Florida Board of Governors

Request to Offer a New Degree Program

Florida International University University Submitting Proposal	Fall 2011 Proposed Implementation Date
College of Arts & Sciences jointly with Herbert Wertheim College of Medicine Name of College or School	Chemistry &Biochemistry, Biological Sciences jointly with Medicine Name of Department(s)
Biochemistry Academic Specialty or Field	Ph.D. (CIP 26.0202) Complete Name of Degree

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

September 24, 2010 Date Approved by the University Board of Trustees	9-23-10 President — Date
9/24/10 Signature of Chair, Board of Trustees — Date	9/23/10 Provost & Executive Vice President — Date

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 2. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation Timeframe	Projected Student Enrollment (From Table)		Projected Program Costs (From Table 2)		
	HC	FTE	Total E&G Funding	Contract & Grants Funding	E&G Cost per FTE
Year 1	5	3.75	250,912	0	66,910
Year 2	10	7.5			
Year 3	15	11.25			
Year 4	21	15.75			
Year 5	27	20.25	649,263	430,864	32,062

FIU

FLORIDA INTERNATIONAL UNIVERSITY
Miami's public research university

13 September 2010

Dr. Dorothy J. Minear
Senior Associate Vice Chancellor
Academic and Student Affairs
State University System of Florida
Board of Governors
325 West Gaines Street
Tallahassee, Florida 32399-0400

Dear Dr. Minear:

As requested in your memo from July 26, 2010, FIU had an external review conducted on the proposed Ph.D. in Biochemistry program. Subsequently, the FIU Board of Trustees Academic Policy and Student Affairs Committee reviewed and accepted the revised program proposal on September 8, 2010, and recommended it for approval by the full board which is scheduled to meet on Friday, September 24, 2010. It appears on the consent agenda of the full board meeting.

While full board approval is pending, I am forwarding the following documents for your information:

1. The external reviewer's report
2. FIU's response and revisions taking into consideration the external report
3. The revised program proposal (signature page to be delivered upon approval on Sept. 24)

Please let me know if you need any additional documentation at this time.

Sincerely,

Douglas Wartzok
Provost & Executive Vice President

cc: Richard Stevens, FLBOG

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Note: This outline and the questions pertaining to each section must be reproduced within the body of the proposal to ensure that all sections have been satisfactorily addressed.

INTRODUCTION

I. Program Description and Relationship to System-Level Goals

A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.

This graduate program is designed to meet the need for advanced research and training capabilities in the expanding fields of biochemistry and molecular biology. For many years these fields have been growing rapidly. It has become evident that although substantial growth to support an increasingly important biomedical industry has been attained, many fundamental aspects of eukaryotic and prokaryotic biochemistry and molecular biology remain to be explored and brought into biomedical application. It is also our belief that strong programs in biochemistry and molecular biology, leading to a deeper understanding of their principles, will complement the development of research-based medical school programs; having this program will strengthen FIU's new medical school.

Biochemistry has become a fundamental discipline in, biology, chemistry and medicine. The proposed Ph.D. in Biochemistry will be a coordinated program; it will be a shared degree among the Department of Chemistry & Biochemistry, the Department of Biological Sciences, and the Wertheim College of Medicine (henceforth referred to as the three participating units). The primary faculty members participating in the degree will be from one of these three units, each having demonstrated expertise in teaching and research in biochemistry. A strong doctoral program in Biochemistry will attract research faculty to the medical school and provide both expertise and opportunities in research for future students. Graduates will be expertly positioned to obtain employment in academia and industry, particularly in those where biomedical technology is developed or employed.

Although a graduate program in biochemistry does not exist, the Departments of Chemistry & Biochemistry and of Biological Sciences have been very active in expanding their research capabilities in biochemistry and molecular biology. Both departments have been awarding graduate degrees that could have been awarded under the banner of biochemistry had this degree program existed; committees for those students have had faculty from both departments. These students, while getting an excellent, progressive and stimulating education, received diplomas that did not specifically state their major field: Biochemistry. The excellent faculty in Arts and Sciences are now joined by the several accomplished biochemists recently hired by the Wertheim College of Medicine. With that additional faculty, the University is poised for graduate education in biochemistry with active, well funded research programs.

The heart of this degree will be a core of graduate courses that provide a firm foundation in the theory and techniques of biochemistry; with this foundation, students will be prepared to specialize in either biochemistry or molecular biology, thus gaining both the breadth and depth necessary in a doctoral education. Students will be required to complete five major core courses and an additional two elective courses. Graduate seminar courses will delve deeply into the current research literature to provide students with the latest developments in the field. The total

number of credit hours required for the proposed program is 75. The proposed curriculum will provide training specifically targeted at future biochemists, one that fully integrates its two core disciplines, chemistry and biology. Three specific areas of research strength transcend the participating academic units and will give definition to the program: the biochemistry of cell-signaling, enzymology, and molecular genetics. The integration of students with similar research interests, but different perspectives, into one program will benefit both students and faculty.

A program run jointly by three units requires a carefully planned administrative structure. Details will have to be finalized upon approval of the program, but the three participating units have agreed in principle that the following administrative structure would be desirable and workable. A Program Director chosen from among the faculty of the Departments of Chemistry & Biochemistry and of Biological Sciences would oversee the program with input from an executive committee, called the Biochemistry Graduate Committee. This committee would be formed with equal representation from the three participating units. Any faculty member at FIU holding dissertation advisor status and having a relevant research area could in principle apply for inclusion among the Biochemistry Faculty authorized to mentor Biochemistry Ph.D. students. Approval of the three academic units jointly running the program would be required.

B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support. (See the SUS Strategic Plan at http://www.flbog.org/about/strategicplan/)

The proposed program is listed both in the current FIU New Academic Program 5-Year Plan and in the State University System Work Plan. The proposed Ph.D. program directly supports the following goals of the SUS Strategic Plan: Goals 1 (access to and production of degrees), 2 (meeting statewide professional and workforce needs) and 3 (building world-class academic programs and research capacity). The program indirectly supports Goal 4 (meeting community needs and fulfilling unique institutional responsibilities) via the program's support of the new medical school at FIU and the training of local students.

The Florida State University System's Strategic Planning Resource for the period leading up to 2012-13 also identifies the following as priorities: meeting skilled workforce needs and directing resources to targeted fields. Doctorates in emerging technologies are identified in particular. The proposed Ph.D. in Biochemistry meets all of these criteria. The biomedical and biotechnology fields are sustaining a very rapid growth at the present time, as the 21% projected growth in jobs for biochemists and biophysicists between 2004 and 2014 demonstrates.[1] Ph.D. training in biochemistry is critical for meeting the growing workforce demand.

The SUS Strategic Planning Resource also identifies a set of seven Accountability Measures. Among these are (III) to meet state workforce needs and (VII) to build world class academic research capacity. These measures clearly make the proposed program a priority. Furthermore, the SUS projects an increase of 58.2% in the number of first professional degrees, many of which are doctorates, between the 2002-03 and the 2012-13 academic years. The proposed Ph.D. program is clearly and directly supportive of these measures.

[1]D. E. Hecker, "Occupational employment projections to 2014," *Monthly Labor Review*, Nov. 2005, p.70.

II. Need and Demand

A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.

The growth of biomedical research on a national level requires input of doctoral level biochemists. Biochemistry provides the core understanding of not just medical but biological functions. It is the fundamental basis of genetics, physiology, neurology, nutrition, immunology, endocrinology and molecular biology. It has indispensable medical application in the search for new drugs. Scientists with doctoral degree in Biochemistry are employed mostly in pharmaceutical and other biotechnological industries, in medical research and in universities. Research institutions such as Scripps and Max Planck are developing new research centers in South Florida that will add to the demand for trained biochemists.

As mentioned above, a 21% growth in job openings for biochemists by 2014 (with respect to 2004 levels) has been projected.[2] For Florida alone, an annual percent workforce growth of 2.5% for jobs related to Medical and Clinical Laboratory Technology[3] was projected for 2008-2009 (that category would combine Ph.D., M.S., and B.S. openings), and an annual growth of 1.7% for biochemists, biophysicists and microbiologists has been projected for the period 2006-2014 (equivalent to 14% growth over the 8-year period).[3] Thus, the demand for students graduating from the proposed program with a Ph.D. in Biochemistry is clear at the local, state and national levels. Although these projections predate the economic downturn, we expect the trend to be valid as the economy improves.

B. Demand: Describe data that support the assumption that students will enroll in the proposed program. Include descriptions of surveys or other communications with prospective students.

The Department of Chemistry & Biochemistry alone receives 1-2 inquiries per week from students interested in a Ph.D. who would be better served by a Ph.D. in Biochemistry than by one in Chemistry. Many of these are, in fact, better prepared for a Ph.D. in Biochemistry than for one in Chemistry. Students, both from the United States and from foreign countries, have inquired when the Ph.D. program in Biochemistry might commence, and several have expressed a desire to enroll as soon as the program is available.

C. If similar programs (either private or public) exist in the state, identify the institution(s) and geographic location(s). Summarize the outcome(s) of any communication with such programs

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[2]2008-09 Florida Statewide Demand Occupations List, Florida Agency for Workforce Innovation: Labor Market Statistics, http://www.labormarketinfo.com/library/ep/p14sw00.xls.
[3]Florida Jobs by Occupation, Florida Agency for Workforce Innovation: Labor Market Statistics, October 2006, http://www.labormarketinfo.com/wec/tols/08-09_000000.pdf.

with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). Provide data that support the need for an additional program.

Within the Southeast United States, there are ten doctoral programs in the areas of Biological Chemistry, Biochemistry/Molecular Biology, and Biochemistry. In Florida there are only four: Florida State University (Biochemistry), University of Florida (Biochemistry and Molecular Biology), University of South Florida (Biochemistry and Molecular Biology), and the University of Miami (Biochemistry, offered in the School of Medicine). Only one of these is in the southern part of the state. Additionally, Florida Atlantic University's Ph.D. in Chemistry has an emphasis in chemical biology, but this does not serve the same need as a Ph.D. in Biochemistry *per se.* Given the currency of the discipline and the ascendancy of the biotechnology industry, and with the job growth projections of 14-21% by 2014 mentioned earlier, there is a clear and pressing need for more graduate education in biochemistry and molecular biology in South Florida. Furthermore, the proposed program does not duplicate any other program in the State University System. Both UM and UF were contacted but their Biochemistry programs are part of larger programs and do not admit students directly. Only FSU offers precisely the same Ph.D. in Biochemistry, and its program has a strong biophysics emphasis, which the proposed program does not. FIU's would be the only program specifically linked to the three units that are intrinsically tied to Biochemistry: the Department of Chemistry & Biochemistry, the Department of Biological Sciences, and the Wertheim College of Medicine. This coupling would enhance the program's ability to attract competitive federal funding for biomedical research and sustain a vigorous and focused Ph.D. program.

D. Use Table 1 (A for undergraduate and B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. Generally undergraduate FTE will be calculated as 40 credit hours per year and graduate FTE will be calculated as 32 credit hours per year. Describe the rationale underlying enrollment projections. If, initially, students within the institution are expected to change majors to enroll in the proposed program, describe the shifts from disciplines that will likely occur.

During the first year we expect roughly equal numbers of students entering from outside the university and transferring from within the university (to opt for the more specific degree in Biochemistry), for a headcount of 5 (FTE 3.75). This is based upon enquiries we have received from students both at and outside of FIU and is probably easily achievable. In the second year, the number of transfer students is expected to drop, and by the third year transfers will be rare. After the initial 1-2 years, we expect steady enrollment from graduates of other SUS institutions and out-of-state institutions. We expect total enrollment to reach a headcount of 27 (FTE 20.25) by the fifth year of the program, with 6 of these having graduated from FIU, 5 from other SUS institutions, and with most of the remainder being out-of-state or foreign. These projections, while of course approximate, are consistent with interest in the program that has already been expressed by candidate students. As mentioned above, we currently receive 1-2 enquiries per week in the Department of Chemistry & Biochemistry alone.

