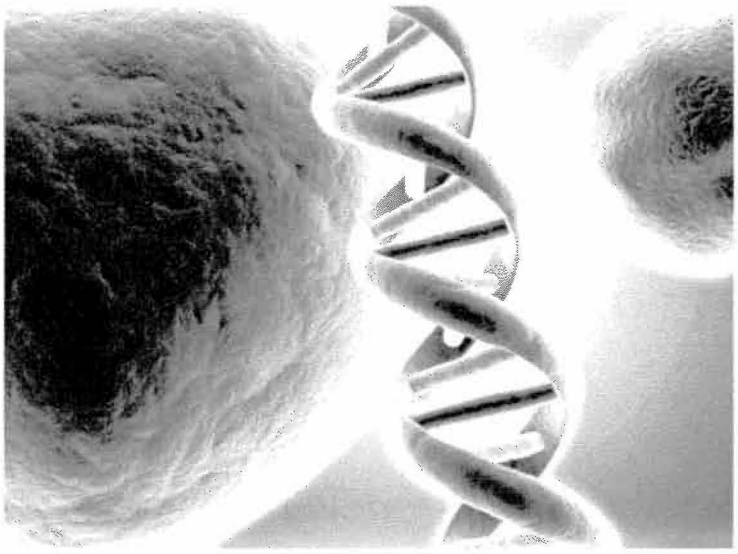
Final Report of the Biotechnology Program Review Panel

August 13, 2010



Members of the panel

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Connie Boogaard: Biotechnology Program Faculty, Biology

Kim Colvert: Biotechnology Program Faculty, Physical Sciences

Roger Mitchell: Biotechnology Program Faculty, Biology

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Elaine Staley: Faculty, College of Professional and Technical Studies

Karen Strasser: Biology Department Head

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Section 1 – Program Overview

Section 1A – Program Overview and Goals

1) **History**. The biotechnology program accepted its first students in 1989. It was designed to provide intensive hands-on laboratory experience to feed a growing biotechnology industry. It was designed to have a very focused curriculum, oriented towards understanding both the principles and theory of biotechnology and the ability to perform relevant procedures in the laboratory. To maintain this focus, the biotechnology program was designed to be small, with a maximum capacity of 15 students per year. Numbers beyond this are unsound from both a physical (laboratory space) and academic (loss of personalized hand-on experience) perspective. Since 1989, the program has continued to evolve as the biotechnology industry has evolved. For instance, many biotechnology students now directly enter graduate school rather than entering the biotechnology industry upon graduation. Personalized medicine, individual genome analysis, and stem cell therapies will only be a few of the new areas that biotechnology and biotechnology graduates will explore in the next decade. However, no matter what the "hot biotechnology topic" of the moment becomes, the hands-on, rigorous nature of the biotechnology program will still be the fundamental guiding principle for both the biotechnology faculty and students.

2) **Pre-professional curriculum.** Because the curriculum is focused on the area of biotechnology and the biomolecular sciences, there is little room for flexibility in course selection. The biotechnology program is similar in level of sophistication to professional programs such as pharmacy, optometry, pre-medicine, and pre-dentistry. These programs share first and second (and sometimes third) year course requirements. This allows students who enter Ferris State to reserve a final decision on their major field of study until their third year of coursework. Students in all of these programs begin with a year of general biology (Biology 121 and 122) and general chemistry (Chemistry 121 and 122), followed by a year of organic chemistry (Chemistry 321 and 322) and anatomy and physiology (Biology 321 and 322 or 205). Students will also usually take one semester of physics (Physics 211), analytical trigonometry (Math 130), and statistics (Math 251) in these first two years. Transfer students from community colleges may use 2+2 articulation agreements the biotechnology program has created with several of these colleges to guide them directly into the third year of the program. The only exception to the guidelines listed above is with quantitative analysis (Chemistry 231), which is not offered at most community colleges and should be completed before proceeding into the third year of the program. The pre-professional curriculum is completed with general education electives to satisfy the requirements for cultural enrichment, global consciousness, and communications competence.

3) **The core biotechnology (professional) curriculum.** The biotechnology core courses of the third and fourth years of the program are designed to address the major areas of both biotechnology theory (lecture) and laboratory skills. The primary areas of the core biotechnology sequence are: recombinant DNA, database analysis and bioinformatics, protein purification, microbiology/immunology, and animal care and handling. Therefore, the lecture requirements for this core sequence include one semester of general genetics (Biology 375), biochemistry (Chemistry 364), microbiology and immunology (Biology 386), advanced cell and molecular biology (Biology 474), molecular genetics (Biology 471), proteins lecture (Biology 472), bioinformatics (Biology 475), and advanced biochemistry (Chemistry 474 - which serves as our capstone course). Also included in this core sequence are a number of laboratory courses beginning with a full year of biochemistry laboratory (Chemistry 332 and 333), followed by one semester of proteins laboratory (Biology

473), an advanced techniques course in immunology and animal care and handling (Biology 476), and finished with a course in recombinant DNA analysis (Biology 471). Usually during the summer between their third and fourth years in the program, students will apply for and obtain a biotechnology internship (Biology 491). Over the past five years, increased focus has been placed on assisting students with obtaining external (off-campus) internships, as these opportunities have the most profound benefit to the development of a young biotechnologist. However, when either unable or unwilling to perform their internship off-campus, students are allowed to finish their internship performing an independent research project under the supervision of a Ferris faculty member.

4) **The biotechnology faculty.** The biotechnology program makes primary use of faculty within the biology and physical sciences department. The biotechnology faculty include the program coordinator Dr. Bradley Isler (Biology), Dr. Connie Boogaard (Biology), Dr. Kim Colvert (Physical Sciences), Mr. Frank Hartley (Biology), Mr. Richard Marble (Biology), and Dr. Roger Mitchell (Biology). These faculty, along with the department heads of the biology (Dr. Karen Strasser) and physical sciences (Dr. David Frank) departments are also members of the internal biotechnology advisory committee, which is responsible for curricular oversight of the program. All biotechnology faculty teach at least one core biotechnology course, along with other non-biotechnology courses.

5) **The biotechnology students.** The typical biotechnology student is intelligent, with a good work ethic, a thirst for exploring the modern frontiers of the molecular biosciences, and the ability to work independently. These are also the attributes requested by employers and graduate advisors when looking for employees or graduate students to work in the field of biotechnology. A reasonable number of biotechnology students are also members of the Honors Program. The formal requirement for admission into the core sequence of biotechnology courses is a GPA of 2.7 or higher in the pre-professional sequence of courses. The selective group of students is generally self-motivated, hard working, and intelligent. They are capable of meeting the challenges of the program and thriving within.

6) **Goals**. The current goals of the biotechnology program can be summarized by the mission statements and program outcomes that were developed by the biotechnology faculty and department heads of Biology and Physical Sciences during the 2008-09 academic year. The mission statement and outcomes were carefully developed to focus on the interdisciplinary and laboratory based nature of the biotechnology program.

Biotechnology mission statement: The mission of the biotechnology program is to provide a quality undergraduate education and a strong foundation in the principles of biology, chemistry, and the biomolecular sciences. The goal of the program is to provide graduates a high degree of advanced technical laboratory skills and the ability to translate these skills in written and oral forms into careers in the biotechnology industry, graduate, or professional school.

Biotechnology Program Outcomes:

1. **Molecular biology and genetics** - Students will be able to recognize, recall, and apply knowledge of the basic processes associated with the transfer and expression of genetic material.
2. **Biochemistry and cell energetics** - Students will be able to recognize, recall, and apply knowledge of chemical processes associated with bioenergetics and metabolism.

3. **Cellular structure, organization, and function (cell biology)** - Students will be able to recognize, recall, and apply knowledge of the composition, formation, and maintenance of cellular structure and function.
4. **Proficiency in a laboratory setting** - Students will be proficient in the performance, careful observation, data collection, and analysis of data from advanced laboratory procedures in the areas of chemistry, biochemistry, molecular genetics, microbiology, and immunology.
5. **Analysis of scientific literature** - Students will have the ability to analyze, evaluate, and present information from peer-reviewed scientific publications in written and verbal form.
6. **Application of knowledge in internships and independent study projects** - Students will have the ability to apply learned biotechnology skills and laboratory techniques in extramural internships and independent study projects.

Section 1B – Program Visibility and Distinctiveness

The following are strengths of the biotechnology program:

1. Students receive quality hands-on training of cutting edge laboratory skills.
2. There is quality teaching in all aspects of the biotechnology program.
3. The curriculum is extremely focused, but students have a wide range of career options open to them following graduation.
4. Class sizes are small with a decreased student-teacher ratio compared to other programs.
5. The biotechnology industry is one of the few industries that has continued to hire B.S.-level graduates during the current recession.
6. The program is very stable, with no turnover of either the program coordinator or faculty in the last five years. This gives the program year to year continuity of both curriculum and teaching style.
7. The biotechnology program is now a member of MichBio, a statewide organization of biotechnology-related entities. This allows program students and faculty to network with the members of the growing biotechnology industry in Michigan and should increase the visibility of the program.

The biotechnology program at Ferris State is very distinctive. The level and depth of material covered in the biotechnology program is much greater than the biology or biochemistry program here at Ferris or other schools. The core biotechnology lectures are taught at a graduate level, which is at a greater level than similar programs at other four year universities. The biotechnology program at Ferris State was the first B.S.-level program in the state of Michigan. Before starting their B.S. Biotechnology program in the 1990's, Wayne State University consulted with Ferris based on the stellar reputation of our biotechnology program. Grand Valley has a professional M.S. degree in biotechnology that resembles the B.S. degree at Ferris, except with a more detailed research component.

Section 1C – Program Relevance

The Ferris State mission statement reads: Ferris State University prepares students for successful careers, responsible citizenship, and lifelong learning. Through its many partnerships and its career-oriented, broad-based education, Ferris serves our rapidly changing global economy and society. Ferris specializes in combining hands-on training with liberal-arts education. It is therefore especially fitting that Ferris had the state's first B.S.-level

biotechnology program. This program teaches hands-on skills using an intensive sequence of advanced laboratory courses. These courses strive to recreate the external biotechnology laboratory environment. This applied part of the program is what elevates the program above others both in the state of Michigan and across the country. At the same time that the program scientifically and technologically strong, it also has a significant requirement for liberal studies. This is consistent with the mission statement's emphasis that liberal studies must be part of every student's program. Quality teaching is stressed throughout the biotechnology program. This is reflected in the success of our graduates.

Section 1C – Program Value

The biotechnology program brings to the campus community many well-qualified students. Their level of scholarship helps "raise the bar" in the courses they take. Through the research projects carried out by the students and faculty, and through the quality of the courses that are taught, the biotechnology program contributes to academic excellence in the community at large.

To attract quality students, awareness of the biotechnology program is promoted through outreach to community colleges and the annual biotechnology camp for high school students. Through contact with alumni and the external advisory committee, the program maintains a high visibility in the state of Michigan. Industry representatives and visiting faculty present seminars that contribute to student and faculty development. Activities of the biotechnology club (Delta Nu Alpha), not only foster a sense of identity among biotechnology students, but also contribute to the quality of campus life through service and events.

The biotechnology program contributes to the state and nation through the training of students in an area that has traditionally been ignored in the academic community at large: hands-on laboratory experience. Our graduates find employment because of the high demand for this training. Many of graduates, having demonstrated success in laboratory settings have moved into managerial positions and turn to our graduates to fill new positions with their companies.

Section 2 – Collection of Perceptions

Section 2A – Graduate follow-up survey

An alumni survey was sent to 32 alumni that graduated with a degree in biotechnology in the past 5 years. Sixteen alumni completed and returned the survey, for a response rate of 50%. The low response rate of this survey was primarily due to the constantly changing nature of personal e-mail addresses, especially those of less recent graduates. A copy of the survey can be found in **Appendix F**.

Question 1: What year and semester did you graduate?

		Frequency	Percent
Valid	Spring 2006	2	12.5
	Spring 2007	2	12.5
	Spring 2008	4	25.0
	Fall 2008	1	6.3
	Spring 2009	4	25.0
	Fall 2009	2	12.5
	Spring 2010	1	6.3
	Total	16	100.0

Question 2: Currently, I am:

		Frequency	Percent
	Attending graduate school	7	43.8
	Employed in a position related to my major	7	43.8
	Working as a contractor at a food company	1	6.25
	Currently looking for work	1	6.25
	Total	16	100.0

- This was expected, as over the past 10 years, an increasing number of biotechnology graduates have attended graduate school. Traditionally, biotechnology graduates directly entered the workforce. However, in this extremely competitive job market, the increased skills obtained with a graduate degree put these students at an advantage compared to students with only a B.S. degree.

Question 3: What is your job title?

- EH&S Hazard Communications Author
- Food Scientist I
- Graduate Assistant
- Graduate Research Assistant
- Graduate Student
- Intermediate Animal Technician
- Lab Technologist

- PA Graduate Student
- Ph.D. Candidate (2)
- Product Manager of Sanitation and Drug Residues
- Research Assistant
- Research Associate I
- Study Technician II

Question 4: Who is your employer?

- Albany Medical College, Dr. Paul J Higgins
- Contracted by Kelly Scientific and working at Kraft Foods Inc.
- Covance, Inc. (2)
- Dr. Karen Beningo, PhD.
- Henry Ford Hospital
- Kelly Scientific Resources/onsite The Dow Chemical Company
- MPI Research
- Neogen Corporation
- TATA Consultancy Services
- University of Minnesota
- Van Andel Institute
- Wayne State University

Question 5: How long did it take to find a job after receiving your terminal degree?

		Frequency	Percent
		2	12.5
	2 months	2	12.5
	3 months	1	6.3
	6 weeks	1	6.3
	About 4 months	1	6.3
	I got my job one week after I graduated.	1	6.3
	I was accepted to VAI a month before I graduated.	1	6.3
	immediately	1	6.3
	It took about 8 months to find a contract job and still looking for something permanent related to my degree.	1	6.3
	No time, I already was accepted before I graduated, but I did my internship in this lab	1	6.3
	Still looking, its been 2 months	1	6.3
	Total	16	100.0

Question 6: What was your starting annual salary?

		Frequency	Percent
	$24,999 or less	5	31.3
	$25,000 - $34,999	9	56.3
	Total	14	87.5
Missing	System	2	12.5
Total		16	100.0

Question 7: How long have you held your current position?

		Frequency	Percent
	Less than one year	7	43.8
	1-2 years	6	37.5
	3-4 years	1	6.3
	Total	14	87.5
Missing	System	2	12.5
Total		16	100.0

Question 8: What is your current annual salary?

		Frequency	Percent
	$24,999 or less	5	31.3
	$25,000 - $34,999	8	50.0
	$45,000 - $54,999	1	6.3
	Total	14	87.5
Missing	System	2	12.5
Total		16	100.0

- Because the majority of the graduates that responded graduated in 2008 and later, it appears that most of them are still in their initial job/graduate program and their salary level has changed very little.

If you are currently attending, or have already attended, a graduate or professional school, please answer questions 9-11. If not, please skip to question 12.

Question 9: What types(s) of program(s) have you attended or are you currently attending? (Please select all that apply)

		Frequency	Percent
	M.S.	2	12.5
	Ph.D.	7	43.8
	M.D.	0	0
	D.O.	0	0
	MBA	1	6.3
Missing	System	6	37.5
Total		16	100.0

Question 10: What is/are the name(s) of the school(s) that you have attended?

		Frequency	Percent
	Albany Medical College	1	6.3
	Central Michigan University	1	6.3
	Davenport University	1	6.3
	Indiana University	1	6.3
	The University of Georgia	1	6.3
	University of Minnesota	1	6.3
	Van Andel Institute	1	6.3
	Wayne State University	3	18.8
	Missing	6	37.5
	Total	16	100.0

Question 11: What is/was your date/expected date of graduation?

		Frequency	Percent
	2009	1	6.3
	2010	1	6.3
	2011	1	6.3
	2012	3	18.8
	2013	4	25.0
	System	6	37.5
Missing	16	100.0	

- Again, it appears that the majority of the respondents have not yet finished their graduate degrees. Most graduates that are attending graduate school are proceeding directly to a Ph.D.

Question 12: I entered the biotechnology program as a:

		Frequency	Percent
Valid	Freshman	8	50.0
	From the Pre-Pharmacy program at Ferris	5	31.3
	A transfer student from another institution	3	18.8
	Total	16	100.0

- A full 50% of the respondents were originally pre-pharmacy students before switching into the biotechnology program. A reduction in the number of these pre-pharmacy students transferring into the program would have a detrimental effect on program enrollment (see **Section 3B**).

Question 13: Please indicate your level of satisfaction with your background in each of the following when compared to other B.S. entry-level lab personnel or graduate/professional students:

Chemistry

		Frequency	Percent
	Somewhat Dissatisfied	1	6.3
	Somewhat Satisfied	9	56.3
	Very Satisfied	6	37.5
	Total	16	100.0

Biology

		Frequency	Percent
	Somewhat Satisfied	3	18.8
	Very Satisfied	13	81.3
	Total	16	100.0

Mathematics

		Frequency	Percent
	Somewhat Dissatisfied	3	18.8
	Somewhat Satisfied	11	68.8
	Very Satisfied	2	12.5
	Total	16	100.0

Preparation for laboratory work

		Frequency	Percent
	Somewhat Satisfied	2	12.5
	Very Satisfied	14	87.5
	Total	16	100.0

Problem solving and critical thinking abilities

		Frequency	Percent
	Somewhat Satisfied	4	25.0
	Very Satisfied	12	75.0
	Total	16	100.0

Computer and database usage

		Frequency	Percent
	Somewhat Dissatisfied	1	6.3
	Somewhat Satisfied	12	75.0
	Very Satisfied	3	18.8
	Total	16	100.0

Scientific and technical writing

		Frequency	Percent
	Somewhat Satisfied	7	43.8
	Very Satisfied	9	56.3
	Total	16	100.0

Oral and interpersonal communication

		Frequency	Percent
	Somewhat Satisfied	6	37.5
	Very Satisfied	10	62.5
	Total	16	100.0

- Overall, graduates are satisfied with all areas of the biotechnology curriculum. Mathematics had the greatest percentage of dissatisfied responses, most likely due to the small number of mathematics classes formally required by the biotechnology program.

Question 14: Please indicate your level of satisfaction with each of the following:

Level of expertise of the Biotech faculty

		Frequency	Percent
	Somewhat Satisfied	5	31.3
	Very Satisfied	11	68.8
	Total	16	100.0

The advising I received while in Biotech program

		Frequency	Percent
	Very Dissatisfied	1	6.3
	Somewhat Dissatisfied	2	12.5
	Somewhat Satisfied	4	25.0
	Very Satisfied	9	56.3
	Total	16	100.0

Degree helped me achieve my career goals

		Frequency	Percent
	Somewhat Dissatisfied	1	6.3
	Somewhat Satisfied	8	50.0
	Very Satisfied	7	43.8
	Total	16	100.0

- The responses to these questions are quite positive, especially with respect to advising. One serious weakness of the program that was noted in the previous APR report was advising. The biotechnology faculty have made advising and streamlining the program a priority in the last 5 years.

Question 15: I would recommend the biotechnology program at Ferris State to prospective students.

		Frequency	Percent
	Strongly Disagree	1	6.3
	Neutral	1	6.3
	Somewhat Agree	6	37.5
	Strongly Agree	8	50.0
	Total	16	100.0

Question 14: My overall level of satisfaction with the biotechnology program is:

		Frequency	Percent
	Somewhat Satisfied	4	25.0
	Very Satisfied	12	75.0
	Total	16	100.0

Question 15: What do you see as strengths of the biotechnology program?

- Excellent, knowledgable faculty. Great core curriculum - the biotech-specific labs are unlike any courses offered at other universities. Several upper-level courses will have prepared me quite well for entering the doctoral program I have chosen for this coming fall.
- Great glasses. Academics and industry are both viable options.
- I received a very strong background in lab work.

- Personal inter-relationships with other students as well as faculty members. Also, the extensive labs involved helped me to be more prepared for rotations than any of the other students in my first year of graduate school.
- Small class sizes in the professional (junior/senior) section of the program, which provided more one-on-one interaction with the professors; also challenging courses which promoted hard work and critical thinking.
- The biotechnology program has given me a great foundation of knowledge and laboratory skills, my employer has been very impressed and surprised with the skills that the program has given me. When I talk with my fellow colleagues about classes that we have taken, I feel like I have been given a much more superior education. Also, when I describe my classes, some say that they took those classes graduate school. I have been very pleased with the final results of the program, yes it may be hard but it gave me more satisfaction when completed
- The faculty are some of the best Ferris has to offer, and they do a great job allowing us to grow in the lab independently.
- The intensive and practical labs with focus on the technical writing. A lot of knowledge for a B.S. level degree.
- The level of expertise by the faculty. Also, the amount of lab experience complemented the theory-based lectures very well.
- The required labs was a good basis for working in my current research lab. The program had a broad range of science subjects, which allowed for flexibility in career choice.
- The small class size is a great benefit. More time is available to communicate and interact with professors. All the labs are not crowded and as a student you have more time to grasp the relative concepts. The Lab environment is a great setup to what is available in the industry.
- The strong biology background and the amount of time spent in the lab.
- This program is a great aid for students who are intending to attend graduate school. The program's faculty know what to expect in graduate school and prepare the students mentally for the challenge. The laboratory skills learned in the classes are incredibly valuable.
- Tough classes that prepare you for school beyond undergrad.

- All of these responses speak to the primary focus area of the biotechnology program: hands-on laboratory training. It is very satisfying to see that our stakeholders (students) recognize our hard work to maintain this focus.

Question 16: What do you see as the areas needing improvement in the Biotechnology program?

- Biotech students should have a mandatory internship and Ferris should be able to provide the students with options to pursue.
- Career advising. The field has changed a lot over the years and receiving a 4 year degree in biotech doesn't mean what it used to. That needs to be conveyed to students so that they can appropriately prepare for the future.
- Even more lab/hands on activities.
- Funding. Certain instruments are vital to biotechnology training and should be repaired as needed for highest benefit to the students and the program.
- Good internships should be set up for the students.

- I'm irritated that I could be the biology student of the year, an honors grad, and do everything right for four years, and then when I leave, I get no help with job placement. What more do I have to do to succeed?
- More animal handling experience; having some exposure to research animals (handling and dosing techniques especially) can open many more career doors to students. Advanced Immunology, while a wonderfully informative and hands-on class, seemed 'cramped' into the program's schedule; we often had to find times to meet on our own time.
- One major improvement would be to getting in touch with major Biotech firms and pharmaceutical companies. More needs to be done to help students find internships in the industry related companies.
- One of the biggest problems of the program is not having enough "real life" research experience. Although, the courses were nice and helped me understand basic concepts, it is NOTHING like a NIH-funded research lab. Ferris should look into having a connection with Van Andel Institute, Center for Molecular Medicine or other universities to allow students the opportunity to work benchside.
- Past research experience is very important for getting into grad schools and many industry jobs, but getting that experience is difficult since there is practically no research taking place at Ferris.
- Placement for internships, jobs, and industry connections. This is traditionally a very weak aspect of the program felt by all the graduates. This is the one area that really needs improvement. It is somewhat dependent on the recent graduates staying in touch with the program. I always try to help the program by staying connected and being a resource for the students.
- Program advising. Help with applications of how the application process works, GRE testing, and good prospective graduate schools. I was on my own to figure out where to go and how it works.
- Replace physics with a calculus class.
- While it is good that Ferris is a teaching-oriented university, and most of the faculty are intently focused on student learning in the classroom and the lab, the down-side is that there are very few opportunities for research experience outside of class. It is also good for students to expand their repertoire by leaving Ferris for internships to gain more experience, but it would be great for more opportunity at Ferris, as well.

- Internship placement is consistently one of the most difficult aspects of the program coordinators job. Many of the strong connections with the Michigan biotechnology industry that the biotechnology program had cultivated in the 1990's were lost when the program went through a period of transition in the early 2000's. Unfortunately, the biotechnology industry moves very quickly and by the time the reestablishment of these connections was attempted starting in 2005, most of the relevant individuals were no longer members of the Michigan biotechnology community. The program coordinator has had to start from scratch to begin reestablishing industry networking connections. This has been a very slow process and only in the past two years have some of these new connections begun to bear fruit with respect to internships. In addition, the current economic climate has led to a reduction in industry-based internships, which has also made placement for academic internships even more difficult. Renewed emphasis has been placed on student involvement in the internship preparation process with a focus on resume development and interviewing skills. The program's new membership in MichBio should also help to promote connections with the biotechnology industry and open more internship opportunities for students.

The requirements for internship credits (BIOL 491) have also been strengthened. Interns are now required to create a scientific poster of their internship research project suitable for presentation at small scientific conferences. This standardizes the requirements for all interns, and also gives the students an opportunity to practice a very useful skill, scientific poster creation and presentation.

However, at the end of the day, students must ultimately realize internships are their responsibility and it is only through their hard work and dedication that they will be successful in obtaining a top-notch internship. In the same way that students do not expect to be "placed" into jobs following graduation, they should not expect to be "placed" into an internship. With the limited resources of the biotechnology program (unless the program receives more release time for the program coordinator or a dedicated internship coordinator) the final impetus for internship selection must fall on the student.

- As is discussed in **Section 4**, laboratory equipment for the biotechnology program is rapidly outdated due to the rapid pace at which advancements occur in biotechnology. As funding allows, new or refurbished equipment is purchased for the program. However, the program will never be able to consistently buy the latest and greatest equipment. Internships and partnerships with biotechnology companies must be utilized to give students expanded hands-on experience with the latest equipment.

Question 17: Any additional comments about the biotechnology program?

- Dr. Boogaard's courses prepared me very well for my graduate level coursework in cell and molecular biology. I actually had to refer to her notes on several occasions because the graduate course had not covered it as well.
- I really enjoyed my education at Ferris and always speak highly of the program. It is quite shocking to see how little the starting salary is for the amount of education that is require to earn the Biotechnology B.S. degree at FSU.
- I thoroughly enjoyed my time in the Biotechnology program, and am very pleased with the amount of knowledge (both book and hands-on) I came out of the program with. it is a very challenging yet ultimately rewarding program!
- The biotechnology program is a good foundation for many careers in science. If the school networked more to establish connections with research labs than I believe this would be a huge plus to the program.
- The internship requirement for graduation was intimidating at first, but useless afterward. I had very little help in finding the internship, then did a few weeks of work and got credit. There should be a more organized/more structured process to help the students find an internship as well as an evaluation of the job done to make sure that the student is well prepared.
- The part of the curriculum that focuses on techniques should be revamped to better cover what is most commonly seen in the literature. I understand that there are some large $$ restraints, but the program could do better.
- Through my interviews with prospective employers and grad schools, I have noticed that people are definitely impressed by the scope of the biotechnology curriculum. I have not encountered many people who have experienced as in-depth and technical coursework and lab work as I have at Ferris. Many people were impressed with the Proteins Lab, DNA Lab, and Immunology Lab because of the direct hands-on experience this gives to students.

Section 2B– Employer follow up survey

No official employer survey was given in preparation for this report. Our original intent was to send a survey to employers based on the responses of our graduate follow-up survey. However, because of the low response rate of our graduates and the lack of detailed contact information for their employers, we decided that any survey that was conducted would not be statistically relevant. Some members of the external advisory committee are employers of biotechnology alumni; this will be discussed more fully in **Section 2F**.

Section 2C– Graduating Student Exit Survey

Exit surveys have been administered to 20 graduating students since 2005. This survey was originally created as a simple question and answer survey (see survey in **Appendix F**) administered by the program coordinator. While the exit survey did produce useful responses about the biotechnology program, it was not designed to produce quantitative data. Unfortunately, it is impossible to easily summarize the responses to these surveys in this report in its original qualitative format. To make the results more easily summarized, the survey responses were evaluated and reclassified into a five question quantitative survey based in part on program objectives, the results of which will be discussed here. While this reclassification allows the data to be discussed in this report, it does not allow for the most accurate representation the richness and depth of the original responses. For instance, the number of "did not answer" responses to the questions does not indicate the students did not the original question, but that the students did not answer the question in a way that allows for a simple quantification of their answer. To simplify future discussion and analysis, the survey will be redesigned in 2010 to produce quantifiable data in the future.

Question 1: Did my coursework allow me to develop a proficiency in laboratory and field techniques appropriate to my discipline?

		Frequency	Percent
	Yes	18	90
	No	0	0
	Did Not Answer	2	10
	Total	20	100

Question 2: Was my coursework intellectually challenging?

		Frequency	Percent
	Yes	13	65
	No	1	5
	Did Not Answer	6	30
	Total	20	100

- The responses to questions 1 and 2 mirror those of responses to similar questions in the alumni survey, which is again verification that the students feel that the biotechnology program is both rigorous and beneficial to their long term career goals.

Question 3: My advising was helpful in planning my course selection and providing advice about my career.

		Frequency	Percent
	Yes	9	45
	No	3	15
	Did Not Answer	8	40
	Total	20	100

Question 4: What course would you identify as the most useful?

Year	Course Name
2006	No discernible trends
2007	Molecular genetics; advanced cell biology (2)
2008	Molecular genetics; advanced cell biology (3)
2009	Proteins lab (3)
2010	Proteins lab (2)

Question 5: What course would you identify as the least useful?

Year	Course Name
2006	No discernible trends
2007	Advanced biochemistry (2)
2008	Advanced biochemistry (2)
2009	No discernible trends
2010	Recombinant DNA; bioinformatics (2)

Section 2D– Student program evaluation

We did not perform an evaluation of current students in the biotechnology program. It was felt that because we have such a small number of students that would be surveyed, along with their varying levels of perspective about the program (freshman versus seniors), this evaluation would not be a strong assessment of the biotechnology program. The larger numbers of graduating seniors and, especially, alumni that were surveyed, along with their

full view of the program makes the survey data discussed in **Section 2A and Section 2C** much better assessments of student satisfaction with the biotechnology program.

Section 2E – Faculty perceptions

An alumni survey was sent to all 20 tenured and tenure-track faculty in the biology department. Ten faculty completed and returned the survey, for a response rate of 50%. This response rate was a bit disappointing, as faculty input from the biology department is very important to the biotechnology faculty. One reason for the poor response rate include the time frame of the administration of the survey (late spring semester and into the summer) when many faculty are busy or not on campus. A copy of the survey can be found in **Appendix F**.

Question 1: Please indicate your level of agreement with the following statements.

Question 1A: The mission of the biotechnology program is consistent with the Ferris State mission statement.

		Frequency	Percent
	Strongly Agree	10	100.0

Question 1B: The objectives and goals of the biotechnology program are consistent with the objectives and goals of the biology department.

		Frequency	Percent
	Somewhat Agree	1	10.0
	Strongly Agree	9	90.0
	Total	10	100.0

Question 1C: The biology faculty supports the biotechnology program.

		Frequency	Percent
	Somewhat Agree	3	30.0
	Strongly Agree	7	70.0
	Total	10	100.0

- All respondents thought the biology faculty supports the biotechnology program. This is especially good news, as one major criticism of the 2003 APRC report was that the biology faculty did not support the program. The biotechnology faculty have spend the past 5 years focusing this rift and making sure the biotechnology program is viewed by the faculty as integral and important part of the biology department and not as a separate fiefdom of only a few biology faculty.

Question 1D: The Ferris State administration supports the biotechnology program.

		Frequency	Percent
	Somewhat Agree	4	40.0
	Strongly Agree	5	50.0
	Missing	1	10.0
Total		10	100.0

- These responses are in line with the opinions of the biotechnology faculty, as the biology department head and Arts and Sciences Dean's office have been very supportive of the biotechnology program.

Question 1E: The biotechnology program trains students in technical and management skills needed for a successful career in the biomolecular laboratory sciences.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	8	80.0
	Total	10	100.0

Question 1F: Biotechnology courses are arranged in a logical sequence from least expertise required to greatest expertise required.

		Frequency	Percent
	Somewhat Agree	3	30.0
	Strongly Agree	6	60.0
	Missing	1	10.0
Total		10	100.0

Question 1G: Question 1I: The biotechnology program offers sufficient opportunity for students to develop critical thinking and problem solving skills.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	7	70.0
	Missing	1	10.0
Total		10	100.0

Question 1H: The biotechnology program offers sufficient opportunity for students to develop good oral communication skills.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	6	60.0
	Missing	2	20.0
Total		10	100.0

Question 1I: The biotechnology program offers sufficient opportunity for students to develop good written communication skills.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	6	60.0
	System Missing	2	20.0
Total		10	100.0

Question 1J: The biotechnology program offers sufficient opportunity for students to master broad knowledge of the major areas of biotechnology.

		Frequency	Percent
	Somewhat Agree	3	30.0
	Strongly Agree	6	60.0
	Missing	1	10.0
Total		10	100.0

Question 1K: The biotechnology curriculum challenges students academically.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	8	80.0
	Total	10	100.0

Question 1L: The biotechnology curriculum is relevant to the career goals of the students.

		Frequency	Percent
	Somewhat Agree	2	20.0
	Strongly Agree	7	70.0
	Missing	1	10.0
Total		10	100.0

Question 1M: The biotechnology program responds to the needs of a growing biotechnology industry.

		Frequency	Percent
	Somewhat Agree	1	10.0
	Strongly Agree	8	80.0
	Missing	1	10.0
Total		10	100.0

- The responses to questions 1E-1M are consistent with the feelings of the biotechnology faculty, which is verification that the biotechnology program remains rigorous, effective, dynamic, and relevant from a faculty viewpoint.

Question 1N: I am not very familiar with the biotechnology program.

		Frequency	Percent
	Strongly Disagree	5	50.0
	Somewhat Disagree	1	10.0
	Somewhat Agree	2	20.0
	Strongly Agree	2	20.0
	Total	10	100.0

- Biotechnology students make up a very small percentage of biology students as a whole. Also, only a small group of biology and physical sciences faculty are involved with classroom and laboratory instruction of biotechnology students in their final two years in the program (the biotechnology core). Because of this, there is some concern that the program could become isolated, misunderstood by other faculty, and lose the support of these faculty. The responses to this question give us an indication of where we stand with respect to quality of communication about the biotechnology program with the rest of the biology faculty. While 60% of the respondents did say they were familiar with the biotechnology program, a full 40% are not familiar with the program. Also, there is a chance that the 50% of biology faculty that did not respond to the survey do not feel familiar enough with the program to complete the survey. This is an indication that the biotechnology faculty need to continue to work on making the biotechnology program a more recognized, integral part of the biology department.

Question 2: What do you see as the strengths of the biotechnology program?

- First-rate faculty. 2) Small class size (particularly in labs). 3) High academic expectations (this applies to both program-specific classes and other science requirements). 4) Students who are exceptionally good by Ferris standards. 5) Combined, these factors allow us to produce mostly top quality graduates, even by national standards. I have always felt the program's main advantage is the increased legitimacy it gives to the entire department, a benefit that extends to college and university. A school requires a quality cell-molecular biology program as one of the many requirements to remain relevant. This is a challenge in a small teaching university.
- Academic excellence.

- It is an important part of biological sciences. Without this program, biology will miss too much.
- It teaches skills and knowledge that would be valuable in a research laboratory or in graduate school.
- The courses that are offered are good strong courses; pertinent to the needs of the student. Some of the statements above I can't answer. I don't' know enough of the exact nature of the courses that are offered - for example, I don't know whether they develop written or oral skills because of the biotech program. I am not sure if the program changes based on the industry? Has it changed and how?
- The faculty
- The internships or external project.
- The program has an outstanding faculty who offer an excellent rigorous curriculum. I do not think students could find such a broad exposure to biotechnology, with hands-on laboratory experience, in any other undergraduate program in the midwest. Brad Isler is an excellent program coordinator. He interacts very well with these students, stays in contact with the industry, and workd on articulation with community colleges. The department head has been very supportive.
- The students receive a strong, broad background in molecular biology that allows them to compete for jobs and/or admission into graduate school.
- Trains students for entry into a growing field with ample opportunities for advancement.

- The responses here echo the responses of question 15 from the biotechnology alumni survey (**Section 2A**), which again dovetails nicely with the primary focus of the biotechnology program: hands-on laboratory training.

Question 3: What do you see as areas needing improvement in the biotechnology program?

- Equipment management and acquisition.
- I am not aware of any major problems.
- I really think that the Biotech program needs to be expanded and grow. I am not sure if we have enough student interest, but possibly a name change including molecular biology might attract more students. The program is way too small! There are ways to increase class size and not loose individual attention to students.
- Most of the equipment used for this program appear to be ancient and do not appear to meet current standards for the industry.
- Programs such as pre-med, pre-dent, etc., have students arrive already seeking those careers. Students are not generally aware of opportunities in biotechnology. Biotechnology needs to find more ways to reach and recruit potential students.
- Sometimes, some colleagues express unhappiness with the small class sizes and/or higher lab costs in the program. Unfavorable opinions do not hurt the quality of the program, but either major increases in class size or cuts in lab expense would compromise a program with unique strengths and requirements.
- The quality of students in the program could be improved overall. There seems to be a few very good students but then also a good number who struggle. Replacing those poorer students with better-quality students would improve the program in general.

- This program would be better at a research university where there would be more opportunities for research experience. That is not something that is very feasible here, though.
- We need more current equipment in a core facility for the students to get adequate training and background in modern biotech methods

- Several of the responses here mention the lack of current equipment, which was also mentioned as a weakness of the program in the alumni survey.

Question 4: Any additional comments?

- Biotech is an excellent program for which Ferris can take pride. It is clearly a program that fits Ferris' mission. Larger universities focus on graduate education in this area, and do not provide undergraduates the opportunity to gain such hands-on expertise. FSU biotechs are prepared well for employment in the industry or for graduate school.
- Excellent program.
- I have these students in Biol-205; and as a group, they are motivated and success oriented. Brad Isler is doing a great job as coordinator of this program and several other faculty make strong contribution. This is a program to which we should give more emphasis.
- This is an excellent program both academically and technically.

Section 2F – Advisory committee perceptions

Members of the biotechnology external advisory committee were chosen not only for their involvement in the biotechnology industry, but also for their past involvement in the biotechnology program internship program as internship supervisors. These individuals are therefore not only actively involved in the biotechnology industry, but have first-hand experience with biotechnology students from Ferris State. The members of the external advisory committee are as follows:

- Nathan Banner, Product Manager of Sanitation and Drug Residues, Neogen Inc. (Biotechnology Program Alumnus)
- Dr. Kelvin Grant, Research Scientist, Pioneer Hi-Bred Interntional
- Dr. Norman Lehman, Researcher, Henry Ford Community Hospital
- Dr. Michelle Mousel, Geneticist, United States Department of Agricuture – U.S. Sheep Research Station
- Dr. Steven Rapundalo, CEO, MichBio

The external advisory committee/internship survey (**Appendix F**) was distributed to all members of the committee. Unfortunately, only two of the five committee members (40%) replied to the survey. Any non-responses were followed by a phone call or personal visit by the program coordinator to collect each advisory committee member's opinions of the biotechnology program. The results of the survey are listed below, followed by some of the responses personally collected by the program coordinator from committee members.

Question 1: Please indicate your level of agreement with each of the following. If something is not applicable to you or you aren't sure, please select N/A.

Question 1A: The content of the biotechnology program reflects what is needed to be successful in today's workplace.

		Frequency	Percent
	Somewhat Agree	1	50.0
	Strongly Agree	1	50.0
	Total	2	100.0

Question 1B: The biotechnology program prepares students to continue their education at a graduate/professional level.

		Frequency	Percent
	Somewhat Agree	1	50.0
	Strongly Agree	1	50.0
	Total	2	100.0

Question 1C: The biotechnology offers quality laboratory instruction not available at most undergraduate institutions.

		Frequency	Percent
	Strongly Agree	2	100.0

Question 1D: Employment prospects for biotechnology graduates are strong.

		Frequency	Percent
	Somewhat Agree	2	100.0

Question 2: Please indicate your level of agreement with the categories given. If something is not applicable to you or you aren't sure, please select N/A.

Question 2A: Compared to students/graduates from similar B.S. programs, Ferris State Biotechnology students and graduates have sufficient technical laboratory skills.

		Frequency	Percent
	Strongly Agree	2	100.0

Question 2B: Compared to students/graduates from similar B.S. programs, Ferris State Biotechnology students and graduates are sufficiently adept at oral communication.

		Frequency	Percent
	Somewhat Agree	2	100.0

Question 2C: Compared to students/graduates from similar B.S. programs, Ferris State Biotechnology students and graduates are sufficiently adept at written communication.

		Frequency	Percent
	Somewhat Agree	2	100.0

Question 2D: Compared to students/graduates from similar B.S. programs, Ferris State Biotechnology students and graduates have sufficient computer and database skills.

		Frequency	Percent
	Somewhat Agree	1	50.0
	Strongly Agree	1	50.0
	Total	2	100.0

Question 3: What do you see as strengths of the biotechnology program?

- Practical hands on with standard techniques.
- The Proteins Lab is very "real world" and prepares the students for working in a lab full time. The classes and labs are diverse and cover many different areas in the Biotechnology field. The Advanced Immunology Lab taught by Mr. Hartley was probably one of the most applicable classes when it comes to the Biotechnology Industry.

Question 4: What do you see as areas needing improvement in the biotechnology program?

- Internships and job placement is something that was lacking when I was going through the program. There weren't many industry connections nor internship opportunities.
- Theory may be a bit weak.

Question 5: Any additional comments about the biotechnology program?

- I enjoyed my education and always speak highly of the program.
- Not all students are at same level. I would recommend the internship be only for 4th year students so that they can get the most out of it.

