Appendix A
Syllabus for Project-Based Cell Biology Class (Summer 2001)

I. Class Meetings

Class meeting	We meet Tuesday, Wednesday, Thursday from 8:30–10:30 in Mary Gates Hall, Room 242
Biology Study Area	Hitchcock 220—Dave Hurley manages the Biology Study Area (BSA), where you can find Macintosh computers to check your e-mail, to do Web searches, and to write your papers. In addition, the BSA maintains a large collection of textbooks, slides, and videos that may be useful for your project preparation and planning.

II. Instructors

Robin Wright wrightr@u.washington.edu 238 Kincaid Hall Lab: 206-685-3651	Robin Wright is an associate professor in the Department of Zoology. She has been at the University of Washington for almost 11 years. Her research focuses on understanding how cells alter their structure in response to physiological or environmental changes. Robin graduated from the University of Georgia, with a B.S. in biology, and obtained her Ph.D. in molecular biology from Carnegie-Mellon University, in Pittsburgh, PA. She then did postdoctoral work at the University of California, Berkeley, for 4 years before coming to the University of Washington in September 1990.
Wendy Rockhill wrockhil@u.washington.edu 248 or 154 Kincaid Hall Lab: 206-616-3383	Wendy Rockhill is a graduate student in the Department of Zoology. She has been at the University of Washington for 2 years. She has bachelor and master of science degrees from Western Washington University. Her master's thesis involved analysis of vertebrate morphology. Her current research is in the area of cellular and developmental biology. She is studying the migration and physiology of gonadotropin-releasing hormone (GnRH) neurons as well as their interactions with olfactory and vomeronasal neurons.

III. Course Goals

The major goals of this class are to help you learn to:

- Ask questions about cell structure and function
- Understand how these questions can be addressed using modern research tools in cell biology
- Gain insight into the relevance of cell biological research to modern biology and medical science

These goals will be accomplished through completion of four team projects centered on discovering, understanding, and presenting the cellular and molecular biology of a human genetic disease. By the end of the quarter, you will be reading primary research papers and be able to explain the hypothesis, experimental approaches, methodology, controls, results, and shortcomings of the particular research.

IV. Course Philosophy

General: This course is designed to serve as a transition from lecture-based learning to inquiry-based learning, forming a bridge from your undergraduate classes to postgraduate or professional education. Most, if not all, courses that you have taken so far are designed to provide you with a survey of information about a particular topic. Instead, this course will help you learn to **think like a scientist**. Consequently, instead of sitting through lectures, you will work in a team to solve problems and give presentations to the rest of the class.

Thus, *you will be directly responsible in large part for the success or failure of the course*.

This responsibility means that you will probably need to work harder to be successful in this class than you have done in more traditional courses. We estimate that you will need to spend 10–15 hours per week studying *outside of class time.*

Cooperative learning: Throughout the course, you will be required to work in teams in order to complete several projects or to formulate presentations for class. Much of the lecture time will be spent working in these teams or presenting projects.

Instructors' responsibility: In this course, our job is to serve as expert learners who can help direct your explorations into the inner secrets of cells. Because the field of cell biology is so immense, we will be there to help keep you grounded and to point out the forest among the trees when you are in danger of getting lost in the details. We will offer suggestions, advice, and exhortation to help you achieve the maximum possible from this course. We will arrange for you to come to our lab or those of colleagues to see the techniques you need to understand for your presentation. We are partners with you in your learning—eager to help you find, evaluate, and use information or other resources that you need.

V. Logistics

The class is divided broadly into four major sections, each punctuated by a presentation in which your team shares what it has learned with the rest of the class and prepares a paper describing those results. The sections are:

1. What is the structure and function of the cellular organelle or process in which this gene product works?
2. What is the cellular and molecular biology of the disease caused by defects in this gene product?
3. What experimental approaches are scientists taking to understand, treat, and/or cure this disease?
4. Poster Presentation (summarizes all of the work you did).

In addition, the final week will be spent working on an individual miniproject or take-home exam that you will prepare on your own.

VI. Evaluation & Grades

For this class, your grade will reflect the quality of your team's projects (both the in-class presentation and the report), and your contribution to the projects.

Projects: Every project must involve the efforts of every team member. On written reports, each member must contribute a portion of the paper and each member must proofread and edit all of the contributions of the other members. The final report must be signed by each team member to confirm that each person has had input into and approves the final version of the report. In addition, the report will specifically describe each member's contributions. Finally, the report must include a project log that includes the times the team met, who was present, and a brief description of what was accomplished.

We will give a grade for the team report that reflects both the presentation and the written report. A checklist for each project will be provided, so you will know in advance what my expectations are for that project. In addition, each student in the team will secretly evaluate the contributions and participation of the other members of the team.

Thus, your final grade on the project will reflect my evaluation of your performance as a team as well as the evaluation of your individual participation by your peers. You will get plenty of feedback to make sure that you can improve your reports and projects over the course of the quarter. See the end of the syllabus for examples.