Thus in Table I-B we have projected growth at a modest rate. The growth rate is based upon the capacity of the current faculty to support the program and the numbers of graduate students who could be included in it, as well as on the projected interest described above. We believe that gradual growth will allow the program to develop in a healthy fashion.

E. Indicate what steps will be taken to achieve a diverse student body in this program, and identify any minority groups that will be favorably or unfavorably impacted. <u>The university's Equal Opportunity Officer should read this section and then sign and date in the area below.</u>

See following page.

Florida International University

DEGREE COUNTS BY COLLEGE, DEPARTMENT, DEGREE LEVEL & ETHNICITY

COLLEGE: College of Arts & Scienc

DEPARTMENT	ETHNICITY	ACAD_YR	BACHELORS	MASTERS	DOCTORAL
Biological Sciences	Asian	2007-2008	14	2	1
		2008-2009	21	0	1
		2009-2010	22	0	0
	Asian Total		57	2	2
	African American	2007-2008	20	0	0
		2008-2009	12	0	1
		2009-2010	18	0	0
	African American Total		50	0	1
	Hispanic	2007-2008	113	3	1
		2008-2009	130	1	1
		2009-2010	147	2	2
	Hispanic Total		390	6	4
	Other	2007-2008	1	1	1
		2008-2009	5	0	0
		2009-2010	6	2	3
	Other Total		12	3	4
	White	2007-2008	22	7	5
		2008-2009	27	4	7
		2009-2010	24	2	6
	White Total		73	13	18
	Not Reported	2007-2008	1	0	0
		2008-2009	1	0	0
		2009-2010	0	1	0
	Not Reported Total		2	1	0
Biological Sciences Total			*584*	*25*	*29*
Chemistry	Asian	2007-2008	3	0	0
		2008-2009	7	2	1
		2009-2010	4	0	0
	Asian Total		14	2	1
	African American	2007-2008	3	0	0
		2008-2009	4	2	1
		2009-2010	6	1	0
	African American Total		13	3	1
	Hispanic	2007-2008	38	2	0
		2008-2009	38	2	3
		2009-2010	32	2	3
	Hispanic Total		108	6	6
	Other	2007-2008	5	1	3
		2008-2009	2	3	2
		2009-2010	2	1	6
	Other Total		9	5	11
	White	2007-2008	4	3	0
		2008-2009	6	3	2
		2009-2010	4	5	1
	White Total		14	11	3
	Not Reported	2009-2010	0	1	0
	Not Reported Total		0	1	0
Chemistry Total			*168*	*28*	*22*
Grand Total			742	53	51

Source: Student Data Course File

* The latest term reflects preliminary data and is subject to change

The above chart summarizes the graduation statistics of the two existing departments for the most recent cohort data.

Clearly, Hispanics are well represented at FIU based upon the demographics of the Miami area. Black students are fairly well represented at the Bachelors level, but their representation drops off at the graduate level in the two participating departments. Since the Ph.D. program in Biochemistry is projected to draw in part from FIU, one way in which we will ensure diversity in the new program is to make information on the program available to undergraduate majors in chemistry and biology, both through written sources and through mentoring, specifically targeting black students. Since Hispanic students are already very well represented at FIU we expect that they will be reached as undergraduate majors by our usual informational outreach. Another way in which we will seek to attract black students is through mailings and faculty visits to historically black colleges such as FAMU. No minority groups will be unfavorably impacted by this program, but the outreach methods mentioned above should be implemented to achieve a diverse enrollment.

Shirlyon McWhorter, Equal Opportunity Officer

9/10/10
Date

III. Budget

A. Use Table 2 to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 to show how existing Education & General funds will be shifted to support the new program in Year 1. In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)

The most expensive component of the annual budget request, after the initial year, is the salary to support full-time graduate students with Teaching Assistantships (TA's). Research Assistantships (RA's) are supported through research grants of existing faculty. While TA's are the single largest cost, this cost is offset by revenue generated from the FTE's generated for the University by the TA's. Furthermore, advanced candidates in the third year (2013-2014) and beyond will be able to participate (fully or in conjunction with faculty) in teaching introductory courses as well as mentor undergraduate research students in their respective laboratories. We have budgeted for 5 TA's in Year 1 (2 from Biological Sciences and Chemistry; 3 new), with an increment of 2 new TA's each year from new funding, leveling off at 13 TA's in Year 5 at a total cost of $830,952, where we expect the program to remain for the foreseeable future. We also project an increase in the number of RA's to 14 in Year 5 funded solely from contracts and grants. (No RA's are planned in Year 1 because students choose their advisor during their first semester and are completing course work in Year 1.)

Since the curriculum shares many courses with the Biological Sciences and Chemistry graduate programs, the faculty costs appearing in Tables 2 and 3 represent the incremental costs of teaching and graduate student direction performed by participating faculty, as well as program direction for Biochemistry. Since the student headcount is projected to grow from 5 in Year 1 to 27 in Year 5, the faculty cost increases from $75,232 to $227,375 during the period, reflecting the percentage of time existing participating faculty will be devoting to the program. These costs represent salaries that the participating units already pay and will continue to support. The program director, to be chosen from the faculty of the participating departments, will devote 15% effort throughout the 5 year period. A half-time secretary to help with program management is also included in the budget. The program benefits from a Biochemistry Seminar Series, where experts from both within and outside of the state of Florida would present their research. This provides students with invaluable exposure to current trends in research. It brings together the faculty from the 3 participating units and provides a forum from which collaborations could grow. This expense is estimated at $2,000. By year 5, the total costs of the program will be $1,080,127.

B. If other programs will be impacted by a reallocation of resources for the proposed program, identify the program and provide a justification for reallocating resources. Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).

The new program will have no significant negative impacts on other programs. The reallocations identified in Table 3 is reflective of the incremental costs attributable to this specific program and will be part of the existing faculty's effort as it is expected that on average each faculty member will mentor one additional student. Most of the TA's will be incremental, not redirected from existing programs. All RA's are expected to be funded from new research awards.

Both the undergraduate and graduate programs in Chemistry & Biochemistry and in Biological Sciences will be positively impacted through increased research opportunities. The research program at the Wertheim College of Medicine will be positively impacted by the availability of student researchers. The new seminar series will expose students in these programs to national and international experts from other universities. An increasingly close working relationship among faculty from the three participating units will have a positive impact on their productivity, result in collaborations, and create a richer intellectual atmosphere for undergraduate and graduate students.

C. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).

There will be no direct impact on programs in any department aside from those discussed in section B. It is likely that as the program becomes generally known, additional undergraduates may be attracted to the Departments of Chemistry & Biochemistry and of Biological Sciences due to the currency of biochemical research and biotechnology. The program will provide an educational opportunity for undergraduate majors who might continue for a Ph.D. at FIU. At the graduate level, there may be a small impact on these departments as a few students transfer from their graduate program to the new one. That should only last 1-2 years, and as the graduate enrollment of the two departments is currently 107 (Biological Sciences) and 76 (Chemistry & Biochemistry), the impact will be relatively small. In the future, the impact on these departments will be positive.

The Ph.D. in Biochemistry will attract highly qualified graduate students. They will work primarily in the Departments of Biological Sciences and Chemistry & Biochemistry and in the Wertheim College of Medicine, but some will work in other science departments. There has already been collaborative work with Physics faculty involving biophysical projects and with Biomedical Engineering faculty involving projects in biotechnology. Because Biological Sciences and Chemistry & Biochemistry have successful ongoing M.S. and Ph.D. programs, the Biochemistry graduate students will be easily accommodated. Both departments have M.S. and Ph.D. students whose research could easily be classified as Biochemistry or Molecular Biology, but have graduated or will be graduating with degrees in Chemistry or Biological Sciences. No other departments or units within FIU have such an academic concentration. The Ph.D. in Biochemistry will strengthen the relationship among the Departments of Biological Sciences and Chemistry & Biochemistry and the Wertheim College of Medicine. Furthermore, it will foster collaborative research between them and also with participating faculty from other departments.

D. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental

entities, etc.). Describe the external resources that appear to be available to support the proposed program.

Federal agencies will be the predominant source of outside resources for the program, in the form of federal research grants. The participating faculty members from the three units are already familiar with these opportunities. Together, they have been awarded $14,368,322 in research grants from federal agencies over the past three years. The predominant granting agencies for these faculty members were the NIH, NSF, EPA, Department of the Interior and Department of Defense. This funding, particularly that from NIH, will likely increase as the program strengthens collaborative research between the departments and the additional students carry out more research. Participating faculty also hold grants from other sources (e.g., American Heart Foundation), and, while these will constitute a more modest funding source than federal agencies, they will continue to be sought out for funding as well.

IV. Projected Benefit of the Program to the University, Local Community, and State

Use information from Table 1, Table 2, and the supporting narrative for "Need and Demand" to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.

Quantitative benefits: Student headcounts in Table 1-B, will grow from 5 to 27 in the first five years of the program. These graduates will help to meet the 14-21% job growth nationally and statewide that is forecast in the area of biochemistry between 2004 and 2014. While at FIU, these students will perform much of the research that is funded by the $20,000,000+ of federal grant money that was brought in by faculty participating in the proposed program over the last 5 years. This program will contribute to increased awards and projects and provide solutions to solve local and national problems. The 11 participating faculty from Biological Sciences, the 12 participating faculty from Chemistry & Biochemistry and the 5 participating faculty from the Wertheim College of Medicine will have much closer contact through joint committees, a joint Biochemistry seminar series, and running a joint Ph.D. program. This will lead to collaborative efforts with a favorable impact on grantsmanship and publication rates. The first class of students for FIU's new medical school entered in 2009. These and future students will be able to do research with faculty participating in the Biochemistry Ph.D. program, which will strengthen the medical school.

Qualitative benefits: FIU is now a High Research university (Carnegie classification) with a strong emphasis on scientific research, and it aspires to become a Very High Research university. Given the current vitality of research in biotechnology, the opening of branches of the Scripps and Max Planck Research Institutes in Palm Beach County and the opening of FIU's medical school in 2009, a Ph.D. program in Biochemistry could hardly be more appropriate. The new program supports and complements many of the strategic goals of the units involved and of the University. The program also strengthens the newly created School of Integrated Science and Humanity within the College of Arts and Sciences, which is envisaged as a platform for multidisciplinary research pertaining to human health. The combination of biochemistry and molecular biology will enhance the graduate programs of all of the units involved as well as

attract superior students. The program supports the University's themes of Health (biomedical sciences), Florida and Local Development (biomedical research supports health product development), International (by attracting international students and supporting collaboration with foreign universities), and Learning Opportunities. Through this joint program, a learning opportunity will emerge in South Florida in which existing FIU faculty are enhanced, and partnerships with biomedical corporations and laboratories locally and abroad are built.

The new medical school will need to provide research opportunities in biochemistry for its medical students. This proposed program consolidates and strengthens such opportunities available through the three participating units, allowing the medical school to concentrate its efforts in medical education. Likewise, students in the Biochemistry Ph.D. program could work with medical school faculty doing research requiring biochemical expertise. Medical students interested in a combined MD/PhD program will enroll in the Biochemistry Ph.D. program.

Finally, as described in section I-B above, the proposed Ph.D. program will benefit the State through direct support of the SUS Strategic Planning Goals 1, 2 and 3 for degree production and meeting professional and workforce needs, particularly in the targeted area of emerging technologies.

V. Access and Articulation – Bachelor's Degrees Only (section omitted, not applicable)

INSTITUTIONAL READINESS

VI. Related Institutional Mission and Strength

A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan.