Additional input was personally collected by the program coordinator for the three committee members that did return the survey. Their comments about the program reflected the responses shown above. Here are some of the major points brought up by the remaining committee members:

- **Excellent technical skills and academic preparation.** All committee members stated that our biotechnology students are generally better prepared from a technical and academic standpoint than students from other schools in the state of Michigan, including major universities such as the University of Michigan and Michigan State.
- **Flexibility of curriculum and co-op opportunities.** Several committee members discussed their negative opinion of standard 12 week summer internship programs. With the advent of more complex molecular techniques, 12 weeks is just not enough time to sufficiently train an intern. An increasing number of companies are moving towards 6 month co-op programs that allow both the student and company to receive maximum benefit from the experience. The committee members stated their preference for these co-op programs and suggested that the biotechnology program investigate ways to make the curriculum more flexible to allow students to more seamlessly integrate a co-op into their course sequence.
- **Previous research experience before internship.** Ideally, internship supervisors would like interns to have as much experience as possible before beginning their internship. In the past, a high GPA and experience from standard laboratory courses were sufficient for a prospective intern to remain competitive for internship selection. However, it is becoming increasingly crucial that students receive not only experience in standard laboratory courses, but also in some sort of independent study/research project prior to applying for internships. Several committee members stated that while biotechnology students are very well prepared from a laboratory course perspective, most do not have the formal research lab experience that is needed for prospective interns. They suggested that the biotechnology faculty and Ferris State investigate ways to increase student research opportunities to give students this added experience.
- **Interviewing skills.** For those committee members that also served as internship supervisors, an overall theme was that many of our biotechnology students need to work on their interviewing skills. Again, all stated that our students are very well prepared from a technical perspective. However, many do not have

the interviewing skills to present this excellent technical knowledge to employers. They suggested that we either add an interviewing course to the biotechnology curriculum or require students to consult with the placement office before interviewing.

Section 3 - Program Profile

Section 3A - Student Profile

1) **Student demographic profile.** The relative number of male and female students enrolled in the biotechnology program is quite dynamic, with a slight excess of male students in the past 5 years (**Table 3A.1.1**). The average age of biotechnology students is 21, which follows trends of similar programs within the college of Arts and Sciences. The majority of students in the program are Caucasian (**Table 3A.1.2**), with minority students generally being of Asian and Pacific Islander backgrounds. The program coordinator continues to work with the International Office to increase the visibility of the program to international students. Most students are Michigan residents (**Table 3A.1.3**), with a few from surrounding Great Lakes states (primarily Chicagoland) and international students. Because of the rigorous nature of the program, very few students are enrolled as part-time students (**Table 3A.1.4**). Of students that do enroll part-time, the majority will be Freshman and Sophomore students, students finishing their internship or co-op requirements, and students finishing courses required for a dual major.

   Because of the hands-on laboratory focused nature of the program, no core biotechnology courses are currently offered online or are being investigated to be offered in this manner. However, students are advised to finish their general education courses in the summer between their first and second and second and third years, and online courses are an excellent option for students that wish to do so.

Table 3A.1.1 Enrollment By Gender

	Males	Females	% Males
Fall 2005	19	21	47.5
Fall 2006	21	20	51.2
Fall 2007	29	18	61.7
Fall 2008	26	12	68.4
Fall 2009	16	15	51.6
Average			56.1

Table 3A.1.2 Enrollment By Ethnic Background

	Black	Hispanic	Indian/ Alaskan	Asian/Pacific Islander	White	Foreign	Unknown	% White
Fall 2005	2	1	0	2	31	4	0	77.5
Fall 2006	2	0	0	3	31	4	1	75.6
Fall 2007	2	0	0	1	41	3	0	87.2
Fall 2008	2	0	0	2	31	3	0	81.6
Fall 2009	0	0	0	3	27	0	1	87.1
Average								81.8

Table 3A1.3 Enrollment by Resident Status				
	Michigan Resident	Midwest Compact	Non-Resident	% Michigan Resident
Fall 2005	35	2	3	87.5
Fall 2006	36	2	3	87.8
Fall 2007	43	2	2	91.5
Fall 2008	35	1	2	92.1
Fall 2009	31	0	0	100.0

Table 3A1.4 Enrollment by Student Status			
	Full Time	Part Time	% Full-Time
Fall 2005	39	1	97.5
Fall 2006	36	5	87.8
Fall 2007	41	6	87.2
Fall 2008	31	7	81.6
Fall 2009	29	2	93.5
Average			89.5

2) **Quality of students.** The average GPA of biotechnology students is 3.01, with an average composite ACT score of 23.92 (**Table 3A.2.1**). The biotechnology program is rigorous. Lecture courses in the final two years of the program are taught at a graduate school level. The biotechnology program attracts excellent students, but the difficulty of the program tends to somewhat depress the average GPA of students from what would be expected from studying their ACT scores in comparison to other programs in the department of Biological Sciences. However, we do not see this as an indicator of a weakness in the program, but as a strength in the program. Rigorous courses produce students that are qualified to enter the very challenging biotechnology industry immediately upon graduation.

   The increase in entrance requirements for the University as whole over the past five years has not had a large impact on the academic level of students entering the biotechnology program. We have observed an increase in the number of students that enter the biotechnology program not as FTIACs, but as transfers from other programs within the University during their Freshman or Sophomore years. Because the biotechnology program is designed to be both small and exclusive, it has always selected a small, well prepared, group out of the recruitment pool as a whole.

Table 3A.2.1 Academic Quality Data		
	Average GPA	Average Composite ACT
Fall 2005	3.06	23.53
Fall 2006	2.95	23.59
Fall 2007	3.07	24.03
Fall 2008	3.00	24.29
Fall 2009	2.99	24.14
Average	3.01	23.92

The academic excellence of Biotechnology students has also been recognized by the campus community as a whole, with the acceptance of several important awards. Jason Workman was named the outstanding graudate of the Honors program in April 2010. The past two outstanding biology graduate awards have been awarded to biotechnology students: Jason Workman (2010) and Elizabeth Tovar (2009). In addition, 2-4 biotechnology students split $3500 in ability based scholarships every year. It should be noted that the amount of yearly ability based scholarship funds given to the biotechnology program has been increased twice in the last five years by the Dean of the College of Arts and Sciences in recognition of the academic strength of the program.

The quality of biotechnology students is also apparent in their work outside of the classroom in the laboratory. In the past five years, biotechnology students have assisted with research projects with the following Ferris State Faculty:

- Dr. Tracy Boncher – The synthesis and characterization of organic compounds with anti-diabetic action.
- Dr. Kim Colvert – Isolation and characterization of ATPase subunits.
- Dr. Clifton Franklund – The mutagenesis and characterization of oral bacteria.
- Dr James Hoerter – The effect of ultraviolet radiation on skin cell growth and repair.
- Dr. Bradley Isler – The association between anophthalmia and genetic polymorphism in rats.
- Dr. Beth Zimmerman – The control of respiratory mechanisms in reptiles.

All students in the biotechnology program are also required to perform an internship before graduation. Some of the students have fulfilled their internship requirement by working with the Ferris State faculty listed above. However, students are encouraged to seek off-campus internships to facilitate networking and skill development. The program coordinator has placed special emphasis on helping students obtain off-campus internships and the number of these placements has increased in the past five years. Students have performed off-campus internships in the following locations:

- National Institutes of Health
- University of Wisconsin-Madison
- University of California-Riverside
- University of Georgia
- Neogen
- The Ohio State University
- Michigan State University
- University of Indiana School of Medicine
- Pioneer Hi-Bred
- United States Department of Agriculture
- Cayman Chemical
- Pfizer
- Proteos, Inc.
- Henry Ford Hospital
- Wayne State University
- Eastern Virginia University
- Northern Biomedical Research

3) **Employability of students.** An alumni survey was sent to 32 alumni (see **Section 2A**) that graduated with a degree in biotechnology in the past 5 years. Sixteen alumni completed and returned the survey, for a response rate of 50%. The low response rate of this survey was primarily due to the constantly changing nature of personal e-mail addresses, especially those of less recent graduates. The following survey questions were helpful with respect to addressing the employability of our students:

- *Currently, I am...* Of the 16 responses, 7 alumni are currently attending graduate school, 7 are currently employed in a position related to their major, 1 was looking for work, and 1 was working as a contractor at a food company.

- *Who is your employer?*
  - Albany Medical College, Dr. Paul J Higgins
  - Contracted by Kelly Scientific and working at Kraft Foods Inc.
  - Covance Inc. (2)
  - Dr. Karen Beningo, PhD.
  - Henry Ford Hospital
  - Kelly Scientific Resources/onsite The Dow Chemical Company
  - MPI Reasearch
  - Neogen Corporation
  - TATA Consultancy Services
  - University of Minnesota
  - Van Andel Institute
  - Wayne State University

- *How long did it take to find a job after receiving your terminal degree?* There were a variety of answers for this question. Four alumni started their job/graduate program immediately following graduation, 4 alumni required between 2-3 months, 1 alumnus required 8 months, and one alumnus is still looking for a job related to their degree.

- *What was your starting annual salary?* Of the 14 responses, 5 earned less than $25,000 in their first position and 9 earned between $25,000 and $35,000. The five alumni that earned less than $25,000 in their first position were most likely the alumni attending graduate school.

- *What type(s) of graduate program(s) have you attended or are you currently attending?* Of the 10 respondents that have attended graduate or professional school, 2 attended a M.S. program, 7 attended a PhD program, and 1 attended a MBA program.

- *My degree helped me achieve my career goals.* Seven respondents were very satisfied with the ability of their biotechnology degree to help them achieve their career goals, 8 were somewhat satisfied, and 1 was somewhat dissatisfied.

Section 3B - Enrollment

Enrollment data for the biotechnology program are shown in **Figures 3B.1, 3B.2, and 3B.3.** The overall number of students enrolled in the biotechnology program increased for several years before decreasing over the past two years (**Figure 3B.1**). This mirrors the trend observed for the number of biotechnology program graduates (**Figure 3B.2**), with an increase followed by a decrease over the past two years. Possible reasons for this decrease are as follows:

- **More rigorous advising.** Over the past several years, the program coordinator and faculty have placed greater emphasis on making sure that students are a good "fit" for the biotechnology program. The biotechnology program is very rigorous and not made for all students. Only those students with the correct motivation and work ethic will succeed in the program. Program faculty have taken a more proactive approach in advising students of their academic options when it appears their skills and career goals are not a good fit for the program. Long term, this makes the biotechnology program stronger both within Ferris and outside in the biotechnology community with our graduates. Unfortunately, in the short term, it also has a negative effect on overall enrollment and graduation numbers, as those students that are not a good fit for the program are more strongly advised to consider if other programs would be a better fit for their skill set and long term goals.
- **Fewer pre-pharmacy students and greater acceptance rate into the Ferris Pharmacy program.** Traditionally, a significant number of biotechnology students were originally pre-pharmacy students that either decided they did not want to enter pharmacy school or could not gain admission into pharmacy school. Keep in mind that most of these students were not substandard by any stretch of the imagination, but when the average GPA for incoming Pharmacy students moved towards 3.80, there was going to be a large subset of the applicant pool that were very good students but not quite good enough. In the past, the biotechnology program received a number of these excellent students every spring after acceptance letters for pharmacy school were distributed. As the number of applicants for the Ferris pharmacy program has decreased in the past few years and the average GPA for incoming pharmacy students has concomitantly decreased, the biotechnology program has seen fewer and fewer of these pre-pharmacy students entering the biotechnology program and even when we do see them, they are of a lower quality than in the past.
- **Small program size and enrollment variability.** A small program such as biotechnology has an inherent amount of sampling error associated with its enrollment numbers. A gain or loss of even a few students has a proportionally greater effect on the overall enrollment than would be observed in a larger program. For instance, while the graduating class for 2009-10 was quite small, the projected graduating class for 2010-11 will be around 15 students and we have one of the largest groups of incoming FTIAC biotechnology students than we have had in quite a few years.

However, we have maintained a consistent number of students entering the core sequence (third year) of biotechnology courses (**Figure 3B.3**). Since the biotechnology program shares the cost of first and second year courses with other programs and departments, the number of students enrolled in the core sequence is the most accurate indicator of program enrollment. Please see **Section 3C** for an additional discussion of the comparison between overall program enrollment and core sequence enrollment.

Figure 3B.1 Overall Biotechnology Program Enrollment

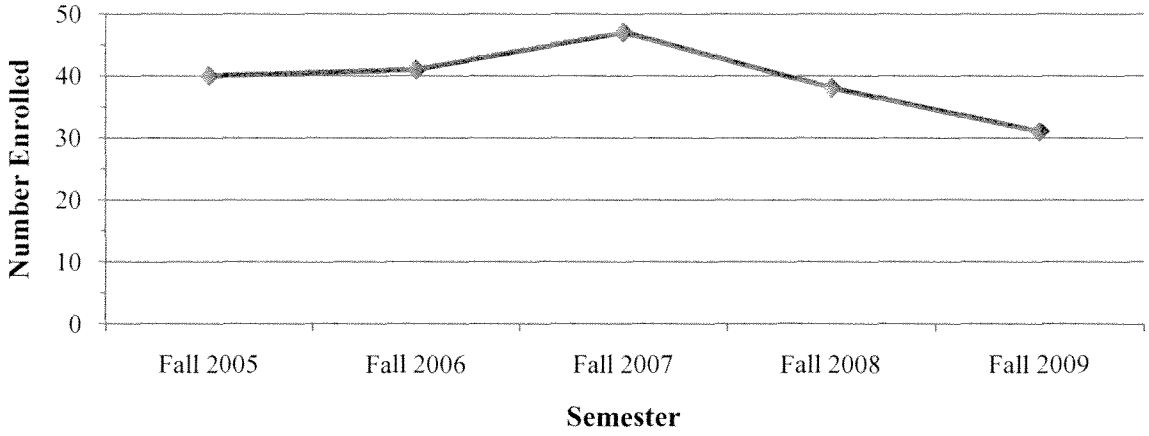
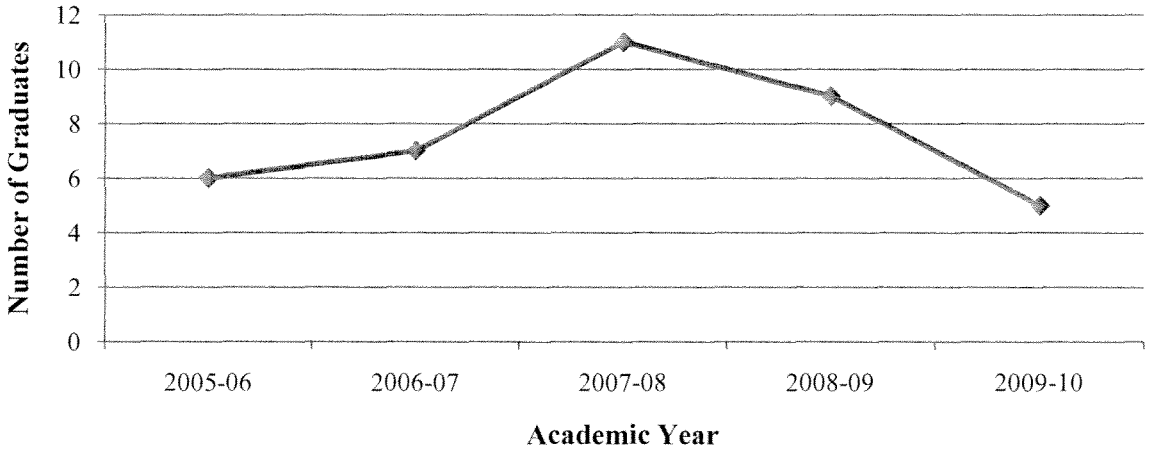
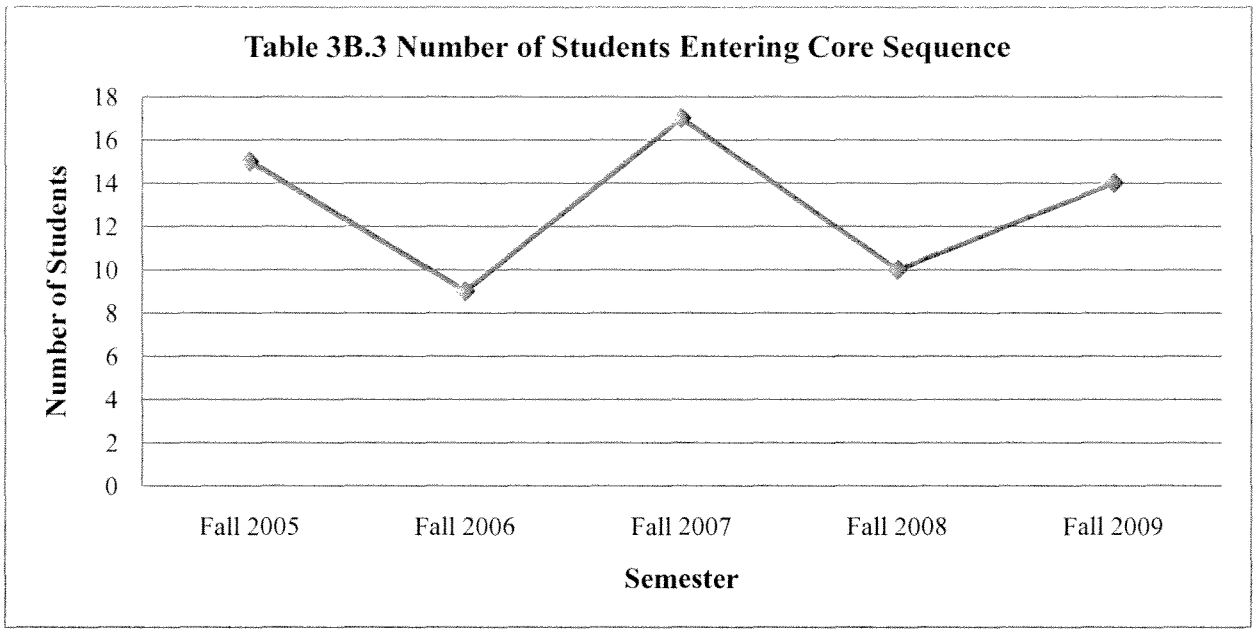


Figure 3B.2 Biotechnology Program Graduates





Section 3C – Program Capacity

In some respects, the biotechnology program is a two-year program. A comparison of the program checksheet of the biotechnology program with that of other biology-related programs and concentrations (pre-medicine, pre-pharmacy, pre-optometry, etc.) shows that the series of courses taken by first and second year students in all of these programs and concentrations are almost identical. It is in the third and fourth years of the biotechnology program that students move into upper-level, program specific core biotechnology lecture and laboratory courses (see **Table 3C.1** for a listing of core biotechnology courses). Faculty resources and biotechnology program costs are concentrated in the final two years of the program, since the costs of the first two years of the program are shared with other biology related programs (of which biotechnology is only a small contributor). The biotechnology program is designed to be a small, focused program, with an emphasis on hands-on laboratory training in the final two years of the program. To maintain these standards, laboratory sizes of the core biotechnology courses have a maximum of 12-15 students. Laboratory sizes larger than this would result in a loss of the individual, hands-on approach that is fundamental to the biotechnology program, besides being greater than the physical space in biotechnology laboratories. Enrollment in third and fourth year classes is capped at this level and our programmatic goal is to maintain the number of students entering the core sequence at this level, which we have done over the past 5 years (**Table 3C.2**). Also, because the biotechnology program actively recruits students from other biology and physical science programs during their first two years of courses, many students do not even enter the program until they are ready to begin their core series of biotechnology courses in their third year. While we continue to recruit FTIAC students via our relationship with the General Biology Advisor and the Admissions Office, we have also placed an increased focus on recruiting students from related programs at Ferris to fill the biotechnology core courses. Our goal is to keep the biotechnology core courses at their capacity with quality students that entered the program as FTIACs and as transfers from other Ferris programs.

Table 3C.1 Core Biotechnology Courses		
Third Year		
Fall		
BIOL 375	Principles of Genetics	3 cr.
CHEM 332	Biochemistry Lab 1	2 cr.
CHEM 364	Biochemistry	4 cr.
Spring		
BIOL 386	Microbiology and Immunology	5 cr.
CHEM 333	Biochemistry Lab 2	2 cr.
BIOL 474	Advanced Cell & Molecular Biology*	3 cr.
Fourth Year		
Fall		
BIOL 476	Advanced Techniques in Biotechnology	2 cr.
BIOL 473	Proteins Laboratory	3 cr.
BIOL 472	Proteins*	3 cr.
Spring		
CHEM 474	Advanced Biochemistry	3 cr.
BIOL 471	Recombinant DNA Laboratory	3 cr.
BIOL 470	Molecular Genetics*	4 cr.
BIOL 475	Bioinformatics*	3 cr.
*These courses are offered every other year. Depending on their year of entry into the core sequence, students may take these courses in reverse order from what is listed here.		

Table 3C.2 Number of Students Entering Core Sequence	
	Number of Students
Fall 2005	15
Fall 2006	9
Fall 2007	17
Fall 2008	10
Fall 2009	14
Average	13

Section 3D – Retention and Graduation

In a small program such as the biotechnology program, retention of high quality students is a key objective. Because the majority of our students enter the program not as FTIACs, but as transfers from other programs at

Ferris, retention is difficult to quantify. It is a bit easier to investigate the two-year retention rate of students from their entrance into the core biotechnology courses in their third year through to graduation. The two year graduation data is listed in **Table 3D.1** (Please see **Appendix B** for a list of all recent biotechnology graduates). What is first obvious is that there is great deal of variability in numbers when dealing with a small sample size such as in the biotechnology program. The two year graduation rates range from over 100% to 50%, with an average of 75%. The largest contributor to the variability lies in the fact that this analysis is not perfect, as it will misclassify students that take longer than two years to complete what should be a two-year series of courses (leading to a 122% graduation rate). The biotechnology faculty have recognized that retention of students is a key priority in a small program. However, due to the rigorous nature of the core biotechnology sequence, we also recognize that every student that enters the core sequence will not graduate with a B.S. in biotechnology within two years. The primary outcomes for these students are the following:

- **Transfer out of the program**. Some students are not prepared for the difficulty of the core biotechnology sequence and determine within one semester that the biotechnology program is not the best fit for their long term goals. Most of these students make this determination within their first semester in the biotechnology core sequence. The majority of these students will transfer to other programs within Ferris State, usually the B.S. in Biology program.
- **Graduate in three years with a dual major**. Some students pursue dual majors with other programs such as Forensic Biology, Chemistry, Biochemistry, and Industrial Chemistry Technology. These students usually finish their core biotechnology courses before completing the courses required by other programs. This will extend their time until graduation to longer than two years.
- **Retake courses and graduate in 3-4 years**. Students that do not do well in the biotechnology core lecture courses and that wish to stay in the biotechnology program must retake these courses before graduation. However, due to the small size of the biotechnology program, some biotechnology core courses are only offered every two years to maximize enrollment. This means that a student must wait two years to retake the course. This will also prevent a student from finishing the biotechnology core in two years.
- **Perform an external co-op and graduate in three years.** An increasing number of biotechnology companies are moving away from the traditional 12 week summer internship cycle and are moving towards a six-month co-op program. This yields the companies a greater return on their investment into the student and provides the student a richer internship experience. However, because of the biotechnology core lecture cycle, these co-op students will miss some courses that only offered every two years. These students will have to delay graduation to complete these courses. As the co-op model is becoming more common, the biotechnology faculty recognizes this weakness in the timing of core biotechnology courses and is discussing ways to make co-op programs more compatible with the curriculum.

Table 3D.1 Graduation and Retention Data

	Number Entering Core Courses	Number Graduating	% Graduating
2006-08	9	11	122.2
2007-09	17	9	52.9
2008-10	10	5	50.0
Average	12.0	8.3	75.1

To improve our two-year retention and graduation rate, the biotechnology faculty have instituted the following changes:

- **Biology 174.** Introduction to biotechnology (Biology 174) was offered in the fall of 2006 and 2007 with the goal of both recruiting more students into the biotechnology program and increasing the retention of those students that entered the program as FTIACs. The course was designed to familiarize first and second year students with the biotechnology faculty and the biotechnology industry as a whole. While the course did fulfill its intended goal to help first and second year students become more familiar with biotechnology, an increasing number of students began to enter the program as third year students. These students did not need and were not required to take the course, since they were entering directly into the core biotechnology sequence. The course has not been offered since 2007 and there are no plans to offer it again in the near future.
- **More careful advising.** Improving the advising of students has been a focus in the program over the past five years. Biotechnology advisors, along with the General Biology Advisor, are more carefully screening prospective students for their academic abilities and dedication before admitting them into the program. This will have a negative impact on enrollment in the program, but will have a positive impact on retention rate and quality of students.
- **Extended recruiting.** To seek out and recruit additional high quality students, we have increased the visibility of the biotechnology program using the following methods:
    - *Work more closely with the International and Admissions Office.* We have initiated increase contact with these offices to place the biotechnology at the front of options for incoming students with an interest in laboratory sciences and research. This has included participating in high school recruiting and Dawg-Days activities.
    - *Increased pre-pharmacy recruitment.* The majority of students in both entry level biology and chemistry courses are pre-pharmacy majors. A fraction of these students are more interested in pharmacology and pharmaceutical research than working as a practicing pharmacist. For these students, the biotechnology program may be a more direct route to this career goal than the Ferris State Pharmacy program. However, many of these incoming pre-pharmacy students are not aware of the biotechnology program. For the past two years, upper-level biotechnology students have given short presentations to all general biology lecture and biology FSUS sections during the fall semester to make these pre-pharmacy students aware of the biotechnology program. If these efforts yield even one additional biotechnology student a year, this would be a significant percentage increase to the total biotechnology enrollment.
    - *General Biology Advisor.* The hiring of a general biology advisor that handles advising for all Freshman and Sophomores has aided our recruiting efforts greatly. Because the general biology advisor meets with all entering biology students at least once a semester, this gives the biotechnology program a uniform contact person that can inform students about the biotechnology program. Even though this position is only two years old, we have already observed an increase in the number of students transferring into the biotechnology program as Freshman because of the additional recruiting by the general biology advisor.
    - *Biotechnology summer academy.* Every summer, Dr. Isler coordinates a biotechnology summer camp for high school students. The primary objective of this camp is to get students interested in the molecular biosciences. A secondary objective is to increase the visibility of

the biotechnology program to a group of high achieving prospective future biotechnology students.

Section 3E – Access

As the biotechnology program is small, an increase or decrease in even a few students will have a proportionally large effect on the program enrollment. One of our goals over the past few years has been to recruit a wider variety of students. Some of the initiatives that have been implemented are discussed in the previous section (**Section 3D**) under "extended recruiting". However, we also know that we must continue to evolve the program to fit the needs of both the students and a rapidly changing biotechnology industry. The issue of availability of upper level courses is a continuing one that needs to be addressed in the future. From both an accessibility and an academic standpoint, the offering of upper level core courses in an every other year format is not optimal. Students that must retake a course or accept external co-op experiences will be placed two years behind their classmates. Also, the combining of junior and senior level students leads to a "Goldilocks" situation for the instructor, where they must cover just enough material to keep the seniors involved, while not moving so quickly so as to confuse the younger students.

Section 3F - Curriculum

Please see **Appendix C** for a curriculum checksheet and **Appendix D** for course syllabi.

The biotechnology program has the following basic requirements:

- A minimum 121 credits (including general education requirements) are required for graduation.
- Must maintain a 2.0 cumulative grade point average in all courses.
- No grade lower than a C- in science and math courses will be counted towards graduation requirements.
- At least 30 minimum credits must be earned at Ferris State.
- A minimum of 40 credits numbered 300 or higher.
- Student must obtain and participate in an approved internship.

A number of changes have been made to the biotechnology curriculum since the last program review:

- **Biology 174 and 274**. Introduction to biotechnology (Biology 274) was redesigned as a Freshman and Sophomore level course (Biology 174) with the goal of introducing students to the biotechnology program at Ferris State and increasing student retention. Due to a changing profile of incoming biotechnology students, the course was only offered twice, in the fall of 2006 and 2007.
- **Biology 370.** Developmental Biology (Biology 370) was removed from the program as part of the university-wide requirement to reduce all programs to 120-122 credit hours required for graduation. This course was removed over others because, at the time this decision was made, the material in the course did not fit the needs of biotechnology students.
- **Biology 475**. Bioinformatics (Biology 475) was added to the curriculum as a reflection of the increasing importance of database use and *in silico* modeling in biotechnology.
- **Biology 205 or Biology 321 and 322**. A change was made in the anatomy and physiology requirements for the program, allowing a student to take either a one semester or two semester series for graduation. This change was made to facilitate the recruitment of community college transfers and the creation of articulation agreements with these institutions. Most community colleges do not have Biology 321 and

322 equivalents, which would severely hamper the ability to create 2+2 articulation agreements with these schools. However, students that are not transfers from community colleges are still strongly advised to take the two semester series of anatomy and physiology courses.

- **Biology 388 and 476**. The handling, care, and use of lab animals are important skills for young laboratory scientists to learn. The number of jobs in lab animal handling and care has increased greatly in Michigan in the last five years. To fulfill this need, Biology 388 (Advanced Immunology) was reformatted to include 5 weeks of training in the care and use of laboratory animals. This reformatted course has been given the new course number of Biology 476 and will be offered for the first time in the fall of 2010.
- **Physics 212**. Physics 212 (General Physics 2) was reluctantly removed from the biotechnology curriculum as part of the university-wide requirement to reduce all programs to 120-122 credit hours for graduation. Of courses that were evaluated for removal to meet these credit hour requirements, this course was determined to be the least relevant for the majority of biotechnology students.
- **Alternate year offerings of upper level lecture courses**. As a compromise to allow our upper level laboratory courses to have their cap size reduced to 13, the biotechnology faculty agreed to increase the cap size for all upper level biotechnology lecture courses to 24 and move to an alternate year offering to maximize enrollment in these lecture courses. To facilitate this, cap sizes and prerequisites for upper level courses were changed in the following manner via a course cleanup:
    - The cap sizes for Biology 470 (Molecular Genetics), 472 (Proteins Lecture), 474 (Advanced Cell and Molecular Biology), and 475 (Bioinformatics) were increased to 24 students.
    - The cap sizes for Biology 388 (Advanced Immunology Laboratory), 471 (Recombinant DNA Laboratory), and 473 (Proteins Laboratory) were decreased to 13 students.
    - The prerequisites for Biology 471 were changed to Biology 375 and Chemistry 333 to limit enrollment to senior students.
    - The prerequisite for Biology 473 (Proteins Laboratory) was changed to Chemistry 333 to limit enrollment to senior students.

Section 3G – Quality of Instruction

The quality of instruction in the biotechnology program can best be assessed by looking relevant responses to surveys administered to biotechnology alumni and exit interviews conducted with graduating biotechnology seniors. Please see **Section 2** for a detailed overview of these data.

Section 3H – Composition and Quality of Faculty

1) **Faculty overview.** The following are a listing of all faculty who teach core biotechnology courses that are unique to the biotechnology program:

Name	Date of Entry Into Program	Current Rank
Dr. Connie Boogaard, Ph.D	1987	Professor
Dr. Kim Colvert	1992	Professor
Mr. Frank Hartley	1995	Administrative Associate
Dr. Bradley Isler, Ph.D	2005	Associate Professor
Mr. Richard Marble	2009	Director Of Animal Care Facility
Dr. Roger Mitchell, Ph.D.	1996	Professor

Curriculum vita and resumes for all biotechnology faculty are found in **Appendix E**.

2) **Workload.** Please note that because the biotechnology program is part of the department of biological sciences, when discussing faculty workload, all analyses are based on **department-wide** data.

The lab-lecture format of our classes has led to a somewhat complicated workload formula. Faculty in the Department of Biological Sciences must average no less than 26 "Fonner" points a semester, named for the faculty member (Dr. Doug Fonner) that authored the workload policy.

$$2A + B + C(D+1) + E = 26 - 28$$

A = Lecture hours	SCH Scale	E=
B = New lecture preps	1-99	3
C = Number of labs	100-299	4
D = Lab hours	300-499	5
E = Student credit hours	500-699	6
	>700	7

The formula is meant to balance the workload between faculty by incorporating lecture time, lab time, number of lecture preps, number of labs, and number of students. In the simplest example, a faculty member teaches one large (100 student) lecture and the 4 labs that are attached to it. Faculty often teach more than one lecture. The Supplemental teaching load has varied between 8 and 14 FTE per semester over the last 6 years (**Table 3H.2.1**). During this period, enrollment has increased steadily, as has the number of tenure-line faculty. The number of faculty accepting overloads has stayed fairly constant (**Table 3H.2.2**) thus growth has been met by the addition of new adjunct and tenure line faculty to the Department.

Table 3H.2.1 Supplemental teaching load

	Fall 04	**Sp 05**	**Fall 05**	**Sp 06**	**Fall 06**	**Sp 07**	**Fall 07**	**Sp 08**	**Fall 08**	**Sp 09**	**Fall 09**	**Sp 10**
# tenure-line	16	16	18	18	19	19	20	20	19	19	20	20
1/2FT	1	1	2	2	3	3	3	3	3	3	2	2
1SFT	3	4	4	2	4	4	5	6	6	4	5	3
1SPT	0.44	0.57	0	0	1.58	1.67	0.63	0.4	0.44	1.63	1.58	1.26
RFO	2.88	2.57	3.31	3.25	3.14	3.4	3.2	2.63	3.29	3.17	3.14	2.75
URFO	0.53	1.56	0.91	0.9	0.97	0.59	1.89	0.38	1.07	0.59	0.68	0.34
SO	0.38	0.36	1.16	1.06	1.18	0	0.25	0	0.24	0	0.15	0
Total	8.2	10.1	11.4	9.2	13.9	12.7	14.0	12.4	14.0	12.4	12.6	9.4

Table 3H.2.2 Number of faculty accepting an overload												
	F03	**SP04**	**F04**	**SP05**	**F05**	**SP06**	**F06**	**SP07**	**F07**	**SP08**	**F08**	**SP09**
Ranked	8	8	11	12	14	12	11	12	13	8	12	11
Adjunct	4	3	3	4	3	2	4	2	5	2	4	5

Dr. Bradley Isler receives 0.25 release time for serving as coordinator for the biotechnology program.

3) **Recruitment of faculty**. The biotechnology program has not recruited a new tenure track faculty member in the past 5 years. However, when recruiting new biotechnology faculty members, the overall philosophy of the department of biological sciences is followed and the recruiting methods used depend on the type of position. Tenure track faculty are recruited through national searches in which the position is advertised in the Chronicle of Higher Education, Higheredjobs.com and often a discipline-specific site, such as the Society for Developmental Biology. The search committee evaluates candidates based on credentials and performance during phone and on-campus interviews. Recruitment of adjunct faculty is somewhat similar to a tenure-line search for 1 year positions, while 1SFT or part time faculty are often hired through an abbreviated process, depending on the available time.

   The credentials required for new faculty depend on the type of position. For a tenure line faculty position, candidates must have a Ph.D. in the biological sciences with a degree and/or research background in the discipline we are recruiting for (microbiology, physiology, genetics, ecology, etc). Teaching experience is preferred, but not always required. A one year position would have similar credentials of a tenure-track position, but the expectations for teaching are lessened.

   The biology department (and biotechnology program) is concerned with enhancing diversity and has tried to attract minority candidates. Of the last 4 tenure line faculty hired in the department, 2 are women and 1 is from a minority in terms of race/ethnicity. The department has had difficulty recruiting candidates from minority groups in terms of sexual orientation, which we believe was related to the lack of benefits for other qualified adults. Since the job opportunities in Big Rapids are limited, candidates with same-sex domestic partners were discouraged from taking a position where their partner will have to obtain benefits on their own. A recent change in university policy with regards to benefits for same-sex domestic partners should help the department recruit these minorities in the future.

   Faculty and staff in the department have been very active in the interview-and post-interview period to help assist in the recruitment of new faculty. We do what we can to link first-choice candidates to the information resources they need to evaluate Ferris State and the Big Rapids area.

4) **Orientation.** Faculty are encouraged to communicate with faculty and staff well before they arrive on campus. Text book, sample syllabi, equipment lists, etc are sent to help faculty begin to orient to the new position responsibilities. New faculty are strongly encouraged to attend orientation the week before faculty week, as well as the year-long faculty transition series. New tenure-track faculty are assigned a mentor, who may or may not serve on their tenure committee. While all department faculty may help new faculty develop professionally, their mentor serves as a stable point of contact throughout their first year. Last year adjunct new full-time adjunct faculty were also assigned mentors to assist in their transition.

5) **Reward Structure.** Since the department offers few classes on-line or through FSU-GR, incentive money has not been a substantial part of the budget. Funds acquired (typically less that $3000) have been used to purchase lab equipment, or to help us reduce our deficit (before our base budget was adjusted to compensate for our growth). Faculty pursuing professional development activities seek funding for travel from the Faculty development committee, as well as the department general fund. Activities that support enhanced teaching, research or involvement with undergraduates are supported when it is possible to do so (in that priority listing). Several faculty seek additional professional development funds from internal grant sources (TIMME, Faculty research grants, Foundation grants, professional Development grants) as well as external sources (NSF or NIH). Faculty use professional development incentives (PDIs) earned from the Faculty Center, or through advising /assessment positions, to help support their development activities. Salary ranges in the department have kept up with changes in the market. New faculty salaries are tied to recent CUPA data of their discipline, as well as their level of experience. Salary has not been the primary reason candidates have turned down tenure-line positions in recent searches. While faculty are not rewarded financially for recruiting diverse candidates, they value diversity and do what they can to help attract quality candidates to the department.

6) **Non-tenure track and Adjunct Faculty.** In general, faculty must have a Bachelor's degree in the Biological Sciences to teach laboratories for the department. If faculty have a Master's degree, they can teach lectures, although this is generally limited to non-majors classes. In general, assignment to a majors-class lecture requires a Ph.D. and this is typically limited to faculty hired on 1 or 2 year contracts, rather than 1 semester contracts. Only tenured and tenure-track faculty teach core biotechnology lectures and the majority of core laboratories. Biology 476 (Advanced Techniques In Biotechnology) is the only core biotechnology laboratory not taught by tenured or tenure-track faculty, due to the extensive expertise of Mr. Frank Hartley (immunology and cell culture) and Mr. Richard Marble (animal care and handling).

Section 3I – Service to Non-Majors

Generally, only a small number of non-biotechnology students take core biotechnology courses. The most common programs for these non-biotechnology majors are B.A. biochemistry, B.A. chemistry, B.S. biology with a cell and molecular biology minor, or B.S. Biology with a forensic biology concentration. Of the core biotechnology courses, those most frequently taken by non-biotechnology students include Biology 470 (Molecular Genetics), Biology 472 (Proteins Lecture), Biology 474 (Advanced Cell Biology), and Biology 475 (Bioinformatics). The new molecular diagnostics program in the College of Allied Health (which begins in the fall of 2010) has included Biology 475 in their curriculum.

As a whole, the department of biological sciences also serves students in other Arts and Science majors (such as chemistry B.A. or pre-pharmacy) as well as students from other colleges for program requirements (Allied Health, Education and Human services, Optometry, Pharmacy) or general education classes (Engineering Technology and Business). In this way, almost every class listed as BIOL can be taken by students in programs other than B.S biotechnology, B.S. biology, and B.A. biology. Courses offered in the last year, to students outside of these programs are listed in **Table 3I.1.**

Table 3I.1 Recent service courses taught by department faculty for students outside of Biology Department		
Course	**Audience**	**Program Faculty involved recently**
BIOL 101 Human Genetics	Non majors, Gen Ed	Drs. Mary Murnik and Bradley Isler
BIOL 103 Biological Concepts	Integrated Science majors (Ed)	Dr. James Hoerter
BIOL 108 Medical Microbiology	Allied Health majors	Drs. Michael Ryan and Clifton Franklund
BIOL 109 Basic Human Anatomy/Physiology	Allied Health majors, Gen Ed	Dr. David Griffith and Mr. John Johnson
BIOL 111 Environmental Biology	Non majors, Gen Ed	Dr. Gary Rodabaugh and Ms. Arlene Westhoven
BIOL116 Nature Study	Non majors, Gen Ed	Ms. Cindy Fitzwilliams-Heck
BIOL 280 Applied Fermentation	Travel, Gen Ed	Dr. Michael Ryan
BIOL 331-332 (ending SP09)	Pharmacy students (P1)	Drs. Doug Fonner and Christopher Westerkamp
BIOL 387 Clinical Microbiology/Immunology	Pharmacy students (P2)	Drs. Michael Ryan and Clifton Franklund
BIOL 438 Microbiology and Immunology for Optometry	Optometry students	Dr. Michael Ryan
INBI 303 Integrated Ecology	Integrated Science majors (Ed)	Drs. Scott Herron and David Griffith
OPTM 630 General Pathology	Optometry students	Dr. James Scott
SSCI 114 Human Sexuality	Non majors, Gen Ed	Dr. Robert Friar

Section 3J – Degree program cost and productivity data.

The biotechnology program has cost per a student credit hour of $242.46. The total program cost for a biotechnology student (in 2007-08) was $29,338.26. When looking at the cost per student credit hour for individual courses in the biotechnology program, there is a general increase in the cost as you proceed to the 400-level core biotechnology laboratory courses. However, the excellent efficiency of the biology department and lower level (first and second) courses somewhat counterbalances the increased cost of the core biotechnology courses.

Course efficiency as measured by percentage of offered seats filled for the biology department was 92.1% in spring 2010 (**Table 3J.1**). Biology department productivity has been on the increase over the past two years and currently stands at 668.12 (**Table 3J.2**). The biology department has the second highest efficiency of any department at Ferris State.

Table 3J.1 Course Efficiency for Sp10			
	Seats Available	**Seats Filled**	**Efficiency**
BIOL 100-200	1392	1297	93.2%
BIOL 300 and up	721	643	89.2%
Overall	2113	1947	92.1%

Table 3J.2 Biology Department Productivity					
	2004-05	**2005-06**	**2006-07**	**2007-08**	**2008-09**
SCH	15305	15898	16617	17715	17784
FTEF	24.27	26.62	28.45	29.46	26.62
SCH/FTEF	630.61	597.23	584.14	601.31	668.12

Section 3K – Assessment and Evaluation.