VII. Grading Policies

The specific grading policies will be established in collaboration with the class. One possibility is shown below:

Topic	Presentation	Paper
Cellular organelles or process	100	100
Cellular & molecular biology of disease	100	100
Current research	100	100
Poster Presentation/Summary	200	
Take-home exam		200

There is no curve in this class. Your grade is the grade you earn, regardless of the performance of your classmates. This means that collaborative efforts should pay off for everyone. The following grade scale will be used:

Grading Standards

Presentation, reports, exams	General standard
A	Excellent work, could not have done any better, clearly exceptional
B+	Very good work, but there is room for improvement in one area
B	Good work, but there are several areas where significant improvement is possible
C+	Acceptable, average work; nothing out of the ordinary
C	Passing work, but a considerable amount of improvement is needed in many areas
D	Work not up to minimal expectations, but effort was clearly made
Not passing	Work not acceptable; little or no effort is apparent

VIII. Tentative Schedule of Activities

Tuesday	Wednesday	Thursday
June 19 Syllabus, discussion of goals, overview of course, settle registration; set up teams; choose data set; begin analysis	June 20 Hypothesis building: what cellular structure is affected by this disease? How are the symptoms related to cellular structure & function?	June 21 Computer search strategies for proteins and nucleic acids; what is your gene and how was it found? Turn in identity of gene, its function in cell, pages in text for assignment
June 26 Work on presentation (cell structure & function)	June 27 Work on presentation (cell structure & function) Turn in plan for disease presentations	June 28 Work on presentation (cell structure & function)
July 3 Presentations (cell structure & function)	July 4: HOLIDAY	July 5 Lecture: Cell biology of disease Receive references for review papers; work on cell biology of disease presentation
July 10 Work on cell biology of disease presentation	July 11 Work on cell biology of disease presentation Turn in plan for disease presentations	July 12 Work on cell biology of disease presentation
July 17 Work on cell biology of disease presentation	July 18 Disease presentations	July 19 Disease presentations Receive research paper(s)
July 24 Work on research presentation	July 25 Work on research presentation	July 26 Work on research presentation
July 31 Work on research presentation/poster	Aug 1 Work on research presentation/poster Turn in plan for research presentations	Aug 2 Work on research presentation/poster Take-home exam given
Aug 7 Work on research presentation/poster	Aug 8 Research presentations	Aug 9 Research presentations Work on poster presentation
Aug 15 Finish up poster; make sure it is printed	Aug 16 Poster Session	Aug 17 Take-home exam due Looking back, looking forward

IX. Sample Feedback for Team Project

After your presentation and paper have been completed, I will give you the checklist on which I wrote comments during your presentation, together with comments such as those shown below. The checklist will have the number of points your team earned for this project.

Group 3	Members: A., E., M., D. Disease: Machado Joseph Disease Protein/gene: Ataxin Cell biology topic: Ubiquitin-mediated protein degradation
Presentation Grade: 43	Slides were well designed and attractive. Unique approach ("kiss of death, chamber of doom") makes presentation interesting. You handled the history of discovery of ubiquitin very well. Did a nice job in describing how proteins get ubiquitinated. Your whole team fielded questions well. You needed to include more information on cell cycle (how cyclins work) and on ubiquitin-related diseases; switch slides 6 and 7; heat shock = stress response; slide 11: don't use abbreviation without defining (HPD?); not clear what "highly conserved" means—what 3 changes occur (amino acids, nucleotides, etc.)? *Suggestions*: Keep up good work—you knew the material, but needed to fill in a few more details to really do justice to the process. For example, stating the differences between mono- and polyubiquitination earlier would have helped set the stage. The sperm stuff was interesting, but in interest of time, you probably should have talked more about diseases associated in general with ubiquitin. You MUST have references to your photos and diagrams.
Paper Grade: 38	On the basis of this paper, I think you know the topic pretty well—but I'm not sure that your audience (your classmates) will really understand it in sufficient detail just on the basis of what you wrote. There are several areas that would benefit from more careful organization (grouping all the enzymology together, for example). Adding more information in several places would also help. In its current form, it is only "C"-quality work. But you can rewrite it for a new grade if you want, after you get feedback from the rest of the class. Note my suggestions onthe paper itself. *Suggestions*: Before you begin editing, sit down and read the entire paper together, discussing my recommendations and those you'll get from your classmates. Then make appropriate changes and corrections and additions. You should able to bring this grade up considerably by including more information and doing some considerable editing. If you have any questions, schedule a 30-minute block of time for the whole group to talk to me.

X. Sample Feedback for Individuals

In addition to the grading for the overall project, each person will receive an evaluation that reflects comments from the team. These comments will be typed by me and are anonymous. The idea is to give you a venue for making helpful comments to your team without hurting feelings or potentially damaging any working relationship. Here is an example of such an evaluation:

Individual 1

Your team really appreciates the time you spent going to the bookstore to buy the poster board. In addition, they are amazed at the amount of information you know concerning the immune system. It is clear that they value your contributions. However, there is some concern that your family problems forced you to miss several meetings. They understand it was unavoidable, but it did make things difficult for the rest of the team to make up the work. You may want to consider ways to still participate fully in the activities even when you couldn't meet with the team because your daughter was ill.

Full credit for participation

Individual 2

Your group recognizes and appreciates your hard work on the project. They also like your attention to detail. They are really impressed with the number of articles you read and the amount of research you did. However, your impact would be even greater if you were able to work on communicating more effectively with others. The group is a little afraid of you—even though you don't raise your voice, they think that you are angry and upset at them and that you don't appreciate their input. Apparently they feel that your editing job did not retain their contributions. You'll need to work hard on communication skills if the team is going to work well and be able to build upon the strengths of all of the members. Asking for more input and suggestions from the others would a good place to start.

Full credit for participation