In its Mission Statement, FIU identifies research for discovery, invention, and innovation as a priority. The proposed program clearly addresses this priority through its support of biotechnology and medical advancement. The Mission Statement identifies FIU's region of service as extending from the local--South Florida--to the State and beyond to the national and international arenas. The proposed program expects to draw students from all of these regions and, upon their graduation, expects to place them in all of these regions as well, although with an emphasis on South Florida and the State. The Ph.D. in Biochemistry will also support the Mission Statement's emphasis on "discovering new knowledge," with the synergy that will be created as faculty from Chemistry & Biochemistry, Biological Sciences, and Medicine engage in research projects that will greatly contribute to our understanding of biochemistry and molecular biology.

To carry out its Mission Statement, FIU has identified six Strategic Themes. The Biochemistry Ph.D. embodies three of them: Health, Florida and Local Economic Development, and Learning Opportunities. The connection with Health has already been made amply clear through the Biochemistry Ph.D. program's support of the new medical school. Support of economic development locally and statewide will be effected by training students for work in the emerging biotechnology field and biotechnology institutions such as Max Plank and Scripps that are locating to the area. The joint effort of the three units involved will make the program an

exciting and novel learning opportunity in South Florida.

Finally, we note that FIU's explicit vision is to be a top, urban, public, research university. Achieving this goal requires a strong research program in the context of today's emerging technologies. Clearly, the proposed Biochemistry Ph.D. program addresses this need, and its collaboration with the Wertheim College of Medicine make its prospects for success particularly strong. Thus, the proposed program is strongly supportive of FIU's Statements on Mission, Vision, and Strategic Themes.

B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.

The proposed program has specific relationships with a number of programs from around the University. First, this program strongly supports FIU's strengths in Biological Sciences and Chemistry & Biochemistry, two departments demonstrating academic success and breadth at both the undergraduate and graduate levels. This strength is demonstrated, for example, through competitive grant support of biomedical research and training. Faculty in both departments have been successful in obtaining significant support from the National Institutes of Health, National Science Foundation, Environmental Protection Agency, Department of the Interior, and Department of Defense for biochemical and molecular biological research. The Department of Biological Sciences is, with 41 faculty, one of the largest in the university; the Department of Chemistry & Biochemistry, with 31 faculty, is also one of the larger departments. The Ph.D. program in Chemistry identifies biomedical research as one of its two areas of explicit emphasis. Both departments and their Ph.D. programs will be strengthened by the research and intellectual activity brought through the joint Biochemistry Ph.D. program.

Second, the proposed program will also support and be supported by the recently opened Wertheim College of Medicine. The biochemists already hired by this college are ready to recruit students into the proposed program. Biochemistry and molecular biology are an integral part of the research conducted by scientists in medical schools around the nation. Third, the faculty in the Department of Biomedical Engineering within the College of Engineering and Computing are already collaborating with those in Biological Sciences and Chemistry & Biochemistry; they are expected to play an important role in the training of the students in the proposed program and to expand their current research projects with their colleagues in Arts and Sciences.

C. Provide a narrative of the planning process leading up to submission of this proposal. Include a chronology (table) of activities, listing both university personnel directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program.

The planning process began in 2000 when a departmental review suggested strengthening the Department of Chemistry in the area of Biochemistry. This was consistent with one of two areas of strategic emphasis identified for the Ph.D. program in Chemistry at its inception. In 2001, the name of the department was changed to Chemistry & Biochemistry in keeping with this emphasis. More broadly, faculty from Biological Sciences and Chemistry & Biochemistry have repeatedly suggested that a Ph.D. in Biochemistry would enhance both departments' graduate programs and more accurately reflect the nature of graduate research in both departments.

Faculty from each department have long been serving on thesis and dissertation committees of the other department. That Biochemistry has traditionally been a marriage of bioorganic chemistry and molecular biology was another impetus for development of a joint program.

Ongoing discussion among the Departments of Chemistry & Biochemistry and Biological Sciences and the office of the Dean of the College of Arts & Sciences culminated with the placement in 2005 of a Ph.D. in Biochemistry on the Master Plan for new program development. Thus, in 2005 a Biochemistry Ph.D. Committee was established and began discussions on how such a program could be implemented using the strengths of the departments. A feasibility study was developed by Fall 2006 and was approved in Summer 2007. It was then developed into a full proposal. The proposal was approved at all required levels of University governance. However, the financial crisis that began in 2008 kept the proposal from being advanced to the Board of Governors at that time. Ph.D. programs were being eliminated statewide, and new ones were not being established. The opening of FIU's Wertheim College of Medicine in 2009 increased the urgency of the need for the Ph.D. in Biochemistry. This final version incorporates the earlier version with necessary changes to include time-sensitive information.

Planning Process

Date	Participants	Planning Activity
2000	Department of Chemistry and Outside Program Reviewer	Department Review
2001	Department of Chemistry	Change of name to Department of Chemistry & Biochemistry
2005	Dean of the College of Arts & Sciences and President of FIU	Biochemistry Ph.D. added to university Master Plan for new program development.
Spring, 2006	David Chatfield (Chemistry & Biochemistry) and John Makemson (Biological Sciences)	Begin drafting the feasibility study. Held several joint faculty meetings to develop an academically rigorous program that successfully links both departments.
Fall, 2006	same	Feasibility study completed; full proposal begun.
Fall, 2009	David Chatfield (Chemistry & Biochemistry), John Makemson (Biological Sciences), and Barry Rosen (Wertheim College of Medicine)	Full proposal revised with the inclusion of the Wertheim College of Medicine

Events Leading to Implementation

Date	Implementation Activity
Fall, 2006	Feasibility study submitted to the Dean's Office and Graduate School for review.
Summer, 2007	Feasibility study approved; full proposal preparation begun with newly released forms
Fall, 2007	Proposal submission through FIU's curricular process: approval by Arts and Sciences Curriculum Committee and Dean's Office.
Spring, 2008	Proposal approved by Faculty Senate after review by the University Committee Curriculum Committee and the Graduate Council.
Spring, 2010	Proposal approved by FIU Provost and President.
Fall, 2010	Proposal approved by FIU Board of Trustees
Fall, 2010	Submission to the Florida Board of Governors

VII. Program Quality Indicators - Reviews and Accreditation

Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit. List all recommendations and summarize the institution's progress in implementing the recommendations.

Department of Chemistry & Biochemistry

The American Chemical Society has long accredited the undergraduate B.S. degree program of the Department of Chemistry & Biochemistry. The Chemistry Program was last re-accredited in 2007.

The graduate program developed a strategic plan in 2002, which formed an important part of the Department's program review; its external reviewer was Dr. R. Bruce Dunlap, then of the University of South Carolina. The administration of FIU, under the leadership of then-provost Mark Rosenberg, formed a set of priority recommendations for the Department on the basis of Dr. Dunlap's recommendations and the strategic plan. The main points and the Department's response to them are summarized below.

The Department's Strategic Plan for 2002-2010 set as a goal significant progress toward becoming one of the top 50 chemistry departments in the country. To move toward this goal, the plan focused on faculty hires, external funding, the growth of the graduate program, and the needs of the undergraduate program. Below, goals are in italic, and progress made toward achieving them is in normal font.

1. *A hiring target of one incremental faculty per year was established; it was recommended that four of the eight recommended hires be biochemists, as biomedical research is one of two areas of explicit emphasis of our doctoral program.* Since 2002, seven incremental tenure-track faculty have been hired, four of them biochemists [Dr. Watson Lees (bioorganic chemistry) in 2003, Dr. Xiaotang Wang in 2005, Dr. Jaroslava Miksovska in 2007, and Dr. Yuan Liu in 2010].
2. *An increase in start-up packages to an average of $300,000 was recommended to attract competitive applicants.* The biochemistry hires since 2002 have received $170,000 (2003, bioorganic), $300,000 (2005), $325,000 (2007) and $350,000 (2010) in start-up. Clearly, the university has moved toward being competitive in this regard.
3. *In recognition that a strong level of external funding is needed to support a graduate research program, specific targets were made, with the 2009-10 target of $3,780,000 roughly double the 2001-2002 level.* That target was surpassed in 2009--$4,483,468.
4. *To support growth of the program in terms of funding, research and new hires, the Department established a target increase in the total number of graduate students from 36 in 2001 to 76 in 2009, and an increase in Ph.D. students in particular from 16 in 2001 to 56 in 2009.* In 2009, these numbers were 73 for total graduate students and 65 for Ph.D. students. The external program review in 2002 proposed a growth in RAs to 30% by 2009. From 2007-2009, the number of RAs averaged 25% of the total number of funded graduate students; fluctuations occur when new students are put on RAs and old students graduate. We are seeking to improve this number through continued increases in external funding.
5. *The Department has maintained a commitment to strong undergraduate teaching. It was recognized that research-active faculty must have lower teaching loads if they are to be productive in research, and a target of two courses per year per research active faculty was established.* In 2002, the average load was four courses; by 2007 it has become three courses. To allow this reduced teaching load without compromising the quality of undergraduate

teaching, since 2002 non-research-active faculty have assumed heavier teaching loads, and the Department has hired two additional instructors (Drs. Uma Swamy and Joseph Lichter), who do not have research assignments.

The External Program Review by Dr. Harry A. Frank in 2008 was generally complimentary to the program. He wrote in his "Overall Perspective:"

"The Department of Chemistry and Biochemistry has many positive attributes. Among these are a well-informed and dedicated Chair in Dr. Wnuk, a faculty deeply committed to its mission of teaching, research and service, undergraduate and graduate students proud to be associated with this community of scholars, well-equipped instrument laboratories for research and teaching, and a well-organized support staff dedicated to their tasks."

Regarding establishment of a joint Biochemistry Ph.D. program, Dr. Frank wrote:

"I am strongly in favor of this proposal. Biochemistry is a highly interdisciplinary field of science that uses the fundamental theoretical and experimental tools of chemistry for the exploration of problems in biology. Desirable concentrations for the proposed degree should build on existing faculty expertise and complement their research interests."

Dr. Frank also made specific recommendations. Those relevant to the graduate program are given below in italics, with Department responses following in normal font.

1. *Identification of adequate space for [new] hires and prompt renovation and preparation of the space has been problematic*. While this is still an issue, our most recent hire received brand new research space immediately upon arrival.
2. *Graduate student stipends are too low to attract the best and brightest.* Since the Dr. Frank's review, stipends have been raised from $18.5K to $23K.
3. *Faculty salaries are across the board too low*. The salaries of newly recruited faculty are now among the highest in the state. The problem of salary inversion remains but is also a national problem.
4. *There is a critical need for two Ph.D. level scientists to oversee the core NMR and mass spectrometry facilities.* We have since hired a Ph.D. scientist to oversee the mass spectrometry facility. We continue to apply for funding of a second position through a major research instrument grant.
5. *Hire a full time accountant to help with fiscal management of the research operation.* We have recently hired an accountant to do this.
6. *Hire an additional clerical person to help with the myriad activities of the Chair*. Movement on this has been slow.
7. *Clarify how the Environmental Chemistry and Environmental Health Science emphases in the Chemistry Ph.D. program are related.* The emphasis is really single: environmental chemistry. The health aspect was added at a later date and is not intended to be a separate emphasis. We are clarifying this in our new website. We recently approved an environmental track within our Chemistry Ph.D. program, and this will also make the nature of the environmental emphasis clear.
8. *Do not request faculty to charge for academic year effort in grant proposals.* This is no longer being required of faculty.
9. *Redesign the Department website.* A brand new website went online in spring 2010.

