Review
Department of Biochemistry and Molecular Biology
East Carolina University School of Medicine
Executive Summary

The performance of our department must be seen in the context of the mission of the Brody School of Medicine. That mission is: to increase the supply of primary care physicians to serve the state, to improve the health status of citizens in eastern North Carolina and to enhance the access of minority and disadvantaged students to a medical education. In addition, our new unified vision statement is: To be the national model for rural health and wellness by creating a premier trusted academic health care delivery system for the benefit of the people of eastern North Carolina. The department of Biochemistry and Molecular Biology strives to meet that mission by giving the best possible training to our medical students and graduate students and by working towards mitigation of the effects of disorders common to eastern North Carolina. While we meet that mission we do see the potential for improvement. This document focuses largely on areas that can be improved so that we can grow.

Our criteria for the quality of graduate education for recent graduates consists of several quantifiable outcomes including: publications, citations, awards, presentations, grants and job offers. The most important criterion is success in finding a postgraduate program or an occupation. As shown in Table A7 of Appendix 2, the graduates that we have been able to contact were successful in getting the kinds of jobs that they wanted. Therefore, our program is successful. A more detailed analysis of the data in the appendices follows this executive summary.

One must look further back in time to gauge the success of our graduates in their chosen fields. Most of our past graduates have excelled in industry (i.e. Drs. Anindita Sen, Peter Cornelius, Kevin McGowan, Sheree Ling, Renu Jain), academia (i.e. Drs. Russ Price, Jackie Stephens, Mark Hemric, Brett Beall) and government (i.e. Drs. Frank Lu and Vince Contreras). Many, like Drs. Russ Price (Emory University), Dr. Jackie Stephens (Director of Basic Research Pennington Research Center) and Anindita Sen (Director, Regulatory Affairs-US Eli Lilly and Company) are leaders in their fields. Our PhD graduates have been successful.

Our graduate student body is small (Table A1), perhaps too small for the number of faculty in our department. The state of NC has cited us for being a low productivity program judged by the number of degrees awarded per year. Most of the basic science departments at the Brody School of Medicine are also considered to be low productivity programs. To correct this situation, all basic science departments have combined their graduate programs into a single large program. We expect that this change will increase the number of applications to our program. We also hope that this restructuring will give our students a more broad education.

The quality of our admitted students can be judged from Table A2. The scores of our students are sound but not exemplary. We are also aware that these scores do not show the full potential of our students. These test scores do not show the desire, inquisitiveness and drive that our students have. We try to gauge those qualities during the interview process. We choose students who we believe have the potential to be scientists and we work closely with them to help them to reach that potential. The majority of these talented individuals do succeed. We believe that we do an outstanding job in producing excellent scientists.

Another part of our mission is participating in the training of graduate students who are enrolled in basic science departments on our East campus. We have had particularly close relationships with the department of Biology and have participated in training of many M.S. students (7 this year alone).
Our graduate program has a good balance between men and women (56% female and 44% male; Table A4). Most of our students are white (71%) with the remaining being Asian, African American, non-resident aliens or of unknown ethnicity. We have not had great success in attracting African-Americans or Native Americans (Appendix 2; Table A4). We need to review our procedures to understand the reasons for our failure.

**Strengths and weaknesses of the department**

One of our challenges is to remain a cohesive department while being divided between two locations. Three of our faculty have relocated to the East Carolina Diabetes and Obesity Institute (ECDOI) on the 4th floor of the Heart Center. That transfer has resulted in beneficial scientific interactions for those who have moved but it has diminished the interactions with those who remain at the Brody Basic Sciences Building.

Our department has a history of excellence in teaching both graduate and medical students. We are committed to preserving that excellence. Teaching is often time intensive. In addition to preparing and delivering lectures it is sometimes necessary to give assistance to individual students. Our students have diverse backgrounds and we sometimes find ourselves reviewing concepts that are prerequisites for the topics that we teach. This system is under stress as the medical school increases its efforts to stimulate research productivity. We are attempting to release our more successful researchers some of their teaching activities. The result is that students will be learning less from experts in a particular area and that there will be less time for individual student consultation. We need to find ways of insuring the success of our training programs while expanding our research efforts. Some of our faculty will have to adopt additional teaching. We will use the teaching hours of the research-intensive faculty where they will have the most impact on education such as in advanced courses. With every change that we make we will have to insure that we preserve our excellence in training scientists and physicians.

The Department of Biochemistry & Molecular Biology was formerly one of the best-funded departments at East Carolina University. Our present funding is not at the same level as in the past and many of us are surviving on funds remaining from prior grants or from local “starter” grants. We are fortunate to have opportunities for obtaining local funds to establish new research areas. The Brody Brothers Research Foundation and other ECU grants have led to external grant applications and to funded grants.

Although we have a shortage of research dollars, our research programs are generally of high quality and linked to human health. One can see, from the biographical data in Appendix 3 that all members of our department are actively publishing in excellent journals.

Our faculty are driven to improve our research enterprise and are taking positive steps in that direction. We have informal lunch seminars where each member of our faculty takes a turn giving an update of his or her research. The forums are a chance of a researcher to discuss progress in one of the aims of a grant or progress toward answering the criticism of a review of a manuscript. In these meetings we give candid reviews of the research presented. We discuss issues ranging from the significance of the research, to the best approaches to answer the question to the best way to obtain funding for that work. This forum is also also an opportunity to appeal for help, either in terms of collaboration or material help.

Our interim chair, Joseph Chalovich, organizes a monthly research meeting in which investigators have an opportunity to discuss their research ideas with a more diverse group of scientists from the entire university. These research meetings have been held for about 20 years. They are currently held at the Crave restaurant (Evans Street) on the 3rd Wednesday of each month.
from 4:30 to 6:00. These meetings are not intended to be normal seminars: “Our research discussions are intended to be forums for getting informal and straight feed-back for research ideas, results and approaches. Presenters may use slides although conversation is preferred. Typical meetings have either two-15 minute presentations each with 15 minutes of discussion, or 1 30-minute presentation with 30 minutes of discussion. Meetings often work best if discussion occurs during the presentation rather than at the end. Ideally, we would like to have an exchange of ideas rather than a seminar. We occasionally have an "Open Mike" where everyone is invited to make a brief research statement to stimulate discussion; puzzling results often make for good discussions.” These informal meetings are a way of building collaborations and of getting critiques from a diverse group of researchers.

**Major findings**

**Graduate Student Training:** Our graduate students are well trained as they were in the past. Our students are successful in the workforce (Appendix 2; Table A7); this is evidence that our graduate program is healthy. We would like to increase the size of our graduate program and the diversity of our students.

**Changing Faculty Obligations:** Our faculty are devoting more of their time in the training of medical students as a result of problem-based learning, the summer program for future doctors and summer medical biochemistry remediation. Although these activities are time intensive, they contribute to the success of our medical students and that is a key part of our mission. Our faculty must adjust to further changes in the medical student curriculum as they occur over the next year; we are unsure what the further changes will be.

Our faculty must also deal with the reality that we have more responsibilities now than in the past. Faculty now does some of the work that was previously delegated to secretaries or other professionals. We have to find ways of maximizing the time spent on activities such as teaching and research as these activities are most tightly tied to our mission.

Our department is in the middle of a transition. Several senior faculty members who have had grant support from various agencies have relocated (Drs. Dohm & Barakat), retired (Pennington, Pekala) or lost their external support (Chalovich, Johnson). The burden has been placed on faculty at the associate and assistant professor levels. We have to deal with the reality that national funding of research may not return to the levels that some of us enjoyed 25 years ago. While the funds available for research have become more competitive, the cost of doing research has grown.

There is a renewed sense of urgency in increasing the vigor of the research enterprise at the Brody School of Medicine. Several basic science departments have grown in size and have increased their funding. We have decreased in size because of the loss of our chairperson and another faculty member who was beginning to flourish. We have not replaced these key personnel as the structure of the Basic Science Departments is being debated. We are confident that our faculty will flourish irrespectively of the final structure of our department.

**Departmental Finances:** Our operating funds are dangerously low as a result of state reversions and our inability to compensate with other sources of funding. We have tried to adapt by taking on additional fee based teaching as several other departments have done. We do not believe that this is the path to success for our department. The amounts of money that we have been able to glean are small. The summer course that we taught last year in the Chemistry Department has a low
level of remuneration. Our participation in the higher paying Dental Biochemistry course is minimal. Furthermore, as we are encouraging all faculty members to obtain external funding, we are returning half of the revenues from teaching back to the faculty to run their laboratories. We have also found it necessary to return the departmental share of F&A back to the investigators in some instances. The returned money is an investment that will pay dividends in the future but it creates a short-term shortfall.

Because of the changing teaching landscape, we have not yet achieved a balance between didactic teaching and research productivity. We do not have enough data from 2015-2016 to make a projection but indications are that further changes are needed. We face the possibility that some faculty will eventually migrate to a full teaching role whereas others will adopt a role in which their effort is almost exclusively research. This presents challenges including the time taken to master a new area of teaching, differences in reward structure for teaching and research, changes in one’s identity from a scientist to a teacher and our University code that requires research, teaching and service from every faculty member. Remunerated courses also cause short-term difficulties in fulfilling our teaching mission since in tough economic times there is a natural desire to teach in courses that provide operating expenses for research.