In the past, outcomes assessment was implemented at the individual course level. Biology and biotechnology faculty have utilized a variety of means to measure and track student learning, including: pre/post tests, assessment questions embedded into exams, research projects, laboratory experiments and notebooks, and "clicker" assignments. In many cases, this data has been collected and archived for many years. Up to this time, there has not been a formal mechanism to collect and analyze the compiled data from all faculty on a departmental or program-wide basis. At this time, biotechnology faculty have modified all course syllabi to include measurable outcomes. These course outcomes have been integrated with the revised mission statement and learning outcomes (see **Section 1**) that were agreed upon by the biotechnology faculty in 2009 and are currently being deposited on the TracDat system for the core biotechnology courses.

Recently, the biology department has initiated the use of a national standardized test (Major Field Test in Biology – Educational Testing Service) to measure academic achievement and to assess the educational outcomes of the students. Beginning in spring 2008 and every subsequent spring semester, graduating biotechnology students have also been administered the Biology Field Exam. The Field Exam is administered by approximately 400 universities and colleges nationwide, which allows us to compare our students to similar institutions across the country. Each student who completes the Field Exam receives a total score and subscores in four areas: cell biology, molecular biology and genetics, organismal biology, and population biology, evolution, and ecology. In addition, faculty receive cohort data (per semester) and percentiles for student achievement in seven specific subject areas, which are more specific partitions of the subscores described above. These subject areas are biochemistry and cell energetics, cellular structure, organization, and function, molecular biology and molecular genetics, diversity of organisms, organismal – plants, organismal – animals, population genetics and evolution, ecology, and analytical skills.

A comparison of our limited set of biotechnology graduate data (n=15) to national average and percentile data is quite positive. In the subscore areas that correspond with our programmatic learning outcomes (cell biology and molecular biology), our biotechnology graduates scored well above national averages (**Table 3K.1**), in the 60th-85th percentile. Those areas where biotechnology graduates scores were below average generally corresponded to subscore areas that are not foci of the biotechnology program (organismal biology and ecology).

An analysis of the Field Test results for the subject area data (**Table 3K.2**) shows similar results to that of the subscore data described above. Subject areas stressed in the biotechnology program include biochemistry and cell energetics (30th-75th percentile), cellular structure (95th percentile), molecular biology and genetics (90th-95th percentile), and analytical skills (40th-85th percentile). In the majority of these areas, biotechnology graduates scored incredibly high, well within the top 25% of all students taking the Field Exam nationwide.

The small number of biotechnology graduates per year limits the amount of data we have compiled to this point, so broad conclusions from these data are difficult to make. However, from these results, it appears that our rigorous, directed curriculum is preparing our biotechnology students at a higher level than students in comparable programs across the country.

Table 3K.1 Biology Field Exam Subscore Data

	Spring 08	Spring 09
Number of Students	6	9
Total Score Percentile	40th	70th
Cell Biology Subscore Percentile	60th	70th
Molecular Biology Subscore Percentile	70th	85th
Organismal Biology Subscore Percentile	25th	60th
Ecology Subscore Percentile	30th	55th

Table 3K.2 Biology Field Exam Subject Area Data

	Spring 08	Spring 09
Number of Students	6	9
Biochemistry and Cell Energetics Percentile	30th	75th
Cellular Structure, Organization, and Function Percentile	95th	95th
Molecular Biology and Molecular Genetics Percentile	90th	95th
Diversity of Organisms Percentile	15th	80th
Organismal - Animals Percentile	20th	60th
Organismal - Plants Percentile	10th	65th
Population Genetics and Evolution Percentile	10th	70th
Ecology Percentile	35th	55th
Analytical Skills Percentile	40th	85th

Section 3L – Administration Effectiveness

As part of the faculty survey (See **Section 2**) the biology department faculty were asked to assess administrative effectiveness by answering the question: *The Ferris State administration supports the biotechnology program.* 9 of 9 (100%) respondents agreed with this statement. Also, no faculty respondents listed administrative support as an area of the biotechnology program that needs improvement.

Section 4 - Facilties and Equipment

Section 4A – Instructional Environment

The facilities and equipment supporting the program have been sufficient for the needs for the program but many high use (and high cost) items are reaching the end of their life span. The major concern is the ongoing need for repair and replacement budget for such equipment. This sentiment was echoed in the faculty survey (see **Section 2**), where the following comments were submitted in repose to the question *"What area(s) of the biotechnology program need improvement?"*

- Equipment management and acquisition.
- Most of the equipment used for this program appear to be ancient and do not appear to meet current standards for the industry.
- We need more current equipment in a core facility for the students to get adequate training and background in modern biotech methods

Currently, equipment needs are being met as budgets allow. Both the Biology and Physical Sciences departments have improved the holdings for courses that support the program by targeting funds specifically for use in the biotechnology labs to address the more pressing needs. Administration has been helpful in one-time funding, including new spectrophotometers, a used ultracentrifuge, and a reconditioned DNA analyzer. However, we will always be in a battle to keep our current equipment working, while still finding funds to purchase new, more modern equipment. The rapid pace of progress in biotechnology leads to the rapid obsolescence of laboratory equipment compared to what is found in external labs. We will never be able to continually purchase the latest, greatest equipment, and in fact that is one of the primary reasons for the internship component of the program. Our hope is that increased contacts with the Michigan biotechnology industry will result in donation of older, but still very useful instrumentation to the biotechnology program.

The biotechnology has several areas dedicated specifically to the biotechnology program:

- Core biotechnology laboratories are located in Sci 337 (biotechnology lab), Sci 338 (instrument room), and Sci 201A (tissue culture laboratory). The total floor space of these labs is 1615 ft^2.
- There is a cold room dedicated to biotechnology, with an area of 64 ft^2.

The biotechnology program also shares several areas with other programs:

- Teaching laboratory space is shared with both the biology (9617 ft^2) and physical science (5657 ft^2) departments.
- Lecture rooms are shared with other biology (3885 ft^2) and physical sciences (7663 ft^2).
- The Ferris State animal care facility is also utilized for some biotechnology courses and biotechnology research
    - PHR 314F: (rabbit room): 160 ft^2
    - PHR314M: (rat room): 32 ft^2
    - PHR 314C: (surgery/lab): 200 ft^2
    - SCI animal care room: 940 ft^2
- Several research labs are also used by biotechnology faculty and students for independent study and internship projects

- SCI 234 (Drs. Mitchell and Isler): 527 ft.^{2}
- SCI 338 (Dr. Colvert): 358 ft.^{2}
- SCI 201 (Dr. Hoerter): 360 ft.^{2}
- SCI 229 (Drs. Watson and Murnik) 374 ft.^{2}

Please see **Table 4A.1** for a summary of instrumentation and equipment connected to the biotechnology program.

Table 4A.1 Equipment Survey

Item	Quantity
TEMPERATURE CONTROL	
Incubator 4 cu. Ft	2
Hybridization incubator	1
Plant tissue incubator	1
Plant cold storage	1
CO2 incubator	1
Large water bath	1
Small water bath	6
Freezer (-20°C)	3
Refrigerator (4°C)	3
Freezer (-70°C)	1
SAMPLE ID AND SEPARATION	
FTIR spectrometer	2
Atomic absorption spectrometer	1
Gas chromatograph	4
Gas chromatograph detector, UV-vis	1
Gas chromatograph detector, UV	2
Gas chromatograph detector, Ion	1
Gas chromatograph detector, refractometer	1
Gas chromatograph detector, fluorescence	1
HPLC w UV flour, detection, photodiode array detection gradient	2
ELECTROPHORESIS	
2-D isoelectric focusing system	1
Large horizontal gel apparatus	3
Medium horizontal gel apparatus	3
Small horizontal gel apparatus	15
Sequencing gel apparatus	1
Immunoelectrophoresis apparatus	1
Tube gel electrophoresis apparatus	1
Western blot chambers	4
Large vertical gel electrophoresis apparatus	4
Small vertical gel electrophoresis apparatus	8
High volt power supply	2

Small power supplies	6
BALANCES	
Large capacity balance	1
Medium capacity balance	1
Analytical balance	1
CENTRIFUGES	
Microcentrifuges	2
Sorvall prep centrifuge	1
Ultracentrifuge	1
Clinical centrifuge	2
Other	
Orbital shaker	2
Transilluminator	1
Land camera	1
Inverted scope	2
Biohazard (vertical) laminar flow tissue culture hood	2
Horizontal laminar flow (plant) tissue culture hood	2
Spectrophotometers	4
Ice maker	2
MillQ watermaker	1
Pipette aids	12
Small light box	1
Large light box	1
pH meters	2
Stir/hot plates	6
Vortex mixers	4
Blender	1
Peristaltic pumps	2
Microwave	1
Homogenization motor	1
Lyophilzer	1
Gel dryer	1
Fraction collector	4
Autoclave	2
Dishwasher	2
X-ray film cassette large	1
X-ray film cassette small	4
X-ray film development machine	1
Scintillation counter	1
Hybridization bag sealer	2
Evaporating centrifuge	1

ELISA plate reader	1
ELISA plate washer	1
PCR thermal cycler	3
ABI 310 DNA Analyzer	1
Scanner	1
Halogen lamp	1
Dynamil	1
IBM compatible Computer workstation	3
Mac computer work station	1

Section 4B – Computer Access and Availability

In addition to the computers that are found in the offices of the program faculty and staff, additional computing resources can be found in the biotechnology laboratory (Sci 337) and instrument room (Sci 338). Computers are also available in most of the faculty research labs for students participating in independent research projects. For some biotechnology courses, students are encouraged to use the computer resources found in FLITE.

Section 4C – Other Instructional Technology

For the biology department and biotechnology program, the only other relevant instructional technology includes the equipment and materials that are used in the teaching sections of the core courses. These resources are managed by our laboratory personnel, Frank Hartley and Lisa Johns. In general, materials are made available as changes to laboratory protocols occur. Requests for equipment are made directly to the department head as needed.

Section 4D – Library Resources

Library resources for the biotechnology program are adequate. Program faculty are generally satisfied with the library resources available to them, including instruction services provided by the library and the FLITE budget allocation for the biology department. The increasing availability of both subscription-based and free electronic journals over the past 5 years has been an asset to the program, as students and faculty have a much easier time in timely obtaining peer-reviewed research articles.

Section 5 - Conclusions

Section 5A – Relationship to Ferris State Mission

The Biotechnology Program fulfills the mission of Ferris State to "prepare students for successful careers...Through its many partnerships and its career-oriented, broad-based education" by training students prepared to move quickly and productively into biotechnology laboratory environments. The depth of their academic knowledge and technical skills is recognized by both faculty and individuals of the biotechnology community and has made them valuable resources in companies and schools in both Michigan and across the country.

Section 5B – Program Visibility and Distinctiveness

For many years the Biotechnology degree at Ferris was the only undergraduate biotechnology program in the state of Michigan. Growth in the field has prompted the formation of a number of biotechnology programs at other institutions in Michigan. The efforts of the biotechnology faculty to promote the program, maintain quality classroom and laboratory instruction, operate summer camps for high school students, and to work with the external advisory committee and alumni has kept the program familiar to employers and prospective students. With the competition increasing for high caliber students, even more effort should be made to recruit and guide our biotechnology students. The program has recently become a member of MichBio, a statewide organization of biotechnology related entities, including biotechnology companies and large universities. The association with MichBio should present the program with useful networking contacts within the local biotechnology community.

Section 5C – Program Value

The need for qualified students trained in the biomolecular sciences will continue to increase across the nation as scientists integrate new discoveries in genetics, cell biology, and biochemistry with medicine, the environmental sciences, and agriculture. For Ferris State and its graduates to remain competitive in this new era, the university must continue to offer programs such as biotechnology that train students in more specific and technical areas than are typically part of more general degrees such as biology and chemistry. Biotechnology students are contributing to this innovation by serving as laboratory scientists, graduate students, and eventually managers and research leaders in both large and small biotechnology companies and academia.

Section 5D – Enrollment

Enrollment in the biotechnology program has stabilized over the past five years, with a small decrease in the past two years. However, upper level courses specific to the biotechnology program (the biotechnology core) have been at capacity or nearly so every year for the past five years. The biotechnology faculty need to continue working with the admissions office, other faculty, and administrators to attract high quality students to the program.

Section 5E – Characteristics, Quality and Employability of Students

Of the students pursuing employment upon graduation (rather than graduate or professional school) the placement rate has been approximately 90%, even in the recently difficult economic climate. Our students have also been very competitive with respect to admission into graduate and professional school with nearly 100% of interested students receiving an acceptance to M.S. and Ph.D. programs. Salaries for new graduates are generally between $25,000 and $35,000, with students moving into industry making towards the top end of the range and students moving into graduate school at the lower end.

Section 5F – Quality of Curriculum and Instruction

The best indicator of quality of instruction is the success of our students. Biotechnology students begin their academic careers here at Ferris with excellent instruction from biology and physical sciences faculty in pre-professional courses and are generally well prepared when entering the biotechnology core sequence. Graduating seniors and alumni are satisfied with their preparation in the major curriculum areas (biology, chemistry, etc.) and with the expertise of the biotechnology faculty. With a small program such as biotechnology, it is very important that any causes of dissatisfaction in the program be isolated and rectified as quickly as possible.

The biotechnology program is laboratory intensive and, by design, has small class sizes. Laboratory supplies and equipment for biotechnology are more expensive than for lower level laboratory classes and require direction from highly qualified instructors. Space is limited and extensively utilized. While the total cost per student credit hour for the biotechnology may seem high, the biology and physical sciences departments are ranked as two of the most productive on campus. Approximately half of the credit hours required for the biotechnology program are not from small expensive courses, but larger, less expensive first and second year biology and physical science courses that make up the majority of the efficiency of these two departments. The academically rigorous nature of the biotechnology program may lead to increased attrition and diminish the enrollments in core biotechnology courses, but is necessary to maintain a reputation among members of the biotechnology community.

Section 5G – Composition and Quality of Faculty

The faculty most closely associated with the Biotechnology Program are Dr. Bradley Isler (Biology program coordinator - Biology), Dr. Connie Boogaard (Biology), Dr. Kim Colvert (Physical Sciences), Mr. Frank Hartley (Biology), Mr. Richard Marble (Biology), and Dr. Roger Mitchell (Biology). They have all maintained a variety of professional and scholarly activities including research, publications professional associations, workshops, and student organization mentoring.

Date : August 13, 2010

To: Matt Wagenheim, Chair, Academic Program Review Council
From: Karen Strasser, Department Head of Biological Sciences
RE: Analysis of BS in Biotechnology program for APR

The Biotechnology program supports the Ferris Mission of preparing students **"for successful careers, responsible citizenship, and lifelong learning".** Students are given a strong foundation in cellular/molecular coursework and intensive lab experiences that prepare them to work in today's research environment. For most students, a BS in the biological sciences represents the start, rather than the end, of their college education. The Biotechnology program is unique, and well aligned with the Ferris Mission, because students gain the knowledge and experiences necessary to succeed in a biological laboratory at graduation. The Program strives to meet the expectation of "**a rapidly changing global economy and society**" by assuring that the content of program courses draw from the international community of scientists, in addition to the trends and research projects occurring within our region. Students are exposed to work being done locally at the VanAndel institute, as well as the newest advances just published from Scientists in Japan.

Program faculty are experienced, remain current in their respective fields, and carry appropriate credentials. Most faculty regularly travel to (and sometimes present at) discipline-related conferences, in addition to attending conferences with and without students. The program coordinator, Brad Isler, is not only well credentialed in the field, but has worked hard to rebuild a network of regional contacts and resources to enhance the student experience. Besides connecting students to industry formally through internship assignments and recommendations, Dr. Isler also serves as the Faculty advisor for Delta Nu Alpha (the DNA or Biotechnology club). With this group, Dr. Isler brings together students and scientists in the region by taking the club to visit labs, see lectures and participate in undergraduate research meetings. He has also hosted events on campus including company interview sessions and scientific lectures. Dr. Isler has been successful in creating a community of students within the larger Department that have pride in the program, its success, and the success of individuals within it.

Although the program is a Bachelor's degree, in many ways it is functionally a two year program. The first two years are very similar to the series of courses taken by Pre-Pharmacy students, or any other Biology Program. Thus students are often recruited as they complete their Second year, when they have demonstrated their ability to succeed in major's level biology and chemistry coursework. The Biotechnology program is small by design, including lab experiences that utilize high-end equipment and procedures that necessitate close faculty supervision (and small cap sizes). The coordinator and internal advisory board have worked very hard to make class offerings as efficient as possible by offering intensive lab classes annually, and lecture only courses biannually. This structure allows a predictable schedule of program classes, making it possible for students to navigate though the program in a reasonable time frame.

The University has been supportive of the program, investing in new equipment (such the new ABI 310 genetic analyzer), faculty and student travel to meetings, and reassigned time for coordination. This support, combined with the dedication of its coordinator Brad Isler and enthusiasm of faculty, provides students with a high quality educational experience. I believe the program is successful and should continue to receive strong support from the University.

Appendix B – Biotechnology Program Graduates

Graduation Year	Last Name	First Name	Last Known Location	Career Type
2006	Banner	Nathan	Neogen.	Industry
2006	Bourgo	Ryan	University of Cincinnati	Graduate School
2006	Jorae	Jessica	Unknown	Unknown
2006	Kuipers	Tara	Wayne State University	Graduate School
2006	Trombley	Jami	Northern Biomedical Research	Industry
2006	Veenstra	Rachelle	University of Minnesota	Graduate School
2007	Bach	Robert	Wil Research Laboratories	Industry
2007	Bennett	Adam	Unknown	Unknown
2007	Choi	Chesca	Unknown	Unknown
2007	Corgan	Cynthia	Central Michigan University	Professional School
2007	Hotchkiss	Timothy	Wayne State University	Graduate School
2007	Sauer	Michael	Alticore	Industry
2007	Thao	Mai	University of Northern Illinois	Graduate School
2007	Tilley	Sara	MPI Research	Industry
2008	Foos	Matthew	Alticore	Industry
2008	Hartman	Nathan	University of Georgia	Graduate School
2008	Laplante	Heather	Covance	Industry
2008	Overstreet	Jessica	University of Albany	Graduate School
2008	Pathak	Shivang	Unknown	Unknown
2008	Reder	Christine	University of Georgia	Graduate School
2008	Ward	Rebecca	Biodiscovery, LLC	Industry
2009	Baker	Ryan	Michigan Milk Producers	Industry
2009	Chellappa	Akshay	Pharmaceutical Research	Industry
2009	Senger	Tyler	Interviewing	Interviewing
2009	Tovar	Elizabeth	Wayne State University	Graduate School
2009	Valkenburg	Kenneth	Van Andel Research Institute	Graduate School
2009	VanDusen	Nathan	Indiana University School of Medicine	Graduate School
2010	Leutscher	Joshua	Iowa State University	Graduate School
2010	Williams	Caitlin	Henry Ford Community Hospital	Industry
2010	Workman	Jason	Dow Chemical	Interviewing
2010	Wyatt	Allison	MPI Research	Industry

BACHELOR OF SCIENCE IN BIOTECHNOLOGY

FERRIS STATE UNIVERSITY

PROGRAM COORDINATOR: DR. BRADLEY ISLER
OFFICE: ASC 2118 Phone: (231) 591-2641 E-Mail: islerb@Ferris.edu

Admission requirements: First year student admission is open to high school graduates (or equivalent) who demonstrate appropriate academic preparedness, maturity and seriousness of purpose. High school courses and grade point average, ACT composite score, and ACT Mathematics and Reading sub scores will be considered in the admission and course placement process. Transfer students must have at least 12 credits at the time of application with a minimum 2.0 overall GPA including an English and mathematics course or they will be considered as first year students.
Admission to the Junior Year Professional Sequence is competitive

Graduation Requirements

1. 2.0 Cumulative Grade Average in all courses. No grade lower than a C- in science and math courses allowed for graduation
2. Minimum 121 credits including general education requirements
3. Residency Requirements: 30 minimum FSU semester credits
4. Minimum 40 credits numbered 300 or higher

Program requirements: for students entering Biotechnology Fall Semester 2007

REQUIRED		COURSE TITLE – FOR PREREQUISITES NOT INDICATED, SEE FSU CATALOG COURSE DESCRIPTIONS		FSU S.H.	GRADE
Major – 91 credit minimum - No grade lower than a C- allowed for graduation.					
BIOL	121	General Biology 1	(CHEM 114 or 121 concurrent)	4	
BIOL	122	General Biology 2	(BIOL 121 & CHEM 114 or 121)	4	
BIOL	205	Human Anatomy/Physiology	(CHEM 114)	5	
Or					
BIOL	321	Human Physiology and Anatomy 1	(BIOL 122 and CHEM 122)	4	
BIOL	322	Human Physiology and Anatomy 2	(BIOL 321)	4	
BIOL	375	Principles of Genetics	(BIOL 122 and a Biological CHEM course)	3	
BIOL	386	Microbiology and Immunology	(BIOL 322 and a Biological CHEM course)	5	
BIOL	470	Molecular Genetics	(CHEM 364 and BIOL 375)	4	
BIOL	471	Recombinant DNA Laboratory	(CHEM 333 and BIOL 375)	3	
BIOL	472	Proteins	(BIOL 122 and CHEM 322)	3	
BIOL	473	Proteins Laboratory	(CHEM 333)	3	
BIOL	474	Advanced Cell & Molecular Biology	(CHEM 364 and BIOL 375)	3	
BIOL	475	Bioinformatics	(BIOL 375)	3	
BIOL	476	Advanced Techniques in Biotechnology	(CHEM 333 and BIOL 386)	2	
CHEM	121	General Chemistry 1	(MATH 115 and prior CHEM)	5	
CHEM	122	General Chemistry 2	(CHEM 121)	5	
CHEM	231	Quantitative Analysis	(CHEM 122)	4	
CHEM	321	Organic Chemistry 1	(CHEM 122)	5	
CHEM	322	Organic Chemistry 2	(CHEM 321)	5	
CHEM	332	Biochemistry Lab 1	(CHEM 322, corequisite = CHEM 364)	2	
CHEM	333	Biochemistry Lab 2	(CHEM 332)	2	
CHEM	364	Biochemistry	(CHEM 322)	4	
CHEM	474	Advanced Biochemistry	(CHEM 364, BIOL 375, and CHEM 231 or 451)	3	
MATH	130	Advanced Algebra & Analytical Trigonometry	(MATH 120 or placement)	4	
MATH	251	Statistics for the Life Sciences	(MATH 130)	3	
PHYS	211	Introductory Physics 1	(MATH 116 or 120)	4	
CHOOSE ONE:					
BIOL	491	Biotechnology Internship	(instructor consent)	3-6	
BIOL	497	Independent Studies in Biology	(instructor consent)	3-6	
CHEM	497	Independent Studies in Chemistry	(instructor consent)	3-6	

GENERAL EDUCATION REQUIREMENTS

Courses which qualify in the Scientific Understanding (Z), Cultural Enrichment (C) and Social Awareness (S) categories are delineated in the General Education section of the FSU electronic catalog:

http://www.ferris.edu/htmls/academics/gened/courses.html

I. GENERAL EDUCATION REQUIREMENTS

A. COMMUNICATION COMPETENCE — 12 Sem Credits

Course	Grade	Credit
ENGL 150		3
ENGL 211 or 250		3
ENGL 311,321,323 or 325		3
COMM 105 or 121		3
	TOTAL	

B. SCIENTIFIC UNDERSTANDING — 7 Sem Credits

This requirement is satisfied in the program requirements area.

C. QUANTITATIVE SKILLS

This requirement is satisfied in the program requirements area.

D. CULTURAL ENRICHMENT — 9 Sem Credits

Only approved "C" courses may count toward this category. Requirements: 1) one course must be 200+ level, 2) maximum 5 credit hours of music and/or theater activities may apply

Course	Grade	Credit
200+ level		
	TOTAL	

E. SOCIAL AWARENESS — 9 Sem Credits

Only approved "S" courses may count toward this category. Requirements: 1) two different subject areas including at least one "foundation" course, 2) one 200+ level course

Course	Grade	Credit
Foundation		
200+ level		
	TOTAL	

F. GLOBAL CONSCIOUSNESS

Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.

Course:

G. RACE/ETHNICITY/GENDER

Each student must complete one course from the list of qualifying courses presented in the FSU catalog. This course may also count toward fulfilling the Cultural Enrichment or Social Awareness requirement.

Course:

Sample Course Sequence: The following chart depicts one method to begin the course work requirements. In order to compete this program in a four year plan, students must average 16-17 credit hours per semester. Students MUST consult their faculty advisor to develop a course sequence plan appropriate to their academic development and educational plans.

First Year

Fall		Spring	
BIOL 121	4	BIOL 122	4
CHEM 121	5	CHEM 122	5
ENGL 150	3	MATH 130	4
COMM 105 or 121	3	Cult. Enrich Elec.	3
	15		16

Second Year

Fall		Spring	
BIOL 205 or 321	5 (4)	Soc. Aware. (BIOL 322)	3 (4)
CHEM 231	4	CHEM 322	5
CHEM 321	5	PHYS 211	4
	13-14	ENGL 250	3
			15 -16

1) Admission to the third year level is granted on a competitive basis based on GPA and space available. As a Biotechnology student, you must have completed the course prerequisites and have earned an overall GPA of 2.7 or above to be eligible to apply.
2) Students must take their remaining social awareness and cultural enrichment courses during their third and fourth years.

Third Year

Fall		Spring	
BIOL 375	3	BIOL 386	5
CHEM 332	2	CHEM 333	2
CHEM 364	4	BIOL 470 (Even yrs.)	4
BIOL 472 (Odd yrs.)	3	BIOL 474 (Odd yrs.)	3
	9-12	BIOL 475 (Even yrs.)	3
			10-14

Summer
Internship or Independent Study 3-6

Fourth Year

Fall		Spring		
BIOL 476	2	CHEM 474		3
BIOL 473	3	BIOL 471		3
ENGL 311	3	BIOL 470	(Even yrs.)	4
MATH 251	3	BIOL 474	(Odd yrs.)	3
BIOL 472 (Odd yrs.)	3	BIOL 475	(Even yrs.)	3
	11-14			9-13

Strongly recommended that students take electives during the first and second year summer semesters either at Ferris State University or at a community college, as it will lighten the load during the year.

NOTICE REGARDING WITHDRAWAL, RE-ADMISSION AND INTERRUPTION OF STUDIES

Students who return to the university after an interrupted enrollment (not including summer semester) must normally meet the requirements of the curriculum which are in effect at the time of their return, not the requirements which were in effect when they were originally admitted.

Upper Level Biotechnology Checksheet Supplement

If you will take CHEM 332 (Biochemistry Lab 1) in the fall of an odd year (07, 09, 11) you should take this series of biotech classes:

Third Year

Fall		Spring	
BIOL 375	3	BIOL 386	5
CHEM 332	2	CHEM 333	2
CHEM 364	4	BIOL 470	4
BIOL 472	3	BIOL 475	3
	12		14

Fourth Year

Fall		Spring	
BIOL 476	2	CHEM 474	3
BIOL 473	3	BIOL 471	3
	5	BIOL 474	3
			9

If you will take CHEM 332 (Biochemistry Lab 1) in the fall of an even year (06, 08, 10) you should take this series of biotech classes:

Third Year

Fall		Spring	
BIOL 375	3	BIOL 386	5
CHEM 332	2	CHEM 333	2
CHEM 364	4	BIOL 474	3
	9		10

Fourth Year

Fall		Spring	
BIOL 476	2	CHEM 474	3
BIOL 473	3	BIOL 471	3
BIOL 472	3	BIOL 470	4
	8	BIOL 475	3
			13

Several of the upper level biotechnology classes are only offered every other year (BIOL 470, 472, 474, 475). Failure to take any of these courses when they are offered will result in a wait of **two years** to take the course again. It is **VERY** important that you stay on schedule with these courses. Carefully consult with your advisor when entering your third year of biotech classes. **You are ultimately responsible for graduating on time!**

BIOLOGY 121: GENERAL BIOLOGY 1
Dr. Boogaard, Fall 2009

Biology 121 is a 4-credit class. The lecture meets in Sci 126 on M, W, and F at 10:00 to 10:50am. Lab sections 231, 232, 233, and 234 meet in Sci 212.
Instructor: Dr. Boogaard; office: ACS 2015; Phone: 591-2544;
e-mail: boogaarc@ferris.edu
Office hours: M & W, 11-11:50; W & F at 9:00-9:50 am; **or by appointment**.

Course Description:
The first semester of a year-long sequence in introductory biology designed for the science major and as a prerequisite for advanced biology courses. The topics include an introduction to scientific thinking, ecology, cell division, Mendelian genetics, evolution, the diversity of the biological kingdoms (bacteria, Protista, Fungi, and Plantae), and plant structure and function. Laboratory exercises are designed to enhance the lecture material with hands-on experiences. Designed for students in science baccalaureate degree programs. This course meets General Education requirements: Scientific Understanding, Lab.

Requires: CHEM 121 or CHEM 114 as a pre- or co-requisite

Required Materials:
1. Campbell and Reece, **Biology**, 8th Ed; Pearson/Benjamin Cummings pub.
2. Fadayomi, Mitchell, Stewart and Strasser, **Biology 121: General Biology Lab Manual**; Fall 2009. This is available at Great Lakes Book and Supply, 840 Clark, Big Rapids; (231) 796-1112; 1 street behind (west of) Rite-Aid drugstore, which is across State Street from Williams Auditorium and the Starr building. You will need a calculator.
3. **Lecture Notes** for Biology 121 will be available on Ferris Connect.

Other Materials Required:
You are required to bring to class on exam days, a #2 pencil, and a Scantron Form 882-E sheet. For dissection labs, you may be required to purchase or bring gloves.

General Education Outcomes: This course may be used to help fulfill the general education requirement for Scientific Understanding. A student succeeding in this course should:
1) have a working knowledge of the fundamental principles of a natural science discipline;
2) be able to use appropriate scientific reasoning skills to interpret and analyze content in the natural sciences;
3) have a basic understanding of the scientific method, scientific concepts, and the evolution of scientific ideas;
4) have a more positive attitude toward science and an increased confidence in their ability to understand science.

Specific Course outcomes: This course is the first of a two part introductory biology sequence, thus it will lay the foundation for further study in biology. A student succeeding in this course should be able to:

1) demonstrate by examination a majors-level introductory knowledge in ecology, cell division, Mendelian genetics, evolution, diversity of bacteria, protists, fungi, and plants, and plant structure and function.
2) demonstrate the ability to use mathematics to solve problems in Biology and utilize graphs or tables to present data effectively.
3) use the scientific method to formulate hypotheses, design experiments, collect / analyze data, and draw conclusions.
4) show an ability to utilize equipment (such as a microscope) safely and effectively to complete lab assignments.

Grading Policy:

Exams:
Exams will be multiple-choice format. Exam material may be taken from both lecture and text. There will be four lecture exams and a final exam, each worth 100 points. Lecture exams will be curved to a minimum of 73%, if the class does not achieve this without a curve. The final exam may be partly on the last portion of the lecture topics, and partly comprehensive. Lecture exams cannot be made up. Students who are absent on exam day, and do not have a legitimate excuse, will receive a grade of zero on that exam. Students who must be absent on the day of the exam, for a legitimate reason, may write a comprehensive final exam to replace the missed exam. The instructor reserves the right to decide whether a reason for absence is a legitimate excuse. When writing an exam, **YOU MUST KNOW YOUR SECTION NUMBER. TWO POINTS WILL BE DEDUCTED FROM A TEST SCORE IF THE SECTION NUMBER IS WRONG**.

For-Credit Quizzes:
There will be 12 quizzes worth 10 points each, spread throughout the term. The lowest 2 quiz scores will be dropped. These for-credit quizzes will be announced during lecture, the day before the quiz will be held. These quizzes are meant to encourage students to attend class, and to remain current in their studying. These quizzes cannot be made up. If you must miss a quiz for a legitimate reason, that will be one of the dropped quizzes.

Extra Credit Quizzes: Unannounced random bonus quizzes may be given for extra credit. These cannot be made up.

Grades: The 4 lecture exams will contribute 400 points to the final grade. The final will contribute 100 points. For-credit quizzes will contribute 100 points, and the laboratory will contribute 170 points. The total number of points is therefore 770. Bonus quiz points will be added to the student's total, prior to calculating percentage out of 770. 93-100% = A; 90-93% = A-; 87-89% = B+; 83-86% = B; 80-82% = B-; 77-79% = C+; 73-76% = C; 70-72% = C-; 67-69% = D+; 63-66% =D; 60-62% = D-.

Cheating will result in failure of the course. Additional action may be taken by the University.

Attendance Policy:
Attendance in lecture is expected. Be on time. Exhibit professional behavior. For-credit quizzes and bonus quizzes will be held during lecture, and cannot be made up. Attendance in lab is mandatory. The Biology Department has an attendance policy, which states that no student may miss more than two laboratory sessions. If you miss a lab, you will receive a score of zero for that lab. Labs cannot be made up. The instructor reserves the right to decide whether a reason for absence is a legitimate excuse. If you must be absent for a valid reason, you may attend any of the other sections of the lab. There are over 20 lab sections; these are listed at the end of this syllabus. If you attend a different lab section, to make up for a legitimate absence, you must give the instructor a card with your name, student number, and usual lab section. That lab instructor will give this card, and your graded lab quiz, to your regular lab instructor, as evidence of your attendance. If you miss more than two labs you will fail the course. The main points of the week's lab will be reviewed during Friday's lecture session. Lab quizzes usually cover these main points.

Studying is the responsibility of the student. The following are guidelines:

1. Read the material before coming to class. It is helpful to take notes on the text material also.
2. Attend the lecture and lab every class meeting. Be on time.
3. Review your notes within one day of class.
4. Work the problems at the end of each chapter.
5. If you are having difficulty understanding the material, get help at once. I am happy to help students with the material, and the university also has a free tutoring service.
6. You may wish to form a study group with a small number of students.

Studies have clearly shown that long-term memory formation requires **repeated stimulus**. **Read all of the material, go to every class, and *do not fall behind* on studying.**

Dropping the class with a **"W"** grade must be done on or before Nov. 4, 2008.

Electronic Devices must be turned off in the lecture hall.

The College of Arts and Sciences Policy on **Incompletes,** on **Disruptive Behavior**, on **Academic Misconduct**, and other information, is attached as part of the College of Arts and Sciences Syllabus Attachment.

The following is a tentative schedule of topics to be included in the lectures, and of the exams. This is a tentative schedule only. The instructor reserves the right to change the order or length of time spent on each topic, and to make needed and appropriate adjustments in the syllabus.

TENTATIVE LECTURE SCHEDULE

WEEK	DAY	DATE	TOPIC	CHAPTER
Ecology				
1	M	8/31	Introduction: Ten Themes of Life	1
	W	9/2	General Ecology and the Biosphere	52
	F	9/4	Biosphere	52
2	M	9/7	Labor Day	
	W	9/9	Populations	53
	F	9/11	Population Ecology	53
3	M	9/14	Behavior	51
	W	9/16	Community Ecology	54
	F	9/18	Communities and Ecosystems	54/55
4	M	9/21	Ecosystems	55
	W	9/23	Review or Conservation Ecology	56
	F	9/25	EXAM #1 (Chapters 1,51,52,53,54,55,56)	
Classical Genetics				
5	M	9/28	Mitosis: The Cell Cycle	12
	W	9/30	Cell division	12
	F	10/2	Meiosis I	13
6	M	10/5	Meiosis II; Mendelian Inheritance	13,14
	W	10/7	Mendelian Inheritance	14
	F	10/9	Mendelian Inheritance	14
7	M	10/12	Chromosomal Basis of Inheritance	15
	W	10/14	Chromosomal Basis of Inheritance	15
	F	10/16	Exam #2 (Chapters 12,13,14,15)	
Evolution				
8	M	10/19	Descent with Modification: Darwin	22
	W	10/21	Darwin, and Evolution of Populations	22,23
	F	10/23	Evolution of Populations	23
9	M	10/26	Origin of Species	24
	W	10/28	Origin of Species	24
	F	10/30	History of Life on Earth	25
10	M	11/2	History of Life on Earth	25
Diversity				
	W	11/4	Phylogeny and Tree of Life ***W-day***	26
	F	11/6	Phylogeny and Tree of Life	26
11	M	11/9	Prokaryotes: Bacteria and Archaea	27
	W	11/11	Exam #3: (Chapters 22,23,24,25,26,27)	
	F	11/13	Protists	28
12	M	11/16	Protists	28
	W	11/18	Protists	28
	F	11/20	Fungi	31
Plant Diversity, Structure and Function				
13	M	11/23	Plant Diversity I	29
	W	11/25	Plant Diversity II	30
	F	11/27	Thanksgiving: no class	
14	M	11/30	Plant Diversity	30
	W	12/2	Plant Structure and Growth	35
	F	12/4	Plant Structure and Growth	35
15	M	12/7	Plant Transport	36
	W	12/9	Plant Transport	36
	F	12/11	Review	
16	T	12/15	Final Exam at 10 am in Sci 126	

TENTATIVE LABORATORY SCHEDULE

Science Room 212 or Science Room 216

Lab#	Week of	Exercise Subject
1	Aug. 31	The Scientific Method: Pill Bug Lab
	Sep. 7	Labor Day: no labs
2	Sep. 14	Population growth; Quiz for Lab 1 (10 pts)
3	Sept. 21	Field Trip: Macroinvertebrate communities; Quiz for lab 2 (10 pts)
4	Sep. 28	The Microscope & Cell Division ; Quiz for lab 3 (10 pts)
5	Oct. 5	Mendelian Genetics I; Quiz for lab 4 (10 pts)
6	Oct. 12	Mendelian Genetics II & ABO and Rh Blood Types; Quiz lab 5 (20 pts)
7	Oct. 19	Mendelian Genetics III & Genetics Problems (handout); Biochemical Evolution; Quiz Lab 6 (20 pts)
8	Oct. 26	Survey of Bacteria; Quiz for Lab 7 (20 pts)
9	Nov. 2	Survey of Protista; Quiz for lab 8 (10 pts)
10	Nov. 9	Survey of Fungi; Quiz for lab 9 (20 pts)
11	Nov. 16	Survey of Plants; Quiz for lab 10 (10 pts)
	Nov. 23	Thanksgiving, no labs
12	Nov 30	Plant Anatomy; Quiz for lab 11 (10 pts)
13	Dec. 7	Plant Physiology; Quiz Lab 12 (10 pts); Quiz Lab 13 at end of lab (10 pts)

Lab Grades:
The laboratory will be graded by the lab instructor, by a quiz to be held each laboratory period. Most labs will be worth 10 points, but some will be worth more, to bring the total for the lab to 170 points. **Students arriving late to lab will have one point deducted from their quiz score for each minute they are late.**

In accordance with department rules, no children will be allowed in the laboratory.

The following indicates the laboratory sections, time, and room:

Sect #	Time	Room		Sect #	Time	Room		Sect #	Time	Room
211	M 12-3	Sci 212		***231***	***T 8-11***	***Sci 212***		251	M 9-11	Sci 212
212	M 3-6	Sci 212		***232***	***T 3-6***	***Sci 212***		252	M 3-6	Sci 216
213	T 3-6	Sci 216		***233***	***T 12-3***	***Sci 212***				
214	W 9-12	Sci 212		***234***	***R 12-3***	***Sci 212***		254	R 8-11	Sci 212
221	T 12-3	Sci 216		241	T 8-11	Sci 216		261	M 9-12	Sci 216
222	W 12-3	Sci 216		242	T 12-3	Sci 212		262	M 12-3	Sci 216
223	R 12-3	Sci 216		243	R 8-11	Sci 216		263	W 8-11	Sci 216
								264	W 3-6	Sci 216

BIOLOGY 122: GENERAL BIOLOGY 2
Dr. Boogaard, Spring 2010

Biology 122 is a 4-credit class. The lecture meets in Sci 126 on M, W and F at 9:00-9:50am.
Lab meets in Sci 212 or in Sci 216.

Instructor: Dr. Boogaard; office: ACS 2015; Phone: 591-2544; e-mail: boogaarc@ferris.edu

Office hours: M, W, F 10-10:50 am; T: 2-2:50 pm; **or by appointment**.

Course Description:
Biology 122 is the second semester of a year-long sequence in introductory biology. The topics covered include molecular biology, cell biology (including bioenergetics and metabolism), molecular genetics, diversity of the Kingdom Animalia, and animal structure and function. Laboratory exercises are designed to enhance the lecture material with hands-on experiences. Designed for students in science baccalaureate programs. This course meets General Education requirements: Scientific Understanding, Lab.

Requires: BIOL 121 and CHEM 121 or CHEM 114

Required Materials:
1. Campbell and Reece, **Biology**, 8th Edition; Benjamin Cummings
2. Fadayomi, Mitchell, Stewart and Strasser, **Biology 122: General Biology Lab Manual**; Spring, 2010. This is available at Great Lakes Book and Supply, 840 Clark, Big Rapids; (231) 796-1112; one street behind (west of) Rite-Aid drugstore, which is across State Street from Williams Auditorium and the Starr building. You will need a calculator.
3. **Lecture Notes** for Biology 122 will be available on FerrisConnect

Other Materials Required:
You are required to bring to class on exam days, a #2 pencil, and a Scantron Form 882-E sheet. For dissection labs, you may be required to purchase or bring gloves.

General Education Outcomes: This course may be used to help fulfill the general education requirement for Scientific Understanding. A student succeeding in this course should:
1) have a working knowledge of the fundamental principles of a natural science discipline;
2) be able to use appropriate scientific reasoning skills to interpret and analyze content in the natural sciences;
3) have a basic understanding of the scientific method, scientific concepts, and the evolution of scientific ideas;
4) have a more positive attitude toward science and an increased confidence in their ability to understand science.