An External Review of the Doctoral Program in Chemistry was carried out by Dr. Arthur Ellis in 2009. In his review, Dr. Ellis stated "Overall, I was impressed by the current quality of the department and its capacity for nurturing excellence in scholarship." Dr. Ellis noted that the

program has grown rapidly, and he made specific recommendations, given below in italics, as the program enters a more mature stage. The Department responded by approving programmatic changes, provided below in normal font. As the review is so recent, implementation of many of these changes is planned to take place during the 2010-11 academic year.

Recruitment of Doctoral Students

1. *Increase financial support for students as feasible.* The University recently increased doctoral stipends to $23K.

2. *Eliminate unexpected fees for students upon their arrival at FIU for orientation.* The University recently adopted a policy of deducting those fees over the course of several paychecks rather than demanding them of new graduate students immediately upon arrival.

3. *Redesign the Department website so that it is a more effective tool for attracting prospective students.* Redesign of all department websites has been undertaken by the College of Arts & Sciences. The new website went live in Spring 2010.

Departmental Community.

4. *Identify a common space where doctoral students can meet informally.* A dedicated space for doctoral student use was identified and has been provided. This space will serve as office space for new students before they choose advisors and as informal meeting space for all students.

5. *Increase graduate student involvement in Departmental polity.* The Department recently approved graduate student liaisons for four Department committees.

6. *Decrease the faculty interview load for new students.* The Department recently approved decreasing the requirement from interviewing all research faculty (~31) to interviewing 10 faculty, including all faculty within one subdivision. This will significantly decrease the burden on students and faculty while ensuring that students become well acquainted with the Department before their choice of research advisor is final. The requirement for interviewing all faculty dated from a time when the Department was smaller; the policy revision is timely.

Professional Development of Doctoral Students

7. *Ensure that the requirements for the doctoral degree, particularly the milestones and timelines that need to be met, and the forms that need to be filed, are clear to students.* The Department approved creation of a succinct document outlining these issues to supplement the existing graduate program manual.

8. *Establish a process to ensure that duplication of topics in different graduate courses is minimized.* The Department has approved periodic review of graduate course syllabi by the Department's graduate committee.

9. *Address issues regarding candidacy exams. Having two kinds (comprehensive exams for forensic track students but cumulative exams for all others) causes confusion. Greater transparency (announced/unannounced topics, prompt grading) is desirable.* The requirements for the forensic track have been changed so that now all doctoral students in chemistry take cumulative examinations. A new policy of announcing topics within the first two weeks of the semester and of grading within two weeks following the exam has been successfully implemented.

10. *Make the purpose and requirements of the original proposal clearer to students.* The Department passed a motion to clarify the requirements and to make available to students examples of successful original proposals.

11. *Make further teaching opportunities, including for example recitation sections, available to students.* The Department recently approved recitation sections to be taught by

graduate students on a limited, trial basis with evaluation and possible expansion following.

12. *Introduce graduate students to issues of intellectual property and technology transfer.* The Department recently approved offering seminars on this topic on a biannual basis.

13. *Encourage student-initiated proposals for fellowships and travel funds.* The Department recently approved announcing such opportunities on the Departmental website and encouraging students to apply.

14. *Enhance training and access to Departmental instrumentation.* The Department recently approved having regular group training sessions on Departmental instrumentation. This supplements the previous policy, which was to provide one-on-one training at a student's request. One-on-one training will still be offered, but the group training will make the process more efficient by decreasing the length of time needed for one-on-one training.

15. *Computational facilities for scientific computation: Urge the administration is urged to establish a campus plan with broad campus input.* A University study is currently underway to design a central facility to house and administer scientific computing clusters.

Strengthening the Doctoral Program

16. *Encourage sharing of mentoring approaches*. The review committees for tenure-earning faculty have been charged with discussing mentoring strategies with new faculty.

17. *Make policies concerning masters-to-doctoral transitions clearer.* Masters-to-doctoral transitions are not automatic and require application to the doctoral program. The Department has undertaken to make the requirements and timeline clearer at the time that students enter the program.

18. *The administration should consider expanding opportunities for exploratory research by providing seed funding*. The Department is preparing a proposal to the College of Arts & Sciences for dedicating a portion of IDC money for support of students during the summer following completion of the qualifying exam, to enable them to make a fast start on research.

Evaluation

19. *Establish exit interviews for students upon graduation*. Procedures have recently been put in place for having an oral exit interview supplemented with a questionnaire.

20. *Establish an alumni chapter and corporate partners.* The Department has made this an explicit priority for the 2010-11 academic year. It has already established communication with the University alumni association office to begin the process.

Department of Biological Sciences

While the American Chemical Society accredits the B.S. in Chemistry, Biology has no degree accreditation by any professional organization. The last program review was held in 2009.

The External Review was conducted by Dr. Peter Greenberg (Professor, University of Washington Medical School, Member NAS). Dr. Greenberg made specific recommendations. His overall impression is that Biology is a productive department "The Department of Biological Sciences should be applauded for building a vibrant PhD program in the course of its short existence."He recommended: "It is the recommendation of this reviewer that HLS research space should house investigators from both the Department of Biological Sciences and the Wertheim College of Medicine. The research activities in both units will be closely aligned and this approach will ultimately foster beneficial interactions among investigators in both units." From the 2002 Program Review, Dr. Block's comments on undergraduate and graduate course work: "The Department is delivering appropriately challenging course work. I heard no

criticisms about the quality and content of the coursework; however I did hear complaints about the quality of the instrumentation in many teaching labs." And with regard to department's infrastructure: "barely adequate at present, the infrastructure will not support serious growth in laboratory experimental science. Perhaps the most serious problem for growth of the department in molecular and cellular areas is the lack of an adequate AAALAC-approved vivarium. Any significant growth in research programs requiring rodents will be impossible without more animal rooms, a full-time veterinarian on staff, and adequate support personnel."

In response to Dr. Block's major criticisms, the department has hired four new faculty in the Cell and Molecular Biology area (Drs. Barbieri, Kim, Mathee, and Noriega) to support the Biochemistry Ph.D. program. These faculty (joining the department since 2002) have obtained NIH and other grants. Dr. Noriega was awarded an R01 grant, and others (such as Dr. Mathee, formerly in Biology, now in the Wertheim College of Medicine) have also obtained NIH funding outside of MBRS and MARC funding. See section VI.A.4 for the equipment the department has acquired since Dr. Block's review; it is extensive and includes a confocal microscopy. Furthermore, the small animal quarters has been remodeled and a new cage washer and sterilizer have been added along with a full time AAALAC licensed technician.

The Department does not have a gene chip array facility but does have an agreement with the U.S. Department of Agriculture Research Station in southern Miami-Dade County that has a robotic gene chip array maker and other gene chip analytical equipment. Department faculty and students have used this facility in plant molecular biology studies. These investments in the Department by the University have paid off in terms of grant funding from federal sources (see section IX).

The FIU Administration's Executive Review Committee Report (August 2002) supported the "department's proposed programmatic initiatives…to strengthen programs in molecular and cellular biology, integrative biology, and marine biology. Also there is an expected continuing shift in emphasis toward doctoral education in all components of the department." This was reflected in one of the specific recommendations: "Increasing the number of doctoral students and the proportion of doctoral students supported by externally-funded research assistantships." The department has done that as well and has "Continue[d] interdisciplinary collaborations." Much of the Executive Review Committee Report did not specifically address Biochemistry, as the Department has other major programs in Marine Biology, Integrative Biology, and Ecology and Evolution besides the biochemically relevant Molecular and Cellular Biology program. At this time line, the major emphasis is to develop Molecular and Cellular Biology.

The Provost (November, 2002) provided the priority recommendations in italics below. The Department of Biological Sciences has addressed each recommendation as it relates to the Biochemistry Ph.D. program, as described in normal font.

1. *Develop a strategic plan that includes an implementation timeframe that addresses aggressive research, enrollment and faculty recruitment objectives the department has identified. Special attention must be given to development of a plan for graduate enrollment growth and doctoral degree production.* The number of biochemical faculty has increased, and the number of graduate students pursuing degrees in Molecular and Cellular Biology has increased to constitute roughly 1/3 of those pursuing Ph.D.s.

2. *Identify and plan for enhanced multidisciplinary research initiatives in areas such as biomedical, environmental, SERC, and bioinformatics.* The proposed Biochemistry Ph.D. program is multidisciplinary, encompassing both classical biochemistry and molecular biology.

3. *Address concerns about graduate workloads, externally funded research*

assistantships, and undergraduate advisement. The Department has reduced graduate teaching assistant workloads and increased the number of graduate students on research assistantships.

4. *Expand federal support for shared research equipment, NIH funding, and dissertation improvement fellowships through NSF.* We have expanded federal support and acquired shared equipment (sequencing lab, animal facility, electron microscope facility). Many students have been supported by EPA fellowships, and two are supported by NSF fellowships.

VIII. Curriculum

A. Describe the specific expected student learning outcomes associated with the proposed program. If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.

The Student Learning Outcomes for the proposed program are attached using the university format.

B. Describe the admission standards and graduation requirements for the program.

For admission into the program, students will:

(a) Hold a B.S. degree in Biology or Chemistry or the equivalent from an accredited college or university. At least 28 credits, including labs, of chemistry or biology courses at the upper division level are required. The following courses are recommended as background regardless of undergraduate major: biochemistry or molecular biology, two semesters of organic chemistry, and two semesters of general biology. Students not having taken physical chemistry or genetics will be required to make up these deficiencies either before or during their first year of graduate study by taking appropriate coursework.

(b) Have a GPA of at least 3.0 (on a four-point scale) during the last 60 credits of undergraduate program.

(c) Have a combined score of 1120 (verbal and quantitative) on the Graduate Record Exam.

(d) Have three letters of recommendation sent to the Biochemistry Program Director evaluating the applicant's potential for graduate and research work.

(e) Receive approval from the Biochemistry Graduate Committee (BGC).

(f) Foreign students whose native language is not English must obtain a score of 80 or higher on the TOEFL iBT (this corresponds to 550 on the old TOEFL test) or 6.3 overall on the IELTS. The University Graduate School has a list of countries that are exempt from this requirement.

The graduation requirements for the program will be:

(a) Completion of formal coursework (see above).

(b) Rotation and choosing an advisor. Students will spend 4-5 weeks in the laboratories of each of three Biochemistry Faculty. Some flexibility in length of rotation is acceptable. In most cases, the rotations will be completed during the first semester of study, but extension into the second semester is possible. At the end of each rotation, the student and the faculty member will complete an evaluation form. The form will be given to the BGC and kept in the student's file for reference in assessing the student's progress as well as monitoring the rotation program in general. After completing three (or in exceptional cases, four) rotations, students will submit an

ordered list of three advisors they would like to work with to the BGC. The BGC will make the assignment. Usually, but not necessarily always, this will be the student's top choice.

(c) Completion of Candidacy Exam. The Candidacy Exam consists of two parts: a written Qualifying Exam, and presentation of an Outside Research Proposal followed by a Preliminary Oral Exam.

The written Qualifying Exam will be administered at the end of the third semester of study (excluding summers), by which time all core courses should have been completed. The exam will be designed primarily to test material mastered in the core courses. The exam will be written by and graded by Biochemistry Faculty on a rotating basis. In a given semester, the same set of questions will be given to all students. It is expected that portions of the exam will be written with flexibility, allowing students a choice among questions involving depth of knowledge. Failure on the first attempt will result in one of the following:

1) dismissal from the program

2) reexamination or

3) application for transfer to the M.S. program in one of the participating departments.

Application for transfer to an M.S. program must be made to the department's Graduate Committee by the student with approval of the student's Dissertation Committee [see (f) below]. A request for reexamination must be made to the BGC jointly by the student and the dissertation committee. If approved by the BGC, reexamination may be scheduled after a minimum of one and a maximum of two semesters have passed. Only one reexamination will be allowed. Failure of the reexamination results in dismissal from the Biochemistry Ph.D. program.