**Significant actions or changes that have been planned as a result of the self-study.**

**Graduate Student Training:** We are making a significant change in our graduate program by consolidating into a Biomedical Sciences PhD program (umbrella program). Students in this combined program will have a wide choice of research experiences to choose from. We also expect that this combined program will attract more highly qualified and more diverse students. Another factor that limits the number of graduate students is the ability of faculty to support the costs associated with the students and their research. Training graduate students in biochemistry and molecular biology is an expensive proposition. We must increase our submissions to NIH, NSF and other granting organizations. In addition, all students must increase their efforts in obtaining their own small grants. There is a narrow window for obtaining graduate student funding. We will explore ways of front-loading this process so that graduate students will have a greater chance of supporting themselves.

State reversions, in recent years, have caused us to greatly reduce the number of visiting scientists that we can invite for seminars and lectures. Those same cuts have made it difficult for us to support student travel to meetings. These are related activities that greatly enrich the training of graduate students. We will explore ways of revitalizing our seminar program (perhaps by joining forces with other departments) and of supporting student travel. The ability of a scientist to obtain funding is linked to the exposure that scientist receives.

**Changing Faculty Obligations:** As we focus on maintaining our teaching excellence and of returning our research productivity to high levels we have evaluated factors that detract from meeting those goals. One key factor is faculty time. Our time is more interrupted now than in the past and it is occupied with more ancillary activities. We must review each faculty member’s use of time and make such changes as are possible to increase time spent in either teaching or research. This will become a part of the annual review of each faculty member.

We need to evaluate our continued participation in summer teaching such as CHEM 2770. While that course brings in modest funds, it results in lost time for summer research. Participation in this course may help the department indirectly by increasing our exposure to potential future
graduate students on our main campus. We need to monitor the advantages and disadvantages of participating in this course over the next few years.

We should reward faculty according to their total productivity (teaching + research + service). Some faculty are productive in research and yet they carry a relatively high teaching load. In some cases, the teaching loads should be reduced. In other cases this cannot be done because of the particular expertise of the faculty or because it is the faculty members choose to maintain their teaching load. Those who make a great contribution to our mission should be rewarded accordingly.

The departmental office must take some of the burden off of the faculty to free their time for activities for which they were trained. Perhaps the greatest need is in facilitating grant submissions. Someone who routinely routes proposals through RAMSES and the various web submission sites will be more efficient than a faculty member who visits these sites only on occasion. This will probably require an investment from the Medical School in a person or persons to spearhead grant submissions for several departments.

**Departmental Finances:** The greatest opportunity that we have for increasing departmental revenue is from external grants and contracts and from fees for research services. To do this we must retain our most productive faculty and recruit the best possible chairperson and junior faculty member. The top priority in future hires must be the fundability of the person. The ideal candidate would have significant funding already and would be able to integrate into an existing productive research program. We may wish to incentivize present faculty with a reward for every scored grant submission, every contract and every successful fee-for-service activity.

It does not seem possible for us to significantly alter our financial situation by taking on additional teaching. Few courses produce significant remuneration. Our participation in Foundations of Medicine and Chem 2770 are done primarily to support the mission of the University and to increase our exposure to potential graduate students.

The fees generated from added teaching introduces a bias in scheduling teaching. Currently, half of the funds generated from additional teaching goes into the laboratory of the teacher. It is easier to fill the teaching slots for those extra courses than for our core courses. It may be necessary to distribute the income from extra courses according to the total number of lectures given (core courses + extra courses) to support our overall teaching mission.

**Departmental Space:** The 5th floor of Brody pales in comparison to the 4th floor of the heart center where some of our faculty are located. Students, technicians and other personnel would prefer to be housed in the heart center. It is important that our research prosper at both locations. We must plan to beautify the 5th floor of Brody and to make better use of current space. We must also plan to put our vacated laboratories to better use. We are considering using one unfurnished room as a place for graduate students to read and think away from the distractions of the laboratory. We would like to bring other researchers with common interests onto the 5th floor to increase the chances for scientific exchanges.

Much of the equipment at Brody is old and in need of replacement. Fortunately, Dean Cunningham directed state funds to basic science departments this year to help revitalize research. We replaced several items that are essential to our research. These items ensure that we will be able to do the most basic parts of our research for several years to come. It will be up to the success of faculty in acquiring external funds to purchase additional equipment specific to individual research projects.
Review of Biochemistry and Molecular Biology

1. Program Purpose

1.1 The purpose of the doctoral program in biochemistry and molecular biology is to train the next generation of biomedical investigators who will generate new knowledge in the area of human biochemistry and who will develop new insights into diseases that might be helpful in their treatment. We provide students with a rigorous and broad educational experience that will prepare them for this task.

The training of graduate students in basic medical sciences is recognized by the medical profession as being indispensable, in that it complements the other functions of the medical school. These functions include the education and training of medical students, the continuing education of physicians and the expansion of the knowledge base that is required for the successful treatment of diseases. The graduate programs in the basic sciences enrich the educational environment of the medical center. Each of these activities is enriched by the other and cannot be conducted in isolation.

The doctoral program in biochemistry and molecular biology is integrally integrated into the mission of East Carolina University as a whole and into the Brody School of Medicine in particular. For students entering with a bachelor’s degree, a minimum of 76 semester hours is required to obtain a degree (see Appendix 1). In addition to core courses, the program consists of a doctoral candidacy examination involving a research proposal based on an NIH format, execution of the proposed research, a seminar based on the thesis research and a thesis defense. The course listing for our current and future PhD program structure is found in Appendix 1.

Biochemistry and molecular biology serves as the foundation of most medical school graduate programs, both at the MS and PhD levels. Students from each of the other graduate programs at the medical school except for Anatomy and Cell Biology take BIOC7301 (Biochemistry 1). BIOC7310 (Molecular Biochemistry) is also heavily populated by students from other departments at Brody School of medicine. Students from the Departments of Nutrition Science, Kinesiology, Chemistry as well as Bioenergetics and Exercise Science have been enrolled in our courses. Moreover, the Ph.D. program in Bioenergetics and Exercise Science, which is housed in the Department of Kinesiology within the College of Health and Human Performance, is offered in conjunction with the Departments of Physiology and Biochemistry in the Brody School of Medicine. This program combines study in exercise science, kinesiology, biochemistry and physiology culminating in a Doctor of Philosophy degree. The program investigates how energy produced and released by the metabolic process is harnessed to perform work in the cell/body. Our department also participates in the teaching of dental students (16 lectures) and in the teaching of undergraduates (CHEM 2770). It should be noted that we do not put the graduate students in our department in the same biochemistry course that we offer to the medical students. This allows us to present rigorous courses in biochemistry and molecular biology that are more suited for graduate students.

The newest degree program in which our department participates is the M.S. degree in Biomedical Science that was approved by the Board of Governors of the University of North Carolina in June 2010. One of our Emeritus Professors from our department, Dr. George Kasperek, was instrumental in creating and getting the program approved. The Master of Science Degree in Biomedical Science is an interdisciplinary degree program administered by the Office of Research.
and Graduate Studies of the Brody School of Medicine. This research-oriented program prepares students for employment in the biomedical industry as well as provides research training and experience for students interested in more advanced study leading to PhD or MD degrees. The first courses in the program were offered in the fall of 2012. More than 5 students have entered the program each year. For students entering with a bachelor’s degree, a minimum of 38 semester hours is required to obtain a degree as shown below. In addition to core courses, the program consists of a research-based thesis, a comprehensive defense of a thesis proposal, a seminar based on the thesis research and a thesis defense. Our department contributions are two-fold. We offer one of the core courses, BIOC7301, 4 semester hours. Secondly, our faculty has mentored 5 students for their research components. The curriculum listing for the MS in Biomedical Sciences is shown in Appendix 1.

1.2 Alignment to the University’s mission and strategic initiatives.

The educational and training objectives of the departments directly address several of the core components of the University mission. We place a priority on a hands-on approach to training graduate students in research, which frames the didactic coursework in a tangible context. We also place a high priority in training students to effectively communicate their research in oral and written formats, which gives our graduates a distinct advantage in preparation for entering a competitive workforce. As evidenced by the breadth of careers attained by Biochemistry graduates, this training is an effective approach to long-term student success. In addition, the research that our students conduct adds to the body of public scientific knowledge that supports the continuing advancement of human health and wellness. In addition to the University mission, the department is also charged more proximately with carrying out the mission of Brody School of Medicine, which entails the following objectives that overlap in their intent with the broader University mission:

A. Increase the supply of primary care physicians. The disciplines of Biochemistry and Molecular Biology are essential components of medical and dental training, as biochemistry is the underlying chemistry of life. Medical treatments are based on selectively manipulating the chemistry of a particular cell type. As such, biochemistry is the foundation for further studies in bacteriology, microbiology and pharmacology. Molecular biology provides the basis of many diagnostic assays and it is has great potential in the treatment of human disorders, and understanding the molecular basis of disease. Primary Care Physicians of the 21st century need to be acquainted with the basic principles of molecular biology in order to take advantage of emerging methods of diagnosis and treatment.