Specific Course outcomes: This course is the first of a two part introductory biology sequence, thus it will lay the foundation for further study in biology. A student succeeding in this course should be able to:

1) demonstrate by examination a majors-level introductory knowledge in molecular biology, cell biology (including bioenergetics and metabolism), molecular genetics, the diversity of Kingdom Animalia, and animal structure and function.
2) demonstrate the ability to use mathematics to solve problems in Biology and utilize graphs or tables to present data effectively.
3) use the scientific method to formulate hypotheses, design experiments, collect and analyze data, and draw conclusions.
4) show an ability to utilize equipment (such as a microscope) safely and effectively to complete lab assignments.

Grading:

Exams:

Exams will be multiple-choice format. Exam material may be taken from both lecture and text. There will be three lecture exams each worth 100 points. Lecture exams will be curved to a minimum of 73%, if the class does not achieve this without a curve. The final exam may be worth 140 points. The final exam may be partly on the last portion of the lecture topics, and partly comprehensive. Lecture exams cannot be made up. Students who are absent on exam day, and do not have a legitimate excuse, will receive a grade of zero on that exam. Students who must be absent on the day of the exam, for a legitimate reason, may write a comprehensive final exam to replace the missed exam. The instructor reserves the right to decide whether a reason for absence is a legitimate excuse. When writing an exam, **YOU MUST KNOW YOUR SECTION NUMBER. TWO POINTS WILL BE DEDUCTED FROM A TEST SCORE IF THE SECTION NUMBER IS WRONG.** Exams will be available in the instructor's office for student review for 2 weeks after the date of the exam. After 2 weeks, exams will no longer be available.

For-Credit Quizzes:

There will be 12 quizzes worth 10 points each, spread throughout the term. The two lowest of these quiz scores will be dropped, so the total for these quizzes will be 100 points. These for-credit quizzes will be announced during lecture, the day before the quiz will be held. These quizzes are meant to encourage students to attend class, and to remain current in their studying. These quizzes cannot be made up. If you must miss a quiz for a legitimate reason, that will be one of the dropped quizzes.

Extra Credit: Unannounced random bonus quizzes may be given for extra credit. These cannot be made up.

Grades: The 3 lecture exams and the final exam will contribute 440 points to the final grade. For-credit quizzes will contribute 100 points, and the laboratory will contribute 175 points. The total number of points is therefore 715. Bonus quiz points will be added to the student's total, prior to calculating percentage out of 715.

Cheating will result in failure of the course. Additional action may be taken by the University.

Grading scale:

A = 93-100%	B+ = 87-89%	C+ = 77-79%	D+ = 67-69%
A- = 90-92%	B = 83-86%	C = 73-76%	D = 63-66%
	B- = 80-82%	C- = 70-72%	D- = 60-62%
			F = < 60%

Attendance Policy:
Attendance in lecture is expected. Be on time. Exhibit professional behavior. For-credit quizzes and bonus quizzes will be held during lecture, and cannot be made up. Attendance in lab is mandatory. The Biology Department has an attendance policy, which states that no student may miss more than two laboratory sessions. If you miss a lab, you will receive a score of zero for that lab. Labs cannot be made up. The instructor reserves the right to decide whether a reason for absence is a legitimate excuse. If you must be absent for a valid reason, you may attend any of the other sections of the lab. There are many lab sections; these are listed at the end of this syllabus. If you attend a different lab section, to make up for a legitimate absence, you must give the instructor a card with your name, student number, and usual lab section. That lab instructor will give this card, and your graded lab quiz, to your regular lab instructor, as evidence of your attendance. If you miss more than two labs you will fail the course. The main points of the weeks' lab will be reviewed during Friday's lecture session, and are covered in the lab summary posted on Ferris Connect. Lab quizzes usually cover these main points.

Studying is the responsibility of the student. The following are guidelines:

1. Read the material before coming to class. It is helpful to take notes on the text material.
2. Attend the lecture and lab every class meeting.
3. Review your notes within one day of class.
4. Work the problems at the end of each chapter.
5. If you are having difficulty understanding the material, get help at once. I am happy to help students with the material, and the university also has a free tutoring service. (Tutors Kimberly Betters, Lindsey Reder and Alex Barker are recommended)
6. You may wish to form a study group with a small number of students.

Studies have clearly shown that long-term memory formation requires **repeated stimulus**. **Read all of the material, go to every class, and do not fall behind on studying**. Study on a regular on-going basis. Do not leave studying until just before tests.

Dropping the class with a **"W"** grade must be done on or before ***March 25, 2010***.

Electronic Devices must be turned off in the lecture hall.

The College of Arts and Sciences Policy on **Incompletes,** on **Disruptive Behavior**, on **Academic Misconduct**, and other information, is attached as part of the College of Arts and Sciences Syllabus Attachment.

The following is a tentative schedule of topics to be included in the lectures, and of the exams. This is a tentative schedule only. The instructor reserves the right to make appropriate or necessary changes to the order or length of time spent on each topic, as need arises.

TENTATIVE LECTURE SCHEDULE

WEEK	DAY	DATE	TOPIC	CHAPTER
1	M	Jan 11	Chemical Context of Life	2
	W	Jan 13	Water Chemistry	3
	F	Jan 15	Carbon and Molecular Diversity	4
2	M	Jan 18	M.L.K. Day: no classes	
	W	Jan 20	Macromolecules	5
	F	Jan 22	Macromolecules	5
3	M	Jan 25	Cell Tour	6
	W	Jan 27	Cell Tour	6
	F	Jan 29	Membranes	7
4	M	Feb 1	Membranes	7
	W	Feb 3	Metabolism	8
	F	Feb 5	Metabolism	8
5	M	Feb 8	**EXAM 1** (Chapters 2,3,4,5,6,7)	
	W	Feb 10	Respiration	9
	F	Feb. 12	Respiration	9
6	M	Feb. 15	Respiration	9
	W	Feb. 17	Photosynthesis	10
	F	Feb. 19	Photosynthesis	10
7	M	Feb. 22	Molecular Inheritance	16
	W	Feb. 24	Molecular Inheritance	16
	F	Feb. 26	From Gene to Protein	17
8	M	Mar 1	Gene to Protein	17
	W	Mar 3	Gene to Protein	17
	F	Mar 5	**EXAM 2** (Chapters 8, 9,10,16,17)	
9	M	Mar 8	SPRING BREAK ALL WEEK	
10	M	Mar 15	Regulation of gene expression	18
	W	Mar 17	Regulation of gene expression(bacteria only)	18
	F	Mar 19	Viruses	19
11	M	Mar 22	DNA technology (cloning only)	20
	W	Mar 24	Animal evolution	32
	F	Mar 26	Invertebrates	33
12	M	Mar 29	Invertebrates	33
	W	Mar 31	Invertebrates/vertebrates	33/34
	F	Apr 2	Mid-semester recess	
13	M	Apr 5	Vertebrates	34
	W	Apr 7	review	
	F	Apr 9	**EXAM 3** (Chapters 18,19,20,32,33,34)	
14	M	Apr 12	Animal Structure and Function	40
	W	Apr 14	Digestive System/Nutrition	41
	F	Apr 16	Digestive System/Circulatory system	41/42
15	M	Apr 19	Circulatory system	42
	W	Apr 21	Endocrine system	45
	F	Apr 23	Endocrine System	45
16	M	Apr 26	Reproductive system	46
	W	Apr 28	Reproductive system	46
	F	Apr 30	review	
17	M	May 3	**FINAL EXAM** (Chapters 40,41,42,45,46	

TENTATIVE LABORATORY SCHEDULE

#	Week	Exercise # & Subject	Quiz:
1	1/11	Organizational meeting of lab	
2	1/18	Macromolecules	
3	1/25	Osmosis & Diffusion	Quiz 1: Macromolecules (15 pts)
4	2/1	Enzymes 1	Quiz 2: Osmosis (10 pts)
5	2/8	Enzymes 2	Quiz 3: Enzymes 1 (15 pts)
6	2/15	Energy	Quiz 4: Enzymes 2 (10 pts)
7	2/22	DNA I: Transformation 1 & Electrophoresis 1	Quiz 5: Energy (15 pts)
8	3/1	DNA II: Transformation 2, Electrophoresis 2 & Transcription/Translation	Quiz 6: DNA I (15 pts)
9	3/8	No labs: spring break	
10	3/15	DNA III: Transformation 3; Properties of DNA	Quiz 7: DNA II (15 pts)
11	3/22	Invertebrates I	Quiz 8: DNA III (15 pts)
12	3/29	No labs: mid-semester recess	
13	4/5	Invertebrates II	Quiz 9: Invertebrates 1 (15 pts)
14	4/12	Chordate Diversity /Card Wildlife Center	Quiz 10: Invertebrates 2 (15 pts)
15	4/19	Histology	Quiz 11 : Chordates (10 pts)
16	4/26	Vertebrate anatomy	Quiz 12: Histology (10 pts)& Quiz 13: Verts (15 pts)

Lab Grades:
The laboratory will be graded by the lab instructor. The lab will be graded by a quiz to be held each laboratory period. Most labs will be worth 10 points, but some will be worth more, to bring the total for the lab to 175 points. **Students arriving late to lab will have one point deducted from their quiz score for each minute they are late**. Also, one point will be deducted for each minute the instructor must spend cleaning your bench after you leave. In accordance with department rules, no children will be allowed in the laboratory.
The following indicates the laboratory sections, time, and room:

Sect #	Time	Room		Sect #	Time	Room	
211	T 8-11	Sc 216		***232***	***T 3-6***	***Sci 216***	
212	W 12-3	Sc 212		***233***	***R 12-3***	***Sci 212***	
213	R 8-11	Sc 212		***234***	***R 8-11***	***Sci 216***	
214	R 12-3	Sc 216					
221	W 12-3	Sci 216		241	T 12-3	Sci 212	
222	W 3-6	Sci 216		242	T 3-6	Sci 212	
				243	W 3-6	Sci 212	

BIOL 205
HUMAN ANATOMY AND PHYSIOLOGY
SYLLABUS FALL SEMESTER 2009

Human Anatomy & Physiology is fascinating and exciting because it is about one of the most interesting things in the world -- OUR BODIES.

Biol-205 should be one of the most interesting, enjoyable, and valuable classes you will ever take.

A. COURSE INSTRUCTORS:

Robert Friar, PhD
Phone: Office: 591-2542
Home: 796-9470

email: friar@ferris.edu

Telephone help hours:
MTWTFSS 8:00 - 9:30 PM

Office: ASC-2019
Office Hours:
M---- 9:30a - 11:00a - In office
M---- 1:00p - 2:00p - In office
-T--- 2:00p - 3:00p - In office
--W-- 1:00p - 3:00p - In office
---R- 9:30a - 11:00a - In office
---R- 2:00p - 3:00p - In office
Lect Review ---R- 11:30a - 11:55a - In 126 or 222
Lect Review ----F 12:00p - 12:50p - In 222 or office
Lab Review ----F 1:00p - 3:00p - In 222 or office
(Other hours by appointment)

B. TEXT and SUPPORTIVE MATERIALS: Prerequisite: Chemistry 114 or 121.

1. *Anatomy & Physiology*, 4th Ed (2007); Author: Saladin. Publisher: McGraw Hill. Page numbers slightly different between 3rd, 4th & 5th Eds. Chap numbers same in 3rd, 4th, & 5th Eds. Fifth Ed.(2009) cost more but no better than 4th Ed. To save money, look for 4th Ed. online. ISBN: 978-0-07-287506-5.

   READ YOUR TEXT DAILY. Assignments for 4th Ed are on Pages 8, 9, and 10 of this syllabus. Bring your textbook to LAB. You do NOT need to bring your textbook to lecture.

2. BIOL 205 Lecture Outlines, Study Guides, and Lab Manual, by Friar --$~14.00; Purchase at Rankin Bookstore.

C. COURSE DESCRIPTION: This course meets the General Education requirement for Scientific Understanding. This is an integrated course in Anatomy & Physiology and it emphasizes structure and function as it relates to clinical consideration.

D. COURSE CONTENT:
This course will provide you with the opportunity to study the HUMAN BODY. This course will begin with the CELL and progress through TISSUES, ORGANS and organ SYSTEMS. The organ systems to be studied are SKELETAL, MUSCULAR, INTEGUMENTARY, NERVOUS, ENDOCRINE, CIRCULATORY, RESPIRATORY, DIGESTIVE, RENAL, and REPRODUCTIVE.

E. COURSE FORMAT and CLASS SCHEDULE: 4 hrs lecture and 3 hrs lab each week. (5 credit hours)

	DAY	TIME	ROOM	INSTRUCTOR
1. LECTURE:	MTWR-*	12:00 - 12:50 p	Sci 126	R. Friar

* "How to Study" and "How to Succeed in College": Thur, Sept 3, at 11:00-11:50 or Fri, Sept 4, at 12:00-12:50. Optional but very important; Bonus points. Attendance will be taken.
An extra lecture will be given on Thur, Sept 10 at 11:00a, and again on Friday, Sept 11, at 12:00.
This is REQUIRED. It replaces Nov. 5 when I will be at conference.

(If you have a conflict with these sessions, see me to arrange a time convenient for you.)

2. LAB SECTIONS

CODE	DAY	TIME	ROOM	INSTRUCTOR
211	Mon.	3:00 - 5:50 p	Sci 222	R. Friar
212	Mon.	6:00 - 8:50 p	Sci 222	R. Friar
213	Tue.	8:00 - 10:50 a	Sci 222	D. Griffith
214	Wed.	8:00 - 10:50 a	Sci 222	R. Griffith

3. REVIEWS: Highly recommended for all students. Required if your grade falls below C+.

Lect Review Thur.	11:30 - 11:50 a	Sci 126	R. Friar
Lect Review Fri.	12:00 - 1:50 p	Sci 126	R. Friar
Lab Review Fri.	1:00 - 3:00 p	Sci 222	R. Friar or D. Griffith

4. TUTORING: To be arranged as requested. Additional reviews on request. Ask me if need these.

F. PURPOSE OF BIOL-205:

1. To study the **ANATOMY** (structure) and **PHYSIOLOGY** (function) of the human body and to develop the prerequisite knowledge, skills and values needed for designated courses and curricula, e.g. applied biology, bio-technology, dental hygiene, medical records, medical lab technology, medical technology, nuclear medicine, forensic science, nursing, dental hygiene, respiratory therapy, science education, and others.
2. To learn the descriptive and technical terminology used in anatomy and physiology.
3. To be able to identify the major structures (molecules, organelles, cells, tissues, organs and organ systems) which make up the human body and to understand the functions of these structures.
4. To develop an appreciation for how structure determines function and the importance of homeostasis.
5. To comprehend the philosophy and methodology of science.
6. To develop the ability to read and comprehend scientific information - especially in one's chosen professional field and in the popular press and also on radio and TV.
7. To develop the ability to critically evaluate new information, as well as to question established "facts," when formulating an opinion or attitude.
8. To develop the ability to **THINK** and reason logically in technical and nontechnical areas and to maintain an open mind and to be flexible on all issues.
9. To develop the ability to apply scientific knowledge to one's profession and to one's personal life.
10. To develop the ability to analyze scientific, medical, social and political issues and to think clearly and sensibly in determining good, unbiased, workable solutions.
11. To develop the willingness and ability to take a stand on important issues confronting one's profession and our society -- family, community, state, nation, and world.
12. To develop a sense of the importance of community involvement and helping our fellow humans and to foster community service.
13. To develop an awareness of the many things that each of us can do to improve and maintain good health and to be able to differentiate between health fads and myths and good health practices.
14. To apply what we learn about our bodies to develop a lifestyle that will improve and maintain good health and enhance happiness for our lifetime.
15. To develop the knowledge and skills that will contribute to our quality of parenting skills.
16. To answer questions related to the human body, its functions and care.

G. COURSE OUTCOMES. At the conclusion of this course:

1. Using microscopes, diagrams, pictures, models, skeletons, and human cadavers, the students will be able to identify, give location and names of approximately 3,000 designated anatomical structures (molecules, organelles, cells, tissues, organs, and organ systems that make up the human body. (Complete list of anatomical structures that students need to know are given in the Lab Manual Study Guides and the Lecture Study Guides.)

2. Students will be able to illustrate and explain the importance of designated biochemical reactions that are essential for life and health related problems when one of the key factors is/are missing. (See Study Guides.)
3. Students will be able to explain the designated physiological processes (functions) of hormones, neurotransmitter, receptors, organelles, cells, tissues, organs, and organ systems. (See Study Guides for complete list.)
4. Students will be able to carry out specific experimental procedures and observe other experimental demonstrations, collect data, make appropriate calculations, and then evaluate experimental data to develop an understanding of and be able to explain the significance of the information collected from the results of the experiments. (See Lab Manual Study Guides for each experiment for list of skills, calculations, and knowledges needed.)
5. Students will be able to apply their knowledge of anatomy and physiology and to think logically, realistically, and judiciously about the importance of the application of anatomy and physiology to their careers choices.
6. Students will be able to apply their knowledge of anatomy and physiology to the human body and especially to their own body as it relates to achieving and maintaining good health.

H. COURSE ASSESSMENT:

1. Outcome 1: The students will be assessed most weeks in lab by an oral quiz at the end of lab and an in-depth written quiz at the beginning of the next lab over the materials covered and by a comprehensive final lab exam at the end of the semester.
2. Outcome 4 will be assessed by a 20- to 30-point essay quiz at the beginning of the next lab.
3. Outcomes 2, 3, and 5 will be assessed by five, 100-point lecture exams and one comprehensive final lecture consisting of TF, MCQ, short answer, and essay questions.
4. Outcome 6 will be assessed by students keeping a daily record of health related factors: diet, exercise, sleep, achieving and maintaining ideal body weight, limiting caffeine, avoiding drugs, e.g. nicotine, alcohol, and other "recreational" drugs, maintaining a positive attitude, managing time wisely by limiting time spent on TV, internet, video games, telephone, partying, and planning time each day for class attendance, study, exercising, relaxing, socializing, working, and other things important to the individual. These daily records will be turned in each Monday in lecture.

I. TESTS and QUIZZES:

1. LECTURE EXAMS: There will be four lecture exams plus the final exam. Each lecture exam will cover the previous three weeks of lecture related material and be worth 100 points. The COMPREHENSIVE FINAL lecture exam will be 200 points. The questions on the final exam will be approximately 50% from the last 3 weeks of the course and 50% from the first 12 weeks.

2. Source of Questions: Questions will be taken primarily (~80%) from lectures -- refer to Study Guides at end of each unit -- and reading assignments (~20%) with a few questions from biological, medical, health related, political, social, and ethical issues in the news which have been mentioned in class. You should keep current in the above news items by reading at least one news magazine/week or newspaper/day or both. I will expect you to use your anatomical and physiological knowledge to think reasonably, rationally, and logically about items in the news. *Each of us must learn to think for ourself. Don't let anyone think for you. Those who want to think for us (tell us how and what to think and what to do or not do) usually want to control us and manipulate our thoughts and actions.*

3. Types of questions: Each exam will include true/false, multiple choice, matching, fill-in-blanks, definitions, essay questions, and diagrams. In addition to testing your knowledge (recognition) of the material covered, I will ask you to propose or discuss realistic solutions to biological, medical, health-related, political, and social problems and ethical issues, and to make value judgments. You will be required to use logic to justify your answer(s). (NOTE: LECTURE exam questions will NOT come from lab and VICE VERSA.)

4. THE EXAM DATES are listed below and in the **Lecture Schedule & Reading Assignment.**
NOTE: For those who wish additional time, the first four exams will begin at 11:30 a.m.

I. Thursday Sept 13
II. Thursday Oct 4
III. Thursday Oct 25
IV. Thursday Nov 15
V. FINAL EXAM, Tue., Dec. 15 @ 12:00-1:40 pm.

***(Anyone who misses one of the lecture exams must notify me in person or by phone AS SOON AS POSSIBLE and must arrange with me to take a make-up exam. If you are unable to call, have someone contact me. The NO FAULT policy also applies to missing an exam!)*

Since persons who take exams late have additional time to prepare for the exam, to be fair to the rest of the class, I will **deduct 5%** from the score for each day the exam is delayed. (You will also lose 5 pts for being absent.)

5. UNANNOUNCED QUIZZES: There may be 5 or 10-point pop quizzes given in lecture. Some of these quizzes will be given during the first three minutes of lecture and cover material discussed in the previous lecture or over the reading assignment. Others will be given at the end of the lecture and cover material discussed in that day's lecture. Because one reason for the pop quiz is to encourage students to be prepared, to participate in discussions and to comprehend the material, a missed lecture quiz **MAY NOT** be made up.

6. LAB QUIZZES: Each week there will be a 20 to 30-point quiz at the beginning of lab. This will usually be a combination of a pre-lab quiz over that day's lab and especially over the material covered in previous lab. If you miss a lab quiz, see me at once and GET INTO ANOTHER LAB that week! A missed quiz becomes a zero. If you miss more than one lab, a grade of "I" will be given and you must take that lab the next semester. There will be a 5 to 10-point quiz at the end of some labs.

Lab scores will make up 25% of your class grade. Lab can have a major affect on your final class grade. Every student could make an "A" in lab if he/she ALWAYS came to lab FULLY PREPARED. Each lab exercise tells what you need to know. Study thoroughly before lab and make good scores!

J. GRADING SYSTEM: Your grade will be based on your:

((lecture exams + quizzes + Reading guides + attendance + pledge) x (75%)) + (lab scores x 25%) = ___%

It is my belief that too much emphasis is placed on grades and not enough emphasis is placed on learning, retaining and applying the information, skills, and values taught. If you master the material, you don't need to worry about grades. If you don't master the material, worry won't help you!

Because grades strongly motivate some and because grades should reflect your progress in a course, I will post grades each week on the bulletin board outside SCI 222. Check it weekly to be sure no scores are missing and that each score is correctly recorded. Report any suspected errors to me at once.

GRADING SCALE

Grade %	Grade %	Grade %	Grade %	Grade %
	B+ = 87	C+ = 77	D+ = 67	F = 59.9999999
A = 93	B = 83	C = 73	D = 63	
A- = 90	B- = 80	C- = 70	D- = 60	

This is a set scale and will NOT be changed. I will not curve the class. I do not give extra points to persons who are "close" to the next letter grade. In this course you will be provided with extra opportunities to learn

the material and therefore to excel in both lecture and lab. If you want an "**A**", be sure you have the points required. THE CHOICE IS YOURS. REMEMBER:

==>Life is about choices. When we chose a behavior, we chose the consequences.<==

K. ADDITIONAL HELP -- Extra Help, Lecture & Lab Reviews, Tutoring, Personal Help, Email, Telephone.

1. REVIEWS: To enhance learning and retention of anatomy and physiology and to make learning easier, we will have two to three hours of reviews/week. These reviews will provide extra time for discussion, practice, drill, and development of study skills to make learning anatomy and physiology easier and more enjoyable. I encourage all students to take advantage of this additional help and instruction. It is for you, but it can't help you if you do not participate.

   (If your grade falls below a C+, you will be required to attend at least one hour per week.)

2. TELEPHONE HELP: Each evening between 8:00 and 9:30 you may call me at my home (796-9470) for help. I'm setting this time aside seven nights each week to be available to assist students, so don't hesitate to call. Don't wait until the night before an exam. If I am on the phone when you call, try calling back in 5 to 10 minutes. If I am out when you call, leave your name, number, and latest time to call on my answering machine and I will return your call.

3. E-MAIL HELP: If you have questions, suggestions, comments, or personal problems you want to discuss, email me at: friar@ferris.edu. I strive to respond within 24 hours. Email is available 24 hours per day.

4. LAB TUTORING will be available if needed. Ask if you want additional lab reviews.

5. LECTURE TUTORING may not be needed with the reviews, but will be available if requested.

6. OFFICE HOURS and personalized help are available daily. If you cannot make one of my established office hours, request an appointment. If you have personal problems you wish to discuss, come see me.

7. SUGGESTIONS on HOW to STUDY will be given on the First Thur at 11:00-11:50 a.m. and Fri. 12:00-12:50 in Sci-126. (See me if you cannot attend one of these times.) Be sure you develop an effective system for studying anatomy and physiology early in the course. See me if you need help with study skills. I encourage EVERYONE to JOIN or ORGANIZE a STUDY GROUP by the end of the first week or middle of the second week.

8. There are very few reasons why anyone should do poorly in this course. If you put forth the effort to learn and master the material, you can and WILL be successful.

===> **THE "I WILL" IS MORE IMPORTANT THEN THE "I.Q."** <===

No matter how much others do to help you, it is of no value to you if YOU do not use the help and if YOU do not use effective study skills. Remember, YOU are the ONLY one who can transfer INFORMATION into your BRAIN and retain it for future use. If you do well, the credit is yours. If you do poorly, the blame is on your shoulders.

L. CLASS ATTENDANCE POLICY: **Simply stated, I expect you to be in class EVERY DAY**. You are paying a substantial amount in both time and money for your education. Be sure to get what **you are paying for.** You can't get it if you miss classes or if you don't study and master the course materials. Furthermore, Michigan tax payers are paying part of your college education bill. They have a right to expect you will do your best. You have an obligation to do your best! I will expect you to do your best!

1. LECTURE: Because there is a close correlation between class attendance and class performance (grades), attendance will be taken each day. You will lose 5 pts for each absence; 2.5 pts if tardy or if leave early.

   a. Recognizing that emergencies may occasionally occur, you will be allowed three absences during the semester without penalty to your grade. Each additional absence beyond the first three will result in 5 points being deducted from your lecture grade. To encourage perfect attendance, each person who is present and on time for all classes will receive 15 bonus pts at the *end of the semester.* Persons with one absence will receive 10 bonus pts. Persons with two absences will receive 5 bonus pts. Persons with three absences will receive 0 bonus pts. Remember, absences beyond three will cost you 5 points each. If tardy or if leave early you lose 2.5 points.

   b. "NO FAULT" ATTENDANCE POLICY: Despite all of the excuses, there are very few reasons that justify an absence. Because it is difficult to establish the validity of excuses, I use a "No Fault" attendance policy. Therefore, the reason for an absence, whether personal problems, illness, funeral, religious holiday, job interview, bad weather, too lazy to come to class, indifference, etc., does not matter.

   c. If illness or other emergency forces you to miss a lecture, call me, email me, or come see me. If unable to call, have someone call for you. This is important so I can assist you with getting the material missed. Please share with me any problems that you have so I am aware that the problem exists and so I can offer assistance in resolving the problem.

   d. TARDINESS: All lectures and labs will begin on time and end on time. You are expected to be in your seat at least 30 seconds BEFORE class begins. If you have a handicap or other problems which will cause you to be tardy, discuss the situation with me during the first week of class.

   e. SEAT ASSIGNMENT: To facilitate taking attendance in lecture, each person will have an assigned seat. Your assigned seat will be the seat you select when you come to the second class. Be sure to get a seat that you want for the rest of the semester. If you have trouble seeing or hearing, sit in the front near the center.

2. **LAB:** If you miss a lab, you must make it up during the same week by arranging to attend another lab. There are six lab codes and all are full. Strive to avoid changing a lab. (The labs are listed above along with the day and time that each lab meets.) If you have a special event, e.g. a field trip in another course, PLAN AHEAD to attend another lab. Don't get caught short. (CALL me IMMEDIATELY if you miss a lab.)

   a. *You* **MUST GET PERMISSION** *from me to attend another lab.*

   b. A lab that is missed and not made up by attending another lab will result in a "zero" grade for that lab.

   c. MISSING MORE THAT ONE LAB will result in an "I" for the course and you must take the missed labs next semester. (Remember an "I" becomes an "F" if not removed by the end of the following semester.)

M. SUGGESTIONS on HOW to STUDY: will be given the First Thursday at 11:00 (also Friday at 12:00). Be sure you develop an effective system for studying anatomy and physiology early in the course.

One important factor is to be in an effective study group. I strongly urge everyone to be in a good study group by the end of the first week. A good study group is one which meets at a set time one to four times per week and in which everyone contributes. It is the responsibility of all members of the group to see that the group functions well. If that group does not function well for you, politely tell the other members of the group your concerns and if they are not met, find or form a new group. No one should stay in a study group that does not meet regularly, is ineffective or is incompatible. *(Be sure you are not the reason for the group being ineffective or incompatible.)* If discussions irrelevant to studying A & P occur, politely suggest the topic be discussed after the study session. *(Be sure to write down the names and phone numbers of all persons in your group.)*

My function as the teacher is to develop an environment conducive to efficient learning and to guide your learning experiences. I shall strive to do this for you. I greatly enjoy working with people who are dedicated to excellence, who are organized, read text before class, always arrive on time, come prepared, pay attention, think, ask good questions, apply new knowledge to themselves, study diligently, work hard, and who are pleasant, congenial, helpful and cooperative with classmates. *(Remember, if you are not this type of person, you can become whatever you wish to be and I will be happy to work with persons who want help in changing behaviors and traits they consider undesirable.)*

No one appreciates people who waste time or persons who don't try, don't care, arrive late, miss class, leave class early, procrastinate, are lazy, make excuses, blames others for their failures, abuse their health, lack respect for others, sleep in class, talk in class, and/or who make no effort to change their behaviors that interfere with learning and self development.

If I do a good job teaching this course and if you do a good job studying and learning about the human body, this should be one of the most interesting, enjoyable, and valuable classes you will ever take. While there are many specific parts and functions to learn about the human body and many concepts, ideas, skills, and values to ascertain and while studying this course will require considerable time and effort, this is a course that everyone can do well in if they put forth a serious effort and really try. GOOD LUCK!

Remember, I am here to help you.

"Anyone who is not mentally retarded (and none of us are) can achieve any reasonable dream and master any subject, if he/she is willing to devote the necessary time and energy to reaching his/her goals."

1. YOU CAN HAVE ANY REASONABLE DREAM IF YOU ARE WILLING TO WORK 1000'S OF HOURS TO ACHIEVE IT!

2. THE SECRET OF LEARNING AND MAKING GOOD GRADES IS, "MASTERING EACH DAYS WORK AS IT COMES." NEVER GET BEHIND.

3. DON'T WAIT UNTIL THE NIGHT BEFORE AN EXAM TO STUDY.

4. A MAJOR FACTOR IN SUCCESS IS TIME ON TASK!

5. JOIN OR ORGANIZE A SMALL STUDY GROUP.

6. TAKE ADVANTAGE OF REVIEWS, TUTORING, AND EXTRA HELP.

7. REMEMBER, EXCUSES SATISFY ONLY THE PERSON WHO MAKES THEM!

8. A HANDICAP IS NOT A HANDICAP UNTIL IT BECOMES AN EXCUSE.

9. IF YOU SCORE HIGH IN ALL OF YOUR COURSES, YOUR PROBABILITY FOR SUCCESS IN LIFE WILL BE FAR HIGHER THAN FOR SOMEONE WHO JUST GETS BY.

10. OUR HISTORY IS WRITTEN IN OUR GENES AND IN OUR ACTIONS. WE CAN DO LITTLE ABOUT OUR GENES, BUT WE CAN DO VIRTUALLY EVERYTHING ABOUT OUR ACTIONS.

11. SHOWING UP ON TIME AND BEING PREPARED IS 90% OF LIFE. (Woody Allen)

12. NEVER BLAME OTHERS. TAKE RESPONSIBILITY FOR EVERY ASPECT OF YOUR LIFE. (Plato)

COMMON COURTESIES:

The behavior of a few students would suggest that they never learned, or have forgotten, the basic rules of respecting the rights of others.

Persons Of Quality Do NOT Interfere With The Rights Of Others.

Talking during lecture and other disruptive behaviors which interfere with the rights of others or their ability to learn, is unacceptable. Cell phones, pagers, i-pods, tape or disk players, etc. MUST BE TURNED OFF before you enter the classroom.

FOOD and BEVERAGES (water is okay) should NOT be consumed in lecture or lab.

Small children do NOT belong in lecture or lab.

If anything occurs during lecture or lab that interferes with your ability to concentrate or to learn, let me know.

BEST WISHES FOR A GREAT SEMESTER AND A WONDERFUL YEAR !

BIO 205 LECTURE SCHEDULE & READING ASSIGNMENTS in 4th Ed of Saladin

For your SAFETY and to PROTECT others, please do NOT consume FOOD or BEVERAGE in LECTURE or LAB.

Always read assignment before class.
Always read the Objectives for each section.
Always answer questions in Before You Go On.
Ponder questions in Think About It.
Read & understand INSIGHT – Clinical Application.
Study Review of Key Concepts at end of each chapter. These are great summaries.
Answer questions in Testing Your Recall, True or False, and Testing Your Comprehension.
You may wish to check out the website at end of chapter.

Lect	DATE	DAY	LECTURE TOPIC	READING ASSIGNMENT
-- Week 1 ----------				
				Scan over: "Preface" - pp. iii-xi. Read "Preface" - pp. xii-xxiv. Study pictures on pp.242-280 for first lab.
1	Aug 31	M	Syllabus; **(1LO)** Introduction to A & P	Study Chp 1, pp. 1-51. Skim pictures on pp. 41-49.
2	Sept 1	T	Complete Introduction to A & P	Read Key Concepts pp. 50.

Know Anatomical Planes and Directional Terms on pp. 31-32. These are Very Important!
Know the 12 Organ Systems on pp. 39-40. (Note: We will combine these 12 organ systems into 10 organ systems.)

=====> Read and Study Chp 2, "Chemistry of Life". This is a very important chapter.
Know 24 elements in Table 2.1 on p. 55. Understand ionic and covalent bonding, pp. 59-60.
Be sure you understand organic and inorganic compounds and their importance to living matter.
Have general knowledge of structures of carbohydrates, proteins, & lipids and their importance to living matter.
Be sure you understand atomic structure; ions; free radicals; solutions, colloids, suspensions; molarity; pH.
Be sure you do well on the Testing Your Recall questions on pp. 87-88.

3	Sept 2	W	**(2LO)** Cell Structures & Functions	Chp 3, 89-124
-	Sept 3	R	11:00-11:50 today or Friday 12:00-12:50; You may come at either time.	

If you cannot come Thur. at 11:00 or Friday at 12:00, see me and I will arrange a special time for you.
(1LO-stud) How to Study A & P? Factors Affecting Learning & Memory; Short-term & Long-term memory.
Factors Affecting Success in College & Success in Life:
Applying knowledge of A & P to enhancing the quality of our personal life; PLEDGE; Attendance will be taken at this lecture.

4	Sept 3	R	Cell Structures & Functions	Chp 4, 125-139
-	Sept 4	F	12:00 in Sci-126: repeat of **(1LO-stud)** "How to Study A & P".	

-- Week 2 ----------

- Sept 7 M **NO LECTURE: Labor Day** (Enjoy family and friends. Do some studying.)

Special Note For Students In The Monday Lab Codes. Monday 3:00-5:50p lab will not meet.
Monday 6:00 to 8:50p lab will meet at regular time; however, if you prefer to not come, we will hold a lab Tuesday at 3:00-5:50p and Tuesday 6:00-8:50p. Sign for lab time you prefer.

5 Sept 8 T Complete Cell; Protein Synthesis — Chp 4, Scan 140-149; Read Insight 4.4 p.148-149.
6 Sept 9 W **(3LO)** Tissues; Histology; Epithelium; — Chp 5, 153-163
7 Sept 10 R Required: You may come at either 11:00-11:50 today or 12:00-12:50 Friday. Attendance will be taken.
This is to replace November 5th when I will be at a Professional Conference.
(3LO) Bones; Joints (11:00-11:50a) — Chp 7, 213-240
Read: Chp 9 (Joints), pp.289-308; Skim 308-319. (Know 4 types of joints; 6 synovial joints; joint movements.)
7 Sept 11 F Same lecture as yesterday at 11:00-11:50a. (Must attend one of these lectures.)

- - **Week 3** -

8 Sept 14 M Connective, Mus., & Nerv. Tis.; — Chp 5, 162-186
Skin; Integumentary System — Chp 6, 187-211
9 Sept 15 T **(4LO)** Nervous Sys; Membrane Potential — Chp 12, 453-459; Be sure you understand all of this.
- Sept 15 T 7:00-8:00 PM in lab: Optional review for Exam I.
10 Sept 16 W Depolarization/Repolarization/AP — Chp 12, 441-453; Know cell types & types of neurons.

11 Sept 17 R **EXAM 1** 11:30-12:50. Bring two # 2 Pencils, Eraser, and blue or black ballpoint -- NOT red.
Wait outside door. Pick up Scantron on back table as you enter. I will hand exam to you as I assign you a seat. (Leaving the room during an exam disturbs others and is inappropriate. PLEASE, just prior to the exam, get drink, go to rest room, etc., bring tissues and anything else you might need.)

- - **Week 4** -

12 Sept 21 M Conduction, Velocity, Synapses — Chp 12, 459-467; Be sure you understand all of this.
13 Sept 22 T Synapses; NT; coding; processing — Chp 12, 467-472; Be sure you understand all of this.
14 Sept 23 W Coding; Processing;
*- Sept 24 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
15 Sept 24 R **(5LO1)** Neurons; Glial Cells; Regener. — Review pp. 442-453.
*- Sept 25 F Optional Review at 12:30-12:50 in Sci-126. Bring your questions.

- - **Week 5** -

16 Sept 28 M **(5LO2)** PNS; 12-CN; SpCd; Cerebellum — Chp 13, 481-501; Chp 14, 526-527; 547-557.
17 Sept 29 T **(6LO)** CNS; Reflex; Brain Stem — Chp 13, 501-511
18 Sept 30 W Cerebrum, Sensory, Thought, Motor — Chp 14, 513-529; 539-544;
*- Oct 1 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
19 Oct 1 R Cerebrum: Speech, RF, Alcohol and other Dugs, Memory. Chp 14, 529-539; 545-547; 557-562.
*- Oct 2 F Optional Review at 12:00-12:50 in Sci-126. Bring your questions.

- - **Week 6** -

20 Oct 5 M Cerebrum: Memory, Language, CNS development Chp 16, 585-593.
21 Oct 6 T **(7LO)** Senses, Touch, Smell, Taste — Chp 16, 593-598.
22 Oct 7 W Balance; Hearing — Chp 16, 598-612.

23 Oct 8 R **EXAM 2** 11:30-12:50. Bring two # 2 Pencils, eraser, and blue or black Ballpoint. Wait outside door. Pick up Scantron on back table as you enter. I will hand exam to you as I assign you a seat. (Prior to the exam, get drink, go to rest room, bring tissues and anything else you need.)

- - Week 7 -

24 Oct 12 M Complete Hearing; Vision — Chp 16, 612-634
25 Oct 13 T Complete Vision **(9LO)** Muscles — Chp 10, 321-326; Chp 11, 405-411.
26 Oct 14 W Muscles, Anatomy and Histology — Chp 11, 412-421.
*- Oct 15 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
27 Oct 15 R Muscle Physiology; Contraction — Chp 11, 421-426.

- - Week 8 -

28 Oct 19 M Muscle Physiology; Energy, Metabolism — Chp 11, 426-440
29 Oct 20 T Muscle Physiology; Threshold, Twitch, Tetanus. Look over pp. 327-381. Use to label Lab 9.
30 Oct 21 W **(8LO)** Autonomic Nervous System (ANS) — Chp 15, 563-583
*- Oct 22 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
31 Oct 22 R Finish ANS; Start **(10LO)** Endocrinology — Chp 17, 635-646.

- - Week 9 - - Mid-Term Grades Due Oct 26 -

32 Oct 26 M **(10LO)** Endocrine System; Hormones — Chp 17, 635-645 to "Control of Pituitary".
33 Oct 27 T Hypothalamus, RH & IH; Pituitary — Chp 17, 645-651 to "The Gonads".
34 Oct 28 W Pituitary, Growth Hormone, hGH — Chp 17, 651-657.

35 Oct 29 R **EXAM 3** 11:30-12:50. Bring two # 2 Pencils, eraser, and blue or black Ballpoint. Wait outside door. Pick up Scantron on back table as you enter. I will hand exam to you as I assign you a seat. (Prior to the exam, get drink, go to rest room, bring tissues and anything else you need.)

- - Week 10 -

36 Nov 2 M Thyroxine; Parathormone — Chp 17, 658-668 to "Endocrine Disorders".
37 Nov 3 T Pancreas, Insulin, Glucagon; DM — Chp 17, 668-678
38 Nov 4 W Adrenal Cortex, G and M

==>*Nov 4 W* **LAST DAY TO DROP OR WITHDRAW WITH A " W ".** <============

- Nov 5 R **No Class Today**. I will be at a professional conference. Lecture made up Sept 11 or 12.

- - Week 11 -

39 Nov 9 M **(11LO)** CVS, Arteries, Veins, Blood, Bld. Clot — Chp 18, 680-714
40 Nov 10 T Anatomy of Heart — Chp 19, 715-728 to "Cardiac Conduction".
41 Nov 11 W Anatomy of Blood Vessels — Chp 20, 753-762 to "Bld Pressure, Resistance -".
*- Nov 12 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
42 Nov 12 R Actions of Heart, Cycle, Sounds, — Chp 19, 728-741 to Cardiac Output. (Scan 777-800 for lab)

- - Week 12 -

43 Nov 16 M **(12LO)** Cardiac Output, Body Fluids — Chp 19, 741-751
Blood Flow; Blood Pressure — Chp 20, 762-777; 801-806
44 Nov 17 T Lymphatic System; Immunity — Chp 21, 807-852, read for general thought.
45 Nov 18 W **(13LO)** Digestive System, Anatomy — Chp 25, 953-971 to Digestion and Absorption".

46 Nov 19 R **EXAM 4** 11:30-12:50. Bring two # 2 Pencils, eraser, and blue or black Ballpoint. Wait outside door. Pick up Scantron on back table as you enter. I will hand exam to you as I assign you a seat. (Prior to the exam, get drink, go to rest room, bring tissues and anything else you need.)