After passing the written Qualifying Exam, the student will present and defend an original research proposal (on a topic not related to the student's specific doctoral research project) and undergo an oral examination. This will usually take place at the end of the fourth semester and not later than the end of the fifth semester of study (excluding summers). The original research proposal should be of moderate length. A brief update on the student's dissertation will also be given. The presentation and examination will occur consecutively in a single session. The examination will be conducted by the student's Dissertation Committee and may include questions on the oral presentation, the student's dissertation research, and the student's major and cognate fields. Passing the oral exam may not be conditional. The student either passes or fails on the basis of performance on the exam and cannot be passed contingent on satisfactory completion of courses or submission of research papers.

Upon passing the oral examination and having successfully completed all required course work and the Qualifying Exam, the student advances to Candidacy.

(d) Supervised Teaching. The ability to teach at the university level is an important skill that should be encouraged in all graduate students. For this reason, the Ph.D. in Biochemistry requires of all students two semesters of supervised teaching or documentation of the equivalent amount of teaching experience. In order to support the breadth of this interdisciplinary program, students will split their two-semester teaching requirement between the Department of Chemistry & Biochemistry and the Department of Biological Sciences, so that each student teaches for at least one semester in each department (unless credit is given for prior teaching experience). Teaching assignments must be approved by the Biochemistry Graduate Director and may be reviewed by the student's Dissertation Committee to ensure that the student's background is appropriate for the course he or she is to teach (generally a laboratory section).

(e) Presentation of a formal proposal of the dissertation topic, the Dissertation Research Proposal (Form D-3). Each student must present a public seminar on their proposed research.

This is done in the context of a one-credit course (see table below) for a letter grade. The members of the student's Dissertation Committee (see below) must be present, and they will probe the student's ability to discuss the proposed research as well as to present it.

(f) Annual Dissertation Committee Meetings (Form D-4). The student's Dissertation Committee, consisting of at least five members including the student's advisor, is formed immediately after the student's advisor is chosen. The committee's purpose is to guide and monitor the student's programs through the graduate program. Each doctoral student is required to meet at least annually with his or her Dissertation Committee, and the meetings are documented by annual submission of a completed form D-4 to the Biochemistry Program Director. In addition, every Spring Semester each student will meet with Biochemistry Graduate Program Director or her or his representative to provide an independent evaluation of the student's progress. This evaluation shall become a permanent part of the student's Graduate Program File.

(g) Submission and defense of a dissertation based upon original research in biochemistry. A dissertation is required of all candidates for the Ph.D. degree and must conform to the format outlined in the Regulations for Thesis and Dissertation Preparation Manual available to students online from the FIU Graduate School. Once a student advances to candidacy, the student must be continuously enrolled in at least three credits each semester including Summer term until he or she graduates.

After submission of the dissertation and completion of all other prescribed work for the Ph.D. degree, the candidate will give a public presentation of the completed research and be given a final oral examination by the Dissertation Committee. Successful completion of all of these steps will culminate in the granting of the Ph.D. degree.

C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements. Identify the total numbers of semester credit hours for the degree.

The proposed PhD in Biochemistry will require 75 semester hours. Its curriculum has been designed to ensure that the students gain a firm grounding in biochemistry while at the same time allowing for specialization in either biochemistry or molecular biology. Students will receive rigorous training in the theory and techniques of biochemistry and molecular biology through formal coursework, laboratory rotations, doctoral mentoring, dissertation research, and the writing of the dissertation. Students will develop scientific communication skills through formal courses, internal seminars, and presentations at meetings at the local and national levels. Students will be trained in scientific ethics and entrepreneurship. Students are expected to become expert in the field of biochemistry and/or molecular biology and be competitive for careers in the private sector and in academics.

The aim of the proposed Ph.D. program in Biochemistry is to train future scientists who can be independent investigators either in industry or academia. To this end, we have designed a curriculum that emphasizes both basic knowledge of and recent advances in biochemistry as well as common techniques required in contemporary biochemical/pharmaceutical research. Our program will also address industrial applications of biotechnology and entrepreneurship. The success of applying biotechnology in the development of novel industrial processes and products has greatly improved the quality of our daily lives and has created an increasing commercial and public interest in the recruitment of highly qualified graduates. For this reason, we believe this

program will attract numerous students who can take on the challenge of advanced research in biochemistry. No industry advisory council for programs in biochemistry at the Ph.D. level currently exists. We will organize such a council to provide input and improvement for curriculum development and student assessment.

The course and credit requirements are summarized in the following table.

REQUIRED COURSES

Course Number	Description	Credits
	CORE COURSES	
CHM/BCH 6831	Introduction to Biochemical Research	3
CHM 6108	Biochemical Techniques	3
CHM 6036	Advanced Biochemistry I	3
PCB 6025	Molecular and Cellular Biology I	3
CHM 6037 PCB 6027	Advanced Biochemistry II **or** Molecular and Cellular Biology II	3
BSC 6930 (tentative number)	Ethics, Publication, and Intellectual Property	1
	COURSES BEYOND THE CORE	
CHM, BSC, PCB, MCB or BCH	Two Electives, see below	5 (minimum)
BSC 5945 or CHM 6940	Supervised Teaching	2 (minimum)
BSC 6913 or CHM 6910	Student Research Laboratory or Graduate Research in Chemistry (for Lab Rotations)	1
BSC 7961 or CHM 6936	Dissertation Proposal Seminar or Chemistry Colloquium	1
BSC 6936 or CHM 6935	Topics in Biology or Graduate Seminar	4 (minimum; 1 each semester)
BSC 7980 or CHM 7910	Ph.D. Dissertation or Dissertation Research	24 (minimum)
BSC 7982 or CHM 7980	Dissertation Defense Seminar or Ph.D. Dissertation	1 (minimum)

ELECTIVE COURSES

Course Number	Description	Credits
	COURSES	
BSC 6415 BSC 6415L	Animal Cells in Culture Animal Cells in Culture Lab	3 2
CHM 5302	Organic Chemistry of Nucleic Acids	3
CHM 5325	Physical Chemistry of Proteins	3
CHM 5351	Computer Modeling of Biological Molecules	3
CHM 5440	Kinetics and Catalysis	3
CHM 5503	Physical Chemistry of Nucleic Acids	3
CHM 5506	Physical Biochemistry	3
CHS 5536	Forensic DNA Chemistry	3
MCB 6935	Advanced Topics in Microbiology	3
PCB 5665 PCB 5665L	Human Genetics Human Genetics Lab	3 2
PCB 5725	Membrane Signal Transduction	3
PCB 5786	Membrane Physiology	3
PCB 6236	Comparative Immunology	3
PCB 6526	Advanced Molecular Biology	3
PCB 6566	Chromosome Structure and Function	3
PCB 6786	Membrane Biophysics	3
PCB 6935	Advanced Topics in Genetics	3
	WORKSHOPS	
BCH 6130C	DNA Synthesis & Amplification	1
BCH 6132C	Electrophoresis	1
BCH 6133C	DNA Sequencing	1
MCB 5315C	Prokaryotic Cloning	2

D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.

The formal course curriculum is designed to ensure thorough grounding in Biochemistry as well as choice for specialization. A set of core courses is required of all students (Introduction to Biochemical Research, Biochemical Techniques, Advanced Biochemistry I, Molecular and Cellular Biology I, and Ethics, Publication and Intellectual Property), with a choice between Advanced Biochemistry II or Molecular Biology II as the final core course. Two electives, chosen from a list of approved courses, are also required. Two workshops, short courses introducing particular experimental techniques, may be substituted for one of the electives. The electives and workshops are chosen in consultation with the student's dissertation committee and with the approval of the Biochemistry Graduate Committee.

Course of Study:

First Year, Fall Semester:

Students enroll in 2 core courses: Advanced Biochemistry I and Biochemical Techniques. Students will also spend 4-5 weeks in the laboratories of each of three faculty members in the Biochemistry Ph.D. program as part of their research rotation (BSC 6913 or CHM 6910; 1 credit). In addition, students will register for Supervised Teaching (1 credit) and the seminar course, which will be a unique seminar series in biochemistry (1 credit). The total number of credits for new graduate students is 9 credits in their first semester.

First Year, Spring Semester:

Students take Introduction to Biochemical Research, Molecular and Cellular Biology I, and Ethics, Publication, and Intellectual Property. If students have chosen a research advisor, they are required to perform research in the advisor's laboratory. Alternatively, students may do a fourth rotation if they have not chosen a research advisor. After this rotation, the students are expected to choose a research advisor and conduct research in the advisor's laboratory. In addition, students will register for Supervised Teaching (1 credit) and, as in all spring and fall semesters, for the seminar series (1 credit).

First Year, Summer Semester:

Students will enroll in 6 research credits to conduct research work in their advisor's laboratory.

Second Year, Fall Semester:

Students are required to take one more core course, either Advanced Biochemistry II or Molecular and Cellular Biology II. Graduate students are also required to take a 3-credit elective course or its equivalent, in consultation with the student's dissertation committee and with the approval of the Biochemistry Graduate Committee. In this semester, students will present the Dissertation Proposal (1 credit) to their dissertation committee. Students will also register for seminar series (1 credit) and for research hours.

Second Year, Spring Semester:

In consultation with the student's dissertation committee and with the approval of the BGC, students enroll in another elective course, the seminar series (1 credit) and additional research hours.

Other Requirements:

A grade of "C" or higher must be obtained in all courses, and a cumulative GPA of 3.0 or

higher must be maintained. At least 21 credits of formal course work are required, distributed between required and elective courses (see section B for detail). In addition, credit is earned for Graduate Research, Dissertation Research Proposal, Graduate Seminar, Dissertation Research, Dissertation Defense Seminar, and Supervised Teaching. These requirements for non-elective courses beyond the core are fulfilled through courses offered in either the Department of Biological Sciences or the Department of Chemistry and Biochemistry (see table above); either choice will satisfy the requirement. The student's Dissertation Committee will assist the student to choose a curriculum suitable to the student's interests, goals, and background. This will include selection of electives as well as the suggestion of other courses that may be needed to develop skills critical for the student's research and career goals, especially quantitative skills.

E. Provide a one- or two-sentence description of each required or elective course.

Core courses:

1. CHM/BCH 6831: Introduction to Biochemical Research. Analysis of existing biochemical data and experimental design.

2. CHM 6108: Biochemical Techniques. Introduction of theories of basic biochemical techniques commonly used in a biochemistry laboratory.

3. CHM 6036: Advanced Biochemistry I. Provides beginning graduate students with an overview of the structure and function of proteins, enzymes, and nucleic acids with an emphasis on the current literature of these topics.

4. CHM 6037: Advanced Biochemistry II. Introduction to biochemical pathways regulation and intra- and extracellular communication on the molecular level.

5. PCB 6025: Molecular and Cellular Biology I. Protein structure, catalysis, kinetics, and molecular conformation, intermolecular forces; Prokaryotic molecular biology including prokaryotic recombination, transcription and translation, gene regulation and genome organization.

6. PCB 6027: Molecular and Cellular Biology II. Eukaryotic recombination, transcription, translation, gene regulation and genome organization; cellular components, cell structure, cell division, cell signaling, development, immunology and cancer.

7. BSC 6930 (tentative number): Ethics, Publication, and Intellectual Property. Introduction to research ethics & social responsibility; research misconduct, conflicts of interest/commitment; authorship/publication/peer review; data security/ownership; and intellectual property including entrepreneurship.

Courses beyond the core:

1. BCS 5945/CHM 6940: Supervised teaching. Graduate student serves as lecturer and demonstrator in undergraduate laboratories coordinated and supervised by a faculty member.

2. BSC 6913/CHM 6910: Student Research Laboratory / Graduate Research in Chemistry. Student works directly with a professor on a research project; credit is assigned on the basis of four hr/wk per credit hour.