As experts in Biochemistry and Molecular Biology and as experienced teachers, we are able to lead our students through these disciplines. We also nurture the analytical skills that will be the basis of their practice of medicine. Biomedical information is growing so fast that it is impossible for students to master everything. Because of our experience, we are able to determine which aspects of Biochemistry are most critical for their training. Because we are involved in biomedical research, we are able to provide the context for the information that is being mastered.

Our faculty give students every opportunity to learn Biochemistry and Molecular Biology. We provide roughly 60 lectures each year. These lectures are videotaped as a study guide for the students. We have at least four review sessions prior to every examination. Students are encouraged to visit our offices or chat via email or Yammer if they have problems. We conduct nine small group conferences during the year to allow small groups of ~10 students to interact with a faculty member and discuss medical cases related to the coursework. We also provide eight clinical interactions where a physician will present a patient or a topic related to the lectures in our Medical Biochemistry course.
Medical students often choose to spend the summer doing research with some of our faculty. This is an invaluable experience that helps students learn how to solve problems, and is an excellent preparation for clinical practice. It also helps students to think about their clinical practice in a broad sense. Rather than treating a single individual, they may find patterns that will improve treatment of many people.

We occasionally have a student who did not perform well in Medical Biochemistry. If the student has performed well in other courses, we give that student a chance to remediate during the summer. Faculty give their own time to tutor the students during the remediation. This is a successful program, and usually results in the student going on to successfully complete their preclinical training.

We try to limit the number of students needing remediation by being proactive. We also participate in the Summer Program for Future Doctors, in which we volunteer our time to give an abbreviated Medical Biochemistry course during the summer to matriculating and prematriculating students who hope to be physicians. We are able to fill in gaps that would otherwise be stumbling blocks upon entering a medical curriculum.

Four members of our faculty participate in Foundations of Medicine, which has its origins as an explicit and direct manifestation of the BSOM mission. That number was reduced to three with the departure of Dr. Bridges. This is a 2-part course administered by the Office of Medical Education. It entails a series of instructional sessions to discuss keys and approaches for success in medical school, combined with multiple Problem Based Learning cases. The Problem Based Learning casework provides students with an opportunity to begin the process of differential diagnosis, by working through a medical case that is incrementally revealed by a team of facilitators. These facilitators are comprised of a clinical faculty member and a basic science faculty member, who guide the student-driven diagnostic process and are specifically trained to do so. This system allows students to apply their didactic knowledge, and to identify learning issues or further independent research. In this manner, students learn how to approach a problem as individuals and as part of a group, and how to identify and utilize appropriate resources to guide their diagnostic process. This course is very faculty labor-intensive, and comprises a significant proportion of the student contact hours of the faculty members who participate.

B. Improve the health status of citizens in eastern North Carolina. The existence of the Brody School of Medicine has greatly improved the practice of medicine in eastern North Carolina. We act as the hub of a large medical complex. Many of the students that we train remain in this area. Many of our students participate in local health initiatives associated with the Greenville Community Shelters, the Boys and Girls Clubs of America and other health clinics.

The research done by our faculty is focused on disorders that are prevalent in eastern North Carolina. Research is conducted on heart disease (Chalovich), Cancer (Cabot, Mansfield, Schwalbe, Johnson), nutrition & metabolism (Shaikh, Shewchuk), reproductive disorders (Keiper), neurodegenerative disorders (Zeczycki, Schwalbe), and immunological and endocrinological disorders (Shaikh, Shewchuk).

C. Enhance the access of minority and disadvantaged students to a medical education. We participate in several programs whose explicit goal is to enhance the training and education of underrepresented groups. One example is the Summer Ventures program, a statewide program to enhance math and science training of underrepresented groups. The Summer Program for Future
Doctors also have diversity as a driving objective. We are not responsible for student admissions into medical school but our student population is diverse, typically exceeding national trends. We have struggled to enroll a racially diverse group of graduate students. Our Ph.D. graduates have been European Americans, Europeans, African Americans, and Asians or Asian Americans. Though our enrollment has averaged just 29% non-white students, we have graduated roughly 40% non-white students as PhDs, indicating that they are more successful than the average in completing the degree (Appendix 2; Table A4 and A6). Applications from African American students and Hispanics have been low. Minority students who participate in summer research are often interested in medical school rather than graduate school. We need to explore other means of attracting underrepresented minorities to our graduate program. At least five minority undergraduates who we have mentored have gone on to medical school and one has gone to graduate school. Also, though we have not achieved full cultural diversity, our Program excels in gender diversity for PhD training. Here too, females appear to have greater than average success in completing the PhD in our Program; our enrollment averages 56% female, but a full three quarters (67%) of recent graduates have been female (Appendix 2, Table A4 vs. A6). We interpret these limited data to mean that continued effort to attract minority applicants is warranted, but every one of our students is receiving equal access to educational tools and research mentoring by our faculty.

Several of our faculty work with high school students and undergraduate students involved in independent research activities. In the past year we trained eight undergraduate students and one high school student, and have trained several more in the recent past. The students were diverse in ethnicity and in background, and many of them successfully continue training and careers in science and medicine with the benefit of this background.

1.3 Specific and unique features of the program that distinguish it from others.

Our department has a small faculty, and each member is broadly involved in all aspects of research, graduate training and medical education. We do not maintain separate teaching and research faculty like many other medical schools and departments. Lectures to the medical students, graduate students, and even to undergraduates in most cases, are given by active researchers who are experts in the respective fields. This ensures that the students are receiving the most current information in any research topic, with emphasis on where the most interesting new questions lay. Our faculty's broad involvement is critical to the development of future research areas at ECU as well.

Research projects directed by Biochemistry and Molecular Biology faculty cover all major areas of biomedical investigation, including metabolism, gene expression, and cancer using structural, functional, and kinetic aspects of biomolecules. Yet even with the breadth of topics, we invariably find overlap in our projects that leads to collaboration. Some of these collaborations are with clinical faculty from ECU's medical departments. We are at some advantage geographically, because we have a unique patient base in eastern North Carolina that allows us and our students to work on relevant human diseases with human tissues.

We are most proud of the strength of our student training. In addition to didactic learning and hands-on research training, our students receive uniquely excellent training in research presentation. When our MS and PhD graduates leave to give research seminars at conferences, or job talks for a postdoc or academic position, they invariably receive praise for their confidence, passion and professionalism. We have received (directly or through the student) compliments from outside universities, established investigators and companies. Remarkably, our graduates are pretty equally split between both career paths (Appendix 2; Table A7). By focusing on rigorous research method and skillful professional communication, our PhD training program is geared
toward careers in both academia and industry. Our PhD graduates secure prestigious positions and lead fruitful careers.

In recent years our department has participated in the Medical Student Research Distinction Track. This gives selected medical students an opportunity to maintain an active research program during their entire 4-year medical program. Similarly, we participate in a Leukemia Program Project Grant (via Dr. Myles Cabot) with Hershey Medical Center and UVA cancer center. The PPG provides further unique training opportunities for postdoctoral fellows and students in cancer research and communication.

1.4 External factors that impact the program’s enrollment and market demand of its graduates based on statewide, national and/or professional studies.

Budget constraints at National Institutes of Health and the National Science Foundation have made it difficult to obtain grants to support graduate students. As a result, only the faculty members who have active grants or who have accumulated funds over the years from previous grants are currently taking students into their labs.

North Carolina has many outstanding universities that provide the highest quality of graduate education. We compete for graduate students with our outstanding neighbors including UNC-Chapel Hill, Duke, Bowman Gray and NC State.

Based on the data from the United States Department of Labor, biochemists and biophysicists held about 34,100 jobs in 2014 (the base year). The industries that supported the most individuals in these fields are:

- Research and development in the physical, engineering, and life sciences: 47%
- Colleges, universities, and professional schools; state, local, and private: 16%
- Pharmaceutical and medicine manufacturing: 14%
- Management of companies and enterprises: 3%
- Basic chemical manufacturing: 2%

The employment of biochemists and biophysicists has been projected to grow by 8% from 2014 to 2024. This is about as fast as the average for all occupations. More biochemists and biophysicists are expected to be needed to do basic research that increases scientific knowledge as well as to do research and develop biological products/processes that improve the quality of life. However, budgetary concerns may limit researchers’ access to funding for basic research.

A large portion of basic research in biochemistry and biophysics is dependent on funding from the federal government through the National Institutes of Health and the National Science Foundation. Therefore, federal budgetary decisions will have a large impact on job prospects in basic research from year to year. Typically, there is strong competition among biochemists and biophysicists for research funding.

Most applied research projects that involve biochemists and biophysicists require the expertise of scientists in multiple fields, such as microbiology, medicine, and chemistry. Biochemists and biophysicists who have a broad understanding of molecular biology and its relationship to other disciplines should have the best job opportunities.

We attempt to provide our students with a broad and rigorous background. As a result, they should stand a better chance of attaining employment. Our students are equally split between
academic and industrial careers. As a result, they have been successful in obtaining jobs. All but one of our recent graduates are employed in a scientific field (Appendix 2; Table A7). The one who is out of science has decided to leave the field to raise her children. This is in contrast to the national trend of PhD graduates having difficulty finding employment in their areas.