-- **Week 13** --

47 Nov 23 M Physiology of Digestion — Chp 25, 971-1000
48 Nov 24 T Nutrition and Metabolism — Chp 26, 1001-1034

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- Nov 25 W **NO CLASS TODAY -- THANKSGIVING BREAK begins at noon today.**
Take your books with you; study; relax. Hug family and friends! Enjoy the long weekend. Smile, be congenial, say "Please", "Thank you" and "I love you" often.

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-- **Week 14** --

49 Nov 30 M (14LO) Anatomy Respiratory System — Chp 22, 853-865 to Pulmonary Ventilation".
50 Dec 1 T Ventilation & Mechanics of Breathing — Chp 22, 865-876 to "Gas Exchange".
51 Dec 2 T Transport of O2 & CO2 — Chp 22, 876-886
52 Dec 3 W Control of Respiratory — Chp 22, 886-892.
*- Dec 4 R Optional Review at 11:30-11:50 in Sci-126. Bring your questions.
53 Dec 4 R **(15LO)** Urinary System Anatomy — Chp 23, 895-904 to "Urine Formation".

-- **Week 15** --

54 Dec 7 M Physiology of the Nephron — Chp 23, 904-930
55 Dec 8 T Counter current Mechanism; Acid/Base. — Chp 24, 931-952
56 Dec 9 W **(16LO)** Male Reproductive System — Chp 27, 1035-1064
*- Dec 10 R Review for Final Exam: 11:00-11:50 a.m. in Sci-126. Bring your questions.
57 Dec 10 R Female Anatomy and Physiology — Chp 28, 1065-1088 to "Adjustments to Preg".
Pregnancy and Parturition — Chp 28, scan 1087-1102
Summary & Conclusions — Optional: Chp 29, 1105-1140.
- Dec 14 M Optional Review for Final Exam 12:00-12:50 in Sci-126. Bring your questions.

--------- **FINAL EXAM WEEK** --

Dec 15 T **FINAL EXAM: Tuesday, 12:00 - 1:40 pm:** in Sci-126
Final Exam will be comprehensive and have 200 questions:
100 pts from weeks 13-15; *plus* 100 pts from weeks 1-12.
Bring two # 2 Pencils, eraser, and blue or black Ballpoint. Wait outside door.
(Prior to the exam, get drink, go to rest room, bring tissues and anything else you need.)

BIOL-205 LABORATORY SCHEDULE FALL 2009

Be sure to study lab assignments before coming to lab. Labs will begin with a pre-lab quiz over that day's lab and a post-lab quiz over the material from the previous week's lab.

ANATOMY LABS: Label and study all anatomy diagrams before coming to lab.

PHYSIOLOGY LABS: Read entire lab and ponder the Review Questions (on yellow pages) before coming to lab.

Week/Date	Lab #	LECTURE TOPIC	INSTRUCTIONS and READING ASSIGNMENT (Review pages below in 4th Ed A & P by Saladin.)
1 8-31	Lab 3	Skeletal System Anatomy (Monday labs sign for next week's lab time.)	See *Text*: pages 243, 258-280. (Label diagrams in Lab 3.)
2 9-07	Lab 4	Cell Physiology	Read lab 4; Review *Text*: pages 54-66, 101-112 (Diffusion).
		(No class Monday, Sept 7. Make up Monday labs on: M 6-9p, T 6-9p; T 8-11a; W 8-11a; F 9-12n.	
3 9-14	Lab 1	Microscopy -	Read pages 1-3 of Lab 1
	Lab 2	Histology - Epithelium	Read pages 1-5 of Lab 2; Review *Text*: pages 155-162;189.
4 9-21	Lab 2	Histology - Connective, Muscle, Nerve tissue:	Read p. 6-9 of Lab 2; Review *Text*: 162-173.
5c 9-28	Lab 5	Neural Anatomy	Review *Text*: 482-484; 493-495; 514-516; 519-526; 532; 542-545; 614-615.
		Bones of Skull	Review *Text*: 245-255 (Label diagrams in Lab 5.)
6o 10-05	Lab 7	Membrane Action Potential	Review *Text* pages 453-461; Read Lab # 7.
7 10-12	Lab 6	Nervous System Function	Review *Text* pages 586-588; 591; 594-598; 600-604; 618-620;
8p 10-19	Lab 8	Contraction of Skel. Muscles	Review *Text* pages 415-426; Read Lab # 8.
9c 10-26	Lab 9	Muscle Anatomy	*Text*: 326-381; 392-404; (Label diagrams in Lab 9)
	Lab 10	CVS Anatomy: Blood Cells	*Text*: (Review WBC on pages 698 and 699 before coming to lab.)
10c 11-02	Lab 10	CVS Anatomy	*Text*: 720, 722, 725; 778, 791; (Label diagrams in Lab 10)
	Lab 11	Respiration Anatomy	*Text*: 855; 857; 858; 860-864; (Label Lab 11)
	Lab 11	Digestion Anatomy	*Text*: 955-961; 967-968; 975-977; 980-982; 991; (Label Lab 11)
11p 11-09	Lab 14	Cardiac Muscle Physiology: Turtle Heart:	Review *Text* 731-736; (Read Lab # 14.)
12p 11-16	Lab 12	Circulatory System: Human ECG, Bld Pressure:	Review *Text* 731-745; (Read Lab # 12.)
13c 11-23	Lab 13	Urinary Anatomy	*Text*: 897-903; (Label diagrams in Lab 13)
	Lab 13	Reproductive Anatomy	*Text*: 1042-1047; 1066-1068; 1072; 1079-1084; (Label Lab 13)
14 11-30	Take Quiz over Lab 13; REVIEW for Lab Practical; Sign for 1.4-hour time-slot to take Lab Exam next week.		
15 12-07	**LAB PRACTICAL EXAM OVER ALL LABS** Come on the day and at the time for which you sign.		

FOR YOUR SAFETY, PLEASE DO NOT BRING FOOD or BEVERAGES into LAB.

FOR THE SAFETY OF SMALL CHILDREN, THEY ARE NOT PERMITTED IN LAB.

Biology 321/322 Word and Prefix list

Sooner or later (probably sooner) you will come across the following words and prefixes listed below in the course of anatomy and physiology. They signify location or direction.

Superior (Cranial, rostral)	= toward the head or on top
Inferior (Caudal)	= toward the tail or at the bottom
Anterior	= toward the front
Posterior	= toward the back
Medial	= toward the midline
Lateral	= away from midline of the body
Intermediate	= between a medial and a lateral structure
Proximal	= closer to the origin of the body
Distal	= farther from the origin of the body
Superficial	= toward or at the body surface
Deep	= more internal, away from the body surface
Apical	= at the top (apex)
Basal	= at the bottom (base)
Afferent	= leading toward
Efferent	= leading away
Supra-	= on top
Infra-	= under
Extra-	= outside
Intra-	= inside, within
Inter-	= between
Para-	= to the side of
Exo-	= to the outside
Endo-	= to the inside
Epi-	= on top of
Peri-	= around
Ento-	= inner
Ecto-	= outer
Meso-	= middle
Centro-	= center
Ad-	= to or toward
Ab-	= away from

BIOLOGY 321 Human Anatomy and Physiology
Lecture Schedule
Fall Semester 2008

(Subject to change)

Week	Day		Lecture	Chapter
1	M	Aug 31	Introduction to Anatomy and Physiology	Chap 1-3
	W	Sep 2	Cell structure and function	Chap 1-3
	F	Sep 4	Histology – The study of tissues	Chap 4
2	M	Sep 7	**Labor Day – No classes**	
	W	Sep 9	Histology – The study of tissues	Chap 4
	F	Sep 11	Integumentary System	Chap 5
3	M	Sep 14	Integumentary System	Chap 5
	W	Sep 16	Nervous System	Chap 11
	F	Sep 18	Nervous contd. – Resting membrane potential	Chap 11
4	M	Sep 21	Nervous contd. – Action Potential	Chap 11
	W	Sep 23	Synaptic Transmission	Chap 11
	F	Sep 25	**Exam 1**	
5	M	Sep 28	Post-synaptic potentials	Chap 11
	W	Sep 30	Neurotransmitters and Receptors	Chap 11
	F	Oct 2	Neuronal pathways and circuits	Chap 11
6	M	Oct 5	Central Nervous system	Chap 13
	W	Oct 7	Peripheral Nervous System	Chap 12
	F	Oct 9	Autonomic Nervous System	Chap 16
7	M	Oct 12	Autonomic Nervous System	Chap 16
	W	Oct 14	Neural Integration	Chap 14
	F	Oct 16	Special senses – Sensory receptors	Chap 15
8	M	Oct 19	Special senses – Olfaction, taste	Chap 15
	W	Oct 21	Special senses – Vision	Chap 15
	F	Oct 23	**Exam 2**	Chap 15
9	M	Oct 26	Special senses – Vision	Chap 15

	W	Oct 28	Special senses – Hearing	
	F	Oct 30	Skeletal System – structure/histology	Chap 6
10	M	Nov 2	Skeletal System – bone growth and formation	Chap 6
	W	Nov 4	Skeletal System -	Chap 6
	F	Nov 6	Muscle – histology/anatomy	Chap 9
11	M	Nov 9	Skeletal Muscle – contraction/relaxation	Chap 9
	W	Nov 11	Skeletal Muscle – contraction/relation	Chap 9
	F	Nov 13	Skeletal Muscle – motor units/action potential	Chap 9
12	M	Nov 16	Skeletal Muscle – mechanical properties	Chap 9
	W	Nov 18	Skeletal Muscle – neural control of movement	Chap 9
	F	Nov 20	**Exam 3**	
13	M	Nov 23	The Endocrine System – receptors and function	Chap 17-18
	W	Nov 25	**Thanksgiving – No class**	
	F	Nov 27	**Thanksgiving – No class**	
14	M	Nov 30	Hypothalamus and Pituitary	Chap 18
	W	Dec 2	Hypothalamus and Pituitary	Chap 18
	F	Dec 4	Thyroid and parathyroid glands	Chap 18
15	M	Dec 7	Pancreas	Chap 18
	W	Dec 9	Adrenal Gland	Chap 18
	F	Dec 11	Other hormone glands	Chap 18

Final Exam - Wednesday, December 16, 2008 12:00pm-1:40pm

BIOLOGY 321 Human Anatomy and Physiology
LAB Schedule
Fall Semester 2009

Week	Dates	Subject	Reading
1	Aug 31- Sep 4	Microscopy Tissues – Epithelial	Lab 2 Lab 4
2	Sep 7-11	**No Labs**	
3	Sep 14-18	Tissues – Connective, Muscle, Nerve Integumentary System	Lab 4 Lab 5
4 **Exam 1**	Sep 21-25	**Cell membrane permeability	Handout Lab 3
5 **Quiz**	Sep 28-Oct 2	Peripheral nervous system Central nervous system – spinal cord	Handout Lab 16, 18
6	Oct 5-9	Central nervous system – Brain and cranial nerves	Lab 17
7 **Quiz**	Oct 12-16	**Compound action potential	Handout
8 **Exam 2**	Oct 19-23	**Special senses – reflexes Sensory Taste Vision Hearing	Lab 19 Lab 20 Lab 21 Lab 22 Lab 23
9	Oct 26-30	Skeletal system	Lab 6 – 9
10 **Quiz**	Nov 2-6	Skeletal muscle anatomy	Lab 12-15 List provided
11 **Quiz**	Nov 9-13	**Skeletal muscle physiology	Handout (Lab 11)
12 **Exam 3**	Nov 16-20	**Neural – Smooth muscle physiology	Handout
13	Nov 23-27	**Thanksgiving – No labs**	
14	Nov 30 - Dec 4	Open Lab for Review	
15	Dec 7-11	**Comprehensive lab final**	

** - Physiology labs

Biology 322 - Human Anatomy and Physiology

Course Syllabus

Spring Semester 2010

Course Description: Second of two semesters of a comprehensive, integrated course in anatomy-physiology developing logical correlations between structures and their function. Topics: respiratory, digestive, metabolic, cardiovascular, excretory and reproductive systems. Designed for students in science baccalaureate degree programs.

Instructor:		Dr. M. Beth Zimmer, PhD	
Office:		2120 Arts and Science Commons	
Phone:		(231) 591-5022	
Email:		MaryZimmer@ferris.edu	
Office hours:		M: 9:00 – 10:30am	
		W: 12:00- 2:30pm	
		By appointment	
Lectures:		M, W, F 11:00-11:50pm	126 SCI
Labs:	211	Monday 3:00-6:00pm	SCI 228
	212	Tuesday 8:00-10:50am	SCI 228
	213	Tuesday 12:00-2:50pm	SCI 228
	214	Tuesday 3:00-5:50pm	SCI 228

Course Prerequisites: BIOL 122, 321 and CHEM 122

Required Texts:

1. ***Lecture Material:*** Seely R, Stephens T, and Tate D. 2006, Anatomy and Physiology, 8th Ed, WCB/McGraw-Hill, Boston, MA
2. ***Lab Material:*** Wise, E. 2006, Anatomy and Physiology Laboratory Manual, 8th Ed, WCB/McGraw-Hill, Boston, MA

Note: Older editions (6 or 7) of the textbook will be sufficient; however, chapter and page numbers will not match those listed in class or on the syllabus.

Course Outcomes:

1. Students will be able to identify and name designated anatomical structures (both histological and gross) within the following organ systems: the digestive system, the respiratory system, the cardiovascular system, the male and female reproductive system, and the renal system.
2. Students will be able to explain physiological functions and mechanisms within the following organ systems: the digestive system, the respiratory system, the cardiovascular system, the male and female reproductive system, and the renal system.
3. Students will be able to apply their knowledge of anatomy and physiology to think critically about the application of anatomical and physiologic concepts to case studies: analyze the specific situation and predict the outcome and the possible consequences of additional changes.
4. Students will be able to carry out experimental procedures, evaluate experimental data and form an understanding of the process that comes from the results of the experiment. Students will also be able to write reports based on their results using the scientific method.

Lecture and Lab NOTES - FerrisConnect and the Internet:

All lecture and lab notes will be made available via FerrisConnect.

Although the internet has become a major source of scientific information, one should remember that, unlike scientific papers or textbooks, web sites do not undergo the process of peer review. Consequently, never assume that absolutely everything posted on the web is correct, actually assume the opposite. When surfing the net, choose web sites that belong to well-established institutions such as colleges and universities. I will attach some sites that may become useful for study. If you find any sites that you'd like to share, please let me know and we can attach the links to the course site.

Evaluation:

The lecture mark is based on: (500pts total)

- Three lecture exams – 100pts each
- Final exam – 200pts total (100pts cumulative/100pts ~4 weeks of material)

The lab mark is based on: (300pts total)

- Quizzes – 5 at 40pts each (200pts total)
- Comprehensive exam – 100 pts

Lecture exams: will be given approximately every 4 weeks. They will consist of questions that pertain to the previous ~4 week's information (you will be told which subject areas are on a particular exam). More specific details will be given out prior to each exam.

Final Lecture Exam: A Comprehensive exam covering all of the material taught throughout the semester will be given. Along with this will be a section of the exam that will cover the material from the previous ~4 week's information.

Lab Quizzes: will be given at the start of lab sections and consist primarily of anatomical identification, short answer, fill-in-the-blank, multiple choice and/or true/false questions designed to test students' comprehension of lab material.

Comprehensive Lab Exam: A comprehensive lab exam will be given on the last day of scheduled lab. This will include both anatomy and physiology labs covered in the lab section only. More details will be provided later in the course.

Course Policies

Grading:

93 – 100 = A	73 – 76.9 = C
90 – 92.9 = A-	70 – 72.9 = C-
87 - 89.9 = B+	67 – 69.9 = D+
83 – 86.9 = B	63 – 66.9 = D
80 – 82.9 = B-	60 – 62.9 = D-
77 – 79.9 = C+	Below 60 = F

Attendance: Attendance at lectures is expected. There is a positive correlation between students who attend lecture regularly and good grades. I will not take attendance, but it is in your best interest to attend lecture. I will on occasion assign some extra credit points to those people that attend lecture. If you need to miss lecture and it is a valid excuse, please email me a quick note to be excused and not lose any extra credit points.

Lab attendance is MANDATORY. There will be no make-up labs. If you have a valid excuse for missing lab, please ***see me or contact me immediately (phone, email)***. Otherwise, any missed lab will be recorded as a "0" (no make-up tests or quizzes without valid excuse). Any 2 missed labs for ANY reason will result in a failing grade.

Academic Integrity: Cheating of any kind will NOT be tolerated. Any reports of cheating or plagiarism will be forwarded to the Office of Student Conduct and be treated accordingly.

It is easy to succeed in Biology 321/322 as long as you approach this course with a certain degree of maturity and proper attitude. The few points suggest some strategies that you may find helpful in your study of the lecture material.

1. Always read chapter material before coming to lecture. You are responsible for the entire content of lecture material. Because there is not enough time to discuss everything in detail, we will concentrate on those concepts that are either more difficult or critically important for the comprehension of the entire topic. Therefore, you must read the material ahead of time in order to place each lecture in proper context.

2. Study consistently. DO NOT wait with studying until the last 48 hours before the exam! The amount of information will overwhelm you! It is much more effective to spend a short amount of time (even 15-20 minutes) in the evening following each lecture trying to *understand* the material. This way you should establish good comprehension of each individual concept and can concentrate on "putting the pieces together" during week before the exam.

3. Ask questions. Many aspects of physiology are complex - DO NOT HESITATE TO ASK QUESTIONS each time you run into a problem. You can see me in my office hours or make an appointment to see me. Or simply ask other student in the class or your study group. This can be done in small study groups (see #4) or over the Internet.

4. Study in small groups. I strongly encourage students to study in small groups. It won't be long before you will get to know other students in the class, you may know some already. Try to establish a small study group and try to get together once a week to reinforce each other's comprehension of the material. Ask and answer questions aloud. If you can explain a concept aloud then you will have mastered the concept, try it! Such interactions will help you to assess your knowledge and point the areas that you overlooked in studying on your own.

BIOLOGY 322 Human Physiology and Anatomy-2
Lecture Schedule
Spring Semester 2010

(Subject to change)

Week	Day		Lecture	Chapter
1	M	Jan 11	Introduction – Digestive system	Chap 24
	W	Jan 13	Digestive system anatomy/physiology	Chap 24
	F	Jan 15	Digestive system anatomy/physiology	Chap 24
2	M	Jan 18	**Martin Luther King Day – No class**	
	W	Jan 20	Digestive system physiology	Chap 24
	F	Jan 22	Digestive system physiology	Chap 24
3	M	Jan 25	Digestive system physiology	Chap 24
	W	Jan 27	Digestive system physiology	Chap 24
	F	Jan 29	Digestive system physiology	Chap 24
4	M	Feb 1	Respiratory system anatomy	Chap 23
	W	Feb 3	Ventilation	Chap 23
	F	Feb 5	**EXAM 1**	
5	M	Feb 8	Lung function – lung volumes	Chap 23
	W	Feb 10	Principles of gas exchange	Chap 23
	F	Feb 12	Oxygen and CO2 transport	Chap 23
6	M	Feb 15	Control of ventilation	Chap 23
	W	Feb 17	Introduction to cardiovascular system	Chap 20
	F	Feb 19	Cardiac anatomy	Chap 20
7	M	Feb 22	Cardiac physiology	Chap 20
	W	Feb 24	Cardiac physiology	Chap 20
	F	Feb 26	Cardiac physiology	Chap 20
8	M	Mar 1	Regulation of the heart- Cardiac physiology	Chap 20
	W	Mar 3	Heart and homeostasis	Chap 20
	F	Mar 5	**EXAM 2**	

9	M	Mar 8	**SPRING RECESS – NO CLASS**	
	W	Mar 10	**NO CLASS**	
	F	Mar 12	**NO CLASS**	
10	M	Mar 15	Blood vessel anatomy	Chap 21
	W	Mar 17	Pulmonary – systemic circulation	Chap 21
	F	Mar 19	Dynamics of blood circulation	Chap 21
11	M	Mar 22	Control of blood flow and pressure	Chap 21
	W	Mar 24	Blood	Chap 19
	F	Mar 26	Blood continued	Chap 19
12	M	Mar 29	Lymphatic system	Chap 22
	W	Mar 31	Lymphatic system	Chap 22
	F	Apr 2	**Mid Semester break – NO CLASS**	Chap 26
13	M	Apr 5	Renal anatomy	Chap 26
	W	Apr 7	Renal physiology	
	F	Apr 9	**EXAM 3**	
14	M	Apr 12	Renal physiology	Chap 26
	W	Apr 14	Renal physiology	Chap 26
	F	Apr 16	Water, electrolytes, acid-base	Chap 27
15	M	Apr 19	Water, electrolytes, acid-base	Chap 27
	W	Apr 21	Male Reproductive Anatomy	Chap 28
	F	Apr 23	Male Reproductive Physiology	Chap 28
16	M	Apr 26	Female Reproductive Anatomy	Chap 28
	W	Apr 28	Female Reproductive Physiology	Chap 28
	F	Apr 30	Female Reproductive Physiology	Chap 28

Final Exam - Thursday, May 6 - 10:00am 11:40am

BIOLOGY 322 Human Anatomy and Physiology
LAB Schedule
Spring Semester 2010

Week	Dates		Subject	Reading
1	Jan 11-15		Digestive Anatomy	Lab 38
2	Jan 18-22		**NO LABS**	
3	Jan 25-29	Quiz	** Digestive Physiology **	Handout Lab 39
4	Feb 1-5		Structures of the Respiratory System	Lab 35
5	Feb 8-12	Quiz	Respiratory Function Breathing and respiration	Lab 36
6	Feb 15-19		Structure of the heart	Lab 27
7	Feb 22-26	Quiz	** Cardiac Physiology **	Lab 29 Handout
8	Mar 1-5		** Functions of the heart ** ** ECG and Blood pressure **	Lab 28 Handout
9	Mar 8-12		**Spring Break - NO CLASS**	
10	Mar 15-19		Blood vessels of the upper and lower body	Labs 30-32
11	Mar 22-26	Quiz	Renal Anatomy	Lab 40
12	Mar 29-Apr 2		Renal Physiology	
13	Apr 5-9		**Mid semester break - NO Labs**	
14	Apr 12-16	Quiz	Reproductive Anatomy	Labs 42-43
15	Apr 19-23		Open Lab for Review	
16	Apr 26-30		**Comprehensive lab final**	

Biology 375 - 001

Principles of Genetics
Spring 2010
3 Credits

Instructor Office
Dr. Brad Isler
ASC 2118
Phone: 591-2641
E-mail: islerb@ferris.edu

Class Hours
MWF 11:00-11:50 AM
Science 137

Office Hours
MWF 10 AM-11 AM
W 12-1 PM

Course Description

A comprehensive course in genetics including molecular aspects of gene structure, function, and control in prokaryotes and eukaryotes, transmission genetics and genes in populations. Designed for students in science baccalaureate programs. Prerequisite: BIOL 122.

Course Outcomes and Assessment

Upon completion of the course, a student will be able to:

- **Demonstrate** understanding of factual knowledge about genetics and, using critical thinking skills, be able to apply this knowledge to the study of inheritance patterns, the molecular mechanisms by which genes control cell metabolism, growth, and differentiation, and the evolutionary implications of genes in populations.
- **Analyze** inheritance patterns, probability, linkage relationships, genetic control mechanisms, quantitative genetics, molecular genetics, and gene frequencies and the impacts of population size, random mating, mutation, migration, and selection on gene frequencies.

These outcomes will be assessed using the following measures:

- Comparison of class performance on specific examinations questions.
- Student performance on quizzes and assignments provides timely assessment of mastery of specific concepts.
- Student responses to regular questioning in class indicates student understanding of current concepts and provides the opportunity to immediately revisit concepts, if necessary.

Required Materials

- Genetics: A Conceptual Approach, Third Edition, B. A. Pierce, W.H. Freeman and Company, 2008.

Grading

Your final grade will be determined from the total of all points earned on exams, class participation, pop quizzes, and homework assignments.

	Maximum possible points
Exams	450
Pop quizzes	?
Homework	?

There will be three **exams** during the semester worth 100 points each and a final exam worth 150 points that will contain a mix of "new" and "old" material. Only standard, non-graphing calculators can be used on exams.

Pop quizzes will be administered during selected lecture sessions and will cover information discussed in the previous lecture session.

Homework assignments will be assigned after many of the lecture sections and will serve to reinforce topics covered during lecture.

Exams
During the semester, exams will be held outside of the normal lecture times on the following days at 6 PM:

Exam 1	February 9
Exam 2	March 4
Exam 3	April 8

If you have a legitimate conflict with these exam times, please contact Dr. Isler as early in the semester as possible so alternative arrangements can be made.

Cheating
Cheating on exams, pop quizzes, or homework assignments will result in a zero on affected assignments and failure of the course. Additional action may be taken by the University.

Attendance Policy
Attendance will not be taken in lectures. However, since BIOL 375 is an upper level course, attendance is expected. Besides covering relevant material, lecture sessions will explore how to analyze and solve genetic problems. It will be very difficult to correctly solve genetic problems on exams, quizzes, and assignments if you are absent from lecture.

If you are absent from class, it is your responsibility to obtain information that was presented. It is also your responsibility to contact Dr. Isler to obtain any homework assignments you may have missed.

Homework assignments that are submitted late will automatically receive a 33% penalty.

Students arriving late for class on the days on which pop quizzes are administered will receive a zero for that quiz. No make-up pop quizzes will be given.

Students who have a legitimate reason for missing an exam may use their final exam score to replace the missed exam. Legitimate excuses include a suitable statement from a physician, a bail bond ticket, evidence of a funeral, etc. Students who are absent on an exam day and do not have a legitimate excuse will receive a zero for that exam. No exceptions are allowed.

Class Participation
Class participation is not mandatory but will be considered when your final grade is determined. A student that is actively involved in a course will always perform at a higher level than a student that spends lecture periods sleeping, chatting with their friends, playing with their cell phone, or not paying attention.

Reading the Text
You should review the assigned sections of the text following lecture for increased understanding of the lecture material. Your text is an important part of this course and was chosen because it is the best available for explanations, reasoning, illustrations, problem solving, and connecting important topics.

FerrisConnect
FerrisConnect will be used throughout the course to post lecture notes, grades, articles, and animations. Lecture notes will posted by chapter following the completion of an entire chapter.

Class Decorum

The College of Arts and Sciences strives to maintain a positive learning environment and educational opportunity for all students. Patterns of behavior which obstruct or disrupt the learning environment in the classroom will be dealt with under the College *Disruptive Behavior Policy*. ***Cell phones, iPods, and laptop computers must be turned off, and interpersonal conversations cease during the class period.***

Help!

Dr. Isler will be happy to help you during office hours or during any other available time. Please contact Dr. Isler for help or to arrange an appointment.

Biology 375 tutoring sessions will be held every Monday at 6 PM in Science 117 and every Thursday at 6 PM in Science 136. Your tutor is Rachel Scheib.

Tutoring is also available at the tutoring center in ASC 1017. Call 591-3543 or stop by the tutoring center to arrange a tutoring session.

Grading Scale

93 – 100%	A
90 – 92.9%	A-
87 – 89.9%	B+
83 – 86.9%	B
80 – 82.9%	B-
77 – 79.9%	C+
73 – 76.9%	C
70 – 72.9%	C-
67 – 69.9%	D+
63 – 66.9%	D
60 – 62.9%	D-
< 60%	F

The grading scale may be adjusted depending upon class performance

Tentative Lecture Schedule

	Topic	Reading
Jan 11	Introduction to genetics Chromosomes	*Chapter 1* *Chapter 2*
Jan 13	Mitosis and meiosis	*Chapter 2*
Jan 15	Mitosis and meiosis	*Chapter 2*
Jan 18	**NO CLASS**	-
Jan 20	Principles of segregation and independent assortment	*Chapter 3*
Jan 22	Probability and chi-squared test	*Chapter 3*
Jan 25	Sex linked traits	*Chapter 4*
Jan 27	Variations in Mendelian principles	*Chapter 5*
Jan 29	Variations in Mendelian principles	*Chapter 5*
Feb 1	Modes of inheritance	*Chapter 6*
Feb 3	Pedigree analysis	*Chapter 6*
Feb 5	Pedigree analysis	*Chapter 6*
Feb 8	Linkage and recombination	*Chapter 7*
Feb 10	Linkage and recombination	*Chapter 7*
Feb 12	Eukaryotic gene mapping	*Chapter 7*
Feb 15	Eukaryotic gene mapping	*Chapter 7*
Feb 17	Chromosome variation	*Chapter 9*
Feb 19	DNA	*Chapter 10*
Feb 22	DNA	*Chapter 10*
Feb 24	Chromosome structure	*Chapter 11*
Feb 26	Chromosome structure	*Chapter 11*
Mar 1	DNA replication	*Chapter 12*
Mar 3	DNA replication	*Chapter 12*
Mar 5	DNA replication	*Chapter 12*
Mar 8 -12	**NO CLASS**	-
Mar 15	Transcription	*Chapter 13*
Mar 17	Transcription	*Chapter 13*
Mar 19	Transcription	*Chapter 13*
Mar 22	Transcription	*Chapter 13*
Mar 24	RNA Processing	*Chapter 14*
Mar 26	RNA Processing	*Chapter 14*
Mar 29	Translation	*Chapter 15*
Mar 31	Translation	*Chapter 15*
Apr 2	**NO CLASS**	-
Apr 5	Translation	*Chapter 15*
Apr 7	Control of gene expression in prokaryotes	*Chapter 16*
Apr 9	Control of gene expression in prokaryotes	*Chapter 16*
Apr 12	Control of gene expression in prokaryotes	*Chapter 16*
Apr 14	Control of gene expression in eukaryotes	*Chapter 17*
Apr 16	Population genetics	*Chapter 25*
Apr 19	Population genetics	*Chapter 25*
Apr 21	Population genetics	*Chapter 25*
Apr 23	Population genetics	*Chapter 25*
Apr 26	Quantitative genetics	*Chapter 24*
Apr 28	Quantitative genetics	*Chapter 24*
Apr 30	Quantitative genetics	*Chapter 24*
Monday May 3	**Final Exam 8:00-9:40 PM** **Science 120?**	-

GENERAL MICROBIOLOGY AND IMMUNOLOGY

BIOL 386 (5 CR: 4+1) SPRING 2010

PREREQUISITES: BIOL 232 AND BIOCHEMISTRY/
CONCURRENT BIOCHEMISTRY
OR INSTRUCTOR PERMISSION

COURSE SYLLABUS

	DATE:	TOPIC:	REFERENCE:
1.	MON 1/11	Introduction and History	**Brock** ch.: 1
2.	WED 1/13	Prokaryotic & Eukaryotic Cells	B.pp: 57-60,99-100
	MON 1/18	**MLK DAY NO CLASS**	
3.	WED 1/20	Bacterial Structure & Function	B. ch: 3, ,5, pp:91-95,743
4.	MON 1/25	Bacterial Growth/ Sporulation/ Taxonomy	B. ch:12,13,14
5.	WED 1/27	Viral Structure & Replication	B. ch.: 8
6.	MON 2/1	Viral Structure & Replication	B. ch.: 8
7.	WED 2/3	Fungal Structure & Taxonomy	B. ch.:17
8.	**MON 2/8**	**EXAM I**	
9.	WED 2/10	Microbial Metabolism	B. ch. 4,11,15
10.	MON 2/15	Microbial Metabolism	B. ch. 4,11,15
11.	WED 2/17	Microbial Genetics	B. ch.: 6, 7,9,10
12.	MON 2/22	Microbial Genetics	B. ch.: 6, 7,9,10
13.	WED 2/24	Micro Control: Antimicrobial/Disinfectants	B. ch.: 18
14.	**MON 3/1**	**EXAM II**	
15.	WED 3/4	Mech. of Microbial Pathogenesis	S. ch. 8.9.10,31
	MON 3/8	**SPRING BREAK**	
	WED 3/10	**SPRING BREAK**	
16.	MON 3/15	Respiratory Tract/ Oral cavity	S. ch. 13,19,21,23,57,58,59
17	WED 3/17	CNS/ Skin and Mucosal Membrane Infect.	S..ch.: 36,39,58,48, 61
18.	MON 3/22	GI Tract Infections/ Intoxications	S. ch. 16,17,22,32,37,42,73
19.	WED 3/24	Wound Infections	S. ch.: 11,15,20,35
20.	MON 3/29	STD	S. ch.:14,24,27,66
21.	**WED 3/31**	**EXAM III**	

22.	MON 4/5	Immune System Innate Immunity, Phagocytosis	**Kuby** ch,.: 1,2, 3,4,5,6,18,19
23.	WED 4/7	Humoral Immunity	K. ch.:4-6, 11
24.	MON 4/12	Complement/ Acute Inflammation	K. ch.: 7,13
25.	WED 4/14	Cellular Immunity	K. ch.: 8,.9,10,12,13,14,20,21
26.	MON 4/19	Chronic Inflammation	K Appendix: A1,A27
27.	**WED 4/21**	**EXAM IV**	
28.	MON 4/26	Hypersensitivity / Autoimmunity	K. ch. :15
29.	WED 4/28	Hypersensitivity / Immune Based Disease	K. ch.: 16,17
30.	**MON 5/3**	**FINAL EXAM (4 - 5:40 PM)**	

TEXTS: 1) **Brock: Biology of Microorganisms**, 11TH Edition, 2006 by Madigan and Martinko.
(N.B.: Working glossary at the beginning of each chapter and G1-G14 at the back of the text.)
2) **Mechanisms of Microbial Disease**, 3rd Edition, 1998, by Schaechter, et.al.
2) **Kuby Immunology**, 6th EDITION, 2007, by Kundt, Goldsby, Osborne (Glossary /Chapter Q&A)

EXAMS: There will be 4 scheduled exams plus a comprehensive final. Each of these exams are worth 100 points and **will be individually curved**, if necessary, to 75%. **In addition laboratory will be worth 100 points for a total of 600 points** for the course. Exam format may include multiple choice, matching, essay, and problem solving case studies. **Make up exams**, for valid and documented absences, are essay in format and are graded without a curve.

SCALE: 100-93 = A, 92-90 = A-, 89-87 = B+, 86-83 = B, 82-80 = B-, 79-77= C+, 76-73 = C, 72-70 = C-, 69-67 = D+, 66-63 = D, 62-60 = D, 59- = F

ATTENDANCE: You are **EXPECTED** to attend every lecture and to explain any absence.

INSTRUCTOR: M. Ryan, Ph.D., ASC2115, Voice mail: 231-591-5892. FAX: 231-591-2540, Email: ryanm@ferris.edu
Office hours: M 2-250 PM, T/R Noon-1:50 PM, 2-2:50 PM and by appointment.
If I am not available, please leave a message via voice mail or e-mail.

LEARNING OBJECTIVES:
1) To learn how professionals in microbiology use the scientific method to gain new knowledge and to modify/eliminate existing paradigms.
2) To learn collaborative skills by working in groups for some assignments.
3) To learn how to apply certain course material to develop problem solving and critical thinking skills in microbiology.
4) To learn the language/terminology of microbiology.
5) To learn the fundamental principles of microbial structure and function, microbial metabolism, microbial growth and reproduction, microbial genetics, and the use of antimicrobial drugs.
6) To learn the principles, mechanisms, and theories of microbial pathogenicity in humans.
7) To learn the structure, function, and control of the immune system and the mechanisms of hypersensitivity.

LECTURE LEARNING OUTCOMES :

GOAL	CLASSROOM ACTIVITY	MEASUREABLE OUTCOME/ASSESSMENT
1. The student will learn the scientific method as it applies to medical microbiology – BIOL 386	Instruction in the Koch's Postulates which have been used historically and contemporarily to establish the microbial etiology of diseases	Student will demonstrate knowledge of the Koch's Postulates. Assessed by examination questions.
2. The student will learn problem solving/critical thinking skills as they apply to medical microbiology – BIOL 386	Instruction in both lecture and laboratory in the analysis of clinical case studies, bacterial generation time problems, and dilution problems	Student will demonstrate knowledge solving case studies, generation time and dilution problems. Assessed by lecture and laboratory examination questions.
3. The student will learn the structures and functions of bacteria, viruses and fungi studied in BIOL 386	Instruction from lectures, study guide and textbook assignments on microbial structure and function	Student will demonstrate knowledge of microbial structure and function. Assessed by lecture and laboratory examination questions.
4. The student will learn how to analyze scientific data generated during BIOL 386 laboratories	Instruction in the graphing and charting of scientific data generated in laboratory sessions	Student will demonstrate knowledge constructing graphs and/or charts. Assessed by completion of lab assignments requiring graphs/charts and examination questions.
5. The student will learn how to use scientific instruments such as the compound light microscope	Instruction in the preparing and visualization of stained microorganisms using all levels of magnification of the compound light microscope, including oil immersion,	.Student will demonstrate knowledge of microscopy. Assessed by laboratory examinations.

GENERAL EDUCATION OUTCOMES: This course may be used to help fulfill the general education requirement for Scientific Understanding. A student succeeding in this course should:

1) have a working knowledge of the fundamental principles of a natural science discipline;
2) be able to use appropriate scientific reasoning skills to interpret and analyze content in the natural sciences;
3) have a basic understanding of the scientific method, scientific concepts, and the evolution of scientific ideas;
4) have a more positive attitude toward science and an increased confidence in their ability to understand science .

Spring 2010

BIOL 470: MOLECULAR GENETICS

COURSE INFORMATION: BIOL 470, Molecular Genetics, is a 4-credit course. This class meets Tuesdays and Thursdays from 9 am to 10:50. There may also be out-of-class time activities such as seminars, which students may be required to attend.

INSTRUCTOR: Dr. C. Boogaard

OFFICE: ASC 2015; x2544; office hours: M, W, & F, 10-10:50 am, and T, 2-2:50 pm; **or by appointment**. Call to make an appointment.

COURSE DESCRIPTION: An analysis of genetic phenomena at the molecular level. Topics include: structures of DNA, replication, recombination, mutation, repair, genomic sequences, chromatin structure, transcription, processing, translation, and the theory of selected techniques. Emphasis is on regulatory mechanisms.

Pre-requisites: BIOL 375, & either PHCH 320 or CHM 364

REQUIRED MATERIALS:
Text: Watson et al, Molecular Biology of the Gene, 6th edition, Pearson/Benjamin Cummings, 2007.
Lecture Notes will be available on the Ferris Connect site for this course.

COURSE OUTCOMES:

1. Students will be able to demonstrate by examination, a senior-level understanding of genetic phenomena at the molecular level, including replication, recombination, mutation, and repair, the structures of the DNA, the genome and the chromatin; and the control of gene activity through transcription and splicing of RNA.
2. Students will be able to demonstrate by examination, a senior-level understanding of the experimental basis of scientific discovery as it applies to molecular genetics.

ATTENDANCE POLICY: Attendance in lecture is expected. Be on time. You are responsible for all material and information covered in lecture, even if you are absent. Exhibit professional behavior.

GRADING:
Grading is based on 3 lecture exams, worth 100 points each, and a final worth 100 points. The exam format may include: short-answer essay, problems, multiple choice, and/or fill-in-the-blanks. The final may be cumulative. There will be 10 for-credit quizzes given during the semester, on days to be announced in lecture. The quizzes will be worth 10 points each. In addition, extra credit points may be given for especially insightful

classroom participation and discussions. Optional extra credit quizzes may be given without warning. At the end of the term, the student's total (out of 500 points) will be calculated, and grades will be assigned on a curve.

The following is a tentative outline. The instructor reserves the right to vary the outline, including the right to make necessary and reasonable adjustments to the syllabus.

Tentative Lecture Schedule

Week	Day	Date	Topic	Chapter
Background Review				
1	T	Jan 12	Mendel & Nucleic Acids are genes	1 & 2
	R	Jan 14	Structures of DNA; topology	6
Maintenance of the Genome				
2	T	Jan 19	Genome Structure and Chromosome Diversity	7
	R	Jan 21	Higher Order Structures; Nucleosome Assembly	7
3	T	Jan 26	DNA Synthesis at the Fork; Initiation of Replication	8
	R	Jan 28	Origin Selection, Termination, Telomere Replication	8
4	T	Feb 2	Mutation and Repair; Replication errors	9
	R	Feb 4	**Exam 1** (Chapters 1,2,6,7,8)	
5	T	Feb 9	DNA Damage, Repair Mechanisms; End Repair	9
	R	Feb 11	Homologous Recombination: Models, Proteins	10
6	T	Feb 16	Mating Type switching; Consequences of recombination	10
	R	Feb 18	Conservative site-specific recombination	10
7	T	Feb 23	Transposition & Transposable Elements	11
	R	Feb 25	Regulation of Transposition	11
8	T	Mar 2	**Exam 2** (Chapters 9,10,11)	
Expression of the Genome				
	R	Mar 4	Mechanisms of Transcription: Bacteria	12
	T,R	Mar 11	Spring break	
9	T	Mar 16	Transcription in Eukaryotes	12
	R	Mar 18	Finishing Transcription	12
10	T	Mar 23	RNA Splicing; Spliceosome; Splicing Pathways	13
	R	Mar 25	Alternative splicing, exon shuffling; RNA editing	13
11	T	Mar 30	Translation machinery; stages	14
	R	Apr 1	Mid semester recess	
12	T	Apr 6	Regulation of translation	14
	R	Apr 8	Genetic code	15
13	T	Apr 13	**Exam 3** (Chapters 12,13,14,15)	
Regulation				
	R	Apr 15	Transcription Regulation in Prokaryotes	16
14	T	Apr 20	Phage λ molecular switch	16
	R	Apr 22	Transcription Regulation in Eukaryotes	17
15	T	Apr 27	Transcription Regulation in Eukaryotes	17
	R	Apr 29	Regulatory RNAs	18
16		May	Final exam (Chapters 16,17,18)	

BIOLOGY 471: BIOTECH 2: RECOMBINANT DNA LAB, SPRING 2009

Credits: 3, prerequisites: BIOL 375, CHEM 333.