3. BSC 7961/CHM 6936: Dissertation Proposal Seminar / Chemistry Colloquium. Presentation of doctoral dissertation proposal seminar; students are coached on techniques of oral presentations, present their own proposal seminar, and observe the seminars of the other students.

4. BSC 6936/CHM 6935: Topics in Biology / Graduate Seminar. An examination of various current research topics in biochemistry and molecular biology.

5. BSC 7980/CHM 7910: Ph.D. Dissertation / Dissertation Research. Research towards the completion of a doctoral dissertation.

6. BSC 7982/CHM 7980: Dissertation Defense Seminar / Ph.D. Dissertation. Completion of doctoral dissertation and presentation of dissertation defense.

Elective courses:

1. BSC 6415/6415L: Animal Cells in Culture. Biology of animal cells cultured in semi-synthetic media: cell nutrition growth, cell cycle analysis, cellular transformation and differentiation, heterokaryons and somatic cell genetics.

2. CHM 5302: Organic Chemistry of Nucleic Acids. Organic chemistry of ribose sugars, nucleoside bases, mechanism-based inhibitors of enzymes involved in nucleic acid metabolism, and chemical synthesis of DNA.

3. CHM 5325: Physical Chemistry of Proteins. Protein structures, dynamics and functions; use of spectroscopic methods; thermodynamics of protein folding and ligand binding; enzyme kinetics.

4. CHM 5351: Computer Modeling of Biological Molecules. Introduces use of computers in studying biological macromolecules, covering simulation and visualization methods; software; databases.

5. CHM 5440: Kinetics and Catalysis. Theory of elementary reactions, activated complex theory,
mechanisms of complex reactions.

6. CHM 5503: Physical Chemistry of Nucleic Acids. Physical chemistry of nucleic acids including spectroscopic determination of structures of DNAs, RNAs, and DNA-protein complexes and thermodynamics and kinetic studies of nucleic acid-ligand complexes and nucleic acid structures.

7. CHM 5506: Physical Biochemistry. Physical properties of biomolecules, molecular conformation; thermodynamic, kinetic, and spectroscopic properties of biomolecules.

8. CHS 5536: Forensic DNA Chemistry. The application of molecular genetic techniques in forensic DNA typing including extraction, PCR amplification and population statistics

9 MCB 6935: Advanced Topics in Microbiology. An intensive study of particular microbiological topics not otherwise offered in the curriculum.

10. PCB 5665/5665L: Human Genetics. Principles and techniques in the analysis of the human race.

11. PCB 5725: Membrane Signal Transduction. Hormones and neurotransmitters as extracellular messengers; membrane receptors and mechanisms of signal transduction: membrane channels and enzymes, direct linkage and G-protein linkage; second messengers.

12. PCB 5786: Membrane Physiology. Chemical and physical properties of the plasma membrane, its biosynthesis and functions in transport and signal transduction.

13. PCB 6236: Comparative Immunology. An analysis of the immune systems and mechanisms of invertebrate and vertebrate animals.

14. PCB 6526: Advanced Molecular Biology. Molecular genetics, controlling mechanisms, recombinant DNA, gene splicing and gene vector construction of viral, bacterial, plant and animal systems.

15. PCB 6566: Chromosome Structure and Function. Structural organization and function of the prokaryotic and eukaryotic chromosome: euchromatin/heterochromatin, replication, repair, DNA sequence organization and changes during differentiation and development.

16. PCB 6786: Membrane Biophysics. The structure and function of cell membranes: ionic transport, passive electrical properties, and excitation.

17. PCB 6935: Advanced Topics in Genetics. An intensive study of particular genetical topics not otherwise offered in the curriculum.

18. BCH 6130C: DNA Synthesis & Amplification. Workshop in the chemical synthesis of DNA and the amplification of specific genes by the polymerase chain reaction (PCR). Students may synthesize DNA oligonucleotides for use in their own research.

19. BCH 6132C: Electrophoresis. Workshop in the application of electrophoresis to biochemical and genetic experimentation. Students may use material from their own research in the laboratory section.

20. BCH 6133C: DNA Sequencing. Workshop in the manual and automated sequencing of DNA; students may sequence DNA from their own research.

21. MCB 5315C: Prokaryotic Cloning. Workshop on the description of molecular genetic methods for manipulation of prokaryotic DNA.

F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and identify if any industry advisory council exists to provide input for curriculum development and student assessment.

No such industry council exists and therefore specific industry-driven competencies were identified through the faculty participating in the design of this program. It bears noting that the development of this program has spurred conversation in Southeast Florida about the need to establish such a council to provide this needed component as the program develops.

G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate.

There is no accrediting agency for programs in biochemistry at the Ph.D. level.

H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?

The American Chemical Society establishes requirements for ACS approved Bachelor of Science degrees in Chemistry and Chemical Engineering and makes recommendations with respect to Bachelors of Arts degrees in Chemistry. The Department of Chemistry & Biochemistry offers a Bachelor of Science degree that is approved by the ACS. The American Society for Biochemistry and Molecular Biology (ASBMB) has interests in undergraduate and graduate education in biochemistry and molecular biology but does not involve itself in program approval or accreditation activities at this time.

I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 2. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

The traditional delivery system on the main campus approach will be employed for the Ph.D. in Biochemistry Program. The delivery program does not require specialized services for delivery. It is not feasible to deliver the program in collaboration with other universities, whether public or private. It is expected that the program will eventually include graduate students from the Department of Biomedical Engineering.

IX. Faculty Participation

A. Use Table 4 to identify existing and anticipated ranked (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practica, and supervising thesis or dissertation hours).

There are 28 faculty from the three units who plan to participate in the program. All of these faculty will hold dissertation advisor status. Items (a) through (g) are detailed in Table 4. Of the 28 faculty, 23 are tenured and 5 tenure-earning. This will provide ample faculty resources for mentoring, research, and teaching.

B. Use Table 2 to display the costs and associated funding resources for existing and anticipated ranked faculty (as identified in Table 2). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.

The proposed program draws upon 28 existing faculty (see Table 4). The total cost for faculty rises from $75,232 in Year 1 to $227,375 in Year 5. The increased cost reflects the growth in student enrollment from 5 to 27, with the consequent increase in faculty resources dedicated to the program. These salaries are already paid by the departments concerned, and this will continue. There are no adjunct faculty participating in the program and therefore there are no costs reflected in Table 2.

Faculty will be incrementally responsible for teaching three additional courses the first year and one additional courses in the second year that were not already provided by the departments of Biological Sciences and Chemistry & Biochemistry. Since many of the faculty are qualified to teach these courses, the additional instructional effort was distributed among all faculty as their assignment may vary based on sponsored research activities.

C. Provide the number of master's theses and/or doctoral dissertations directed, and the number and type of professional publications for each existing faculty member (do not include information for visiting or adjunct faculty).

Below is a table with the name of each faculty participating in the program, the number of theses and dissertations directed and the number of refereed publications.

Faculty Name	Theses	Dissertations	Professional Publications
Alejandro Barbieri	3	10	55 refereed
Hiranmoy Bhattacharjee	0	0	23 refereed
Charles Bigger	6	3	26 refereed
David Chatfield	2	0	24 refereed
Tim Collins	2	2	24 refereed
Anthony DeCaprio	1	1	51 refereed

Javier Francisco-Ortega	4	1	80 refereed
Rene Herrera	17	7	105 refereed
Konstantinos Kavallieratos	3	0	21 refereed
Leung Kim	0	0	10 refereed
Lidia Kos	4	3	15 refereed
John Landrum	13	0	47 refereed
Fenfei Leng	4	1	12 refereed
Watson Lees	4	5	40 refereed
Yuan Liu	0	0	24 refereed
John Makemson	15	0	31 refereed
Kalai Mathee	9	1	30 refereed
Bruce McCord	1	8	49 refereed
Jaroslava Miksovska	1	0	28 refereed
Joong-Ho Moon	0	0	16 refereed
Rita Mukhopadyay	0	0	42 refereed
Kenneth Murray	0	0	7 refereed
Fernando Noriega	0	0	35 refereed
Kathleen Rein	2	3	38 refereed
Barry Rosen	2	20	198 refereed
Martin Tracey	19	4	42 refereed
Xiaotang Wang	0	0	28 refereed
Stan Wnuk	5	2	96 refereed

D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.

The three participating units have been successful in attracting external funding support. For example, over the last 3 years, biochemical-molecular grants for faculty in the Department of Biological Sciences totaled $4,801,854. Thus, the faculty demonstrate competence in obtaining federal research funding. During the same period, the biochemical-molecular grants for faculty in the Department of Chemistry & Biochemistry totaled $4,733,468, almost entirely from federal agencies. Also during this period, the biochemical-molecular grants for the participating faculty in the Wertheim College of Medicine totaled $4,883,000, all from federal agencies (since the Wertheim College of Medicine is so new, this includes grants obtained by those faculty while at their previous institutions). The major granting agencies for all these faculty are NIH, NSF, EPA, Department of the Interior and Department of Defense.

The Departments of Chemistry & Biochemistry and of Biological Sciences both have full, active graduate programs at the M.S. and Ph.D. levels: for AY 2009-10 Biological Sciences had 95 graduate students; Chemistry & Biochemistry, 76 graduate students. Over the past three years, the Department of Chemistry & Biochemistry has graduated 21 Ph.D. students; the Department

of Biological Sciences has graduated 18. 502 Grad I and Grad II FTEs have been generated (this figure includes FTEs in all the sub disciplines).

Achieving this level of productivity has required that both departments coordinate the teaching load of tenured and tenure-track faculty to ensure adequate time for faculty to mentor graduate students and perform research. Consequently, both departments have a good foundation for further development of their graduate programs with the addition of the Ph.D. in Biochemistry.

X. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5. Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and subsection B have been reviewed and approved for all doctoral level proposals.

Journals

Library subscriptions by general count

The most specific approximation (according to the Citation Linker on the library's web page) is 475 online journals in Biochemistry. On a broader level, FIU has an additional 304 online journals in Biological Sciences and 1,350 additional online journals in Chemistry. The print-journal collections number 265 in Biological Sciences and 46 in Chemistry.

Overall, FIU has 2,440 journals in Biological Science and Chemistry, of which 89% (2,129) are online. Online-journal packages: A precise count of online journals for any subject would be nearly impossible, given the cross-disciplinarities and their acquisition in bulk vendor-based packages. FIU packages include the American Chemical Society (37 journals of which six are in biochemistry); American Society for Microbiology (11 titles); Elsevier (284 titles in biochemistry plus 90 in chemistry); Wiley Interscience (28 in biochemistry plus 177 in chemistry); and Springer (234 in chemistry plus 150 in biochemistry). Trade-publisher packages have online archives back to 1997 or 2000; the ACS online archive is comprehensive.

Citation-ranked literature

Of the 307 ranked titles in Biochemistry and Molecular Chemistry, FIU has or is now acquiring 182 (60%).

Collection development

Acquisitions now under way are for the journals having the very highest citation-impact factors. Prior to this report, FIU had four of the top nine in the literature of Biochemistry and Molecular Chemistry. The library is now acquiring or shifting from print to online the other five through a broader expansion of Annual Reviews and Nature Publishing titles for the collections as a whole.

