spring Semester 2001-2002
Shubhik K. DebBurman

GENERAL INFORMATION

Peer Teachers: Angie Eakley'03 (eakleal@lfc.edu) Also Tuesday Lab Assistant
Svetla Stamenova'02 (svetos@lfc.edu) Also Thursday Lab Assistant

Writing Consultant: Jennifer McGuire (mcguijm@lfc.edu) Meet by Writing Center Appointment

Course Web Page: <http://www.lfc.edu/~debburman/BIO221S02syllabus.html>
Library research guide <http://www.lib.lfc.edu/resource/bio.html>

Class Hours::

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

Office Hours:

10:00 AM -12:00 noon	M-W-F	Johnson 201
1:00 – 4:00 PM	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

Note: I WILL EMAIL YOU REGULARLY BY FORESTER EMAIL. CHECK YOUR EMAIL EVERYDAY.

COURSE GOALS

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

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!) of many simple organisms are now known, and new ones are being deciphered 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, 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

and underwent its first true revolution in early 20th century, when cytology merged with modern genetics and classical 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. **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 DebBurman 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.

2. **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 20th century.

3. **BIOL221 Laboratory Manual:** You will receive your lab manual on the first day of class. In it, you will find protocols for the five labs you will undertake in this class, guidelines on how to write lab reports in the form of primary articles, guidelines on how to conduct yourself in the lab as well instructions to maintain a complete, well-detailed lab notebook.

4. **Primary Paper Readings (Johnson 215)** This reserve packet is also available to you via the on-line cell biology research guide (go to forester BIO221course site and click on PRIMARY PAPER RESERVES). Papers 11-13 are required readings for all. Papers 11 & 12 are true classics that have been obtained from microfilm archives, since our library does not have Nature issues from 1953! Their quality is not as good, but definitely readable. To obtain publication quality PDF copies of Papers 1-10, I recommend that you print electronic versions here. 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). 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.

5. **Cell Bio DebBurman 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.*
- Biochemistry, by Voet & Voet.
- The World of the Cell, by Becker, Reece & Poenie.
- Science Times Book of the Brain (collection of New York Times science stories)
- How to Write and Publish a Scientific Paper, by Robert Day.
- Pathological Basis of Disease, by Cotran, Kumar, Robbins.
- The Metabolic & Molecular Basis of Inherited Diseases (Volume 1-4)

PHILOSOPHY

Attendance: I will 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 will regularly attend my lectures. Invariably, in each lecture, I will 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 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 must be corroborated by the student health services. 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 after 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: This is my first year teaching at Lake Forest College. While I am an experienced teacher, every institution is different. I am very excited about being here and doing this. 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 very 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 quarter. 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

Content (50%)

Lecture

Six Quizzes	15%	150
Midterm Exam	20%	200
Final Exam	15%	150

Process (50%)

Laboratory

Laboratory Notebook Assessment 1	7.5%	75
Laboratory Notebook Assessment 1	7.5%	75

Mock Experiential Research Projects

1. Journal Club	5%	50
2. Medical News Journalism	5%	50
3. Disease Review Article	5%	50
4. Disease Symposium Seminar	5%	50
5. Laboratory Report as a Primary Article	10%	100

Resource Use and Collaborative Preparation	5%	50
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TOTAL (100%) **100%** **1000**

Scale

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

In the past 3+ years, I have not curved even once. But, in the rare event that I might, a student will not get a grade less than that expected by the above scale.

Cell Biology Peer Teachers

I have taught this course six times and seen over 200 students succeed; no one has yet failed. Four such times, I have employed peer teachers. Average class performance was significant higher those four times. 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 to be stronger were just as active participants and benefited just as much as those who perceived themselves to be weaker students.

I could not have selected two better-prepared & motivated students than Angie and Svetla 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 three substantial research-driven papers: one primary article (based on lab experiments), one medical journalism article (based on primary article reading), and one research review (literature review of a field). Each paper has its own specific style. I selected your Writing Center Consultant (Jen) because of her obvious talents and interest in science writing and in peer editing. You are expected to consult Jen (and/or your peer teachers) on each writing assignment to get Research Use and Collaboration Use credits as explained at the end of this syllabus.