Section: 211, Lecture: W 12:00 – 1:50 PM in Sci. 337, lab: T and W 12:00 – 3:50 PM in Sci. 337.

Instructor: Dr. Roger Mitchell. **Office hours**: ASC (Commons) 2118: Wednesday 11:00 AM – 11:50 AM and 1:00 - 3:50 PM. Make an appointment, or drop by to see if I am available at some other time. Knock if the door is closed! You may call my office at any time: 591-5879. email: mitchelr@ferris.edu

Materials you are required to have:

lab manual: "Laboratory DNA Science" by Bloom, Freyer, and Micklos.

additional materials: purchase a lab notebook, a three-ring binder, lab coat and other materials as necessary.

recommended: students should have a means of saving files from Dr. Mitchell's laptop computer. Possibilities include USB memory devices and recordable CD and DVD.

Course outcomes: A student succeeding in this course should be able to:

1) perform professional-quality, hands-on lab techniques in molecular genetics. These include the following:
   - Bacterial transformation.
   - DNA extraction.
   - Gel electrophoresis.
   - Restriction enzyme digests
   - Use of plasmids.
   - Southern blots and colony lifts.
   - Membrane hybridization and probe preparation.
   - PCR.
   - DNA sequencing.
   - Basic DNA bioinformatics.
2) demonstrate by examination, report preparation, and other methods, an understanding of the principals behind the techniques listed above.
3) prepare and organize lab documentation.
4) carry out lab work while maintaining a professional environment.
5) maintain proper lab safety procedures.

Course Description: Practical training in recombinant DNA techniques is provided to students. These include DNA isolation, restriction enzymes, production of recombinant DNA plasmids, bacterial transformation, polymerase chain reaction (PCR), Southern transfer, non-radioactive probe labeling, hybridization, and DNA sequencing. DNA sequence data from internet databases and the use of graphics files to record results are also introduced.

Policies and Course Requirements:

Final exam time and place will be announced

Lab reports will be assigned that will be prepared by computer.

Dropping with the "W" grade must be done on or before **March 26**.

Incompletes will be given only at my discretion and will require proof of exceptional need. Consistent with university policy, the student must have passed 75% of the class

prior to being forced to stop attending due to circumstances beyond their control. The "I" grade must be cleared or it will become an "F."

Attendance policy. Attendance is mandatory. Missing more than 2 labs may result in course failure. I reserve the right to treat tardiness as an absence, or require additional work from tardy, disruptive, or absent students.

Due to the nature of these labs you will occasionally need to come in at additional times for brief periods.

Grades will be 25% from your lab notebooks, which may be checked at any time, 25% subjective (including following directions, time management, preparation, effort, lab safety, professional attitude, punctuality, etc.), and approximately 25% for reports and related assignments, and 25% on tests, quizzes, and worksheets. The test/quiz/worksheet category will include points for performance on the ETS Field exam in Biology. Poor lab safety will lead to lower grades.

THE FOLLOWING SCHEDULE IS HIGHLY TENTATIVE:

WEEK	DATE	TOPIC
1	Jan. 11	transformation 1, lecture: safety, overview
	12	transformation 2
	13	transformation 3, DNA purification lecture 1
2	18	NO CLASS: MLK day
	19	plant DNA 1
	20	plant DNA 2
3	25	plant DNA 2, plasmid prep 1
	26	plasmid prep 2
	27	DNA purification lecture 2
4	Feb. 1	plasmid prep 3, restriction enzymes 1
	2	restriction enzymes 2
	3	restriction enzymes lecture
5	8	restriction enzymes 3
	9	pKA recombination 1
	10	PhotoShop lecture
6	15	pKA recombination 2
	16	pKA recombination 3, RAPD 1
	17	PCR lecture
7	22	λ-library 1, RAPD 2
	23	λ-library 2
	24	Lecture: hybridization
8	March 1	λ-library 3
	2	λ-library 4
	3	Lecture: hybridization
9	8-10	NO CLASS: Spring break
10	15	λ-library 5
	16	λ-library 6, Southern 1
	17	Lecture: hybridization
11	22	Southern 2
	23	Southern 3
	24	Lecture: taxonomy methods
12	29	Southern 4
	30	Southern 5
	31	sequencing lecture 1
13	April 5	electrophoresis, other follow-up
	6	electrophoresis, other follow-up
	7	sequencing lecture 2
14	12	sequencing 1
	13	sequencing 2
	14	sequencing demo
15	19	sequencing 3
	20	sequencing 4
	21	Lecture: new technologies
16	26	RAPD 3
	27	complete labs, cleanup
	28	Review

Syllabus, Fall, 2009

BIOLOGY 472
PROTEINS

COURSE INFORMATION: BIOL 472, Proteins, is a 3-credit course. This class meets Tuesdays and Thursdays, from 9:30 to 10:45 am in Sci 120. However, there may also be out-of-scheduled-class time activities such as seminars, which students may be required to attend.

INSTRUCTOR: Dr. C. Boogaard:

OFFICE: ASC 2015; X 2544; hours: M & W, 11-11:50; W, & F 9-9:50; **or by appointment**. Call to make an appointment.

COURSE DESCRIPTION: The theory, molecular mechanisms, and practical aspects of the major techniques used in protein purification. Emphasis is placed on data interpretation and manipulation, trouble-shooting, and prediction of the impact of various errors on the data. Included are: enzyme kinetics; buffer design; cell disruption; differential solubility; ion exchange, gel permeation, and affinity chromatography; ultracentrifugation; chromatofocusing; radioisotope use, PAGE; and IEF.

Requires: BIOL 122 & CHEM 322

REQUIRED MATERIALS: A required lecture notes booklet and study guide are available at Great Lakes Book & Supply (840 Clark St; 796-1112; bookdawg@greatlakesbook.com). No text is required. However, students may find it helpful to reference Alberts et al, *Molecular Biology of the Cell*, 5th Ed, Garland Scientific, 2008. (This book is a required text for BIOL 474-Advanced Cell.). You will need a calculator for this class.

COURSE OUTCOMES:

1. Students will be able to demonstrate by examination, an understanding of the theoretical basis of various techniques used in protein purification, and the practical aspects of carrying out those techniques.
2. Students will be able to demonstrate by examination, an ability to interpret graphical representations of data, to manipulate data for maximum clarity of presentation, and to identify technical errors by examination of data.
3. Students will be able to demonstrate by examination, an understanding of equations describing experimental phenomena.
4. Students will be able to demonstrate by examination, the ability to carry out basic calculations required for technical success.

ATTENDANCE POLICY: Attendance in lecture is expected. Be on time. You are responsible for all material and information covered in lecture, even if you are absent. Exhibit professional behavior.

GRADING:

Grading is based on three exams, worth 50 points each, and a final exam worth 100 points. The final exam may be comprehensive. Some topics apply to the entire course, and can and will be represented on every exam. These topics include: calculating a purification table, interpreting a purification table, Beer's Law calculations, extinction coefficient calculations, buffer design, and enzyme kinetics. Every exam will contain at least one question addressing each of the 4 listed course objectives. Extra credit points may be given for especially insightful classroom participation and discussions. Random bonus quizzes may be given without warning. These cannot be made up.

At the end of the term, the students' total (out of 250 points) will be calculated, and grades will be assigned on a curve.

The following is a ***tentative*** outline of lecture topics. The instructor reserves the right to vary the outline, including the right to change the order of topics, the right to insert new experiences, and to make needed and appropriate adjustments in the syllabus.

			Tissue Culture Techniques	
			DNA Techniques	
			Analyzing Protein Structure and Function	
			Gene Expression and Function Studies	

Tentative Lecture Schedule

WEEK	DAY	DATE	TOPIC	
1	T	9/1	Amino Acids, Buffers, Extinction Coefficients; General Calculations	
	R	9/3	Basic Structure: α helices; β sheets; β turns; Overview of Purification	
2	T	9/8	Assays; Enzyme Kinetics;	
	R	9/10	Purification Tables and Calculations	
3	T	9/15	Buffer Design; Cell Characteristics	
	R	9/17	Review	
4	T	9/22	Exam 1	
	R	9/24	Cell Rupture: Liquid & Solid Shear; Sonication; Chemical & Enzymatic Techniques; Results	
5	T	9/29	Protein Concentration Techniques	
	R	10/1	Salting In and Salting Out; Ionic Strength Calc; pH, T and Salt changes	
6	T	10/6	Precipitation Zones and Back Extractions;	
	R	10/8	Calculating salt additions; data; Results and Troubleshooting	
7	T	10/13	Ion Exchange Chromatography: Principles; Gradient Ion Exchange Columns; Data	
	R	10/15	Gel Permeation: Formulae, Techniques; Data	
8	T	10/20	Review	
	R	10/22	Exam 2 (cell disruption, prot concen; salting out; ion exchange)	
9	T	10/27	Data Interpretation and Troubleshooting gel perm	
	R	10/29	Ultracentrifugation: Principles and Formulae; Sedimentation Coefficients; Rotor Conversions	
10	T	11/3	Density Gradients; Ultracentrifugation; Data	
	R	11/5	Affinity Chromatography; principle, troubleshooting, data	
11	T	11/10	Data analysis: affinity chromatography	
	R	11/12	Hydrophobic, Covalent, and Chromatofocusing	
12	T	11/17	Review	
	R	11/19	Exam 3 (gel permeation, ultracentrifugation; affinity)	
13	T	11/24	Electrophoresis: Principles, Rates of Movement; Buffer Systems; Discontinuous Gels; Tryptic digests	
	R	11/26	Thanksgiving	
14	T	12/1	Zonal, Denaturing, Isoelectricfocusing, Results and Troubleshooting	
	R	12/3	Radioactivity and Radioisotopes; Interactions of Radiation with Matter	
15	T	12/8	Analysis of Protein-Protein Interactions: Epitope Tagging and Flourescence Resonance Energy Transfer	
	R	12/10	Yeast Two-Hybrid System; Phage Display	
16	T	12/14	Final Exam on M at 10 to 11:40 am in Sci 120	

BIOL 473 Proteins Laboratory Fall '08 Wed 9:00-6:00 SCI 337

Dr. Kim Colvert

Office: ASC 3098 MTF 9:00-9:50 F 10-10:50 Other hours by appt.

Ext 5851 Home Phone 796-2058

colvertk@ferris.edu

Text: *Protein Methods*, Bollag and Edelstein, Wiley-Liss (most recent edition)

Supplies: Approved eye protection, notebook with carbon copies.

Learning Outcomes:

Successful students in this course will

1) *research methods in the biochemical literature*
2) *design and adapt purification and analysis protocols from the literature*
3) *perform methods of protein analysis and purification*
4) *maintain accurate and complete records of work*
5) *present the results of the isolation and analysis in a professional format*

Your task this semester is to isolate and purify a protein. You must go to the literature to find a method to purify a protein (enzymes are usually the best bet). You might start with commercial sources of enzymes—you know someone has isolated those! I will also provide direction. The process must be 'feasible' given the resources of the lab, the availability of source material and, unfortunately, the cost of isolation. The method should include a variety of techniques with useful stopping and starting points. Once a method has been **approved** you must develop a list of materials needed, check supplies and submit a list of materials to be purchased. The research portion of your work should take two to three weeks. Start immediately. We do not start with live animals but can obtain a variety of animal materials from abattoirs. Plants, bacteria and yeast are also options for sources. You will then develop a procedure and carry out the isolation. You will also wish to assay the protein and determine as much information about its physical properties as possible. You may need to go to several literature sources to complete your project. All facets of your work must be documented in an orderly and legible fashion in your notebook, including your sources, your exact actions, where you deviated from published methodology and why, etc. 70% of your grade will be based on this notebook. I will periodically check your notebook (**without warning**).

The other 30% of your grade will be based on the 'final'. The final will be a semi-formal presentation of your work to the class that will be jointly presented by you and your partner. Your presentation will be by PowerPoint and is expected to include a flow chart, data and results tables where appropriate. You should also include a bibliography. A copy of your work must be submitted with your notebook. The 'semi-formal' part refers to the fact that it will be a discussion and you will be asked questions and encouraged to explain in detail or ask questions of your own. Your organization and ability to respond to questions about your word will be evaluated. This will take place during the last lab period of the semester and constitutes the "final". You may invite guests. The final exam period will be devoted to lab clean-up.

BIOL 474: Advanced Cell and Molecular Biology
Spring 2009

Instructor: Dr. C. Boogaard
Office hours: M, W & F 10-11; M, 3-4 **or by appointment**
Office: ASC 2015; phone: 591-2544; email: boogaarc@ferris.edu
Biol 474 is a 3-credit class, meeting in Str 136 on T and R from 9:30 to 10:45 am.

Course Objectives: To increase the students' knowledge and understanding of:

1. the basic principles of cellular processes, organization, and growth
2. the nature and genesis of cell structures and organelles
3. the means by which cells move, and interact with each other

Pre-requisite: a minimum grade of C- in PHCH 320 or CHEM 364, and BIOL 375, or consent of instructor.

Textbook: Molecular Biology of the Cell, fifth edition; Alberts *et al.*, Garland, 2008

Optional Material: A lecture notes booklet with study guide included may be purchased at Great Lakes Book and Supply.

Examinations and grading:

1. There will be 3 exams, 50 points each, each covering one third of the material.
2. The exam format is usually short-answer essay. However, problems will be introduced where appropriate. Some problems may be handed out before the exams to be completed as a take-home assignment and turned in at the exam time. Work turned in late will be docked a certain percentage per day.
3. There will be 5 20-point quizzes throughout the term.
4. There may be unannounced pop quizzes. These may be given on an extra-credit basis. There will be no make-up quizzes.
5. Extra-credit points may be assigned for insightful classroom participation.

Tutoring:

The official tutor for this class is Mr. Nathan Hartman. Tutoring sessions will be held in Sci 137 Thursday evenings at 6pm. Mr. Hartman will review correct answers to the study questions, which will be posted on-line. He will also review correct answers to test questions after the tests are returned.

Lecture and Exam schedule:

The following is a tentative schedule of topics to be included in the lectures, and of the exams. This is a tentative schedule only. The instructor reserves the right to make needed and appropriate changes to the order or length of time spent on each topic.

The dates of the exams may be changed according to the wishes of the class, subject to the approval of the instructor. However, no exam will be delayed longer than two weeks.

Date	Topic	Text
Cell Evolution:		
Tues. Jan. 13	Evolution of the Cell	
Thur. Jan. 15	Evolution and Cells and Genomes	Chapter 1
Tues. Jan. 20	Cells and Genomes	Chapter 1
Basic Genetic Mechanisms:		
Thur.Jan. 22	How Cells Read the Genome	Chapter 6
Tues. Jan. 27	How Cell Read the Genome	Chapter 6
Thur. Jan. 29	Control of Gene Expression	Chapter 7
Tues Feb. 3	Control of Gene Expression	Chapter 7
Membranes:		
Thur. Feb. 5	Membrane Lipids and proteins	Chapter 10
Tues. Feb. 10	Mechanisms of Membrane Transport	Chapter 11
Thur. Feb. 12	Gated Channels and the Neuromuscular Junction	Chapter 11
Tues. Feb 17	Exam (Chapters 1, 6, 7, 10)	
Thur. Feb 19	Grand Synaptic Potential &Long-Term Potentiation	Chapter 11
Identity and Maintenance of Cellular Compartments:		
Tues. Feb. 24	Intracellular Sorting: Nucleus, Mitochondria, Plastids	Chapter 12
Thur. Feb 26	Sorting: Peroxysomes and ER	Chapter 12
Tues. Mar. 3	The Endoplasmic Reticulum	Chapter 12
Thur. Mar 5	Vesicle Targeting	Chapter 13
Tues Mar 10	recess	
Thurs. Mar 12	recess	
Tues. Mar. 17	Golgi, Lysosomes,	Chapter 13
Thur. Mar. 19	Cell Surface: Endocytosis, Exocytosis	Chapter 13
Tues. Mar. 24	Exam (chapters 11, 12, 13) Last day to drop with a W	
Cell Signaling and Signal Transduction:		
Thur. Mar 26	Signal mechanisms: integration, scaffolding; binding domains	Chap 15
Tues. Mar. 31	G-protein linked signaling	Chapter 15
Thur. Apr 1	Receptor-enzyme signaling: Src, Ras, MAP Kinases; PLCγ	Chapter 15
Tues. Apr. 7	Cytokine signaling; Jak-Stat pathway; TGFβ, Smads	Chapter 15
Thur. Apr. 9	mid-semester recess	
The Cytoskeleton:		
Tues. Apr 14	Self-assembly and dynamic structure of skeletal elements	Chapter 16
Thurs. Apr. 16	Regulation of skeletal elements	Chapter 16
Tues. Apr. 21	Molecular motors	Chapter 16
Thurs. Apr. 23	Cytoskeleton and cell behavior	Chapter 16
Tues. Apr. 28	Cell Cycle overview and control	Chapter 17
Thurs. Apr. 30	S phase and mitosis	Chapter 17
Week of May 4	Final exam (chapter 15, 16, 17)	

Chapter 8 (Methods) has been transferred to the Proteins class.
Chapter 14 on Energy Conversions is assumed covered in Biochemistry.

Biology 475

Bioinformatics
Spring 2010
3 Credits

Instructor Office
Dr. Brad Isler
ASC 2118
Phone: 591-2641
E-mail: islerb@ferris.edu

Class Hours
MWF 9:00-9:50 AM
Starr 105

Office Hours
MWF 10 AM-11 AM
W 12-1 PM

Course Description

A study of the interface between biotechnology and information technology. Primary focus will be placed on the use of nucleic acid and protein databases in the modern molecular sciences. Prerequisite: BIOL 375.

Course Outcomes and Assessment

Upon completion of the course, a student will be able to:

- **Demonstrate** using assignments, examinations, and discussions, an understanding of the fundamentals of bioinformatics and modern tools of molecular genetics, including: sequence alignment, phylogenetic trees, gene annotation, structure modeling, and gene expression analysis.
- **Analyze** molecular data using both manual bioinformatics methods and electronic tools.
- **Apply** results of bioinformatics analyses to the solution of relevant questions of molecular biology.
- **Interpret** scientific articles, formulate an informed opinion, and communicate this opinion to others in a verbal or written fashion.

Materials

- Understanding Bioinformatics, M. Zvelebil and J.O. Baum, Garland Science, 2007.

Grading

Your final grade will be determined from the total of all points earned on exams and assignments:

	Maximum possible points
Exams	200
Quizzes	?
Assignments	?

There will be two **exams** during the semester worth 100 points each.

Quizzes will be either announced or unannounced. Quizzes will be administered during selected lecture sessions and will cover information discussed in previous lecture sessions.

Assignments will be assigned after many of the lecture sections and will serve to reinforce topics covered during lecture. Assignments that are turned in late will automatically receive a 20% penalty.

Cheating on exams or assignments will result in failure of the course. Additional action may be taken by the University.

Attendance Policy

Attendance will not be taken in lectures. However, since BIOL 475 is an upper level course, attendance is expected. Besides covering relevant material, we will use the time spent in the computer lab to explore the use of bioinformatics tools. It will be very difficult to learn how to use these tools if you are absent from lecture.

If you are absent from class, it is your responsibility to obtain information that was presented. It is also your responsibility to contact Dr. Isler to obtain any assignments you may have missed.

Students arriving late for class on the days on which unannounced quizzes are administered will receive a zero for that quiz. No make-up pop quizzes will be given.

Students who have a legitimate reason for missing an exam should contact Dr. Isler as soon as possible. Legitimate excuses include a suitable statement from a physician, a bail bond ticket, evidence of a funeral, etc. Students who are absent on an exam day and do not have a legitimate excuse will receive a zero for that exam. No exceptions are allowed.

Class Participation

Class participation is not mandatory but will be considered when your final grade is determined. A student that is actively involved in a course will always perform at a higher level than a student that spends lecture periods sleeping, chatting with their friends, playing with their cell phone, or not paying attention.

Reading the Text

You should both read ahead in the textbook before material is covered in lecture and review the textbook following lecture. Your text is an important part of this course and was chosen because it is the best available for explanations, reasoning, illustrations, problem solving, and connecting important topics.

Class Decorum

The College of Arts and Sciences strives to maintain a positive learning environment and educational opportunity for all students. Patterns of behavior which obstruct or disrupt the learning environment in the classroom will be dealt with under the College *Disruptive Behavior Policy.* Cell phones, iPods, and laptop computers must be turned off, and interpersonal conversations cease during the class period.

Use of laboratory computers is prohibited unless the class is actively involved in a computer exercise. Checking of e-mail, Facebook, ESPN, playing games, etc. is not allowed!

Help!

Dr. Isler will be happy to help you during office hours or during any other available time. Please contact Dr. Isler for help or to arrange an appointment.

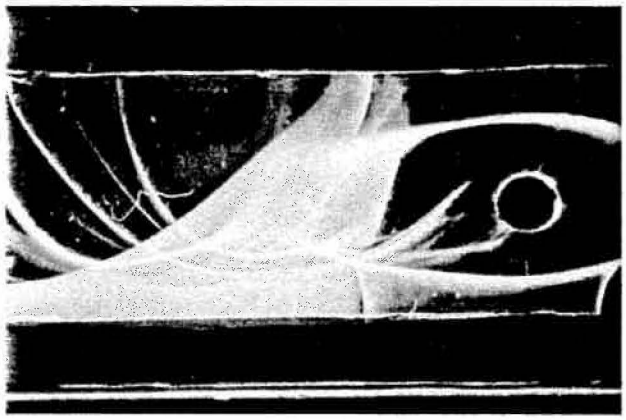
Grading Scale

93 – 100%	A
90 – 92.9%	A-
87 – 89.9%	B+
83 – 86.9%	B
80 – 82.9%	B-
77 – 79.9%	C+
73 – 76.9%	C
70 – 72.9%	C-
67 – 69.9%	D+
62 – 67.9%	D
60 – 61.9%	D-
< 60%	F

The grading scale may be adjusted depending upon class performance

Topic Overview

Topic	Chapters
Database basics	3
Sequence alignment	4, 5, 6
Evolution and phylogenetic trees	7, 8
Genome analysis	9, 10
Protein structure	11, 12, 13, 14
Cellular and system biology	15, 16, 17



Instructors (Office Hours):

Mr. Frank Hartley (SCI 141-D, Friday 12PM-1PM)

Mr. Richard Marble (PHR 314-A, Friday 12PM-1PM)

BIOL 490 Advanced Techniques in Biotechnology Fall 2009

This is a 2 credit course. In this course students will gain practical experience required for conducting animal-based research including the appropriate and humane handling of laboratory animals. In addition each student will: 1) develop and present a research protocol that involves the use of animals, 2) use a variety of laboratory techniques to test hypotheses, 3) assess laboratory design and safety, 4) establish a primary cell culture, and 5) maintain a laboratory notebook. The prerequisite courses are BIOL 386 and CHEM 333. Because of the complex nature of living organisms, the instructors reserve the right to make changes to the course syllabus at their discretion.

Attendance:

>The class is scheduled to meet from 2pm to 4:50pm each Thursday of the term, except November 26 which is Thanksgiving Day. Students may be required to meet at other agreed upon times as necessary to attend to or follow-up on lab exercises.

>Attendance is mandatory. Twenty-five (25) points will be deducted from your final point total for one unexcused absence. If you have an additional unexcused absence you will receive an F for the course.

>Class will begin on time. Three late arrivals will be considered the equivalent of one unexcused absence.

>Excused absences are those due to documented University-sponsored events (approval forms must be completed prior to the absence), jury duty (depending upon the length of service, you may receive an incomplete [a grade of I] for the course), serious illness or death of an immediate family member, or for personal illness. If you are able, notify your instructor prior to the class period you will miss. Upon your return to class you must provide your instructor, from a reputable and verifiable source, documentation for your absence.

>Due to the nature of the laboratory experiences, there will be no make-up labs; your lab notebook will be graded on the basis of entries made during class time.

>Make-up quizzes (for excused absences only) will be in the form of short essay questions.

Text/Lab Materials:

>The text for this class will be provided for you. It is "Guide for the Care and Use of Laboratory Animals", National Research Council, National Academy Press, Washington, D.C., 1996. You will also receive a handout packet for the immunology portion of the course. You must purchase a laboratory notebook (top permanent binding, carbonless copies, three-hole punched sheets – approximate cost is $15.00), a permanent marker (such as a Sharpie®), and a pair of safety glasses.

Grading:

>There are **1035 points** possible in this course. FSU Institutional Animal Care and Use Committee (IACUC) certification tests = **159 points.** Animal care "Mid-term" Exam = **101 points.** Eight immunology/cell culture quizzes at **25 points each = 200 points.** You will turn in your notebook ten times to be graded with a possible **20** points each time = **200 points**. You will use Ferris State University Institutional Animal Care and Use Committee (FSU IACUC) guidelines to develop an experimental protocol involving vertebrate animals and at least one immunological technique, complete the appropriate FSU IACUC protocol application, and give a brief oral presentation of your protocol = **100 points**. You will prepare and turn in a redesign of the tissue culture laboratory = **25 points.** Comprehensive Final Exam = **150 points.** There will also be a maximum of **100 points** awarded based on your instructors' assessment of your laboratory performance (**50 points** for the animal care component + **50 points** for the immunology/tissue culture component). "Bonus points" will not typically be awarded, but may be at your instructor's discretion.

>Your instructors will provide appropriate rubrics* for your notebook, experimental protocol, tissue culture lab redesign, and laboratory performance assessments.

*Rubrics are scoring tools used for subjective assessments; sets of criteria and standards linked to learning objectives that will be used to assess your performance on these assignments.

Grading, continued:

Your point total will be converted to a letter grade as follows (1035 or more points = A+):

Point Range	% of 1035	Letter Grade
963-1034	93-100	A
932-962	90-92.9	A-
900-931	87-89.9	B+
859-899	83-86.9	B
828-858	80-82.9	B-
797-827	77-79.9	C+
756-796	73-76.9	C
725-755	70-72.9	C-
693-724	67-69.9	D+
652-692	63-66.9	D
621-651	60-62.9	D-
0-620	0-59.9	F

Course Outcomes:

Upon completion of this course you will have:
1. Gained an appreciation of the importance of appropriate animal care in research and come to understand the role of an institutional animal care and use committee (IACUC).
2. Weighed, transferred, determined the sex of, and assessed the general physiological parameters of birds, mice, rats, frogs, turtles, and rabbits.
3. Immunized and collected blood from rabbits.
4. Immunized mice, harvested lymphocytes from the spleens of immunized mice, and initiated a primary cell culture of the lymphocytes.
5. Performed a variety of immunological procedures including: immunodiffusion, immunoelectrophoresis, enzyme-linked immunosorbant assay, affinity chromatography, western blotting, and blood typing.
6. Maintained a laboratory notebook that includes appropriately collected, analyzed, and interpreted data.
7. Successfully completed Ferris State University IACUC animal care certifications.
8. Developed and orally presented a research protocol that meets IACUC animal care guidelines.

Assessment of Course Outcomes:

Laboratory skills and animal handling will be assessed by observation of your performance in the laboratory and in the animal care facility.
Assessment of your research protocol and its presentation will be based upon the extent to which each meets clearly stated criteria.
Assessment of your laboratory notebook will be based upon the extent to which it meets clearly stated criteria for its format and content entries.
Assessment of your acquisition of factual information will be through quizzes and exams that will be a combination of multiple choice, short answer, and essay questions.

Schedule
Thursday 2pm-4:50pm

Date	*Location – Description*
9/3	PHR 303 – Introduction, Ferris Connect, History of Animal Research, Animal Care Rules and Regulations, FSU IACUC Certification Testing
9/10	PHR 303 – Immunology Handout Packet &Vocabulary List, Animal Care Resources, Protocol Development, Lab Safety, Zoonosis, Drug Dosage Calculations, Animal Handling Instruction and Hands-on Handling of Rats, Mice, and Rabbits
9/17	PHR 303 – Access to *Immunology Assessment* on Ferris connect, Animal Rights Activism, Animal Welfare and Husbandry, Careers in Animal Research, Animal Handling "Mid-term Test" Study Guide, Animal Handling Instruction and Hands-on Handling of Frogs, Turtles, and Pigeons
9/24	PHR 303 – Pre-immunization Blood Collection from Rabbits, "Mid-term" Animal Handling Test
10/1	SCI 207 (2-3:15) – *Immunology Assessment* Due, Immunology Review, Antigen Preparation [bovine serum albumin (BSA) & bacteriophage (T_4)] PHR 314 (3:30-4:50) – Primary Immunization of Rabbits
10/8	SCI 207 – **Quiz #1**, Immunoprecipitation I, Immunodiffusion, Introduction to Cell Culture, Animal Use Protocol Assignment
10/15	SCI 207 (2-3:30) – **Quiz #2**, Follow-up Immunodiffusion, Bacteriophage Neutralization I, Antigen Preparation (F.H.) PHR 314 (3:45-4:50) – Post-primary Immunization Blood Collection from Rabbits & Booster Immunization of Rabbits
10/22	SCI 207 (2-3) – **Quiz #3**, Sheep Red Blood Cell Antigen Preparation, Introduction to Mouse Splenectomies PHR 314 (3:15-4:50) – Post-booster Immunization Blood Collection from Rabbits, Primary Immunization of Mice
	<u>Monday 10/26</u> – Mid-term Grades Due: Your mid-term grade will consist of your accumulated points for the FSU IACUC Certifications, the "Mid-term" Animal Handling Exam, the Animal Handling Evaluation, and Quizzes #1, #2, and #3. The % for letter grade will be the same as for the course above except the total points possible will be 385.
10/29	SCI 207 – Animal Use Protocol Draft Due, Mice Splenectomies & Initiation of Primary Cell Culture, Immunoprecipitation II
11/5	SCI 207 – **Quiz #4**, Bacteriophage Neutralization II, Affinity Chromatography, Blood Typing
11/12	SCI 207 – **Quiz #5**, Western Blot I, Immunoelectrophoresis (IEP), Bacteriophage Neutralization III

Schedule
Thursday 2pm-4:50pm

Date	*Location – Description*
11/19	SCI 207 – **Quiz # 6**, IEP Follow-up, Western Blot II, Analysis of Affinity Chromatography Fractions
11/26	NO CLASS – THANKSGIVING RECESS
12/3	SCI 207 – **Quiz # 7**, Lab Exercise(s) Wrap-up(s), Affinity Chromatography Analysis Follow-up
12/10	SCI 207 – **Quiz #8**, Animal Use Protocol Presentations
TBA	Comprehensive Final Exam (150 pts)

Biology 491

Biotechnology Internship

Summer 2010

Instructor

Dr. Brad Isler
ASC 2118
820 Campus Drive
Big Rapids, MI 49307
Phone: 231-591-2641
E-mail: islerb@ferris.edu

Course Description

Students participate in an external biotechnology internship to gain valuable technical and networking skills. Internship opportunities are generally obtained in academia (undergraduate research programs), in government (research branches of state or federal agencies), or in the biotechnology industry (national and local biotechnology companies).

Course Outcomes and Assessment

Upon completion of the course, a student will be able to:

- **Translate** biotechnical skills to an independent laboratory environment.
- **Analyze** scientific data collected during the internship.
- **Communicate** results of the internship project to both scientific and nonscientific audiences.

These outcomes will be assessed using the following measures:

- Oral and written correspondence from internship supervisors provides feedback on the laboratory performance of students.
- A scientific poster created by the interns will be evaluated for scientific understanding and clarity.

Grading

Your final grade will be determined from the following:

1. Evaluations from internship advisors.
2. Submission of a scientific poster at the conclusion of the internship.

Scientific Poster Overview

The ability to communicate what you have learned during your internship is invaluable to both you and other students at Ferris State. To facilitate this communication, you will be required to create a standard scientific poster suitable for presentation at Ferris State or external scientific conferences. Because many of your internships will continue beyond the end of the semester, a final draft of the poster is not due until the internship is complete. However, a draft of the poster is due on the final day of the semester (August 11) for evaluation by Dr. Isler. A final draft of the poster will be due to Dr. Isler on September 7, after which time posters will be printed (if needed) and displayed.

The content of your scientific posters will be as varied as the types of internships in which you are involved. Just because you did not perform a complicated set of experiments does not mean that you do not have material suitable for a poster presentation! You should work with your internship advisor and Dr. Isler early in your internship to identify a suitable poster topic. If you need technical assistance on how to create a scientific poster (see below for guidelines), Dr. Isler will be glad to help.

Your posters will be displayed in the biology department and will be presented at a forum to be determined later (Biology Awards Symposium, Van Andel Research Conference, etc.). I also reserve the right to post your poster on FerrisConnect in future semesters for use as a sample poster.

Scientific Poster Guidelines

- **If a poster is required as part of an external internship program**. Some of you may have a poster requirement as part of your internship program (e.g. REU programs at universities). If this is the case, you do not need to make a separate poster to fulfill the requirements for BIOL 491; you may just use the poster created as part of your specific internship program. Note that you must still submit an electronic copy of the poster to Dr. Isler via FerrisConnect before August 11 to receive a grade for BIOL 491.
- **If a poster is not required as part of your external or internal internship program**. For the majority of you, your internship (external government internships, external industry internships, internal externships performed at Ferris State.) will not specifically require the creation of a scientific poster. However, to fulfill the requirements for BIOL 491, you will still need to create a scientific poster. As mentioned above, you should work closely with your internship advisor and Dr. Isler to determine a suitable poster topic and then begin work on your poster as early as possible.

Creating, submitting and printing your poster

- **Creating your poster**. Scientific posters are generally composed of seven basic subsections: title, introduction, materials and methods, results, discussion, conclusion, and literature cited. The simplest and most readily available suite of programs used to construct your poster and organize these subsections is Microsoft Office. Basically, you create one very large PowerPoint slide with the dimensions of your poster and then insert onto the slide text boxes, graphs, tables, and pictures prepared using Microsoft Word or Excel for the subsections.
- **Poster size**. Common poster sizes used in the past include 36"x48", 42"x42" and 42"x48". Keep in mind that many scientific conferences set a limit on the maximum poster size to 48"x48".
- **Poster submission**. All draft and final versions of the poster will be submitted using FerrisConnect. Please do not e-mail the posters as an attachment to Dr. Isler, this has a tendency to clog his e-mail account!
- **Poster printing**. If your internship advisor does not wish to print your scientific poster, posters can be printed by the media production facility at Ferris State free of charge. The printing equipment in media production is limited to **42 inches wide**. Any poster with a dimension greater than 42 inches will be automatically reduced in size by media production prior to printing.
- **Sample posters**. Samples of posters from previous internships are posted on the BIOL 491 FerrisConnect page for your reference.

Schedule

June 28: Poster topic due.
August 11: Draft of poster due.
September 7: Final version of poster due.

Syllabus **CHEM 364 Biochemistry*Z** **4 credits**

MTRF 8:00 – 8:50 FLITE 405

A rigorous course in the chemistry of such biomolecules as amino acids, polypeptides, proteins and enzymes, carbohydrates, lipids and nucleic acids. The structure/function relationships of these biomolecules will be stressed and the biosynthetic and biodegradative pathways discussed. Credit will not be given for both CHEM 324 and CHEM 364. This course meets General Education requirements: Scientific Understanding.

Requires: CHEM 322

Instructor: Dr. Kim K. Colvert ASC 3098 Office Hours: MTF 9-9:50
colvertk@ferris.edu On-Line: T 1:00-1:50
Home 796-2058 (before 10 p.m.)
Ext. 5851

Text: "Principles of Biochemistry," Fourth Edition, Horton, Prentiss Hall. A scientific calculator is also required. It cannot not be a graphing or programmable calculator. If you expect to use the calculator for your exam I must approve its use. Much of our communication will be through the WebCT page so be sure you can access the site. I will only communicate via e-mail from WebCT. You should also bring a red pen or pencil on group days.

Learning Outcomes: As demonstrated through examinations and performance on assignments, successful students will

- apply chemistry concepts and skills acquired in previous courses to living systems to reveal the molecular nature of life.
- master new concepts, facts and skills to support analysis and interpretation of biochemical processes
- relate chemical structures of biomolecules to biological function
- evaluate unfamiliar biochemical information in multiple formats and interpret by analogy to familiar information
- relate reductionist information into an integrated view of biomolecular behavior.

Attendance: There is no specific penalty for absences however in-class assignments cannot be made up. Late assignments will not be accepted. If possible, make arrangements for absences in advance. Excused absences must be documented. Special arrangements for excused absences must be made in person beforehand or as soon as possible after return and no later than the day after return to class. You are responsible for obtaining notes, etc. from classmates or from the web page. Handouts will be available on the web page or from me if not posted there. I will have no sympathy if you choose not to come to class and miss important information or assignments (I warn you now, sometimes these assignments are very spontaneous).

Being late isn't a good idea. Get up early. If you are late come in quietly and avoid disrupting the class.

Class Deportment: See ***Student Handbook***. We will strive to create a friendly, positive environment. If any of us happen to come into conflict these concerns must be addressed outside of class. Try to remember that education is a two-way street. You cannot be magically endowed with knowledge; you must come prepared and strive for understanding both in and out of class. I am a facilitator not a programmer so I must come prepared to help you in that process. There are two common questions I do not answer: 1) "Will this be on the test?" and 2) I'll never use this, why do I have to know it?" In the first case assume that if it is covered in class or in the assigned reading it is fair game for an exam. In the second case assume there is a reason even if it is not immediately apparent. If it is keeping you up nights, come and ask; I probably have an answer. I'd rather you didn't eat in class and falling asleep could prove to be embarrassing. No cell phones are permitted!! Turn it OFF (not on vibrate) before class. No electronic devices (except a recorder if approved in advance) are permitted.

Cheating : In a word, don't. See ***Student Handbook***. Penalty for a first offense will be a zero for that assignment. A second offense will result in failure of the course. Avoid even the appearance of cheating or plagiarism by doing your own work.

Grading: There will be four in-class exams worth 100 pts each. These exams will be short answer/essay/ problem combinations and will primarily test your ability to **apply** the specific knowledge you have accumulated rather than testing your ability to accumulate data. I do not make a point of providing old exams. This is because I feel quite strongly that if you study from an exam you will not "own" the information. By now you all have your own study techniques. Use what works best for you but feel free to ask for help. There will be a comprehensive final worth 100 pts.. It is **not** optional. It can however replace your lowest test score and thus count twice. There will be approximately six group assignments or projects worth 20 pts. each. Other assignments may be made and assigned a value as I deem appropriate. These could include pop quizzes, short internet assignments or homework assignments as I feel are appropriate (see the caveat about missing class).

Grading Scale	Cutoff Grade
89%	A-
78%	B-
67%	C-
56%	D-

Expected Exam Schedule:
Exams will begin at 7:45 a.m. (optional, it's a chance for more time)

Exam 1	Feb. 7
Exam 2	Mar. 6
Exam 3	April 10
Exam 4	May 2

Final May 8 7:40-9:40 a.m.

Review Sessions: (locations to be announced)

Tuesday, Feb. 5	5:45-7:30 p.m.
Tuesday, Mar. 4	5:45-7:30 p.m.
Tuesday, April 8	5:45-7:30 p.m.
Tuesday, April 29	5:45-7:30 p.m.

Class Format: Read the appropriate material before you come to class. Ideally you should be able to take notes without **any** instructor provided aids. You should be able to split your attention between the presentation and taking those notes in such a way that you focus primarily on understanding the information as it is presented. Over the years students seem to have lost these skills so the power point lectures will be posted on Web CT. Notes (outlines) will also be available. I strongly encourage you to listen and take notes to enhance your understanding without worrying about missing the critical. What won't be posted are the enhanced explanations and discussions in the lecture. Work on processing the information in class and be ready to answer and ask questions. Questions are encouraged. Be assured that if you didn't understand something you weren't the only one. By the way, USE YOUR TEXT. There are some excellent reading lists at the end of the chapters and a nice selection of problems. Pay special attention to the problems. These will not be assigned for credit but you **must** do them as part of your study routine. I will assume you have worked these so start early and work some every night. Utilize the publishers' web site. Try not to use the solutions until after you have made an effort. It is conceivable that I could also draw problems or inspiration for problems from these sources when I make the exam. I will not necessarily cover everything in the text and I will have occasional extra information. Remember the rule of thumb for study time: you must spend two to three hours outside of class for every hour in class. Study groups are encouraged. You learn a lot by explaining to others. If you do not spend the time reading and working problems you will not do well. Note: I recommend that you do NOT print out all of the power point slides. They are not designed to be used this way. There are many that will not be useful and will waste paper. Many will be too small to read if you miniaturize them and many will be in your text. Again, I personally would recommend that you work less on taking copious notes and more on understanding the explanation while in class. Take relevant notes with the understanding that you will have access to the slides. The only exceptions would be metabolic paths and mechanisms. It may be helpful to have these printed out full size. Of course you are free to ignore this advice if you find it more helpful to spend the paper but....

Group Assignments: You will be divided into groups of four. Each group will consist of an Alpha, Beta, Gamma, and Delta. One member will be assigned the role of moderator. The moderator will rotate and be responsible for submitting the group's results. The moderator will collect signatures from each participant on the final draft of the assignment and turn in the results. Each Greek letter will be assigned an individual problem that must be completed before class. Two copies of the individual problem should be prepared. Each individual will turn in one copy at the beginning of class to be graded for individual effort. The other will be used to explain the problem to the group. If the group corrects the individual effort make those changes in red. The group will then work on a problem that will utilize the individual efforts in some way. After completion of the group problem the moderator will collect corrected individual problems, attach them to the completed group problem and submit the effort.