2. Enrollment, Degrees and Student Success

Enrollment and Degrees Analysis

2.1 The program’s enrollment trend over the last seven years:

The average annual enrollment of PhD students in the program has varied from a high of 13 to a low of 5, but has averaged nearly 10 students. The seven-year history of the Biochemistry PhD Program clearly shows we have maintained the small, intimate educational and mentoring setting. These principles are best reflected in Table 2.1, which outlines the enrollment census, but also summarizes the reliable recruitment of new talent, and productive and selective awarding of degrees (see also Appendix 2; Table A3). All of these students are full time, and the program confers an average of 1.9 PhD’s annually (Table 2.1). Student diversity is modest but significant; 71% of enrolled students over this period were white, 29% were African American or Asian. The program has enrolled more females (average 56%) than males in nearly all years included here (Appendix 2; Table A4). The early trend was training of students 25-30 years old, but in recent years our program has attracted a greater number of 22-25 year old students (Appendix 2; Table A5). The “younger” trend has correlated with broader recruiting efforts both within western North Carolina, and in home states (e.g. Pennsylvania, Virginia) of our faculty, or where we have research collaborations.

It should be noted that the current program will be consolidated with four other PhD programs at Brody to form the Biomedical Sciences PhD program. Biochemistry and Molecular Biology (BMB) will become a Concentration within the consolidated program in Fall 2017 (see section 2.9 below).
Table 2.1

<table>
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<th>Term</th>
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<th>FT/PT ratio</th>
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<th>Returning Students</th>
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Average 2.1 1.0 7.4 0.1 1.9 9.6

Student Recruitment:

The PhD program continues to be very selective for admissions, accepting less than 20% of applicants annually. The attractiveness of the Biochemistry PhD program is reflected in the fact that typically 90% of students offered admission become enrolled (Appendix 2; Table A1). The undergraduate GPA of enrolled students has improved from 2.80 (2008) to 3.53 (2015), and average GRE scores of 153 (Verbal, ~62 %-ile) and 154 (Quantitative, ~67 %-ile) have remained stable since the new test scoring began in 2009 (Appendix 2; Table A2). This trend bodes well for increased future recruiting under the consolidated Biomedical Sciences PhD program for the new Concentration in Biochemistry and Molecular Biology (see sections 2.4 and 2.9).

2.2 The trend regarding the number of degrees conferred each year.

The number of PhD’s conferred by the program has remained nearly constant at 2 per year since 2011, despite the modest enrollment drop from 11 students to 7. This is due to a lower attrition rate in recent years (see section 2.3).

2.3 The trend regarding completion rates and time-to-degree of the students.

Since its inception, the Biochemistry and Molecular Biology PhD program has graduated 57% of students who enter; prior to 2003 just 49% completed the degree, whereas over 76% have graduated since 2003. The trend of greater retention has continued in the period 2008-2016. The average time to degree in this period is 5.5 years; no student has required more than 6.5 years. To improve student retention and timely degree completion, the thesis advisory committees meets with their candidates more frequently and have become more active in the planning of student progress milestones. The most successful action, however, has been enforcing a stricter timeline for second-year students to take their Candidacy Exam. To prepare students better for the proposal...
and oral presentation examination, a new Research Proposal Strategies course was instituted in 2013 that gives didactic and workshop-style instruction on preparing an NIH-style grant proposal. This course is now in use other PhD programs as well (Anatomy, Physiology, Kinesiology, and Exercise Science). Recent Biochemistry students have had greater success in passing the Candidacy exam with fewer revisions or repeat presentations.

2.4 Program size.
The impending change to the consolidated Biomedical Sciences PhD in Fall 2017 will actually necessitate expansion of the BMB Concentration to keep pace with the four other concentrations. Current resources in the Brody Graduate programs are sufficient to support each PhD Concentration at about 12-16 enrolled students. The consolidation effort was initiated by two successive Graduate Directors from BMB, and was welcomed by the UNC General Assembly and the ECU Graduate School to better represent the productivity of these relatively small degree programs. Growth of the concentrations within the umbrella of Biomedical Sciences is anticipated as resources and educational efforts are pooled, and needs are able to be met from a stronger central governance.

Student Success

2.5 The 3-year trend regarding D/F/W rates in 1000- and 2000-level courses.
The BMB PhD program has no 1000- or 2000-level courses. For introductory (1st year) didactic courses for students in the program (BIOC 7301, 7310, 8320, MCBI 7410, 7440) there have been no failures and just three withdrawals (two students) due to academic performance from Fall 2012 to Fall 2015. No students have failed or withdrawn from practical/lab/seminar courses, except as dictated by withdrawal from the degree program; these were not the precipitating factor. Because of the small class sizes (6-20 max), faculty and course directors have been able to identify academic problems early to work individually with a student and recommend find tutors among their upper class peers.

2.6 Job placement rate of the graduates.
Our PhD graduates have a remarkable success rate in landing the postdoctoral fellowship or staff scientist or academic position of their first choice. Of the 15 PhD graduates since 2008, only two do not have commensurate employment in the sciences. Both of those were by choice by the graduates, for personal/family reasons. Recent PhD graduates have gone to postdocs at Emory University, Baylor College of Medicine, McGill Univ., NIH-Bethesda, NIEHS, UCLA School of Medicine, University of Guelph, Wake Forest Univ. School of Medicine, ECU and Duke Univ. School of Medicine. Several graduates are now faculty, staff scientists or technology/grants officers at NIH, Bayer Crop Science, Lincoln Memorial School of Medicine, and UNC-Lineberger Cancer Center. Even among the four students who withdrew or finished with a MS degree, two are known to be teaching biology at a community college or working in a biotech firm (Appendix 2; Table A7).

2.7 Licensure pass rate of the graduates.
There is no licensure exam.

2.8 Actions taken over the past seven years to improve student success.
The actions that have proven so successful for the PhD graduates from Biochemistry and Molecular Biology are components that were purposefully built into the academic/mentoring structure between 2003 and 2008 by the faculty under the advice of Dr. George Kasperek (Program Director). Measures included individual mentorship by thesis advisors and committees, and very regular opportunities for students to present their work. Rather than oversee only a student’s
research project, the faculty were charged also with instructing and evaluating 1) student seminar presentations (each semester, every student), 2) writing skills (grant proposals, manuscripts), and engagement of the external scientific community (national/international meeting presentations). Anecdotally, we get frequent visits from BMB PhD graduates (generally one or two every year), and they invariably mention that they were much better trained in writing and speaking skills than their peers from larger PhD programs. No doubt these skills are invaluable when the interview for competitive positions.

**Action Plans**

2.9 *Actions planned in the next seven years to increase enrollment and student success.*

The current BMB PhD program will be consolidated with four other PhD programs at Brody School of Medicine to form the Biomedical Sciences PhD program in Fall 2017. Biochemistry and Molecular Biology will become a concentration within the consolidated program. This provides the advantage to students of greater flexibility and uniformity between and among the five Concentrations. For the BMB program, an individual core curriculum will be maintained. Because of a more seamless distribution of resources among Concentrations, and cooperative efforts to integrate course curriculum, there will be room for some expansion of PhD student enrollment over the following six years. The BMB Concentration plans to progress back to an enrollment average of 10-12 students. This will require stipend support, tuition remissions and health insurance for an additional 5 students in each year. With the expansion of PhD student population to that critical mass, it is our previous experience that funding from extramural grants keeps pace with, or exceeds the growth. In the end, the invested funds would be replaced in time with grant funds to train PhD students.

3. **Curriculum, Learning Outcomes and Student Satisfaction:**

Student learning is a high priority in our department. In addition to the required curriculum, *(Appendix 1)* we provide our students with a variety of elective coursework to choose from that is tailored to the unique research interests of our students and faculty. While coursework is kept to a minimum, we strive to provide students material that is current, cutting-edge and engaging. In addition, we have designed the structure of several courses to provide students with the opportunities to develop and refine their critical thinking, writing and scientific communication skills. In this section, we have summarized the general trends in learning outcomes and student satisfaction. Since each course is unique in learning objectives, assessment and outcomes, we specifically address each of these topics within the short course description.

**Curriculum Analysis**

Our curriculum has the advantage of being limited to just a few didactic courses and an emphasis on one-on-one mentoring in research, writing and presentation. For that reason, and owing to the small numbers of students enrolled in each class (generally 4-12), rigorous statistical analysis of performance and outcomes is less informative than the real-time discussions of our faculty and students. Consequently, our faculty has been in the habit of shaping, modifying, updating and improving the course structure/content every year, and even within a semester, as needed. Several such rapid-response changes in course structure or content are described in the Course Summaries below.
It is important to note that because of the advanced content of our didactic courses at all levels, there is no “linear progression” per se to the curriculum. Hence, our courses do not strictly adhere to a strict sequence of topics for learning (see Appendix Item 1, PhD Curriculum Map). Rather, they work together to Introduce (I), Reinforce (R), and lead to Mastery (M) in a more integrative fashion. The primary safeguard in our PhD Program to insure that a student has accomplished each level is the Thesis/Graduate Advisory Committee (GAC). Each student assembles a GAC of three Biochemistry faculty and one external faculty near the end of their first year. In addition to guiding a student’s progress in research, this committee assesses the individual course structure (and actual learned knowledge) taken by the student. The GAC gives guidance to both student and mentor on relevant didactic and elective courses that would help their development. Regarding course number, content, etc., the specifics of the Biochemistry PhD degree requirements are given at the ECU Graduate Catalog site (http://catalog.ecu.edu/preview_entity.php?catoid=6&ent_oid=495&returnto=385) and required courses are listed in Appendix 1.