Evaluation of FIU Journal Collections against the Citation-ranked Literature of <u>Biochemistry and Molecular Biology</u>					
TITLE	Impact Factor	FIU Current Online	FIU Current Print	No Subscription	Citation Ranking of Titles Missing in FIU Collections or Being Acquired
Annual Review of Biochemistry	31.639	Print	Yes, being shifted to online		
Cell	29.219	Elsevier Science Direct			Impact factor of 29.194 / ranked 2 of 262 in Biochemistry & Molecular Biology; and 2 of 156 in Cell Biology
Nature Medicine	27.906	Being Acquired			
Annual Review of Cell and Developmental Biology	27.106	Being Acquired			Ranked 4 of 307 in Biochemistry & Molecular Biology, Ranked 3 of 147 in Cell Biology, Ranked 1 of 33 in Developmental Biology, Ranked 24 of 131 in Biotechnology & Applied Microbiology
Nature Cell Biology	21.944	Being Acquired			Ranked 5 of 307 in Biochemistry & Molecular Biology, Ranked 4 of 147 in Cell Biology
Nature Reviews Molecular Cell Biology	20.556	Being Acquired			Ranked 6 of 307 in Biochemistry & Molecular Biology, Ranked 6 of 147 in Cell Biology
Annual Review of Plant Biology	17.372	Print	Yes, print being shifted to online		
Molecular Cell	16.611	Elsevier Science Direct			Ranked 8 of 307 in Biochemistry & Molecular Biology, Ranked 8 of 147 in Cell Biology
Annual Review of Biophysics	15.235	Being Acquired			Ranked 9 of 307 in Biochemistry & Molecular Biology, Ranked 1 of 63 in Biophysics

Databases The library's databases, about 400 in number, include in Biochemistry and Chemistry *SciFinder Scholar; CRC Handbook of Chemistry and Physics, AccessScience, Science Citation Index; Applied Science & Technology Full Text; Bacteriology Abstracts (Microbiology B). Bioengineering Abstracts; BNA Environment Library; Chemoreception Abstracts; Pollution Abstracts; Toxicology Abstracts, and Toxline.*

Books The library's approval plan for Biological Sciences and for Chemistry covers all university-press titles, including handbooks, at the academic and research-levels; all trade-publisher titles on (a) the history of science, technology, and engineering and (b) contemporary social or public policy aspects of science, engineering, and technology.

Of the library's approximately 62,000 electronic books currently available in the catalog, a keyword search on biochemistry retrieves 45 titles and chemistry another 358. In addition, a package of more than 10,000 titles in Engineering and Computer Science was recently licensed from the publisher Springer, including more than 900 books in Chemistry & Materials Science.

Electronic Journals Since 2007, the Libraries have acted upon several recommendations from the faculty to acquire additional online journal content. Of those titles, we have added online access to the following:

- *Chemical Communications* – online access now available
- *Organic Biomolecular Chemistry* – online access now available
- *Dalton Transactions* – online access now available
- *Faraday Transactions (Physical Chemistry Chemical Physics)* – online access now available
- *Chemical Society Reviews*– online access now available
- *Photochemical and Photobiological Sciences* – online access now available

Library Director

September 10, 2010
Date

B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5. Include projected costs of additional library resources in Table 3.

See above. These are currently used in existing programs and no additional resources are needed.

C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.

Classrooms and Teaching Laboratories: there are adequate classrooms to accommodate this program. Doctoral student classes are conducted as seminars. All three participating units have access to conference rooms and small class rooms. Ph.D. programs in biochemistry generally are not dependent upon teaching laboratories; rather, experimental work is done in existing faculty research labs and common lab facilities. In the relatively new building of the Life Sciences Complex and in the Chemistry and Physics building, teaching laboratories for undergraduate biochemistry provide the platform for graduate students to teach the undergraduate biochemistry labs.

Research Laboratories: the existing faculty who have agreed to participate in the program (Table 4) occupy 71 laboratory suites that support faculty and student research (current graduate students): 33 suites in Biological Sciences, 24 in Chemistry & Biochemistry, 14 in the Wertheim College of Medicine). The participating faculty from Biological Sciences have 14,445 sq. ft. of research lab and office space, those from Chemistry & Biochemistry Department have 9,767 sq. ft., and those from the Wertheim College of Medicine have 5,516 sq. ft.

Additionally, in both departments there are common-use facilities: in Biological Sciences an Electron Microscopy lab, a DNA core facility (DNA sequencing and phylogenetics), Small Animal Facility, research greenhouses with environmental chambers, and a tissue culture lab; in Chemistry & Biochemistry an Advanced Mass Spectrometry Lab, an NMR lab, a Forensic DNA Profiling Facility, a Trace Metals Facility, Trace Evidence Analysis Facility, and an association with the Center for Study of Matter at Extreme Conditions.

Office space: each faculty member has office space for themselves (standard offices are between 90 and 130 sq. ft.) and often for postdoctoral researchers and graduate students.

D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Table 2. Do not include costs for new construction because that information should be provided in response to X (J) below.

Biochemistry Program Space: The University is advancing plans for dedicated space for a Biochemistry Ph.D. program, to consist of a graduate student office/lounge area, a small conference room, an office for the program director, and a desk for the part-time secretary. The anticipated location is the new graduate student classroom building, for which we will break ground this fall. Each first year student will be assigned a desk in the office/lounge area, which will help build cohesiveness, and all Biochemistry graduate students will have access. The conference room will be used for small meetings such as journal club or committee meetings.

The secretary will be close by to help students, especially first-year students, with challenges.

E. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.

Graduate instructional and research equipment sustains the current research needs of all three units and is listed below.

CURRENT MAJOR EQUIPMENT – Chemistry & Biochemistry, Biological Sciences

Existing Equipment	Purpose	Department
600 NMR spectrophotometer	Macromolecule structure	Chemistry & Biochemistry
FT-IR	Macromolecule characterization	"
JASCO Circular Dichroism J-815	Macromolecule conformation	"
UV-Vis spectrophotometer (4)	Macromolecule characterization	Both
Fluorescence spectrophotometer	Macromolecule characterization	Both
Micro-isothermal titration calorimeter	Thermodynamics	Chemistry & Biochemistry
Differential scanning calorimeter	Thermodynamics	"
Fluorescent/ luminescent/ UV/ Vis plate reader (Biotek, Synergy 2)	Enzyme kinetics	"
High speed centrifuges (6)	Cell fraction purification	Both
Scintillation Counters (2)	Radiometrics	Both
FPLC	Protein purification	Both
Thermocyclers (20)	Polymerase Chain Reaction	Both
Computer Cluster	Macromolecular modeling, Computational Chemistry	Chemistry & Biochemistry
PCR, real time, single color (3)	Gene expression	"
PCR, real time, multicolor (2)	Gene expression	"
DNA sequencers	DNA analysis	"
Electrospray Mass Spectrometry	Proteomics	"
CHI Scanning Potentiostat	Electrochemical measurements	"
HPLC(3)	Purification of small molecules and proteins	Both
Gas Chromatograph	Separation of small	Biological Sciences

Existing Equipment	Purpose	Department
	molecules	
DNA Sequencing Core Facility ABI Prism Sequencers and Analytical Genomic Equipment	DNA sequencing	Biological Sciences
Confocal Imagining Microscope	Cell structure, localization of proteins	Biological Sciences
Gamma counter, multiwell	Measures gamma radiation from ^{22}Na, ^{51}Cr, ^{59}Fe, ^{131}I, etc.	Biological Sciences
GUAVA Cell Cytometer	Characterize cell populations	Biological Sciences
FPLC-ACTA Automated Protein Chromotography	Automated protein purification	Biological Sciences
PHAST Electrophoresis System	Rapid mini-gels	Biological Sciences
ELISA reader	Enzyme-linked antibody assays	Biological Sciences

MAJOR EQUIPMENT BEING ACQUIRED* – Wertheim College of Medicine

Core facility	Equipment
Isotope	Liquid scintillation counter (Beckman Coulter LS 6500)
..	Storm (GE) system for autoradiography, fluorescence and chemifluorescence imaging.
Tissue culture core	XP96 extracellular flux analyzer
..	CO_2 incubators (3)
..	Inverted microscope
..	Cell counter
Freezer farm	-80^{o}C freezers (6)
..	Cryogenic freezer
..	Autofill liquid N_2 storage tank
Microscopy core	Upgrade to confocal microscope described in previous table
..	Olympus BX61 microscope with SmartCapture FISH imaging
Trace metal analysis	ICP-MS
..	Light scattering instrument
Histology	Automatic tissue processor
..	Automatic coverslipper
..	Cryostat
..	Automatic stainer

Core facility	Equipment
..	Light and fluorescence microscopes
Transgenic core	Inverted microscopes
..	Nikon dissecting scopes (3)
..	Sutter micropipette puller
..	Freezers (-80^{o}C)
Targeted drug deliver core	Transmission electron microscope
..	Particle size analyzer
..	Multimode plate reader
..	Fluorescence microscope
..	HPLC
..	Magnetometer
..	Atomic force microscope
..	Zeta meter
..	Fourier-transform infrared spectrophotometer

*The Wertheim College of Medicine, being new, is establishing core instrumentation facilities. The ones in this list will be available by December 2011.

F. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 2.

We currently have specialized equipment and any new equipment needs will be in collaboration with the Wertheim College of Medicine as described above.

G. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 2.

No additional specific resources are expected to be needed.

H. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 2.

Each graduate assistant currently receives a $22,600 assistantship. The projected costs include 13 teaching assistants and 14 research assistants in year 5. Each assistantship will receive a full tuition waiver and expect additional research funding to provide additional assistantships after year 5.

I. Describe currently available sites for internship and practicum experiences, if appropriate

to the program. Describe plans to seek additional sites in Years 1 through 5.

Ph.D. programs in Biochemistry do not require sites for internships or practicum experiences.

J. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 2 includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.

No new capital expenditure for instructional or research space is required during years 1-5. The university is committed to reassessing and meeting research space needs as enrollment in the program grows.

TABLE 1-A
PROJECTED HEADCOUNT FROM POTENTIAL SOURCES
(Baccalaureate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE	HC	FTE	HC	FTE	HC	FTE	HC	FTE
Upper-level students who are transferring from other majors within the university**	0	0	0	0	0	0	0	0	0	0
Students who initially entered the university as FTIC students and who are progressing from the lower to the upper level***	0	0	0	0	0	0	0	0	0	0
Florida community college transfers to the upper level***	0	0	0	0	0	0	0	0	0	0
Transfers to the upper level from other Florida colleges and universities***	0	0	0	0	0	0	0	0	0	0
Transfers from out of state colleges and universities***	0	0	0	0	0	0	0	0	0	0
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

* List projected annual headcount of enrolled students majoring in the program.
** If numbers appear in this category, they should go DOWN in later years.
*** Do not include individuals counted in any PRIOR CATEGORY in a given COLUMN.

TABLE 1-B
PROJECTED HEADCOUNT FROM POTENTIAL SOURCES
(Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE	HC	FTE	HC	FTE	HC	FTE	HC	FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	0	0	0	0	0	0	0	0	0	0
Students who transfer from other graduate programs within the university**	2	1.5	3	2.25	3	2.25	3	2.25	3	2.25
Individuals who have recently graduated from preceding degree programs at this university	1	0.75	2	1.5	3	2.25	5	3.75	6	4.5
Individuals who graduated from preceding degree programs at other Florida public universities	1	0.75	2	1.5	3	2.25	4	3	5	3.75
Individuals who graduated from preceding degree programs at non-public Florida institutions	1	0.75	1	0.75	1	0.75	2	1.5	3	2.25
Additional in-state residents***	0	0	0	0	1	0.75	1	0.75	1	0.75
Additional out-of-state residents***	0	0	1	0.75	2	1.5	2	1.5	3	2.25
Additional foreign residents***	0	0	1	0.75	2	1.5	4	3	6	4.5
Other (Explain)***	0	0	0	0	0	0	0	0	0	0
Totals	**5**	**3.75**	**10**	**7.5**	**15**	**11.25**	**21**	**15.75**	**27**	**20.25**

* List projected yearly cumulative ENROLLMENTS instead of admissions
** If numbers appear in this category, they should go DOWN in later years.
*** Do not include individuals counted in any PRIOR category in a given COLUMN.