Tentative Timetable

Dates		Subject
1/14		Organization
1/15-18	(Ch. 1)	Introduction: Setting the Stage
1/22-28	(Ch. 2)	In an Aqueous Environment
1/29-2/5	(Ch. 3)	It's Amino World
	(Ch. 4)	Proteins: Structure and Function
		Proteins: In the Lab (expanded)
2/8-14	(Ch. 5)	Enzymes: Kinetics
2/15-19	(Ch. 6, 7)	Enzymes: Mechanisms and Coenzymes
2/21-3/4	(Ch. 8)	Sugar (da da da da dit da) Ahhh, Honey, Honey
	(Ch. 9)	What Do You Mean It Won't Dissolve in Water?
		The Wall
		Breaching the Wall
3/7,17-18	(Ch. 10)	Bioenergetics: The Paths to Power
3/24-25	(Ch. 11)	Glycolysis: The Start of Something Big
3/27-4/28	(Ch. 13)	Round and Round We Go : The TCA Cycle
3/28-31	(Ch. 12)	The Rest of the Sugar Saga
4/1-8	(Ch. 14)	Where's the Beef?: Ox-Phos
4/14-15	(Ch. 16)	Butter Lovers Beware: The Catabolism of Lipids
4/17-21	(Ch. 17, 18)	Nitrogen, Amino Acids, and You
		Interlude: Nucleotides
		Nucleotide Metabolism: A Scavenger's Tale
4/22		Connections
4/24-51	(Ch. 19)	Tinker to Evers to Chance: The Central Dogma
		Nucleic Acids
	(Ch. 20)	Replication
	(Ch. 21)	Transcription
		In the Lab: Sequencing 'N Stuff
	(Ch. 22)	Translation

Biochemistry Laboratory 1 CHEM 332 Fall '08

Dr. Kim K. Colvert

R 12:00 pm - 12:50 pm Starr 233 Lecture
F 12:00 pm - 3:50pm Science 337 Lab

Laboratory theory and techniques of biochemistry are introduced. Experiments focus on the application of photometry, chromatography, electrophoresis and activity assays to the isolation and analysis of biomolecules such as amino acids, proteins, enzymes and nucleic acids. Requires: CHEM 222

Textbook: Boyer, "Modern Experimental Biochemistry", Addison-Wesley, Supplemental materials will be provided.

Supplies: Gridded notebook with perforated carbon sheets, approved safety goggles, metric straight edge, graph paper (no larger than 10 divisions/in.), calculator (suggest a scientific).

Learning Outcomes: The successful student will

- use basic biochemical techniques and equipment
- work neatly and efficiently in lab with respect for others
- use a lab notebook to keep accurate and useful records of laboratory activities
- prepare clear and concise reports of activities that
    - explain the theories of techniques and concepts encountered
    - describe the experimental process
    - use theories to explain experimental results, account for deviations, summarize and propose alternate or future experimentation

Grading: Grades will be based on as many lab reports as we complete, written as described in the following pages. Over the course of the term you must keep a notebook that documents everything you do. The carbon copies will be collected each lab period and are worth 10 pts each. It will be graded primarily for completeness and presentation rather than for content. In other words you could lose points for failure to label properly, leaving out data, not showing important calculations, leaving off units and so on. Remember, keeping the notebook is a real time exercise. No extra time is provided at the end to "catch up". The report will be due the second lab period after completion of the experiment. If the experiment was completed in one session it will be worth 90 pts. If it covers more than one period it will be worth 70 pts per day. There will be a final exam during the last laboratory period and clean up will take place during the scheduled final exam time.

Cheating : In a word, don't. See ***Student Handbook***. Penalty for a first offense will be a zero for that assignment. A second offense will result in failure of the course. The

introduction to your report will be closely scrutinized for plagiarism. Use your own words and organization.

Absences/Make up Labs: There will be no make-up labs. Absence from lecture will not be counted against you but will be to your disadvantage. Absence from a lab which requires more than one lab period will result in a proportionate deduction. For example, if a lab requires 2 lab periods and you miss one you may obtain the data from your partner but 20% will automatically be deducted from the completed report. If you miss a lab that only requires one period an excused absence might be negotiated if the reasons are fully documented. Missing three labs for any reason will result in failure of the course. **Late assignments WILL NOT BE ACCEPTED**!!!!

Tentative Lab Schedule

Sept. 4/5 Introduction Lecture, Lab Tour, Safety

------11/12 Writing and Research, Library Assignment
------18/19 Buffers
------25/26 Spectrophotometry
Oct. 2/3 Centrifugation
Oct. 9/10, 16/17, 23/24 Chromatography
------30/31, Nov.6/7 Electrophoresis
Nov. 13/14, 20/21 Enzyme kinetics
------27/28 Thanksgiving
Dec. 4/5 Computer Lab
Dec. 11/12 Final Exam
Lab Clean-Up during Finals Week

LAB NOTEBOOKS AND REPORTS

Each of you will be required to keep a lab notebook in which you will record all the information necessary to write a report. It is a running account of everything done in an experiment—the procedure (suggested and what you actually did) errors, accidents, the conditions of the experiment, the data collected, the calculations, notes to yourself, lecture notes, literature references, errors and so on. For your own sake, it should include a table of contents and therefore each experiment should be titled and the pages numbered. It is like a diary in many ways. You ought to be able to go back to your notebook, even years later, and know exactly what you did and why you did it. Theoretically, if you were to die, a fellow scientist could reconstruct your research from your notebooks.

It is helpful to prepare tables in advance for any data you need to collect so it is labeled and ready to fill in as you take your measurements. As you work record observations, any stray thought or question and any helpful hints you might receive. When you get ready to finish your report your notebook should have all the necessary data and maybe even a few ideas that will help with the discussion. Whatever you do don't take your data down on the odd piece of paper thinking you will enter it in your notebook later. Neatness is important; you must be able to tell exactly what each piece of data is. If you get sloppy you might not know what information to use where in your write- up.

The notebook should start with a date and a title for the day's objective. It should then include an objective statement that describes the specific goals for that day and indicates that you know why you are doing the experiment. From then on format is really up to you but should be very clear and very detailed. All data should be clearly identified. Computer print outs of data can be pasted into the notebook but you may want a second copy for your report.

Format for a report

TITLE PAGE

TITLE
NAME
DATE

INTRODUCTION: The introduction should not be more than a page or so long and should be **in your own words**. No cut and paste allowed. Strive for concise statements of only the pertinent information. It should include any specific background information necessary for a general understanding of the theories, procedures, techniques and calculations necessary for the successful completion of the experiment and report. Focus on the theories relevant to what was actually done, don't reinvent the wheel. Any given data or literature values should be included here. It should not be detailed as to procedure but a general statement of the objective(s) without procedural details is necessary. It should NOT have a sentence that starts "the purpose of this experiment is..." This should be implied by your discussion of the theories. Again, NO PROCEDURAL INFORMATION HERE!!! This statement is appropriate at the end of the introduction, not the beginning

PROCEDURE: The procedure section pertains to what is done during the laboratory period. Do not copy the procedure handout or from the book. Distill the method provided down to a page or so of concise directions. Try to convey the necessary information in as few words as possible. When appropriate, a table or tables may be used to clearly show reagents, amounts, dilution factors, times, etc. Use passive voice, past tense

Ex. "*I will then add some ammonium sulfate to the solution,*" is incomplete and incorrectly phrased

"*Two milliliters of 0.3 M ammonium sulfate was added to one liter of the protein solution,*" provides much more information and avoids the use of 'I' and 'some'.

DATA: The data section should include tables and/or graphs of **RAW DATA** obtained from direct observation or with the aid of instruments. Some examples of raw data are colors, absorbencies, pHs, degrees of observed rotation, chromatograms, measured distances, etc. Once a measurement or observation is manipulated (for example, by calculation, graphing) it is no longer **RAW DATA** but becomes results. **ALL** tables should be titled. They should have labels that can be understood by the casual reader. All raw data should be clearly and succinctly identified, whether machine recorded or experimenter recorded.

CALCULATIONS: The calculation section should include any mathematical formulas used to handle the data to obtain results. Define the formula, state the formula then show a set-up using actual experimental data. Repetitive use of the same formula using different data is unnecessary. **One sample will do in this section**. If more than one number is generated by the same calculation usually these numbers are presented in graphical or tabular form in the results section. The proper use of standard mathematical manipulations and symbols is expected.

RESULTS/DISCUSSION: The results of the experiment should be presented in a clear and concise form. Each type of data or manipulated data should be presented, whether in tables, graphs or smoothly integrated prose. For instance, suppose that you are asked in the analysis section to plot the absorbance of a solution as a function of time. You would make the graph, label it appropriately with a figure number and then discuss what the graph shows and to a limited extent what trend or principle it illustrates. You would use a phrase like "As can be seen in Figure 6 the rate of the reaction exhibited a maximum at pH 7.2". Sometimes it is appropriate to discuss the results in more detail at this point and you can do a complete analysis. Sometimes it is better to wait and discuss all of the results together as each result relates to others obtained in the experiment. In a discussion the individual observations from the results are explained and, if appropriate, integrated. The discussion should include a comparison of the expected results (from text or literature or lecture) with your experimental results, whether favorable or unfavorable, and an explanation. This is where you prove you understood the principles enumerated in the introduction and relate them to the actual observations you have made. For example, if your results were as above the discussion might include a statement like "The optimum pH for the activity of the enzyme suggests that at least two amino acids are being titrated

as the pH is changed. Protonation of one would be favored coupled with deprotonation of a second."

General statements of conclusions go in this section. It is expected that the last statements of the report are a kind of summary and may include speculations on what might have improved the experiment or other personal insights.

The introduction and results/discussion sections are heavily weighted in the grading.

LITERATURE CITED: Any references you used for literature values or other information should be listed in any accepted style. I suggest the numbering method. When you cite literature follow it with a sequential number that refers to your list of references.

Example: *The molecular weight of hemoglobin is 64 kD (1).* The (1) indicates the information came from reference numbered 1 in your list.

General directions for writing the report.

1) the writing should be well constructed, concise and scientific,

2) all experimental work is to be reported thoroughly and accurately,

3) the report should not have to be reread to 'figure out' what the writer means,

4) the report, written in the passive mode, should be free of mechanical errors

5) Prepare your reports on a computer. You should have access to a versatile graphing program and a word processing program that can handle chemical symbols and integrate tables. I will often require that a graph be prepared by hand—check before assuming you can use a graphing program.

6) When it is not appropriate to use computer-generated graphs they should be done on standard graph paper with 20 squares to the inch. They must conform to the following format:

a. margins free of any writing
b. a suitable and descriptive title
c. x-axis (independent variable) label and units
d. y-axis (dependent variable) label and units
e. both axes conveniently and correctly scaled
f. data points plotted clearly and precisely (consider circles, squares, etc. around point to be sure they are separated from lines and don't forget a legend if necessary)
g. smooth curves or straight lines drawn when appropriate.

h. one idea per graph (may be more than one line, however)
i. neat and pleasing appearance

Note: Even computer generated graphs must follow the format!

Biochemistry Laboratory CHEM 333

Biochemistry laboratory techniques and theory are continued. Experiments will include the isolation of sub-cellular systems such as chloroplasts, mitochondria and microsomes. The metabolic properties of these systems, including chemiosmotic coupling, electron transport and substrate preference will be examined. This course meets General Education requirements: Scientific Understanding, Lab.

Requires: *CHEM 332* ***and*** *CHEM 364*

Instructor: Dr. Kim K. Colvert **Office:** ASC 3098

Hours: MTF 9-9:50 (or by appt.)

Textbook: Boyer, "Modern Experimental Biochemistry", Addison-Wesley, supplemental material will be provided.

Learning Outcomes: The successful student will

- apply basic biochemical techniques and equipment to more complex systems
- work neatly and efficiently in lab with respect for others
- use a lab notebook to keep accurate and useful records of laboratory activities
- use theories to explain experimental observations in appropriate scientific language and format

Supplies: Gridded notebook with perforated carbon sheets, goggles, metric straight edge, graph paper (no larger than 10 divisions/in.), calculator (suggest a scientific), flexicurve (optional).

Grading: Grades will be based on Notebook work and lab reports as described below.

Absences/Make up Labs: There will be no make-up labs. Absence from lecture will not be counted against you but will be to your disadvantage. If you miss connect up with a classmate! Absence from a lab which requires more than one lab period will result in a proportionate deduction. For example, if a lab requires 2 lab periods and you miss one you may obtain the data from your partner but you will lose that day's notebook value. Your report will be worth full value. If the absence can be verified as an excused absence (Dean's definintion) you are still responsible for the report but will not be held accountable for the notebook work. If you have an excused absence for a lab that only requires one period your final grade will be adjusted. Missing three labs for any reason will result in failure of the course.

The Notebook

There must be a Table of Contents at the beginning. Start each lab day with a date and title. List in the table of contents. Begin with a statement of the day's objective (not whole lab if multiple). This is very important and should be based on your understanding

of the task for the day (remember the lecture!). The BIG PICTURE objective will be the start of the lab report.

Ex. In order to determine the melting temperature of calf thymus DNA changes in viscosity and absorbance at 260 nm with respect to temperature will be investigated. Results will be interpreted in light of viscosity and hyperchromic effect theories and compared to literature values.

Then proceed to record **all activities**. Use well-labeled tables when appropriate, record solution concentrations. Include drawings of specialized equipment. Make sure everything is clear by using titles. Do necessary calculations neatly. Record all data. If data is instrument- generated label well and make a copy (print multiples or get copied), one for notebook and one for carbon(you and your partner may share the second). **Be detailed and thorough**. If a subsequent experiment uses an identical procedure the first may be referenced by notebook page number. If the procedure differs then it must be clearly explained how it differs. Remember, errors must be lined through, not scribbled out. I am not going to be very forgiving of sloppy appearance. If your handwriting is bad, improve it. Points will be deducted for unclear presentations, incomplete identification of reagents, failure to use units and illegible work (be grateful I'm not going to tag you for grammar and sentence construction).

At the end of the work day sign and submit the carbon for grading. Each day's work is worth 40 points. In addition, I will be checking your table of contents. I will deduct 10 points if an experiment is not recorded. I WILL BE PICKY!!!!

The Lab Report

Title the report. Start with a context for the total experiment, essentially a re-working of all of the objective statements. This is where you demonstrate your understanding of THE BIG PICTURE. Be sure it is clear in this paragraph what the lab(s) was/were designed to demonstrate. It is not a detailed recounting but is setting the stage for your results. Present and discuss the results, elaborating on the theory that allows your interpretation. Tables and Figures must be properly identified. References **must** be incorporated into the report and tied to the Bibliography at the end. This is how you prove you understood the experiment so be thorough. Each individual piece of information contributes to a total picture so make the connections clearly in a summary. Each report will be worth 60 points for the first day + 20 points for each additional day. (Ex. if a report covers three lab periods it will be worth 100 pts).

Potential Labs (not necessarily in order)

Ligand Binding
Immobilized Enzymes
Photosynthetic Pigments
Mitochondrial Assays
Chloroplast Assays
????

CHEM 474 Advanced Biochemistry

Builds on the introduction to biochemistry presented in CHEM 364. Metabolism will be examined in greater detail, stressing mechanisms, regulation, and research implications. A significant component of the course is literature driven, requiring research, analysis, and discussion of current topics in biochemistry. This course meets General Education requirements: Scientific Understanding.

Requires:

CHEM 231 **or** CHEM 451; **&** CHEM 364 **&** BIOL 375

Dr. Kim K.Colvert
ASC 3098 ex. 5851
Home 796-2058

Office Hours MWF 9-9:50
or by appointment

Text: "Biochemistry", Voet and Voet, 3rd edition, Wiley

Learning Outcomes:

Survey courses in biochemistry lay a general framework of information and analytical skills. By building on this foundation this course will help students pursuing careers relating to biochemistry become more sophisticated in the evaluation and analysis of biochemical relationships. To this end the course will focus on advanced concepts in metabolism and will contain a significant literature review component. Students will:

1) Deepen specific understanding of anabolism and catabolism stressing regulation and interdependency of pathways.
2) Develop the ability to analyze and predict metabolic effects.
3) Increase awareness of biochemical literature.
4) Develop skills in the evaluation of published research.
5) Enhance skills in oral and written communication of scientific information.

Grading:

Grades in this course will be based on three exams, two literature presentations, participation in discussion and a research paper. The exams will be take home exams and partially individualized. Each exam is worth 1/6 of your grade. There will also be presentations of literature required from each student. A paper must be selected for presentation. The paper should be a single-topic, peer reviewed article (not a review paper) must be provided to the class and a copy provided to the instructor the week before. The presentation will consist of a brief explanation of the point of the research, the techniques and the results. Critical evaluation is expected, discussion will take place. The whole class must participate. There will be three of these per student in this semester. Each presentation is worth 1/9 of your grade and your participation is also worth 1/9. The research paper must be at least ten single-spaced, Times-New Roman-12, equivalent pages long, and reference at least ten sources. No more than two of these sources may be internet sources. Topics must be submitted and approved by January 29. Papers are due April 20. The paper is worth 1/6 of your grade. There will be an optional in class final. It can replace one of your exam grades. You are **absolutely** on the honor system

Cheating and Plagiarism

Don't. First offense, zero for that assignment. Second offense, failure of the course. If I suspect your work is not your own, especially on the exams I will not hesitate to implement the penalties. **Don't make it necessary**.

Probable Lecture/Discussion Topics

Review of Metabolism

Biosynthesis of amino acids
- The five families and histidine
- Amino acid analogs

Metabolic fate of aminoTentative acids
Review of Metabolism

Biosynthesis of amino acids
- The five families and histidine
- Amino acid analogs

Metabolic fate of amino acids
- Review of catabolism and links to catabolic paths
- Synthesis of porphyrin, glutathione
- Neurotransmitters

Nucleotide metabolism
- Anabolism, catabolism, regulation
- Biosynthesis of nucleotide coenzymes

Biosynthesis of complex carbohydrates
- Monosaccharides to polysaccharides
- Bacterial cell walls
- Glycoproteins, receptor mechanisms

Photosynthesis
- Light reactions--photosystems and chlorophyll
- Dark reactions--CO2 to sugars

Membranes
- Fatty acid and phospholipid synthesis
- Membrane assembly
- Protein targeting

Cholesterol metabolism
Cholesterol, lipoproteins, bile acids
steroid hormones, vitamin D

Metabolism and hormone action

Exams (Tentative)
1--Post amino acids
2--Post complex carbohydrates
3--Post Hormones
Comprehensive Final As Scheduled By University

FRIDAYS		
January 18	ME	
January 25	_____	_____
February 1	_____	_____
February 8	_____	_____
February 15	_____	_____
February 23	_____	_____
February 29	_____	_____
March 7	_____	_____
March 14	Spring Break	
March 21	Mid Semester Recess	
March 28	_____	_____
April 4	_____	_____
April 11	_____	_____
April 18	_____	_____
April 25	_____	_____

CONNIE BOOGAARD

Biology Department
Ferris State University
820 Campus Dr., ASC 2004
Big Rapids, MI 49307
(231) 591-2544

EDUCATION:

Diploma, Mittlestufe, Goethe Institute, Rothenburg odT, Germany, 1969

B.A. (Honors, Biology), California State University, Fullerton, 1970

M.Sc. (First Class, Zoology), University of British Columbia, 1975. Thesis: "The Effects of Estradiol and Progesterone on the Growth and Differentiation of the Quail Oviduct"; Dr. Cyril Finnegan, advisor.

Ph.D. (Biochemistry), Division of Medical Biochemistry, University of Calgary, Alberta, 1982. Thesis: "Vesicle-Mediated Microinjection of Protamine Messenger RNA into HeLa Cells"; Dr. Gordon H. Dixon, advisor.

PROFESSIONAL EXPERIENCE:

September 1999-present	Professor, Biology Department, Ferris State University
September, 1990-1999:	Associate Professor, and Biotechnology Program Coordinator Biology Department, Ferris State University.
June -August 1991 and 1992	Research Collaborator in the laboratory of Dr. Fred Stevens Argonne National Lab, Argonne, IL.
September 1987-September 1990	Assistant Professor and Biotechnology Program Coordinator, Biology Department, Ferris State University
September 1986-September 1987	Visiting Fellow in the Cell and Molecular Biology Laboratory, Biotechnology Division, Agriculture Canada.
September 1983-June 1986	Instructor, Chemistry Department, Division of Biochemistry, University of Calgary, Calgary, Alberta

HONORS AND ORGANIZATIONS:

NSERC Visiting Fellowship; Animal Research Center, Ottawa, Ontario. 1986-7
Alberta Medical Research Studentship, University of Calgary, Alberta. 1981-2
Medical Research Council Studentship, University of Calgary, Alberta. 1977-81
Isaac Walton Killam Memorial Fellowship, University of Calgary, Alberta.1977-79
Career Development Award from British Columbia Provincial Government. 1975
University Fellowship, University of British Columbia, Vancouver, Canada. 1973-75
Participant, International Students Program, California State University. 1968-69
American Cell Biology Society
American Association for the Advancement of Science
Sigma Xi Scientific Research Society

TEACHING EXPERIENCE:

My teaching assignment at Ferris State has included Molecular Genetics, Proteins, Advanced Cell and Molecular Biology, Introduction to Biotechnology, General Biology 1 and 2 for majors, and Biological Concepts (for non-majors). I have also taught Recombinant DNA Lab, Proteins Lab, and Cell and Tissue Culture Lab. I most enjoy teaching Molecular Genetics from Lewin (Genes VIII), and Advanced Cell from Alberts (Molecular Biology of The Cell). I also very much enjoy teaching the first year majors general biology class.

My teaching assignment at the University of Calgary included Advanced Biochemical Techniques, Lipids and Membranes, and Biochemistry Laboratory.

PROGRAM ADMINISTRATION:

As Coordinator of the Biotechnology Program, I was responsible for coordinating relations with industry and other academic institutions, including: arranging seminars by guest speakers, appointing adjunct professors, overseeing the budget, arranging internships, arranging tours of industry facilities, chairing the External Advisory Committee, ensuring the curriculum meets industry standards, giving tours of our facilities to interested groups from other universities and colleges, making presentations about the program to the transfer conference, visiting community colleges to arrange for pre-biotechnology curricula that will ladder into our program, and sponsoring visitors from Michigan State and the University of Michigan who wish to recruit graduates from our program.

I also coordinated and administered the program within Ferris, including: arrange and chair the Internal Advisory Committee; write the Role and Mission Statement, the General Education Policy Statement, the program brochures, and the program and course descriptions for the university catalogue; revise the curriculum; write checklists for clearing graduates; write the major attachments for the program review; design course completion forms; screen applicants for entry and for graduation; oversee accreditation efforts; design outcomes assessment materials; administer the budget; order major items of equipment; coordinate semester transition efforts; chair the remodeling committee, and several other efforts.

SERVICE: (only the most recent 8 years of service activities are listed)

University Curriculum Committee, Representative of the College of Arts and Sciences (99-02)
College of Arts and Sciences Curriculum Committee (99-present, Chair, 2002-03)
College of Arts and Sciences Standards and Policies Committee (99-01)
College of Arts and Sciences Sabbatical Leave Committee (98-01)
Biology Department Planning Committee (99-02) (rotating chair)
Biology Department Curriculum Committee, Chair (03-present)
Biology Department Head Search Committee, (05-present)
Dr. Joseph Lipar Tenure Committee, (05-present)
Dr. Clifton Franklund Tenure Committee, (06-present)
General Biology Course Committee, (2001-present), Co-chair (03-04)
Ecology/Conservation Search Committee, Chair (01-02)
Full-time Temporary Position Search Committee, Chair (01-02)
Biotechnology External Advisory Committee, Chair (87-99)
Biotechnology Internal Advisory Committee (87-present), Chair (87-89)
Roger Mitchell II Tenure Committee (96–00)
Advising Coordinator for Biotechnology Advisors (87-99)
Program Review Panel, Chair (97-99)
Biotechnology Program Review Panel, (03-04)

PROFESSIONAL DEVELOPMENT ACTIVITIES: (last eight years only are listed)

American Society for Cell Biology Annual Meeting and Conference, every year, 1987-present.
American Association for the Advancement of Science, member, 1987-present.
Subscriptions to *Molecular Cell Biology*, *Science*, and *Scientific American*, 1987-present
Faculty Winter Institute, January, 1999, on use of WebCT for course instruction.
Faculty Summer Institute, May 1999, on WebCT.
Presented a seminar, "Impact of the Human Genome Project on Cell Biology", February, 1999
Attended a workshop on "Proteomics and 2-D Gel Electrophoresis" Sept. 1999
Attended a seminar on Anthrax Toxin Receptors by Dr. Nick Duesbery, Van Andel Institute, 2001

STATEMENT OF TEACHING PHILOSOPHY:

We as human beings have an inherent desire to understand and make sense of the world around us. Teaching is the facilitation of that goal. It is most rewarding when the "light dawns" on students, and they understand for the first time something which has been puzzling them. Those moments when everything seems to break open, and the classroom is suddenly flooded with questions, as if a dam were breaking in the students minds, keep me in the business of teaching.

My goal as a teacher is to help the student to learn more than he would learn on his own. I firmly believe in beginning at the level of the student's current knowledge, not at the level the students are supposed to be. Adjustments in this policy are made at schools with "open door" policies, after consultation with other faculty at the school. I am also a great believer in science as a part of general education. A good biology course is as necessary for a fine arts major as for a science major.

In my own area of specialization (cell and molecular biology), the greatest difficulty encountered by students is in relating each detail to the whole picture. This is not surprising, since the details are chemical, whereas the larger picture is biological. Special care must be taken as an instructor, to ensure that this connection is made. I have developed several exercises designed to make this connection. This connection is equally important in theory and in practice. In technical material, care is always needed to ensure that the student can predict the effect of each possible technical mistake on the data that would be generated. In theoretical material, the student must be able to predict the outcome of mutations affecting each of the details of the process.

My teaching techniques encompass a broad range of technologies. In one year I tested five types of presentations. I came to the following conclusions: 1. Small Group-Based Instruction is not appropriate in an institution with a very broad range of student abilities and backgrounds. 2. Power Point is not as engaging a presentation technique as use of board or overhead, because it tends to lull students into feeling that they are being entertained. 3. Computerized animations of cellular processes are of great assistance to the student in understanding the molecular basis of cell processes. 4. Videos of cellular processes actually being undertaken by cells in culture (cell crawling, motility of cell components within the cytoplasm, cell division, etc) should be shown preceding a lecture on the topic, and should be followed by the computerized animation of the cellular process. These last two technologies in conjunction with each other are the most powerful assist to understanding the topic. 5. Lecture notes in outline form should be provided to the students prior to the class. 6. Projections of overhead transparencies are larger and clearer than computerized projections for most basic information.

These exercises and techniques, in conjunction with WebCt and continuing revision of course material, help to ensure the transfer of this intricate body of knowledge to the next generation of scientists.

STATEMENT OF RESEARCH INTERESTS:

My interest in carrying out research primarily centers on the use of research for teaching purposes. A research project should teach several techniques, the arranging of techniques into a logical sequence, the bridging of techniques, data acquisition, manipulation and interpretation, time management, record keeping, design of controls, and other relevant skills. In addition, it should have a high probability of success. Two examples of projects I am interested in establishing are: RFLP analysis of allelic variations at different loci both within a population and between species, and *in vitro* mutagenesis, followed by analysis of the mutant protein. The first project teaches DNA isolations, restrictions and electrophoresis, Southern transfers, basic cloning of probes, probe labeling, hybridizations, and detections. Through careful choice of loci (repeated sequences), the use of radioactivity can be avoided. The second project teaches *in vitro* mutagenesis, cloning, expression of the clone, protein isolations and enzymatic characterizations.

PUBLICATIONS:

C. Boogaard and G. H. Dixon, Exp. Cell Res. 143: 175-190 (1983). "Red Cell Ghost Mediated Microinjection of RNA into HeLA Cells. I. A Comparison of Two Techniques."

C. Boogaard and G. H. Dixon, Exp. Cell Res. 143: 191-205 (1983). "Red Cell Ghost-Mediated Microinjection of RNA into HeLa Cells. II. Cellular Translation of Protamine messenger RNA, Post-translational Modifications, and Nuclear Binding of Newly-Synthesized Protamine."

C. Boogaard and G. H. Dixon, Can. Fed. Biol. Soc. 24: 248 (1981). "Microinjection of Protamine messenger RNA into HeLa Cells."

C. Boogaard and C. V. Finnegan, Can. J. Zool. 54: 324-335 (1981). "The Effects of Estradiol and Progesterone on the Growth and Differentiation of the Quail Oviduct."

RESEARCH PROJECTS:

The Effect of a Variable Framework Region Mutation, M4L, on LEN κ_{IV} Light Chain Dimerization, Denaturation and Crystallization. A change in residue four, in the variable framework region of the Bence-Jones protein LEN, from methionine to leucine, was engineered. The effect of the change on dimer formation, stability to denaturation, and crystallization was measured. Laboratory and computer simulated HPLC chromatography indicated that the mutant and the wild type have identical Ka's for dimerization. Flourescence measurements on denaturation with guanidine HCl indicate that the ΔG for denaturation of the mutant is –0.99 Kcal/mole less than the wild type. Crystal formation indicates that the wild type forms at least two types of crystals, whereas only one type of crystal was obtained with the mutant. C. Boogaard, R. Raffen, and F. Stevens, Argonne National Lab, Argonne, IL. This was a sabbatical leave project, carried out 1996-7.

The effects of Nitrate and Uranyl Chloride on the Growth of *Thiobacillus Ferrooxidans* and *E. Coli.*: The resistance of *Thiobacillus ferrooxidans* and *E. coli* to ammonium nitrate and uranyl chloride was investigated. *Thiobacillus ferrooxidans* strain ATCC 33020 is not more resistant to uranium than bacterial species that do not inhabit mining waste. *E. coli* is capable of tolerating higher levels of uranyl chloride than *Thiobacillus ferrooxidans*. However, the *E. coli* cells grew slower than normal, and do not take up the uranyl ion, which is chelated by the citrate that is needed to keep it in solution at the pH of growth. The *Thiobacillus* grows at a pH where the uranyl ion is soluble, and therefore available for

uptake. In addition, the uranyl ion may also be interacting with the electron transfers that take place in the oxidation of ferrous sulfate for energy. Therefore, the two cell types are interacting with very different forms of the uranyl ion, and in potentially different ways. Two-dimensional gel electrophoresis of the proteins present in the cells grown in the presence or absence of uranyl chloride indicates several differences between the two samples. C. Boogaard, F. Stevens, and J. Trent, Argonne National Lab, Argonne, IL. A sabbatical leave project, carried out in 1996-7.

A comparison of solution phase (HPLC) and solid phase (ELISA) competitive monoclonal antibody binding assays to the antigen Pertussis Toxin, with the purpose of mapping the antigenic determinants of the toxin. This research project was carried out with Dr. Fred Stevens, Biomedical Research Division, Argonne National Laboratory, as part of the Research Semester Program, summers, 1991 and 1992.

Development of the use of cDNA clones to detect restriction fragment length polymorphisms at the bovine kappa-casein locus, as a means of genotyping animals prior to mating. This project was carried out with Dr. Parviz Sabour at the Animal Research Center of Agriculture Canada Experimental Farm in Ottawa, Ontario, from September 1986-1987.

Entrapment of protamine messsenger RNA in vesicles and fusion of these vesicles to HeLa cells, for the purpose of characterizing the translation of the messenger RNA and the post-translatioinal modifications to the protamines, in a heterologous cell type. This was the Ph.D. thesis, carried out in the laboratory of Dr. Gordon H. Dixon, Division of Medical Biochemistry, Universityof Calgary Medical School, 1979-82.

Investigation of premature chromatin condensation and heterochromatinization induced in chicken cells by fusion to synchronized cells in various stages of the cell cycle. This project was carried out as a research associate with Dr. J. B. Rattner, Department of Anatomy, University of Calgary, 1983.

Extraction of phytoestrogens from plant tissues and investigtion of the binding of these molecules to mammalian estrogen rececptors. This project was carried out with Dr. Kitts, in the Department of Animal Science, at the University of British Columbia, Vancouver, B.C., 1976-77.

The documentation of the growth and differentiation response of the quail oviduct to stimulation with estrogen and progesterone, in terms of DNA, RNA, and protein synthesis, and the synthesis of the differentiation proteins, ovalbumin, lysozyme, and avidin. This project was carried out as a Masters Degree graduate student in the laboratory of Dr. Cyril V. Finnegan, at the University of British Columbia, Vancouver, B.C., 1972-5.

TECHNIQUES:

PCR, *in vitro* site-specific mutagenesis, DNA Sequencing and silver staining,DNA restrictions, electrophoresis, Genomic library handling, Southern transfers, nick translations, multi-prime labelling, probe hybridizations, RFLP analysis, CsCl and mini-prep isolations of plasmid DNA, eukaryotic cell DNA isolations, nucleic acid iodinations (thallium chloride) and protein iodinations (lactoperoxidase). Preparations of liposomes and red cell ghosts, entrapment of nucleic acids, Isolation and *in vitro* translations of messenger RNA.
Use of tritium, carbon-14, iodine-125, and P-32 radiotracers.
Tissue culture of animal cells, microscopy, mutagenesis, cell organelle fractionation, cell fusions.
Protein crystallizations, HPLC, enzymatic assays, antigen-antibody binding assays, filter binding assays, ELISA assays, (normal and competitive), competitive receptor-binding assays, Scatchard plots, Chromatography, Ultracentrifugation (velocity sedimentation and isopycnic), Electrophoresis.

CURRICULUM VITA

Kim K. Colvert

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Big Rapids, Michigan 49307
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Big Rapids, MI 49307
(231) 796-2058
colvertk@ferris.edu

CURRENT TEACHING RESPONSIBILITIES

Survey, introductory and advanced courses in biochemistry and biochemistry labs, proteins laboratory.

Courses Taught at Ferris:

Quantitative Analysis (CHM 231)
Introductory Biochemistry (CHM 324)
Biochemistry (CHM 364)
Instrumental Analysis (CHM 231)
Chemical Calculations (ICT 221)
Biochemistry Lab I (CHM 332)
Biochemistry Lab II (CHM 333)
Organic/Biochemistry (CHM 124)
Inorganic Chemistry (CHM 114)
Introductory Chemistry (CHM 100)
Proteins Laboratory (BIOL 473)
Advanced Topics in Biochemistry (CHEM 474)
Chemistry and Food (CHEM 104)
Intro to Physical Chemistry (CHEM 451)

CURRENT RESEARCH INTERESTS

Binding site interactions and mechanisms of ATP synthases; Plasma membrane adenylate kinases, ATP synthesis assay development.

POST DOCTORAL RESEARCH

In vitro metabolism and macromolecular binding of suspected carcinogens using HPLC, radioisotope, and protein and DNA isolation techniques. Suicide inactivation of cytochromes P450, affinity chromatography.

GRADUATE RESEARCH

Interaction between proteins in the electron transport chain of photosynthesis using protein purification and analysis techniques, enzyme assays, covalent crosslinking and absorbance spectroscopy.

EDUCATION

PhD August, 1984, University of Arkansas, Fayetteville, Arkansas 72701. Major: Biochemistry. Dissertation Title: "Interaction of Ferredoxin with Ferredoxin:NADP Reductase in Chloroplast Membranes." Advisor: Dr. Danny J. Davis

B.A. June, 1977, Hendrix College, Conway, Arkansas 72032. Major: Chemistry.

PROFESSIONAL EXPERIENCE

September, 1988 to present — Asst./Assoc./Full Professor of Chemistry
Physical Sciences Department
Ferris State University
Big Rapids, MI

August, 1986 to August, 1988 — Assistant Professor of Chemistry
Chemistry Department
Southwest Missouri State University
Springfield, MO

August, 1984 to August, 1986 — Postdoctoral position with
Peter P. Fu, Division of Biochemical Toxicology, National Center for Toxicological Research, Jefferson, AR.
(Exchange Program with Veteran's Administration, Little Rock, AR)

ACTIVITIES AND AWARDS

Sabbatical Leave, University of Kansas-Lawrence, August 2001-August 2002
(American Heart Association Grant)
Sabbatical Leave, University of Kansas-Lawrence, August 1994-June 1995
Ferris Faculty Research Grant, June 1993-May 1994
NSF Research Opportunity Award, University of Kansas-Lawrence. June-August 1990 and June-August 1991
Chair, Western Michigan Section, American Chemical Society. 1991
Faculty Research Grant, Southwest Missouri State University. June 1987-June 1988.

COMMITTEES (current)

Departmental: Tenure Review, Candidate Tenure Committees, Assessment,

College: Faculty Support and Development (chair)

University: Biotechnology Advisory

Additional Service: B.A. Biochemisty Program Advisor, Library Liason for Chemistry, RSO advisor for Biotechnology Student organization, Independent Study Advisor (16 students since 2004), Math Science Student project mentor (3 since 2004).

PUBLICATIONS

Quillen, E.E., Haslam, G.C., Samra, H. S., Amani-Taleshi, D., Knight,J.A., Wyatt, D.E., . Bishop, S.C., Colvert, K.K, Richter M.L., Kitos, P.A. "Ectoadenylate kinase and plasma membrane ATP synthase activities of human vascular endothelial cells."_J. Biol. Chem., vol. 281, 20728-20737, 2006

Kirch, R.D., Colvert, K.K., Richter, M. L., Graber, P., "Intrinsic Fluoresence of the Chloroplast H^+-ATPase.", Archives of Biochemistry and Biophysics, vol. 316, 1995.

K.K. Colvert, D.A. Mills, and M. L. Richter, "Structural Mapping of Cysteine 63 of the Chloroplast ATP Synthase Beta Subunit", Biochemistry, vol.31, pp. 3930-3935, 1992

L.Z.Morand, M.K. Frame, K.K. Colvert, D.A. Johnson, D.W. Krogmann, and D.J. Davis, "Plastocyanin Cytochrome $_f$ Interaction," Biochemistry, vol. 28, pp. 8039-8047, 1989.

K. K. Colvert and D. J. Davis, "Characterization of a covalently crosslinked complex involving ferredoxin and ferredoxin:NADP reductase," Photosynthesis Research, vol. 17, pp. 231-245, 1988.

K. K. Colvert, M. W. Chou, and P.P. Fu, "*In Vitro* Binding of Nitro-Polycyclic Aromatic Hydrocarbons and Their Oxidative Metabolites to Macromolecules," presented at the International Symposium on Polynuclear Aromatic Hydrocarbons, National Bureau of Standards, Gaithersburg, Maryland, September, 1987 (published in the proceedings of this meeting).

Kim K. Colvert and Peter P. Fu, "Xanthine Oxidase-Catalyzed DNA Binding of Dihydrodiol Derivatives of Nitro-Polycyclic Aromatic Hydrocarbons," Biochemical and Biophysical Research Communications, vol. 141, pp. 245-250, 1986.

Barbara J. Vieira, Kim K. Colvert, and Danny J. Davis, "Chemical Modification and Cross-linking as Probes of Regions on Ferredoxin Involved in its Interaction with Ferredoxin:NADP Reductase, "Biochemica et Biophysica Acta, vol. 852, pp. 109-122, 1986.

Kim K. Colvert and Danny J. Davis, "Effect of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," Archives of Biochemistry and Biophysics, vol. 225, pp. 936-943, 1983.

PRESENTATIONS

Knight, J., Colvert, K.K., Amani, D., Haslam, G., Samra, H., Kitos, P.A. and Richter, M.L. (2003) "A novel plasma membrane ATP synthesis activity in human umbilical vein endothelial cells" KU undergraduate research symposium

Kim K. Colvert, "Structural Mapping of Cysteine 63 of the Chloroplast ATP Synthase Beta Subunit" Physical Sciences Department, Ferris State University, Big Rapids, Michigan, March, 1993

Gao, F., Colvert, K.K. & Richter, M.L. (1992) *Permanent asymmetry in the chloroplast ATP synthase: evidence against a rotational mechanism,* Midwest Biochemistry Conference, Manhatten Kansas

Mills, D.A., Colvert, K.K., & Richter, M.L. (1990) *Identification and distance mapping of the ATP binding site on the b subunit of the chloroplast ATP synthase,* Midwest Biochemistry Conference, University of Oklahoma

Mills, D.A., Colvert, K.K., & Richter, M.L. (1990) *Structural mapping of the b subunit of the chloroplast ATP synthase,* Gordon Research Conference, Bioenergetics, Vermont

Kim K. Colvert, "Metabolism of Benzo(a)pyrene by Plant Microsomal Enzymes," Midwest Regional Meeting, American Chemical Society, Wichita, Kansas, November, 1987.

K.K. Colvert, N.W. Chou, and P.P. Fu, "*In Vitro* Binding of Nitro-Polycyclic Aromatic Hydrocarbons and Their Oxidative Metabolites to Macromolecules," International Symposium on Polynuclear Aromatic Hydrocarbons, National Bureau of Standards, Gaithersburg, Maryland, September, 1987

Kim K. Colvert and Peter P. Fu, "Reductive Metabolism of Nitrated Polycyclic Aromatic Hydrocarbons to DNA Binding Derivatives," 190th National Meeting of the American Chemical Society, Division of Biological Chemistry, Chicago, Illinois, September 1985.

Kim Colvert and Danny J. Davis, "Preparation and Characterization of a Covalently Linked Adduct Between Ferredoxin and Ferredoxin:NADP Reductase," Ann. Plant Biochemistry-Physiology Symposium, University of Missouri-Columbia, Missouri, April, 1984.

Kim Colvert, Keith Hough, and Danny J. Davis, "Covalent Linkage of Interacting Proteins of the Photosynthetic Electron Transport Chain by a Water-Soluble Carbodiimide," Southwest Regional Meeting, American Chemical Society, Tulsa, Oklahoma, December, 1983.