3.1 Description of how course sequences, including prerequisites, are used to introduce and reinforce student learning prior to students being assessed.

In general, most of our courses require general chemistry, organic chemistry and general biology courses. The basic course sequence is such that students are required to take graduate level core courses in biochemistry and molecular biology courses in their first year. This helps to ensure that students have a solid background in fundamental concepts before proceeding on to more specific, and often more difficult concepts. Fundamental concepts are reinforced throughout the upper-level courses. Specific examples are detailed in the summary for each course.

3.2 The process used to ensure the curriculum is up-to-date.

In order for our students to remain competitive for academic and industry positions, it is essential that we are constantly evaluating our course material to ensure it is up-to-date. Again, this is specific for each course but as we have integrated current literature into our lectures every year, have added new courses (such as the grant writing course) to reflect current needs of the students and use our “Current Topics” course as a way to easily and quickly explore new and cutting-edge themes.

Student Learning Outcomes Assessment

In a PhD program, unlike an undergraduate course of study, the Learning Outcomes are usually assessed by the course lecturer (with the course director) on a more personalized basis in conjunction with just a few students. Our faculty has been extremely responsive to problems or obstacles in the Learning Outcomes process with our students, and often adapt their presentation style/information rate/testing mechanisms within one or two class meetings. In addition, our small faculty meets once annually (“in house retreat”) to discuss the effectiveness of our courses and the need for revision. Changes are initiated at this time and dealt with informally between colleagues.

3.3. Identified strengths and weaknesses in student learning outcomes.

The strengths and weaknesses of specific courses are summarized below. We have identified them using student evaluations as well as the overall evaluation of the course by the lecturer through exam/quiz performance. Other metrics of learning outcome assessment (i.e. improvements in writing skills, funded student fellowships, etc.) are also discussed.

3.4. Differences in student outcomes in face-to-face and online programs.

N/A- we do not offer any online courses at this time
3.5. Changes that have been instituted on the basis of ongoing assessments.

In a few cases, as described in our Unit Assessment Reports from 2009-2012, we recognized a systemic problem in students’ abilities that represented a pattern of poor performance. In this specific case, students showed routinely poor capacity to compose and defend a grant application for their Candidacy Exam (see Appendix items “Unit Assessment Reports-BSOM Program”). As a response, we created a new course (BIOC 7365, Research Proposal Strategies) that would correspond to the period of Candidacy preparation and teach them grant writing skills in a didactic setting (see Appendix item “Unit Assessment Reports-2012-2013”). As an example, this Analysis, Result and Action were very successful, greatly improving the quality and grantsmanship of student’s first-time Candidacy proposals. This is just one example, but other anecdotal deficiencies and corrections are found in the Unit Assessment Reports-BSOM Program (Appendix items). Other changes based on assessment are specific to individual courses, highlighted below and in the Unit Assessment Reports (Appendices).

3.6. Effectiveness of the changes.

The ultimate arbitrator of our success as educators is student success. In a graduate program, that success is most easily determined by the number of students who have gone on to have successful careers in professions where they use their Ph.D. every day. Based on our statistics showing the “value added” success of our PhD graduates moving to prestigious postdocs and positions (Appendix 2; Table A7), we consider the specific changes highlighted here to be very effective.

Student Satisfaction

3.7 Graduating student satisfaction.

As reiterated in the course descriptions below, the small numbers of students enrolled in our courses prevents the use of formal Graduate Student Exit Survey for reasons of anonymity. The best indication of student satisfaction, however, can be found in personal student testimonials. Several of our more senior PhD candidates (Vince Contreras, Tamra Hunsaker, Kaitlin Morrison and Andrew Franklin) agreed to record these testimonials and allow them to be posted online at the Biochemistry and Molecular Biology department website. Reviewers are invited to view these testimonials at http://www.ecu.edu/cs-dhs/biochemistry/testimonials.cfm.

3.8 Evaluation of the knowledge and skills acquired in the program.

As mentioned in Section 1.3 above, we are proud of the strength of our student training as it is exemplified when they move to new jobs or postdocs. Through the statements made in the above testimonials (see the link in Section 3.7), students and alumni invariably say their training put them at some advantage over their peer postdocs or scientists in their new institution.

3.9 Employers evaluation of graduates’ knowledge and skills.

When our MS and PhD graduates present research seminars at conferences or job talks, they invariably receive praise for their professionalism. These compliments from other university faculty or industry scientific directors come to us directly or indirectly through the student.

3.10 Actions taken to improve student support, services, and satisfaction.

The fundamental support unit for PhD students is their Thesis/Graduate Advisory Committee (GAC). In conjunction with the Graduate Director, these committees are helping students to meet deadlines for fellowship applications, Candidacy Exams, manuscript publication and attendance at national and international conferences. In the last 7 years, the Committees and
the Director have become more proactive to remind students in their annual update meeting of important goals for the coming year.

**Action Plans**

*3.11 New curricular and pedagogical changes that the program plans to implement in the next seven years to improve student learning.*

As noted above, we are consistently updating our content of courses to reflect the changing topics in biochemistry and molecular biology research. With the move to consolidate all basic science courses into one consolidated Biomedical Sciences PhD by 2017, there will be some minor changes to the curriculum to accommodate greater flexibility with Concentrations in the parent Program outside of Biochemistry and Molecular Biology.

*3.12 Actions to improve students’ educational experience and overall satisfaction.*

Part of the educational experience in our Ph.D. program is to expose students to scientific conferences in their field, and give them opportunity to present their work in a competitive setting. Thus, attending conferences will enhance their exposure to a broader range of science and further develop presentation skills.

*3.13 Additional resources needed to implement those changes.*

Funds to send every student to at least one national or international conference, and to bring renowned outside speakers to the Brody School of Medicine would greatly improve the educational experience of the students.

**Course Summaries**

Our contribution to Medical Education comes primarily from our course, Medical Biochemistry and from our participation in Foundations in Medicine. In contrast, we are responsible for all aspects of graduate student training in the Biochemistry and Molecular Biology PhD, and several courses in the Biomedical Sciences MS Programs. Graduate training consists of a moderate amount of formal course work and student presentations and a great deal of laboratory research. Both didactic and laboratory graduate student activities are listed in our catalogue as courses. The medical course and the graduate courses are summarized below. Our contributions to Dental Biochemistry, Foundations in Medicine (PBL), and Chemistry 2770 are not included.

**7300 Medical Biochemistry (6 credits)**

This course is designed to follow a logical progression from fundamental principles of chemistry that underlie all biochemistry (overlapping with and reinforcing concepts learned in prerequisite undergraduate coursework), through a description of major biochemical processes, to physiology and disease.

*Student Learning Outcomes Assessment.* Lectures are reviewed and updated yearly. The course director oversees the entire syllabus and attends each lecture in order to monitor content. Many of our faculty also participate in Problem based learning (PBL), which allows targeted reinforcement of Medical Biochemistry material. We also include within the curriculum nine small group conferences based on patient cases, and eight Clinical Correlations with live patient case presentations by ECU physicians, to increase the depth of coverage of important concepts, and to integrate the didactic material with specific clinical contexts.
**Student Success and Satisfaction.** Historically, students have ranked Medical Biochemistry near the bottom-middle of the 13 M-1 courses (average questionnaire scores of ~3.85 on a scale of 1-5). However, in 2014-2015 ranking improved to #2, with a score of 4.22. However, one of the most important outcomes with respect to medical education is student performance on LCME Step exams. In this context, BSOM students consistently perform at the national mean, exceeding the relative performance in many other disciplines within the BSOM pre-clinical curriculum. Students from diverse academic and socioeconomic backgrounds are, as a group, performing at the national average on LCME Step 1 Med Biochemistry questions. A consistently near 100% residency match rate also indicates that program outcomes are training students successfully for the next stage in the medical professional track.

**Action plans.** While we have we routinely have several students fail Medical Biochemistry who withdraw due to failures in other courses, or who must remediate Med Biochemistry in the M1 Summer, the implementation of the Academic Achievement Program has helped. The program was put into place to catch students early who are having trouble, and are aggressively assisted with a range of resources (including the new education specialist in the OME, Terri Edwards). Although this is the first year of this manifestation of the program, it appears to be having a positive effect, as the students who are still struggling are well within the realm of being able to pass the class. In other words, compared to previous years, the failing averages are higher this year (mostly >67). Ultimately, only two of 80 students failed Medical Biochemistry. We are planning to increase the utilization of active learning modalities (e.g. flipped classrooms, formalized concept mapping exercises, PBL-like small group conferences) to achieve the documented improvement in student performance and knowledge retention associated with these techniques. We will also administer more frequent low-stake assessments (i.e. quizzes) in addition to the four unit exams to further distribute the study burden, and to improve long-term knowledge retention and utilization.