COURSE PARTICULARS

A. Evaluation based on Lecture (500 points)

I. Quizzes (150 points)

Six take-home quizzes worth 25 points each will be administered on specific Tuesdays covering specified topics. Each quiz is due the first thing class time on the Thursday following the Tuesday you receive the quiz. 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. Additionally, your midterm will include questions on Primary paper readings 1-3 and the Watson book. The final covers everything from the lecture after midterm till the last lecture. Additionally, your final contains one comprehensive essay question, based on the entire course.

Samples of old midterms and final exams will be made available to peer teachers who will share it with you during review sessions

B. Evaluation Based on Laboratory Experimentation (150 points)

The laboratory experience is an essential component of this course, designed to complement and supplement lectures. Your attendance in lab is required; unexcused absences cannot be made up.

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) prepare data sheets
 - (iii) write a formal lab report in the form of a primary article
 - (iv) conduct your self properly in lab
- Cell biology laboratory notebook (buy from the bookstore)

I. Lab Notebook Grading (150 points):

You have probably never been graded for keeping a 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 lab 1, 2, 3a) 75 points (see lab schedule for due dates)

Lab Notebook Grading Two (based on lab 3b, 3c, 4, 5) 75 points (see lab schedule for due dates)

Later, in the fifth mock experiential project, you will learn to write a lab report in the form of a primary article.

C. Evaluation based on Mock Experiential Research Projects (350 points):

This type of learning is something you have not done before in any science class. These projects are A LOT OF WORK, BUT THEY CAN BE JUST AS MUCH FUN. The following two projects are group-based. In each group, I expect each member to participate fully and equally. Form groups of preferably 4. You will be part of this group for the entire semester and do all projects described as this group.

I. Journal Club (50 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. A primary goal of this course is to help you overcome such initial barriers in reading primary papers. A journal club is a presentation format in which primary literature is discussed with an informed audience in an exciting informal manner. In this first project, your group will role-play graduate students assigned to communicate a primary paper to your peers via a routine research journal club. For the journal club presentation, read “*Guidelines for Journal Club Paper Presentation & Discussion*” below. Attend peer workshop I and make sure to consult grading sheet.

Guidelines for Paper Presentation and Discussion (•Use PowerPoint for your presentation)

1. Immediately after spring break, we will hold a series of cell biology journal clubs where your group will present the paper on which you chose to do your journalism project. Each article will be presented in a 45-minute block, with 15 minutes for questions.

2. For each presentation, the group should construct 2-3 pages handout that effectively complements your journal club presentation. This handout should effectively summarize the paper in a way that your classmates can understand the paper’s “take home” points and gain insight into hypothesis-driven discovery.

2. Every member in your group has to participate in the oral presentation. Your presentation should include the following:

- Introduction*: present authors, title, and journal; provide the overall research summary & background for study. What should we know in order to follow this paper. How have you broken up your presentation—give us a road map.

- Hypothesis*: Given the background you just provided, what were the authors specific goals in this study? Clearly state hypothesis? Explain importance of goals. Establish overall framework.

- Methods*: Carefully, concisely explain strategy and techniques. This section is very important. Especially if techniques used pertain to cell biology—I will look for you to be able to explain such strategies.

- Results*: State, clarify, & summarize each result in the study. Usually, it is best to systematically present from Fig 1 to 2 to 3, etc.

- Discussion*: Interpret & discuss result significance. Explain biological relevance. Did they fit the original hypotheses. Were there any surprises? What caught your attention? Do you have any criticisms, limitations, or cautions?

- Future Directions*: Propose new experiments. Provide a testable model.

4. INVOLVE YOUR AUDIENCE, BE INTERESTING! Your presentation should stress clarity and brevity. A presentation not easily understood or one that is too long is unfair to the class. Convey why should I want to know this paper. Use simple visual aids (flow charts of procedures and simple logical explanation of techniques) in presenting material clearly. Following the presentation, the group should lead a class discussion based on the written questions posed, and any issues raised by the class.