TABLE 2
PROJECTED COSTS AND FUNDING SOURCES

Instruction & Research Costs (non-cumulative)	Year 1						Year 5				
	Funding Source					Subtotal E&G and C&G	Funding Source				Subtotal E&G and C&G
	Reallocated Base* (E&G)	Enrollment Growth (E&G)	Other New Recurring (E&G)	New Non-Recurring (E&G)	Contracts & Grants (C&G)		Continuing Base** (E&G)	New Enrollment Growth (E&G)	Other*** (E&G)	Contracts & Grants (C&G)	
Faculty Salaries and Benefits	63,352	11,880	0	0	0	**$75,232**	227,375	0	0	0	**$227,375**
A & P Salaries and Benefits	0	0	0	0	0	**$0**	0	0	0	0	**$0**
USPS Salaries and Benefits	0	19,800	0	0	0	**$19,800**	19,800	0	0	0	**$19,800**
Other Personnel Services	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Assistantships & Fellowships	61,552	92,328	0	0	0	**$153,880**	338,536	61,552	0	430,864	**$830,952**
Library	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Expenses	0	2,000	0	0	0	**$2,000**	2,000	0	0	0	**$2,000**
Operating Capital Outlay	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Special Categories	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Total Costs	**$124,904**	**$126,008**	**$0**	**$0**	**$0**	**$250,912**	**$587,711**	**$61,552**	**$0**	**$430,864**	**$1,080,127**

*Identify reallocation sources in Table 3.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "other new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

Faculty and Staff Summary

Total Positions (person-years)	Year 1	Year 5
Faculty	0.45	1.5
A & P	0	0
USPS	0.5	0.5

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	$250,912	$649,263
Annual Student FTE	3.75	20.25
E&G Cost per FTE	$66,910	$32,062

TABLE 3
ANTICIPATED REALLOCATION OF EDUCATION & GENERAL FUNDS

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
202600101 Biology	4,817,253	56,664	$4,760,589
202700101 Chemistry	3,983,817	61,461	$3,922,356
342000101 COM Molecular Microbiology	559,272	3,548	$555,724
341000101 COM Human and Molecular Genetics	565,744	3,231	$562,513
Totals	$9,926,086	$124,904	**$9,801,182**

TABLE 4
ANTICIPATED FACULTY PARTICIPATION

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Speciality	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Alejandro Barbieri, Ph.D. Cytoskeletal Biochemistry	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.11	0.08
A	Hiranmoy Bhattacharjee, Ph.D. Molecular Enzymology	Assoc. Prof.	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.02	0.02
A	Charles Bigger, Ph.D. Immunology	Professor	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.04	0.04
A	David Chatfield, Ph.D. Computational Biochemistry	Assoc. Prof.	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.04	0.04
A	Tim Collins, Ph.D. Phylogenetics	Assoc. Prof.	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Anthony DeCaprio, Ph.D. Toxicology	Assoc. Prof.	Ten-earn	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Javier Francisco-Ortega, Ph.D. Plant Phylogenetics	Assoc. Prof.	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Rene Herrera, Ph.D. RNA Molecular Biology	Professor	Tenured	Fall 2011	12	1.00	0.02	0.02	12	1.00	0.08	0.08
A	Konstantin. Kavallieratos, Ph.D. Bioinorg. Coordin. Chem.	Assoc. Prof.	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Leung Kim, Ph.D. RNA Biochemistry	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Lidia Kos, Ph.D. Cellular/Develop. Bio	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	John Landrum, Ph.D. Vision Biochem	Professor	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.04	0.04
A	Fenfei Leng, Ph.D. Biochemistry	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Watson Lees, Ph.D. Protein Biochem	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Yuan Liu, Ph.D. DNA Repair	Asist. Prof.	Ten-earn	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04

A	John Makemson, Ph.D. Microbial Biochem	Professor	Tenured	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Kalai Mathee, Ph.D. Pathogen Molecular Bio	Assoc. Prof.	Tenured	Fall 2011	12	1.00	0.02	0.02	12	1.00	0.08	0.08
A	Bruce McCord, Ph.D. Forensics DNA Chem	Professor	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Jaroslava Miksovska, Ph.D. Biophysical Chemistry	Asist. Prof.	Ten-earn	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Joong-Ho Moon, Ph.D. Imaging and Delivery	Assist. Prof.	Ten-earn	Fall 2011	9	0.75	0.05	0.04	9	0.75	0.10	0.08
A	Rita Mukhopadyay, Ph.D. Molecular Parasitology	Assoc. Prof.	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.02	0.02
A	Kenneth Murray, Ph.D. Virology	Assist. Prof.	Ten-earn	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Fernando Noriega, Ph.D. Insect Biochemistry	Assoc. Prof.	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Kathleen Rein, Ph.D. Algal Biochemistry	Professor	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Barry Rosen, Ph.D. Heavy Metal Detoxification	Professor	Tenured	Fall 2012	12	1.00	0.00	0.00	12	1.00	0.04	0.04
A	Martin Tracey, Ph.D. Molecular/Pop Genetics	Professor	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
A	Xiaotang Wang, Ph.D. Mettalloprotein Chem	Assoc. Prof.	Tenured	Fall 2011	9	0.75	0.15	0.11	9	0.75	0.20	0.15
A	Stan Wnuk, Ph.D. Medicinal Chemistry	Professor	Tenured	Fall 2012	9	0.75	0.00	0.00	9	0.75	0.05	0.04
	Total Person-Years (PY)							**0.45**			**1.89**	**1.50**

Faculty Code		**Source of Funding**	**PY Workload by Budget Classsification**		
			Year 1		**Year 5**
A	Exisitng faculty on a regular line	Current Education & General Revenue	0.45		1.50
B	New faculty to be hired on a vacant line	Current Education & General Revenue	0.00		0.00
C	New faculty to be hired on a new line	New Education & General Revenue	0.00		0.00
D	Existing faculty hired on contracts/grants	Contracts/Grants	0.00		0.00
E	New faculty to be hired on contracts/grants	Contracts/Grants	0.00		0.00

Overall Totals for	**Year 1**	**0.45**		**Year 5**	**1.50**

Relation to Unit's Mission: Educate students in biochemical knowledge & methods and in professional communication & research skills

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will demonstrate a command of the subject content knowledge.	A faculty panel composed of at least three members will use the attached rubric (5 point rating scale; 20 point maximum) at the defense of the dissertation/thesis/project/classroom performance to assess the above artifact using 4 content indicators: • Investigate & research • Examine & identify the problem/question • Analyze and synthesize • Construct& interpret Graduates will attain a minimum of 15 points on the subject content rubric.	
Use of Results for Improving Program		

Relation to Unit's Mission: Educate students in biochemical knowledge & methods and in professional communication & research skills

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will demonstrate effective written communication skills.	A faculty panel composed of at least three members wiluse the attached rubric (5 point rating scale; 20 point maximum) at the defense of the dissertation/thesis/project/classroom performance to assess the above artifact using 4 writing indicators: • Content & development • Organization • Language • Conventions Graduates will attain a minimum of 15 points on the written communication rubric.	
Use of Results for Improving Program		

Relation to Unit's Mission: Educate students in biochemical knowledge & methods and in professional communication & research skills

Student Learning Outcome (Stated in Measurable Terms)	**Assessment Methods**	**Results (Data Summary and Analysis)**
Graduates will demonstrate effective oral communication skills.	A faculty panel composed of at least three members wiluse the attached rubric (5 point rating scale; 20 point maximum) at the defense of the dissertation/thesis/project/classroom performance to assess the above artifact using 4 oral communication indicators: • Subject knowledge • Organization • Connection to audience • Delivery Graduates will attain a minimum of 15 points on the oral communication rubric.	
Use of Results for Improving Program		

Relation to Unit's Mission: Educate students in biochemical knowledge & methods and in professional communication & research skills

Summarize use of results for continuous improvement of the educational program:

Proposed Ph.D. Program in Biochemistry/Molecular Biology at Florida International University

Response to the report submitted on August 31 by the external reviewer.

Dr. Kelsey R. Downum, Professor & Sr. Associate Vice President for Research at the University of Texas at Arlington, visited FIU on August 26-27, 2010 to review the proposed Ph.D. in Biochemistry program. He commented very favorably about the program and rated the overall quality of the proposed degree program as exceptional. He also provided several thoughtful recommendations on how to improve the program. Responses to his specific recommendations are listed below.

> *Recommendation# 1: Many scientific programs at the graduate level also include comprehensive introductions to research ethics & social responsibility; research misconduct, conflicts of interest/commitment; authorship/publication/peer review; data security/ownership; and intellectual property. Although these topics may be covered in an institutional "Responsible Conduct of Research" course already in place, additional training in each of these areas would provide a more detailed professional perspective and be a valuable addition to the curriculum.*

We have added a required, one-credit course to the core curriculum entitled "Ethics, Publication, and Intellectual Property". The course will make use of outside speakers to convey some of the topics such as intellectual property. The course credit will replace a single credit previously assigned to research in the spring of the first year and thus will not alter the total number of credits for the degree.

> *Recommendation #2: Many new students (and faculty) are looking for opportunities to develop and commercialize their research (i.e., take it from the laboratory to the market). Some institutions encourage an active interaction between faculty/Ph.D. students and either the "institutional technology management" office, "entrepreneurial" programs offered through business schools, or associated technology incubators, etc. as a way of providing exposure to these resources. If this program is approved, developing entrepreneurship opportunities may be a promising area to encourage since FIU is home to one of seven Kaufmann Entrepreneur Centers in the US - the Eugenio Pino and Family Global Entrepreneurship Center – that might be a good partner in such an endeavor. This is also a great area for engagement of the local business community, technology incubators, and angel/venture investor groups looking to forge commercialization relations with FIU.*

At the end of the Ethics, Publication, and Intellectual Property course, we plan to have speakers discuss entrepreneurship. Furthermore the Department of Chemistry & Biochemistry invites a speaker to discuss intellectual property and

entrepreneurship on a biannual basis; last year it was a patent attorney. We will have the Biochemistry Ph.D. students attend these seminars.

> *<u>Recommendation #3</u>: FIU faculty have expertise in many diverse areas of biochemistry/molecular biology. This programmatic strength enhances the flexibility and effectiveness of student training and provides many opportunities to benefit from research collaborations to solve problems. However, to be an effective Ph.D. program, programmatic areas of strength need to be identified, the faculty and students in these areas need to meet regularly to interact, review current research topics, and develop the cohesiveness and professional culture typical of a Ph.D. program.*

Three specific areas of research strength transcend the participating academic units and will give definition to the program: the biochemistry of cell-signaling, enzymology, and molecular genetics. The integration of students with similar research interests, but different perspectives, into one program will benefit both students and faculty.

> *<u>Recommendation #4</u>. I strongly recommend that funding for a minimum of 5 graduate student teaching assistants plus tuition be made available to initiate this program. The expectation is that the students recruited for this program will be supported for their 1st year by teaching assistantships, and then be integrated into faculty research programs via research assistant support through external funding awarded to faculty in the departments.*

We have increased the number of students in the early incoming classes from 4 per year to 5 per year.

> <u>Recommendation #5</u>: Since this Ph.D. program is interdisciplinary, students and faculty will be distributed among several departments and buildings. To establish a program identity and encourage collaboration among the cadre of graduate students and faculty, I would encourage the university to identify "biochemistry/molecular biology" space for the Ph.D. program – perhaps a seminar room, small conference rooms (1-2), and lounge area, etc.

We have added a Biochemistry Program space to the proposal that will include a small seminar room, a lounge for all students with desks for first year students, and offices for the program director and part time secretary. The College of Arts & Sciences will advocate for creation of such a space, in the planned Science Classroom Complex.