**7301 Biochemistry I (4 credits)**

*Curriculum analysis.* The purpose of BIOC7301 course is to provide a basic understanding of the structure, function, and chemistry of biological molecules, and their relationship to human metabolism.

*Student Learning Outcomes Assessment.* Assessment is based on exam scores. The course is modified from year to year based on the weaknesses identified from examinations. Changes in the lecture improved overall exam scores or scores of a given question.

*Student Success and Satisfaction.* Based on comments by the student, most them enjoy the learning experience in BIOC7301. This is also reflected in student enrollment from all basic science departments with the exception of students form A & CB. Also it should be mentioned that sustainment in advising their students to take the course is also an indicator that the students are having a good learning experience.

*Action Plans.* Since the break out questions improved scores on Exam 1 and 2, we wish to employ this strategy to the other sections as well. Secondly, we will apply mnemonic strategies to assist the students in memorizing general biochemical information, such as the classification of amino acids. Lastly, information regarding the various biochemical topics is updated on an annual basis. Overall it is the goal of the faculty to provide the necessary biochemical tools that the students will need to conduct basic research. It is our intentions that employment of break out questions and mnemonic strategies will further enhance students' educational experience and overall satisfaction. No additional resources are needed.
7310 Molecular Biochemistry (3 credits)

Curriculum Analysis. This course is a required 1st year didactic course for the PhD degree program (http://catalog.ecu.edu/preview_entity.php?catoid=6&ent_oid=495&returnto=385). Content of this course stresses a linear progression through major steps in gene express, presented specifically from a biochemical structure and function perspective.

Student Learning Outcomes Assessment. The Outcomes of student learning from this course have not been directly assessed in TracDat formulations. However, as one of 5 didactic courses in the pre-Candidacy curriculum, its success has been measured by the readiness of students for cumulative knowledge questioning in their Candidacy Exam, which is assessed. Of the generally 50% of candidates that require a second examination (editing of proposal or oral defense), only about one in five (10% overall) require remediation on BIOC 7310 content or other core curriculum.

Student Success and Satisfaction. Because small numbers of students are enrolled in BIOC 7310 (6-13, generally 10), a formal Graduate Student Exit Survey cannot be employed that maintains anonymity. Anecdotally, every year since 2010 students both inside and outside of the Biochemistry department have approached the Course Director (Dr. Keiper) to praise the organization and rigor of this course. Many have said it was a key component in assimilating the gene expression fundamentals that they required to conduct their dissertation research.

Action Plans. The topical content of this course is updated annually by the three instructors, Drs. Johnson, Mansfield and Keiper. While the breadth of topics, and linear organization continue to be appropriate to students being trained from all basic science PhD programs, the rapid pace of new findings in gene expression necessitate modest content addition each year. Notably, with the consolidation of the Brody PhD programs in 2017, this course was proposed and approved as one of just three core curriculum courses for the Biochemistry as well as the Microbiology concentrations.

7330 Introduction to Research (1-6 credits); 8333, 8336 Research (3,6 credits); 9000, 9001 Dissertation (3-12 credits)

Curriculum Analysis. These courses are treated together because they are all research courses that differ in the level of independence and sophistication expected of the student. These courses form the backbone of graduate education in Biochemistry & Molecular Biology. The execution of a novel research project, and its presentation through peer-reviewed publication and scientific conferences, are the major underlying requirements for the PhD in Biochemistry and Molecular Biology. Because laboratory research is the core of degree, each student’s training and progress are directed through three tiers of Research courses (http://catalog.ecu.edu/preview_entity.php?catoid=6&ent_oid=495&returnto=385).

Student Learning Outcomes Assessment. The assessment of learning outcomes for these Research courses are conducted in a personalized manner for each student individually, as their needs will vary substantially and each project is unique. Evaluation of a student’s laboratory prowess and learning is communicated from the lab rotation mentor to the Graduate Program director (Dr. Keiper), who is the course director for BIOC 7330 and 8333/8336. Student progress in the thesis project is evaluated by the thesis committee and communicated to the mentor (PI), who is the course director for BIOC 9000. A broader assessment of each student’s progress, and of the efficacy of this programmatic structure of research training for all PhD students is part of annual
discussions of the Biochemistry Graduate Committee. Regarding numeric outcomes, since 2008 only 2 of 20 students failed to complete the PhD after successfully achieving Candidacy. Both completed MS degrees as an alternative. Of 27 current and former students, 3 others left the Program in the first four semesters (before Candidacy) due to poor grades in didactic courses. One (1) failed the Candidacy exam and one (1) voluntarily chose to switch to the MS program prior to Candidacy. Fifteen (15) have successfully defended PhDs, and 5 current students are on track.

**Student Success and Satisfaction.** PhD students are anxious to excel in their research courses, as this is the reason they entered the Program. Satisfaction with lab rotation experiences varies widely depending upon the student’s “taste” or interest in the project to which they are assigned. The Graduate Director insists that students’ rotations provide experience in divergent methodologies (e.g. molecular biology, enzyme structure/kinetics, cell biology). Some topics appeal to a student’s interest, others do not, but they all provide a necessarily broad research experience. Once settled in their thesis labs,

**Action Plans.** Since 2014 there have been several initiatives to speed up the student’s research progress to allow them to be fully engaged in thesis-based research within the second programmatic year. In 2014 the Biochemistry Graduate Committee voted to shorten the duration of three research rotations to finish by April of the first year. In 2015 the Committee voted to further abbreviate rotations to 10 weeks each, and making the third rotation optional, subject to research evaluations (7330, 8333). Strong performing students may enter thesis research in their 3rd semester. This is proposed to give students a stronger basis for their Candidacy defense on the thesis proposal. Students entering the Program with a MS degree usually forgo research rotations altogether. In 2016-2017 the Graduate Committee with evaluate the outcomes of accelerated thesis lab placement.

**7335 Seminar in Biochemistry (1 credit)**

*Curriculum Analysis.* The purpose of this course is to provide our students an opportunity to develop scientific communication skills through formal seminars and critiques of current literature and their own research projects.

*Student Learning Outcomes Assessment.* Our students generally give excellent seminars by their second year.

*Student Success and Satisfaction.* Students tell us that while they did not enjoy giving seminars, they found the experience invaluable when giving talks at meetings and when giving job seminars.

*Action Plans.* Our students do not need additional training in speaking but they do need additional training in listening and evaluating. We hope to resurrect our external seminar program to give the students more experience interacting with established scientists.

**7345 Cell Motility (2 credits)**

*Curriculum Analysis.* The purpose of this course is a multidisciplinary exploration of mechanism, structure, and function of motile systems essential for eukaryotic life. The objective is to introduce students into the physics, biochemistry, anatomy, physiology and mathematics of cell motility.
Student Learning Outcomes Assessment. This course typically has 2-4 students. Student reviews have been positive.

Student Success and Satisfaction. The reviews that we have had are mostly positive. Students seem to particularly enjoy hearing from instructors outside of their major discipline.

Action Plans. The course would benefit from even greater diversity in faculty and in student body. It would be exciting to invite researchers from other universities to give guest lectures in this course.

7355 Current Topics (1-3 credits)
(e.g., Methods in Biochemistry and Molecular Biology)
Curriculum Analysis. Current topic courses, in general, give instructors in our department the flexibility to delve into new and contemporary topics relating to biochemistry and molecular biology research. The most recent iteration of the Current Topics course, which focuses on methodology, is designed to introduce and familiarize 1st year graduate students with the use of equipment and biochemical/molecular techniques commonly used in the Biochemistry and Molecular Biology department.

Student Learning Outcomes Assessment. This is the first iteration of this course, so no formal assessment has been performed.

Student Success and Satisfaction. This is the first iteration of this course, so no formal assessment has been performed.

Action Plans. We plan to offer this specific current topics course when new graduate students join the department in order to familiarize them with techniques/equipment in the department. In addition, we will use the current topic course to offer our students the opportunity to have an intensive course in specific contemporary topics central to the research foci and expertise in the department.

7365 Research Proposal Strategies (2 credits)/ANAT 7365
Curriculum Analysis. This is a practical approach to the fundamentals of writing clear, concise and competitive research grant applications. Course content follows NIH and NSF handbook recommendations.

Student Learning Outcomes Assessment. The need for this course was recognized by faculty thesis committees by 2011 and documented in our Program Assessment in TracDat in the 2011-2012 Report. The new course built by Drs. Keiper, Shaikh (Biochemistry) and Geyer (Anatomy) for 2013 has improved student performance. Since inception of the course, (2013-2015), one student passed the Candidacy exam with no revisions, and two others with only modest written revisions. More strikingly, all 3 were accepted to PhD Candidacy within the targeted 5 semesters, greatly improving the timeline for progression from previous years.

Student Success and Satisfaction. Students enrolled in BIOC 7365 were given a voluntary written course evaluation at the end of 2013, 2014 and 2015. Eight surveys were completed and the mean score (1= “helpful”, 5= “not helpful”) for eight categories was 1.6+/-.8.
**Action Plans.** As one course with ready and visible practical outcomes, in the form of better student Advancement to Candidacy experiences, the course is deemed successful even in its first few iterations.

**8305 Physical Biochemistry (2 credits)**  
*Curriculum Analysis.* This course explores the physical principles that define macromolecular structures and interactions.