II. Medical News Journalism (50 points)

Science journalists, in particular, play an increasingly important role in society— they are the harbingers of the latest scientific discoveries that we learn of from newspapers, magazines, and TV. As liberal arts students and science

get an opportunity to harness your nascent journalistic flair. In this next project, you will role-play a medical journalist by writing a lay newspaper report on the same primary paper's discovery, this time the information being intended for the lay public, not science students. Your task is to retell the significance of a recently published noteworthy cell biology paper from *Nature*, *Science* or *Cell* magazines to a lay audience (they represent the top three scientific journals in the world). Imagine that you are the scientific correspondent for New York Times (or your favorite newspaper) and that your audience for this paper is educated, but with a non-science background (like non-science majors at LFC). Your language has to be simple, but you cannot compromise the scientific content. The format will be just like science articles written in New York Times (see DebBurman Cell Biology Reserves for *The Science Times Book of the Brain*). Your goal is to convince your readership that this paper you are reporting on is truly worth their notice and why. You have one additional important requirement, which is not normally done in a real science news article published in a newspaper. That is- you have to cite other scientific articles and provide a bibliography as you write this paper. Referencing other studies are important because they will provide (a) adequate and proper background for the paper you are reviewing, and (b) they will allow you to discuss the broader impact and significance of the paper you are reviewing by comparing and contrasting that work to other published studies. A minimum of 7 references is required (10 is preferred). Fully collaborate with your group in doing library research and to fully understand the article you have to read. But, when it comes to writing the journalistic piece, you have to write your paper independently. Make sure to attend peer workshop I and discuss grading sheet.

Combined Journal Club and Medical News Journalism Guideline:

Week 2: Choose the paper by Tuesday Class time). You may pick any one of the ten articles in PRIMARY PAPER READING PACKET marked Papers 4-13. NOTE: No two groups may choose the same paper. *Schedule mandatory meeting with me (sign up as a group).

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 4 (please also attach Medline abstracts).

Week 5-6:

Attend Peer Teacher Workshop during Week 5:

What is a Journal Club? What is Medical Journalism?

- Peers will give invaluable tips on how to present a journal club and to write a medical journalism paper.
- Successful past examples will be provided & grading protocol will be shared

**Schedule mandatory meeting with me (sign up on my door).* We will read the your paper together. This meeting with me will only work if you come prepared in your readings. I 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 get you the next step.

Week 7-9: Additional Research Time for you. Optional additional group meetings with me are always encouraged. Start making PowerPoint and journalism paper outlines.

Week 10: Journal Club Presentation Week

**Sign up on my door for group practice times for your journal clubs as soon as you return from spring break*

Week 11: Submit the medical news journalism paper by Friday, 3 pm. Attach all papers cited; highlight cited areas in each paper. Submit your Journal Club PowerPoint presentation as well to me for record keeping to get process credit.

III & IV. Disease Review Article and Disease Symposium Seminar (50 points each)

Research Review Paper: 50 points

Symposium Seminar: 50 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 April 16 and April 18. Make sure to attend peer workshop II and discuss grading sheets for both projects.

Combined Disease Symposium Guideline:

Week 2: Disease choice due Tuesday (by class time). Mandatory Group Meeting with me (sign up)

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).

Week 5-10. This is research time on your own. 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.

Week 11-12. A mandatory group with is required (the sooner you schedule this meeting after your journal club, the better). 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.

Week 11: Attend Peer Teacher Workshop (absence will affect your process credit)

How to Write a Review Paper & Present a Research Seminar?

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

Week 13. Disease Abstract is due by Wednesday, 3 pm. Disease Review is due Friday, 3 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.

Week 14: This is the symposium week. You will present a 45-minute group talk during your lab time. You will be provided ample opportunities to practice your talk before your symposium time. Submit PowerPoint to me by Friday to get process credit.

V. Lab Report as a Primary Article (100 points)

Finally, now that you know how to read and communicate articles and synthesize information from several of them, you will get a chance to author a primary article based on experiments you conduct in lab. Each pair will be graded on only one combined laboratory report for the three week long lab 3. Instead of making you write six lab write-ups for the six labs, we will focus on quality and process of writing a 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 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 an “A”, 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. Attend peer workshop I and discuss the grading sheet. For deadlines on submitting Initial & Final Lab Report, see lab schedule for due dates.

Resource Use & Collaborative Preparation Points

So that students receive credit for utilizing the several resources that I provide for your effective learning, I award process points as you take proper steps in developing each project. You earn process points by

- 1) attending the two peer communication skills workshops
- 2) getting drafts of the three written assignments for Projects 2, 3, and 5 critiqued by the writing consultant
- 3) attending mandatory group meetings with the instructor to discuss research progress
- 4) meeting project bibliography deadlines
- 5) practicing their two talks for Projects 2 and 4 in front of peers.
- 6) submit electronic versions of all five projects (papers and PowerPoints) to instructor for record keeping