K. Colvert and D. J. Davis, "Effects of pH and Salt on Km for Ferredoxin in

NADP Photoreduction by Chloroplast Membranes," Ann. Plant Biochemistry-Physiology Symposium, University of Missouri-Columbia, Missouri, April, 1982.

D.J. Davis and K. Colvert, "Effects of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," Midwest Photosynthesis Conference, Argonne National Laboratory, Argonne, Illinois, October, 1982.

K. Colvert and D.J. Davis, "Effects of pH, Salt and Coupling State on the Interaction of Ferredoxin with the Chloroplast Membrane," West Central States Biochemistry Conference, Stillwater, Oklahoma, November, 1982.

Hartley, Frank A.
Ferris State University, Department of Biological Sciences
Laboratory Technologist

1. Academic Degrees

B.S. 1977 Ferris State University, Applied Biology

2. Professional Experience

1979-Present Ferris State University – Department of Biological Sciences, Laboratory Technologist

1978-79 Ferris State University – College of Optometry, Clinical Laboratory Supply Manager
1977-78 Ferris State University, Biology Stockroom Clerk

3. Teaching Experience

2010 BIOL 476 – Instructor, Advanced Techniques in Biotechnology
2009-10 MOISD Math Science Technology Center – Semester Workshops in Microbiology
2008-09 BIOL 490 – Instructor, Advanced Techniques in Biotechnology (Prototype Course)
2003-08 Biotechnology Summer Camp Microbiology Instructor
1993-99, 2005-07 BIOL 388 – Laboratory Instructor, Advanced Techniques in Immunology
1977-2005 FSU Biology Department Laboratory Instructor: BIOL 109 – Anatomy, BIOL 205 – Anatomy and Physiology, BIOL 108 – Medical Microbiology, BIOL 218 – Microbial Ecology, BIOL 286 – General Microbiology, BIOL 386 – Microbiology and Immunology, BIOL 121 – General Biology
1976-77 Ferris State University, Anatomy/Physiology Laboratory Assistant

4. Military Service

1970-73 United States Navy – USS Kitty Hawk, Machinist's Mate

5. FSU Committees

Current Institutional Animal Care and Use Committee
Current Chemical Safety Committee
2000-2006 Applied Biology Internal Advisory Committee

6. Selected Publications

Hartley, F., Hoeksema, W., and Ryan, M. 2001. "Fundamental Microbiology for the Health Care Sciences." Fourth Edition. Kendall- Hunt Publishing Co. 227 pages.

7. Awards and Achievements

2007 Completed the Ferris Employee Leadership Development Program
2001 Received STAGE-M (Big Rapids Community Theater Organization) 'Gordy' for "Outstanding Contributions to the growth and enjoyment of theater arts in mid-Michigan"
1999 Ferris State University Distinguished Staff Award

8. Community Activities

2008-Present	Spiritual Life Commission of the Big Rapids United Church of Christ
1987-Present	Various capacities (actor, director, scenic/lighting designer) in STAGE-M and FSU Theater productions
1993-95	Advisor/director Big Rapids High School Drama Club
1991-92	Elected Trustee of the Big Rapids Public School's Board of Education

Bradley Jacob Isler

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820 Campus Drive
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12833 220th Avenue
Big Rapids, MI 49307
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Professional Experience

***Associate Professor of Biology and Biotechnology Program Coordinator,* Ferris State University, Big Rapids, Michigan, 2005 - present**

- Responsible for the instruction of several biology and biotechnology courses
- As coordinator of the biotechnology program, responsible for recruiting, advising, and supervision of curricular activities
- Current research project: A study of the genetic differences between normally sighted and anophthalmic rats

***Research Geneticist,* U.S. Meat Animal Research Center, Clay Center, Nebraska, 2003 - 2005**

- Postdoctoral position
- Area of focus: Quantitative and molecular genetics of sheep
- Primary research project: Investigation of genomic regions associated with carcass and meat quality traits in sheep
- The U.S. Meat Animal Research Center is a unit of the United States Department of Agriculture and the Agricultural Research Service

Education

***The Ohio State University*, Columbus, Ohio, 1997 - 2003**

- Ph.D. in Animal Genetics, March 2003
- M.S. in Animal Genetics, December 1998
- Area of focus: Quantitative and molecular genetics of swine
- Cumulative GPA: 3.70 / 4.00
- Advisor: Dr. Keith Irvin
- Ph.D. dissertation title: An investigation of the associations between several candidate genes and reproductive traits in swine
- M.S. thesis title: Association between the estrogen receptor gene and reproductive components in swine

Iowa State University, **Ames, Iowa, 1996 - 1997**

- Attended graduate school
- Major: Molecular, Cellular, and Developmental Biology
- Cumulative GPA: 4.00 / 4.00
- Advisor: Dr. Donald Beitz

Ohio Northern University, **Ada, Ohio, 1992 - 1996**

- B.S. in Biochemistry, with High Distinction
- Biochemistry degree certified by the American Chemical Society
- Cumulative GPA: 3.80 / 4.00

Teaching Experience

Associate Professor of Biology, **Ferris State University, August 2005 - present**

- Biology 101 (Genetics: Human Aspects)
  - Course designed for non-science majors
  - Taught fall semesters 2005-09
- Biology 122 (General Biology 2)
  - Second course in the two semester general biology series
  - Taught spring semesters 2005-06, summer semesters 2006-09
- Biology 174 (Introduction to Biotechnology)
  - Course designed to introduce students to the biotechnology program at Ferris State and the biotechnology industry as a whole
  - Newly developed fall 2006
  - Taught fall semester 2006-07
- Biology 375 (Principles of Genetics)
  - Junior-level general genetics course for biology and biotechnology students. Serves a prerequisite for many other courses.
  - Taught spring semester 2008-present
- Biology 491 (Biotechnology Internship)
  - Internship course for biotechnology students.
  - Taught as needed, usually in summer.
  - Redesigned in summer 2009.
- Biology 475/490 (Bioinformatics)
  - Course designed to explore the newly emerging field of bioinformatics, which combines molecular biology and information technology
  - Newly developed spring 2006
  - Taught spring 2006

Instructor, **The Ohio State University, 2002**

- Animal Sciences 320 (Principles of Genetic Improvement)
  - Course designed to introduce students to the basics of animal breeding and genetics
  - Fully responsible for all aspects of course
  - Taught winter semester 2002

Teaching Assistant, **The Ohio State University, 1997 - 2001**

- Animal Sciences 320 (Principles of Genetic Improvement)
  - Prepared and taught daily lectures during professor's absence
  - Prepared and graded student examinations and quizzes
  - Managed supplemental student project (cow herd computer simulation)
- Animal Sciences 543 (Swine Production)
  - Assisted students in laboratories
- Animal Sciences 600 (Capstone Current Issues and Writing Course)
  - Assisted students in preparation of group presentations
  - Prepared and graded student examinations
  - Presented a special lecture on biotechnology and the future of animal agriculture

Teaching Assistant, **Iowa State University, August 1996 - December 1996**

- Biology 201L (General Biology Laboratory)
  - Prepared and taught weekly lectures and laboratory experiments
  - Prepared and graded examinations, quizzes, and reports

Research Experience

Associate Professor of Biology, **Ferris State University, 2005 - present**

- Investigating the genetic differences between normally sighted and anophthalmic rats
- Four biotechnology students and one high school student have assisted with this project

Research Geneticist, **U.S. Meat Animal Research Center, 2003 - 2005**

- Investigated the relationship between regions of the sheep genome and economically important traits
- Performed a genome scan for quantitative trait loci that are associated with production and carcass traits in sheep
- Investigated the PRNP locus in sheep, which codes for the prion protein and is related to scrapie, one of the transmissible spongiform encephalopathies

Research Assistant, **Department of Animal Sciences, The Ohio State University, 1997 - 2003**

- Studied the effect of candidate genes on reproductive tract components in several breeds of swine
  - Study involved the discovery and analysis of novel polymorphisms in a variety of candidate genes: estrogen receptor-α, estrogen receptor-β, paternally expressed 1, paternally expressed 3, H19, prolactin receptor, and retinol binding protein-4
- Studied the genetic and meat quality issues surrounding the Rendement Napole condition in swine

***Research Assistant*, Molecular, Cellular, and Developmental Biology Program, Iowa State University, 1996 - 1997**

- Participated in the molecular, cellular, and developmental biology rotation program
- Studied a variety of topics in molecular and cellular biology, including the role of G-proteins in tumor formation, the porcine PIT-1 gene, and methods to increase the concentration of conjugated linoleic acid in the rumen of dairy animals

University and Community Service

- Biotechnology program coordinator, 2005-present
- Summer registration advisor, 2006-present
- Co-advisor for Delta Nu Alpha (biotechnology student organization), 2006-present
- Biotechnology Summer Academy for high school students
  - Camp director, 2007-09
  - Camp assistant, 2006
- Invited presentations
  - 2007 FSU-Grand Rapids Career Pathways Teachers Academy, summer 2007
  - Honors program "Lunch and Learn" series, fall 2007
  - CARE 102 Career and Education Planning course, fall 2007
- Search committee membership
  - Biology department head, September-November 2006
  - One year developmental biologist, summer 2007
  - Tenure-track developmental biologist, 2007-08 and 2008-09
  - Tenure-track anatomist and physiologist, 2008-09.
  - General biology advisor, summer 2008.
  - One year protein biochemist, summer 2009.
- General committee membership
  - University institutional animal care and use (IACUC), 2006-present
  - Honors program nationally competitive scholarship, 2007-present
  - College of Arts and Sciences standards and policies, 2006- 009
  - College of Arts and Sciences advising excellence, 2007-present
  - College of Arts and Sciences sabbatical leave committee, fall 2009-present
  - Biology department planning, 2007-present
  - Biology department awards committee, 2008-present
- Ferris State faculty representative for the Udall Scholarship
- Recruitment activities.
  - Honors symposium, February 2006.
  - Phone recruitment drive, Spring 2009
- Judge for the local competition of the International Engineering and Science Fair, March 2008 and 2009.

Honors and Awards

- L.E. Kunkle Award, 2003
  - Awarded annually to the outstanding animal sciences graduate student at the Ohio State University
- Charles E. Thorne Memorial Scholarship, 2001
  - Awarded to a single outstanding graduate student selected from all agricultural science graduate students at The Ohio State University
- National Swine Improvement Federation Outstanding Graduate Student Award, 1999
  - Awarded annually to the outstanding swine genetics graduate student in the United States
- Gamma Sigma Delta National Agriculture Honorary, 1999

Grants

- College of Arts and Sciences Dean's grant. A study of the genetic differences between normally sighted and SDF/Fsp-*anop* anophthalmic rats. $4287. 2007-2008.
- Ohio Pork Producers Council. $4,500. Examination of the Relationship between Several Candidate Genes and Reproductive Traits in Swine. 2001-2002

Reviewerships

- *Journal of Animal Science* Editorial Board, 2009- present
- *Human Heredity*, Cummings, Eighth Edition
- *Theriogenology*

Professional Memberships

- American Society of Animal Science, 1997-present

Publications and Presentations

Isler, B.J., B.A. Freking, R.M. Thallman, M.P. Heaton and K.A. Leymaster. 2006. Evaluation of associations between prion haplotypes and growth, carcass, and meat quality traits in a Dorset x Romanov population. Journal of Animal Science. 82: 783-788.

Isler, B.J, B.A. Freking, K.A. Leymaster, and M.A Heaton. 2004. Investigation of the association between prion genotype and economically important traits in sheep. Journal of Animal Science. 83(Suppl. 2): 44 (Abstract).

Isler, B.J, B.A. Freking, and K.A. Leymaster. 2004. 2003-2004 U.S. Meat Animal Research Center annual report to NC-109. Paper presented at the 2004 NC-109 annual sheep research meeting in Duluth, Minnesota.

Isler, B.J., K.M. Irvin, S.M. Neal, S.J. Moeller, and M.E. Davis. 2002. Examination of the relationship between the estrogen receptor gene and reproductive traits in swine. Journal of Animal Science. 80:2334-2339.

Isler, B.J., K.M. Irvin, S.M. Neal, S.J. Moeller, and M.E. Davis. 2002. Examination of the relationship between the paternally expressed gene 3 and reproductive tract components in swine. Proceedings of the 7th World Congress of Genetics Applied to Livestock Production. CD-Rom Communication. N° 08-28.

Isler, B.J., K.M. Irvin, S.M. Neal, S.J. Moeller, and M.E. Davis. 2002. Investigation of the relationship between the estrogen receptor beta gene and reproductive components in swine. Journal of Animal Science. 80(Suppl. 1): 378 (Abstract).

Isler, B.J., K. M. Irvin, M.F. Rothschild, and G.J. Evans. 2001. Examination of the relationship between the prolactin receptor gene and reproductive components in swine. Research and Reviews: Swine 2001, OARDC special circular 185. 83-86.

Isler, B.J., K. M. Irvin, M.F. Rothschild, and G.J. Evans. 2000. Association between the prolactin receptor gene and reproductive components in swine. Poster presented at the 2000 Annual Conference of the National Swine Improvement Federation.

Isler, B.J., K. M. Irvin, M.F. Rothschild, and G.J. Evans. 2000. Association between the prolactin receptor gene and reproductive components in swine. Proceedings of the 27th Conference of the International Society of Animal Genetics. CD-Rom Communication. N° C032. (Abstract).

Isler, B.J., K.M. Irvin, S.M. Neal, S.J. Moeller, M.E. Davis, and D.L. Meeker. 1999. Examination of the relationship between the estrogen receptor gene and reproductive traits in swine. Presentation at the 1999 Annual Conference of the National Swine Improvement Federation.

Isler, B.J., K. M. Irvin, S. M. Neal, S.J. Moeller, M.E. Davis, and D.L Meeker. 1999. The effect of estrogen receptor genotype, breed, and parity on litter traits and reproductive tract traits in swine. Journal of Animal Science. 77(Suppl. 1): 131 (Abstract).

Isler, B.J., K. M. Irvin, S. M. Neal, S.J. Moeller, and M.E. Davis. 1999. Association between the estrogen receptor gene and reproductive components in swine. Journal of Animal Science. 77(Suppl. 1): 32 (Abstract).

Isler, B.J., K. M. Irvin, S. M. Neal, S.J. Moeller, M.E. Davis, and D.L Meeker. 1999. The effect of the estrogen receptor gene on litter traits in swine. Research and Reviews: Poultry and Swine, OARDC special circular 171. 50-53.

Isler, B.J., K. M. Irvin, and S. M. Neal. 1999. Examination of the relationship between the estrogen receptor gene and reproductive tract components in swine. Research and Reviews: Poultry and Swine, OARDC special circular 171. 54-59.

Isler, B.J., K. M. Irvin, and S. M. Neal. 1998. Investigation of the estrogen receptor gene and its association with reproductive tract traits in swine. Research and Reviews: Poultry and Swine, OARDC special circular 164. 49-51.

Isler, B.J., K. M. Irvin, and S. M. Neal. 1998. Investigation of the estrogen receptor gene and its association with reproductive tract traits in swine. Ohio Swine Day 98 Proceedings: Issues For a Healthy Pork Industry.

Irvin, K.M., S. M. Neal, S. J. Moeller, D. L. Meeker, B. J. Isler, R. Emnett, S. Kacirek, and M. Barhorst. 1997-98 Ohio annual report to NC-220. Paper presented at the 1998 NC-220 Annual Meeting in Auburn, Alabama.

Richard Marble

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e-mail address: marblerd@yahoo.com

Skills Summary:

- More than six years experience.
- In-depth knowledge of the environmental conditions necessary for the care and use of laboratory animals.
- Remarkable knowledge of supervisory practices and principles.
- Profound knowledge of the use and maintenance of animal material and supplies.
- Exceptional ability to effectively communicate both orally and written.
- Remarkable knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- Great knowledge of animal science and behavior.
- Considerable knowledge of animal medicine to diagnose and treat simple animal injuries, diseases, and deformities.
- Uncommon time management ability.
- Great critical thinking ability to identify the strengths and weaknesses of alternative solutions,
- Excellent ability to teach and instruct others how to do something.
- Sound ability to determine how money will be spent to get work done, and to account for the expenditures.

Education:

1995-1999 Bowling Green State University, Bowling Green OH 43403
Bachelor of Science, Biology

1991-1995 River View High School, 26496 SR 60 N., Warsaw OH 43844
Diploma, College Preparatory

Experience: **January 2009- Present**

Ferris State University. Big Rapids MI 49307
(231) 591-2550
Dr. Karen Strasser, Department Head

Animal Care Facility Coordinator

- Increased faculty research by thirty percent within first year
- Ongoing enhancement of cross-departmental collaboration to increase timely and effective address of maintenance issues
- Assisting Project Investigators in grant application process
- Collaborating with the IACUC chair in the successful coordination of IACUC committee activities
- Forming networking relationships with state biotechnology organizations/ businesses
- Maintaining facility with adherence to AAALAC accreditation standards
- Ensuring quarantine and sentinel health surveillance programs in accordance with SOPs
- Notable success in the purchasing and acquisition of animals and supplies with cost reduction
- Interactively lectured and successfully instructed college seniors in advanced biotechnology coursework.
- Successful management and coordination of the university animal care facility including motivation of staff and the acquisition of new and updated equipment, while bringing down costs and increasing efficiency and funding.
- Continually assuring compliance with Federal, State, and University policies/procedures/regulations

March 2008-July 2008
Rent 1st, Kalamazoo MI 49048
Accounts Manager

- Rent to Own sales of large appliances and electronics
- Handled late accounts assertively and effectively to increase customer retention and reduce repossession of goods
- Conducted timely delivery of merchandise to customers increasing customer satisfaction

May 2004-March 2008
Covance Research, Kalamazoo MI 49009
Lab Animal Technician, Intermediate (Kennel/Sales Group)

- Provided preventative and routine medical care for sick and injured animals
- Assisted in routine rotation of animals housing in adherence to USDA guidelines
- Regularly chosen and relied upon to complete special projects outside the scope of my daily job routine in a timely and dependable fashion

Lab Animal Technician, Intermediate (Breeding Group)

- Successfully placed animals for breeding
- Selected potential brood stock thereby increasing fecundity and homogeneity of phenotype
- Skilled health observation of breeding colony resulting in early diagnosis and treatment of sick or injured animals.
- Advised management on the status of the current colony and suggesting opportunities for improving the quality and quantity of brood stock
- Proven track record of training less experienced staff
- Actively assisted in colony management to bring up numbers and quality.

Lab Animal Technician, Entry Level (Whelping Group)

- Increased efficiency in the areas of general sanitation and cage cleaning
- Provided outstanding animal husbandry for production's canine colony

March 2004-May 2004
WSI (Covance), Portage MI 49002
Lab Animal Technician(Temporary)

- Performed general sanitation and cage cleaning
- Provided Animal husbandry
- Wet fed young canines
- Assisted in animal rotation
- Utilized pressure washing apparatus in the sanitation of caging

March 2000-May 2000
MPI Research
Research Associate I

- Provided basic animal husbandry to over two hundred animals in 14-17 different studies
- Performed study related dosing of animals with up coming pharmaceuticals in order to test possible side effects before clinical trials begin
- Assisted in veterinary examinations of animals

July 1998-December 1999
Bowling Green State University Life Science Annex (Work Study)
Lab Animal Aide

- Provided basic animal husbandry for over one hundred animals in the facility including the use of cage washing apparatus
- Performed visual health inspections of animals
- Assisted in post mortem c-section of rats to preserve genetic strains while preventing uterine transfer of disease

Teaching Experience: Lecturer AALAS ALAT and LAT technician instruction 2007 & 2008
Lecture and Lab Instruction BIO 490 Advanced Techniques in Biotechnology Animal Handling September-December 2009

Certifications/Licensures:

Working towards completion of a Supervision Certificate through Ferris State University College of Business
RLATG Certification, AALAS August 2009
RLAT Certification, AALAS April 2006
RALAT Certification, AALAS January 2005
Certificate, Canine Theriogenology, The Ohio State University August 2006
Class Completion Certificate for Comprehensive Nutrient Management Planning Provider 1/31/2003
Adult CPR/AED, American Red Cross March 2010

Prof. memberships: American Association of Laboratory Animal Science (National) Jan 2005-Present
American Association of Laboratory Animal Science (Michigan Branch) Feb 2009-Present

Committee Work: Covance Research Products, Employee Relations Committee 2005-2008 (Chair 2007)
Ferris State University Institutional Animal Care and Use Committee (IACUC) 2009-Present
Ferris State University Emergency Response Team (FSU-ERT) 2009-Present

References: Available upon request.

CURRICULUM VITAE

ROGER E. MITCHELL II

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E. Mail: mitchelr@ferris.edu

CAREER GOAL

To teach biology in a college or university setting, with botanical research as a secondary goal.

EDUCATION

B.S., Molecular Biology, 1984, University of Wisconsin (Madison).

- Only 2 classes short of a chemistry major.

Ph.D., Genetics, University of Minnesota (Twin Cities), 1992.

- Thesis advisor, Dr. Irwin Rubenstein. Informal advisor, Dr. David Somers.
- Thesis, "Expression of Zein Associated Protein Genes" in the developing endosperm of *Zea mays* L. (corn).
- Applied a wide range of molecular and tissue culture research techniques to plant systems.
- Classroom emphases: genetics, plant breeding, applied statistics.
- Corn breeding.

POSTDOCTORAL RESEARCH

1993, Louisiana State University, Department of Plant Pathology and Crop Physiology.

- Principal investigator, Dr. Norimoto Murai.
- Gene expression in common bean (*Phaseolus vulgaris* L.).

TEACHING EXPERIENCE

Georgia Southern University in Statesboro, Georgia, Temporary, full-time assistant professor of biology, Winter and Spring quarters, 1994. Courses taught:

- Bio. 151 lecture: Introductory biology for non-majors. Topics: biology as science, survey, ecology, genetics, molecular genetics.
- Bio. 152 lecture: Introductory biology for non-majors. Topics: evolution, biochemistry, plant biology, vertebrate anatomy and physiology.
- Bio. 370 lab: Cell biology lab for mid-level biology majors. Taught: microscopy, cell anatomy, enzymology.

Ferris State University in Big Rapids, Michigan, Temporary, full-time assistant professor of biology, 1994-95 and 95-96 terms. Tenure-track assistant professor of biology, Fall 1996, associate professor, fall 1999 to present, tenured, Fall 2001, Courses taught:

- Biol. 113, lecture and lab: Botany for horticulture majors. Topics: taxonomy, anatomy, physiology, biochemistry
- Biol. 121, lecture and lab: Introductory biology for biology majors. Topics: genetics, evolution, survey, ecology, plant biology.
- Biol. 122, lecture and lab: Introductory biology for biology majors. Topics: zoology, vertebrate anatomy and physiology, biochemistry, molecular genetics.
- Biol. 207 lab only: Forensic Biology for the criminal justice and the forensic biology programs. In Fall '04, I took over the teaching of the DNA-related labs in this course. Dr. Philip Watson teaches the lecture an the remainder of the labs.
- Biol. 353, lecture and lab: Plant physiology for biology majors. Topics: anatomy, water relations, biochemistry, photosynthesis, cellular respiration, growth and hormones.
- Biol. 407, lecture and lab: Forensic DNA lab for forensic biology majors (a track within the B.S. in Biology). This class was new and began in Winter '05. It teaches the theory and methods used by the modern forensic community to solve crimes using DNA evidence.
- Biol. 460 lecture: Senior seminar for biology majors. Students prepare posters and monographs that review a current topic in biology. Includes computer instruction.
- Biol. 471 lab: Recombinant DNA lab for biotechnology majors. Teaches modern methods including cloning, bacterial transformation, DNA purification, Southern hybridization, sequencing, PCR. Includes computer instruction.

RELATED EXPERIENCE

Teaching:

- Teaching assistant, University of Minnesota.
- Three years teaching research methods to undergraduates in graduate lab.
- Attended peer review of teaching workshop, winter '96.
- Attended the Research Link 2000 workshop for biology research, August '00. at Ferris State University in August 2000.

Computers:

- Proficient in wide range of computer word-processing, statistics, graphics, taxonomy, and presentation applications.
- Studied three computer programming languages.

- Set up or upgraded several personal computers.
- Sold computers briefly.
- Teach Microsoft Word, Excel, and PowerPoint, as well as Adobe PhotoShop in two of my classes (BIOL. 353 and BIOL. 471), Fall '94 through present.

Communication:

- Competitive forensics and debate in high school.
- High school debate judge while in college.

UNIVERSITY SERVICE

- Committee service: terms are academic years (Fall and the following Winter/Spring semester), present is the '09 - '10 academic year:
  - Course:
    - Introductory lab revision committee ('94 -' 95 and '96 - '97 through Fall '02), occasional meetings, replaced by:
    - Introductory lab preparation and coordination committee (Winter '03 though present), weekly meetings. Co-chair, then chair, Fall '04.
    - Introductory biology textbook selection committee (Winter '95 and winter '04).
  - Program:
    - Biotechnology program coordination committees ('94 - '95 through present).
    - Biotechnology program review committee ('97 - '98 through present).
    - Forensic Biology program coordination committee ('03 – '04 through present)
  - Department:
    - Department planning committee ('96 - 97 through '99 - '00 and '02 - '03 through '07 - '08), chair, last three terms.
    - Department curriculum committee ('98 - '99 through '01 - '02), chair, last two terms.
    - Department professional development committee ('96 - '97, '99-'00, and '00 - '01, chair, last term).
    - Four search committees, two for 9-month positions, one for a single tenure-track position, and one for four tenure-track positions (three filled)).
    - Department tenure committee, chair ('03 – '04 through present, chair).
    - Candidate tenure committee, for Dr. Scott Herron ('03 – '04 through '07 - '08), Dr. Bradley Isler ('05 – '06 through present),

Dr Joseph Lipar ('05 – '06 through present, chair) and (Dr. Changqi Zhu ('09 - '10 through present, chair).

- Interdepartmental:
  - Forensic science track in criminal justice development committee ('96 - '97).
- College:
  - Sabbatical leave committee ('01 - '02 through '06 - '07), chair, five terms ('02 - '03 through '06 - '07).
  - Standards and policies ('03 - '04).
- University:
  - University scientific understanding committee ('00 - '01 through '03 - '04), chair last term.
  - All university sabbatical leave committee ('04 - '05 and '05 – '06), chair, first term.

- Coordinator of introductory biology (BIOL. 121 and 122) labs. This position involves chairing the introductory biology lab committee, editing and writing new material for the lab manual, training new faculty in the labs, coordinating textbook selection, and coordinating and developing assessment for the courses.
- Helped plan, develop and teach first biotechnology workshop for high school students and teachers (Winter '95).
- Prepared poster for, and represented biotechnology program at, Autumn Adventure, a high school recruitment event (Fall '94 through its discontinuation after Fall '01).
- Supervised two biotechnology student interns in the summer of '97, and again in the summer of '98. Shared supervision of a fifth student in the fall of '98. Supervised two more biotechnology student interns in the summer of '99. Shared supervision of an eighth student Summer '02 through Winter '03.
- Supervised undergraduate student independent study, Winter '97, Winter '98, Fall '98, Fall '00, Winter '03, Summer '03, and fall '08 - Spring '09.
- Supervised high school (Math and Science Center) student projects, '00 - '01, '01 - '02, and '02 - '03.
- Supervised student assistants in my main research program on *Rosa* (rose) species breeding,
- Assessment projects.
  - I served on the committee that wrote the short pre/post test used for the BIOL. 121-122 sequence, and I organize its administration in the labs (Fall '07 - present). I am currently writing a new, expanded version. This test assesses student leaning in the intro sequence, which is programmatically critical.

- I wrote a brief pretest on biologically important chemistry, which I have administered to all of my classes since Fall '07 (some every time the class meets, some selected semesters only). Chemistry competence is highly predictive of student success in biology classes, and I use the results as a basic for advising individual students in BIOL. 353. The chemistry classes required for various biology degrees are also a critical programmatic issue, and I have sought cooperation of other instructors in administering this test in a range of courses.
- I administer the Biology Field Exam to my BIOL. 471 class, representing the seniors in the Biotechnology program. This comprehensive, nationally recognized, standardized exam is also administered to Biology BS students, so it serves as an final assessment of our department's graduating majors.
- I am developing a set of shared questions related to plant biology to administer as a part of regular graded exams in the two classes in which the topic is covered (BIOL. 121, mostly first-semester freshmen and BIOL. 353, juniors and seniors) to asses this topic from a programmatic standpoint.
- I have been selectively breaking down regular graded lecture exam and lab quiz questions to address specific course assessment issues. This most often relates to teaching methodology. For example, compare student performance in BIOL. 353 and 407 on material that is/is not included on sample or is/is not covered by their textbooks.

OTHER ACTIVITIES

- Regularly attend the American Academy of Forensic Sciences yearly meeting ('04, '05, '06) and attended a workshop on the forensic role in terrorism at Duquesne Univeristy ('04).
- Carry out lily breeding program and very large rose breeding program (fall '06 through present).
- Carried a out lab research project on lily (*Lilium*) species taxonomy, utilizing DNA sequencing, Polymerase Chain Reaction (PCR), and other methods. This work is supported by grants from the North American Lily Society, the Wisconsin Regional Lily Society, and the Ferris State University professional development fund. Summer '06 - Fall '00. I presented a talk about this research at FSU in November '00.
- Carried out lab research project on rose (*Rosa*) species seed germination.
- I am very active on the Rose Hybridizing Society's open internet forum. I read it regularly during most of the year, and make contributions when I feel I have something to contribute. This serves to enhance my own research by exchanging information, to document my own work,

and in an educational role, since the other participants often are not scientifically trained, and benefit form explanations of that aspect of the subject.

- I have produce materials on my rose breeding program that have been added to my faculty materials on the FSU web site. This helps to communicate and document my work, as well as providing exposure for FSU to the community of rose breeders.
- Carried out a lab research project on Wisconsin Fast Plants (*Brassica rapa*) salt tolerance.
- Carry out a lab research project on plant chromosome characterization.
- Member of several horticultural societies: North American Lily Society (NALS), Species Lily Preservation group (within NALS), Rose Hybridizers Association, American Rose Society.
- Wrote newsletter articles for, and served as assistant editor of, the Wisconsin Regional Lily Society newsletter.
- Served as flower exhibit chairman for Wisconsin Regional Lily Society.
- Served as an accredited judge for the North American Lily Society.
- Write fiction as a hobby.

PUBLICATIONS:

Peer-reviewed journal:

- Mitchell RE (2009) The Inheritance of Juvenile Recurrence in Rosa Species Hybrids. Floriculture and Ornamental Biotechnology 3 (Special Issue 1), 46-52

Non-peer-reviewed journals, newsletters, books, etc.:

- "Expression of Zein Associated Protein Genes," Roger E. Mitchell II, Ph.D. thesis, University of Minnesota, St. Paul Minnesota, Jan. 1992.
- "Lily hybridizing: Something for everyone," Roger E. Mitchell II, Quarterly Bulletin of the North American Lily Society, vol. 49, #1, March 1, 1995.
- Mitchell, R., "New Genes for Lilies," Yearbook of the North American Lily Society, 1997, pp. 67-68. Subject: genetic engineering of flower crops.
- Mitchell, R., "Colder-Climate Trumpets: Trumpet Lily Hybrids," Yearbook of the North American Lily Society, 1997, pp. 77-80. Subject: horticulture. I have been told by society members, including the yearbook editor, that this article was very well received.
- Mitchell, R., "Species DNA Research Report," Quarterly Bulletin of the North American Lily Society, March 1, 1998, Vol. 52, No. 1, pp. 8-9.
- Mitchell, R., "Lily Hybrids: Understanding Without Intimidation," Yearbook of the North American Lily Society, 1998, pp. 54-62. Subject:

how classical genetics is used by breeders. I have received a lot of favorable feedback about this article, as well.

- Mitchell, R., "What Causes Lily Decline?," Yearbook of the North American Lily Society, 1999, pp. 20-35. Subject: horticulture. This article was the best received in the recent history of the yearbook, according to its editor.
- Mitchell, R., "Rose Hybridizing in the Summer Greenhouse," Rose Hybridizers' Association Newsletter, 2001. The RHA web site is www.rosehybridizers.org
- Mitchell, R., "Rose Hybridizing in the Greenhouse," in "Rose Hybridizing - The Next Step," Rose Hybridizers' Association, John and Mitchie Moe, editors, 2002.
- Mitchell, R., "Rose Hybridizing in Big Rapids, Michigan," Rose Hybridizers' Association Newsletter, 2006.
- Mitchell, R., "Accidental Ground Cover Roses," Rose Hybridizers' Association Newsletter, Spring 2006
- Mitchell, R., "High-Volume Growing and Selection of Rose Seedlings," Rose Hybridizers' Association Newsletter, Spring 2007.
- Mitchell RE (2008) Strategies to maintain species percentage in hybrids. Rose Hybridizers Association Newsletter 39 (1), 15-20
- Mitchell RE (2008) Managing Rose Seedlings. Rose Hybridizers Association Newsletter 39 (3), 7-8
- Mitchell RE (2008) Fertile Seed Parents and a Dilemma Involving Miniature Roses. Rose Hybridizers Association Newsletter 39 (4), 6-7
- Mitchell RE (2009) A miniature Note on Miniatures. Rose Hybridizers Association Newsletter 40 (1), 13
- Mitchell RE (2009) Breeding with *Rosa spinosissima* and its Relatives. Rose Hybridizers Association Newsletter 40 (1), 6-10
- Mitchell RE (2009) Breeding with *Rosa gallica* Relatives, Including 'Alika.' Rose Hybridizers Association Newsletter [published, I need to look up the information]
- Mitchell RE (2009) Classifying the Pimpinellifoliae. Rose Hybridizers Association Newsletter [published, I need to look up the information]

Meeting abstracts:

- "Transient expression of foreign genes in endosperm tissue," Roger E. Mitchell II and Irwin Rubenstein, Maize Genetics Cooperation Newsletter, #64, 1990.
- "Simplified cloning techniques utilizing kanamycin resistant plasmids," Roger E. Mitchell II, John Hunsperger, and Irwin Rubenstein, Maize Cooperation Newsletter, #64, 1990.

PROFESSIONAL MEETINGS ATTENDED:

CURRICULUM VITAE

- North American Lily Society annual meetings ('96 - '03, '05, '06)
- World Federation of Lily Societies ('04)
- American Rose Society spring meeting ('06)
- Rose Hybridizers' Association meeting ('06)
- American Academy of Forensic Sciences annual meeting ('04 – '07)
- meeting on forensic response to biological terrorism ('04)

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Biotechnology APR - Alumni

Every six years, each academic program at Ferris State University is evaluated via an Academic Program Review (APR) process. As part of this process, the Biotechnology program is asking Biotechnology alumni for their perceptions of the Biotechnology program and how well the program prepared them for their future careers. Please take just a few minutes to complete this short survey to assist us in our continuing efforts to maintain the educational quality of the Biotechnology program.

1. **What year and semester did you graduate?**

- ○ Fall 2005
- ○ Spring 2006
- ○ Fall 2006
- ○ Spring 2007
- ○ Fall 2007
- ○ Spring 2008
- ○ Fall 2008
- ○ Spring 2009
- ○ Fall 2009
- ○ Spring 2010

2. **Currently, I am:**

- ○ Attending graduate school
- ○ Attending professional school
- ○ Employed in a position unrelated to my major
- ○ Employed in a position related to my major
- ○ Other

Please Specify:

3. **What is your job title?**

4. **Who is your employer?**

5. **How long did it take you to find a job after receiving your terminal degree?**

6. **What was your starting annual salary?**

- ○ $24,999 or less
- ○ $25,000 - $34,999
- ○ $35,000 - $44,999
- ○ $45,000 - $54,999
- ○ $55,000 or more

7. **How long have you held your current position?**

- ○ Less than one year
- ○ 1-2 years
- ○ 3-4 years
- ○ More than four years

8. **What is your current annual salary?**

- ○ $24,999 or less
- ○ $25,000 - $34,999
- ○ $35,000 - $44,999
- ○ $45,000 - $54,999
- ○ $55,000 - $64,999
- ○ $65,000 or more

If you are currently attending, or have already attended, a graduate or professional school, please answer questions 9-11. If not, please skip to question 12.

9. **What types(s) of program(s) have you attended or are you currently attending?** ***(Please select all that apply)***

- ☐ M.S.
- ☐ Ph.D.
- ☐ M.D.
- ☐ D.O.
- ☐ MBA

10. **What is/are the name(s) of the school(s) that you have attended?**

11. **What was/is your date/expected date of graduation?**

- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- Did not finish

12. **I entered the Biotechnology program as a:**

- Freshman
- From the Pre-Pharmacy program at Ferris
- From any other program at Ferris
- A transfer student from another institution

13. **Please indicate your level of satisfaction with your background in each of the following when compared to other B.S. entry-level lab personnel or graduate/professional students:**

	Very Dissatisfied	Somewhat Dissatisfied	Somewhat Satisfied	Very Satisfied
Chemistry				
Biology				
Mathematics				
Preparation for laboratory work				
Problem solving and critical thinking abilities				
Computer and database usage				
Scientific and technical writing				
Oral and interpersonal communication				

14. **Please indicate your level of satisfaction with each of the following:**

	Very Dissatisfied	Somewhat Dissatisfied	Somewhat Satisfied	Very Satisfied
Level of expertise of the Biotechnology program faculty in their professional area				
The advising I received while in the Biotechnology program				
The ability of my degree in Biotechnology to help me achieve my career goals				

15. **I would recommend the Biotechnology program at Ferris State to prospective students.**

- ○ Strongly Disagree
- ○ Somewhat Disagree
- ○ Neutral
- ○ Somewhat Agree
- ○ Strongly Agree

16. **My <u>overall</u> level of satisfaction with the Biotechnology program is:**

- ○ Very Dissatisfied
- ○ Somewhat Dissatisfied
- ○ Somewhat Satisfied
- ○ Very Satisfied

17. **What do you see as the *strengths* of the Biotechnology program?**

18. **What do you see as the areas *needing improvement* in the Biotechnology program?**

19. **Please use this space for additional comments.**

Thank you for your time and feedback.

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Biotechnology APR - Faculty

Every six years, each academic program at Ferris State University is evaluated via an Academic Program Review (APR) process. As part of this process, the Biotechnology program is asking faculty members for their perceptions of the students' abilities and the Biotechnology program. Please take just a few minutes to complete this short survey to assist us in our continuing efforts to maintain the educational quality of the Biotechnology program.

1. **Please indicate your level of agreement with each of the following statements.**

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
The mission of the Biotechnology program is consistent with the Ferris State mission statement	○	○	○	○
The Biotechnology program is consistent with the objectives and goals of the Biology department	○	○	○	○
The Biology faculty supports the Biotechnology program	○	○	○	○
The Ferris State administration supports the Biotechnology program	○	○	○	○
The Biotechnology program trains students in technical and management skills needed for a successful career in the biomolecular laboratory sciences	○	○	○	○
Biotechnology courses are arranged in a logical sequence from least expertise required to greatest expertise required	○	○	○	○
The Biotechnology program offers sufficient opportunity for students to develop critical thinking and problem solving skills	○	○	○	○
The Biotechnology program offers sufficient opportunity for students to develop good oral communication skills	○	○	○	○
The Biotechnology program offers sufficient opportunity for students to develop good written communication skills	○	○	○	○
The Biotechnology program offers sufficient opportunity for students to master a broad knowledge of the major areas of biotechnology	○	○	○	○
The Biotechnology curriculum challenges students academically	○	○	○	○
The Biotechnology curriculum is relevant to the career goals of students	○	○	○	○
The Biotechnology program responds to the needs of a growing industry	○	○	○	○
Even though the Biotechnology program is part of the department of Biological Sciences, I am not very familiar with the Biotechnology program	○	○	○	○

2. **What do you see as the *strengths* of the Biotechnology program?**

3. What do you see as the areas *needing improvement* in the Biotechnology program?

4. Please use this space for additional comments.

Thank you for your time and input.

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Biotechnology APR - Advisory Board/Internship

Every six years, each academic program at Ferris State University is evaluated via an Academic Program Review (APR) process. As part of this process, the Biotechnology program is asking its Advisory Board/employers of Biotechnology interns for their perceptions of the interns' abilities and the Biotechnology program. Please take just a few minutes to complete this short survey to assist us in our continuing efforts to maintain the educational quality of the Biotechnology program.

1. **Please indicate your level of agreement with each of the following. If something is not applicable to you or you aren't sure, please select N/A.**

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree	N/A
The content of the Biotechnology program reflects what is needed to be successful in today's workplace	○	○	○	○	○
The Biotechnology program prepares students to continue their education at the graduate or professional level	○	○	○	○	○
The Biotechnology program offers quality laboratory instruction that is not available at most undergraduate institutions	○	○	○	○	○
Employment prospects for Biotechnology graduates are strong	○	○	○	○	○

In Question 2, please indicate your level of agreement with each of the categories given. If something is not applicable or you aren't sure, please select "N/A."

2. **Compared to students/graduates from similar B.S. programs, Ferris State Biotechnology students/graduates....**

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree	N/A
Have sufficient technical laboratory skills	○	○	○	○	○
Are sufficiently adept at oral communication	○	○	○	○	○
Are sufficiently adept at written communication	○	○	○	○	○
Have sufficient computer/database skills	○	○	○	○	○

3. What do you see as the *strengths* of the Biotechnology program?

4. What do you see as the areas *needing improvement* in the Biotechnology program?

5. Please use this space for additional comments.

Thank you for your time and feedback.

Biotechnology Survey – Graduating Seniors
Spring 2010

1. What was your most positive experience in the program? In the classroom? In the laboratory?

2. What was your most negative experience in the program? In the classroom? In the laboratory?

3. Do you think the program sufficiently prepares students to compete for internships and jobs/graduate schools?

4. What would you change about the program? (short term goals)

5. If you left campus and did not return for 5 years, what would you hope would have changed with the program in those years? (long term goals)

6. Any other comments?