Student Learning Outcomes Assessment. Students are evaluated by weekly assignments.  
*Student Success and Satisfaction.* Student comments have been positive with regards to this course. For example, “I liked that the course was structured as both a lecture and a small group discussion. The instruction was appropriately geared towards graduate students with an existing level of biochemistry and physical chemistry knowledge, and all material was explained thoroughly. Also, extra attention was given to any of the topics in which one of us was lacking, which was extremely helpful.”

**Action Plans.** Perhaps the most significant change would to have an expert in Mathematica give the first few lectures to get the students off to a good start. With a typical class size of 2-5 students, it is difficult to justify the expense of bringing in a Mathematica expert.

**8320 Biochemistry II (4 credits)/EXSS 8320 –Bioenergetics II: Regulation of Metabolism**  
*Curriculum Analysis.* The purpose of this course is to explore the molecular mechanisms underlying the regulation of carbohydrate, lipid, nucleic acid and amino acid metabolism.

Student Learning Outcomes Assessment. The outcomes of student learning from this course have not been directly assessed in TracDat formulations. The course is designed to reinforce the concepts of education for a new century by promoting critical analysis of current literature surrounding global health issues. In addition, instructors introduce the skill of developing a systematic way to read and analyze primary literature, which is integral to student success in candidacy exams and thesis/dissertation research.

*Student Satisfaction.* Because small numbers of students are enrolled in BIOC 8320/EXSS 8320 (4-10; 8 students for Spring 2016: 3 from Bioenergetics, 1 from Physiology and 4 from Biochemistry), a formal Graduate Student Exit Survey cannot be employed that maintains anonymity. Students in the Spring 2015 course were asked for a general informal and anonymous assessment of what they thought were the strengths of the course and how the course could be improved. Two of the four students responded and of those responses, both had said, “this was one of the best courses they have taken” and wished that more “graduate level courses took this [seminar style] approach.” Anecdotally, students appear to enjoy the active learning style of the course.

**Action Plans.** The content of this course is updated annually and instructors are encouraged to use the most recent examples of primary literature. While the content and topic of discussion is left up to the instructors, many have found that new discoveries in their respective fields necessitate the addition of new content to their lectures and discussions.
4. **Strength of Faculty: Teaching, Research and Scholarship Faculty Resources**

4.1 *Faculty Profile*

Faculty bio sketches can be found in Appendix 3.

The table below lists the faculty. They are 78% male, 22% female, 77% European-American, 11% African-American and 11% Asian-American.

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<td>Associate</td>
<td>Full</td>
<td>Ph.D.</td>
<td>epigenetics in disease</td>
</tr>
<tr>
<td>Zeczycki, Tonya</td>
<td>Assistant</td>
<td>Full</td>
<td>Ph.D.</td>
<td>diabetes/neuro</td>
</tr>
</tbody>
</table>

*Dr. Joseph Chalovich has been the interim chair since December 2014.*

4.2 *Faculty Resources: Does the department have the number and type of faculty to achieve its goals?*

No. With the loss of Drs. Pekala and Bridges we are in need of a permanent chairperson and a junior faculty member. This has increased the teaching load of the remaining faculty, which is a temporary solution at best. We have decided to permit the new chair to be responsible for the new faculty member as an incentive. However, if we do not get permission to recruit a chair within the next 6 months, we may opt to fill the junior position sooner.

4.3 *What actions has the department taken to recruit and retain highly qualified, diverse faculty?*

We had two additional women participate in our last faculty search. During that search we hired one male and one female. However, the hires were made based on areas of research interest, areas of teaching specialty and the qualifications of the applicants. Our goal is to make the interview process inclusive but to hire the best qualified person. In the future we are going to ask the assistance of our Office of Diversity Affairs in setting up the initial announcement. The Office of Diversity Affairs, in collaboration with the Vice Chairs of Inclusion and Diversity (VCDI), and the Brody Women’s Group will be consulted and potentially asked to serve on a search committee. Furthermore, these groups can advise us where to place ads in order to reach a broad spectrum of applicants, particularly targeting minorities and women.

We have not made any special provisions for retaining personnel from under-represented groups.

**Junior faculty mentoring**

The program was established in 2015. There are monthly meetings between the individual junior faculty members and the chair of the department as well as the chair of the personnel...
committee. We work to help the junior faculty members set priorities, identify grant opportunities, to establish connections locally as well as at other institutions with individuals who may have similar research interests, to become aware of the procedure for processing grants for submission and to provide guidance in the tenure process. Also, we attempt to help the junior faculty members strike a balance between their personal lives and their professional careers.

Each semester, every faculty member presents a summary regarding their research and their efforts to obtain funding. In this way, the junior faculty have an opportunity to learn how senior faculty members approach these issues. All faculty are encouraged to have their colleagues review their grants before submission.

**Analysis of Teaching**

4.4 Describe the trend in student credit hour production in the department over the past seven years, for both Distance Education and campus courses, highlighting the department’s contribution to the Foundations Curriculum and other degree programs. Consider the trend of average credit hour production per instructional faculty FTE.

We do not participate in the Foundations Curriculum or other undergraduate programs.

4.5 Based on the Delaware Study data, what is the general teaching load of the department faculty? What has the department done to adjust faculty teaching load?

The Delaware study does not include Brody School of Medicine.

The basic science departments at the Brody School of medicine have gone through a period of evaluation of our SUSTAINABILITY in 2015. Although this process is incomplete, we have begun to restructure our department in line with the expected recommendations. In the summer of 2015 we began to redistribute lectures so that the load of lecturing load is inversely related to research productivity. The graph shown here illustrates the relationship that we had mid-way through 2015 after some adjustments had been made. We have made additional adjustment so that the faculty who fell in the lower left quadrant are have moved closer to the line. We need to reduce the teaching of some faculty who fall to the right of the line. This is complicated by the loss of two faculty from our department that requires everyone to share that extra load. It was not possible to construct a similar graph for the present year as we are still waiting for results of submitted grants.

The most important part of our teaching is done in the laboratory. Everyone participates in this activity. Those with significant funding are more likely to support graduate students and so laboratory teaching should parallel research productivity whereas classroom lectures should be inversely proportional.
This approach to balance the work load among faculty members has deficiencies. First, the relationship used to evaluate research effectiveness is imperfect as in any relationship of this kind. At present, our algorithm is:

\[ \text{Research Rank} = x(\# \text{ publications}) + y(\# \text{ grants submitted}) + z(\# \text{ grants funded}) \]  where \( x=1, y=1 \) and \( z=2 \).

This relationship is nonlinear and compresses those at the upper end of research productivity. As our department achieves greater success, the algorithm will change to accommodate the % of salary covered by grants and the amount of F&A generated.

Another challenge results from the fact that some courses generate fees that can be used to subsidize research. The fact that all courses are not treated identically places a bias on the system. We have lessened the bias, this year, by allowing faculty to collect only half of the funds obtained from such teaching. The remainder goes into the general departmental fund. This is still an imperfect system.

Several of our faculty participate in Foundations in Medicine (formerly PBL) with the Medical Students. This course is faculty intensive and requires that participating faculty have release time from other core courses. This course, while important, makes scheduling other graduate courses difficult.

We expect that once the medical syllabus becomes defined our teaching mission will fall into a more regular pattern.

4.6 Describe the direct contributions (course sections taught) and indirect contributions (grading, tutoring, etc.) of graduate teaching assistants to the departments teaching mission?

We do not require that graduate students participate in teaching. However, many of our graduate students participate in tutoring of medical and dental students.

4.7 Major achievements of department faculty regarding teaching.

Our former chair, Dr. Philip Pekala won the university mentoring award approximately 3 years ago. That award was given for his achievement in directing graduate students through our program. Drs. Pekala and Johnson have received the Master Educator award and Dr. Pekala received the Board of Governors teaching award. Dr. Lance Bridges, who recently accepted a position in another university, received the M1 teaching award from our medical students. Medical students rank our faculty highly in terms of their teaching. Graduate students applaud our teaching.

Analysis of Research, Scholarship and Creative Activities

4.8 Major achievements of the faculty regarding research, scholarship and creative activities.

Our faculty do an excellent job especially when one considers what that job entails. All of us are involved in research, service, didactic teaching and teaching in the laboratory. That was a difficult job 30 years ago but it is more difficult now because of increased expectations and decreased support.

Over the years we have reduced our office staff from 3 to 2 support persons. As a result, all investigators type their own manuscripts and grants. In addition, we prepare our own slides and figures. These changes have given the faculty greater control over the final product but this comes at the price of reduced time for research.
We have assumed additional responsibilities including the Summer Program for Future Doctors (an introductory biochemistry course for potential medical students), a summer remedial program for medical biochemistry and Foundations in Medicine. The faculty appreciate the value of these activities but they do take time away from research.

Our didactic teaching load is not great when compared with similar departments in Colleges of Arts and Sciences. However, our teaching is substantial when compared with other medical biochemistry departments. In addition, some of our teaching activities do not appear in course catalogues (i.e. Foundations in Medicine and the Summer Program for Future Doctors) and are invisible to the casual observer.

All of us, to varying degrees, devote time to teaching students in the laboratory with rotations or thesis research. We spend hours every semester rehearsing presentations with our students. We take student presentations very seriously because of their importance in obtaining permanent jobs and fellowships.

Our faculty are active in trying to obtain external funding for their research. Over the last 7 years, we have submitted a total of 120 grants to external granting agencies (2008-10, 2009-23, 2010-10, 2011-10, 2012-15, 2013-13, 2014-20 and 2015-13). As of February, we have so far applied for 6 external grants in 2016.

The real value of this group of faculty cannot be gleaned from RAMSES or Sedona. This faculty has produced excellent researchers and teachers who will serve our society for years to come. They have contributed to the training of about 70 M.D.’s each year who largely serve eastern North Carolina. This faculty has produced new insights into several diseases that plague the people of eastern North Carolina and the world. Finally, this faculty fully supports the mission of the Brody School of Medicine by participating in Dental Teaching, summer teaching programs, summer research programs, research programs for undergraduates, graduates and medical school students and Foundations in Medicine.

4.9 Relative strengths and weaknesses of Biochemistry and Molecular Biology as compared to departments at peer institutions.

Important Note: We used Academic Analytics to generate this report, as requested. The results of this analysis are shown in Appendix 8. However, the data that we provide are more reliable than those obtained from Academic Analytics. For example, Academic Analytics does not yet capture contributions to grants other than the submitting P.I. Many of our faculty serve as Co-P.I.’s or consultants on grants for which they may receive a portion of their salary, other expenses and F&A. This is a large part of our enterprise and it is missed in the graphics below. Academic Analytics also captures only grants from major funding agencies. Our smaller grants and contracts were not captured in this analysis. Heather Stadden from Academic Analytics sent the following statement to us: “The grants that are included are federal grants to lead PIs (not co-PIs). We have ingested the data for co-PIs for NSF and NIH and that will start to be incorporated into the portal soon. The dollar amounts are also represented as annualized amounts (e.g. a grant for $300,000 for a 3 year project period, we would show $100,000). I have attached more information on our grant coverage.” We have not had time to investigate publications and other data collected for accuracy but we are cautious about the results. Nevertheless, we are striving to improve our research enterprise.

Appendix 8 is a graphic (Productivity Radar) that compares our department to its Peer group. The grey circle shows the 50th percentile results from our peer group for each of the
measures described circumference of the outermost circle. Not shown on this plot is the mean of all departments of Biochemistry. Our assigned peer group out-performs the national average of all departments of Biochemistry. The colored points in the graph are the results from our department at East Carolina University. Each color represents a different class of observables.

Publications and Citations: The blue entries in productivity radar of appendix 8 shows that our department is near the mean with respect to the per-cent of faculty with a publication. The red entries show that the percentage of faculty with a citation and percentage of authors with a citation is at or above the mean. However, we fall short in numbers of publications per faculty and in the number of citations per publication. This pattern occurs because all faculty participate in research but they vary in their research output. Research output is often limited by the number of graduate students in a laboratory. The number of citations per paper is greatly influenced by the publicity that is generated from a research result. That publicity comes largely from presentations and informal meetings with other scientists. The number of citations would likely increase if our faculty attended more scientific conferences.

Awards: See the yellow entries in Appendix 8. We are in the 25th to 50th percentile with respect to awards. We are near the median for the % of faculty with an award.

Grants: We fall below our target group with respect to the number of grants per faculty member and dollars per grant (see green entries in Appendix 8). However, as explained above, Academic Analytics failed to capture all of our grants. It is more instructive to review Appendix 4 that shows our major grants over the last 7 years as principle investigators and Appendix 5 that shows other funding for which we are not serving the primary role. You can see that we have been active and several investigators have had substantial grant support. Nevertheless, we are now at a low point with respect to our own historical funding and we know that this situation must change.

A casual inspection of Appendices 4 and 5 illustrates the interdependence of faculty from different departments. Many of our grants include investigators from other departments at ECU. Conversely, the grants from other departments include investigators from Biochemistry and Molecular Biology. Activities that bring the various research units at ECU together are likely to result in an increase in funding.

4.10 The department’s efforts to support faculty research, scholarship and creative activities?

The department acts as an advocate to the Dean for faculty who are excelling in research, scholarship and, creative activities. Senior members of our department meet monthly with junior faculty to review their progress in research. The faculty meet regularly for informal research presentations at lunch time to give critical evaluation to research ideas. For about the last 20 years, J.M. Chalovich has held a monthly informal research discussion at a local restaurant. That meeting is designed to give constructive criticism from a more diverse audience. The faculty also read and critique each other’s grants and manuscripts. The department has paid for external reviews of grants in the past. We will continue to carry out that program as much as possible in the current budgetary situation.

Dean Cunningham has recently provided an influx of equipment funds into all basic science departments to rebuild the infrastructure. This has allowed significant improvements to be made over the past several months.

Analysis of Service and Outreach activities
4.11 Major service and outreach initiatives of the faculty.

Faculty service contributions are too numerous to list individually but highlights can be found in the faculty bio sketches (Appendix 3). In general, our faculty are highly involved in service to their profession in the form of grant reviews, site visits, study sections, and journal manuscript reviews. Additionally many serve on journal editorial boards, some as editors, and as members of various advisory boards and panels for both private and government enterprises. Several of our faculty serve as officers and members of university committees and groups.

We are especially proud of our commitment to providing research opportunities to students at various stages of their education. We mentor high school students through the Summer Ventures Program, underrepresented undergraduates through the Summer Biomedical Research Program, and medical students through the Summer Scholars Research Program. Students from these programs often continue their science education through STEM undergraduate degrees, as well as graduate and medical school. In addition, many of our members are involved in judging various science competitions including ECU’s Research and Creative Achievement week, as well as providing science demonstrations to the community and serving on various discussion panels.

Finally, our faculty are also very much engaged in the Greenville community at large. In addition to the aforementioned science demonstrations, many volunteer their time through organizations such as Habitat for Humanity, American Red Cross, Greenville Community Shelter, as well as serving their respective churches in many different roles.

The department has been very supportive of all of these efforts and actively encourages participation in all aspects of service. In previous years, departmental funds were available to provide some support for undergraduate research during the school year. However, as the budget situation worsened these practices had to be discontinued.

Action Plans:

4.12 What does the department plan to do to support the teaching, research and service activities of faculty? What resources will it need?

Our immediate goal is to hire two faculty members. The first is a permanent chair and the second is a junior faculty member. We must do our best to attract personnel who have current extramural funding. These persons must either integrate into existing research strengths or else serve as a nucleus for a new strong research program.

The research program headed by Dr. Shaikh on obesity/diabetes/inflammation is currently thriving. It would be natural to build on this strength. Inflammation is a particularly key area because the Department of Microbiology is trying to build its strength in immunology.

Over the last 1.5 years we have begun to adjust teaching loads to the current research productivity of the faculty. We will also have to adjust teaching to meet the changing demands of the medical curriculum. Readjustment of teaching loads also follows the spirit of the Brody School of Medicine Sustainability Committee (headed by Dr. Cunningham).

The sustainability committee also reinforced the notion of having a rigorous promotion and tenure system. This means giving young faculty members as many advantages as possible to jump start their research programs. However, faculty members who do not reach the expected level of excellence in both teaching and research may have to leave their research track position. One possible option for such personnel is to enter a teaching track.
We are going to require strong start-up packages to attract the new chair and faculty member. If we are to build our research enterprise we must hire faculty with a record of extramural funding. Such faculty will come at a high initial cost. The university has been supportive of our recruiting efforts in the last several years. We are hopeful that they will continue their support.

Incoming graduate students prefer to work in the modern laboratories at the EDCOI on the 4th floor of the heart institute. The facilities, comfort, ease of work and ease of communication make the EDCOI most attractive and it is natural that students prefer to work in that environment. It may follow that more students would be attracted to our program if the 5th floor of the Brody building were more inviting. With the loss of several laboratories, the 5th floor of Brody much quieter than in earlier years. Having a new chair and other additional personnel at the Brody site would make that site more attractive. Additionally, we need to consider creating a centralized office space for graduate students and modernizing the appearance of the existing laboratories.

5. Regional Transformation – Economic Development/Public Service

5.1 Activities of the faculty and students to support regional transformation over the last seven years.

Anyone who has lived in Greenville for 30 or more years has witnessed its transformation from a farming community to an economic and cultural center that has first rate medical services. The transition has been great; the transition in health care has been dramatic. All who have served to train medical students, graduate students and dental students have contributed to that transformation.

5.2 What does the department plan to do to support regional transformation? What resources are needed?

Aside from our volunteer activities, our professional activities contribute to economic growth and improved health care in Eastern North Carolina. Most of us study research problems of medical interest. Our research impacts cancer, diabetes, obesity, heart failure and neurodegenerative disorders. Any support given to our research activities contributes indirectly to regional growth and health transformation.

There is potential to have a more direct impact on regional health and economic development by partnering with business or by forming our own public research initiatives. The Millennial Research Campus at ECU is looking for faculty with business partners or with business ideas that need space and support.

One idea that is currently in development is a mass spectrometry core focused on proteomics, lipidomics, and genomics. That core will involve Dr. Kim Sandquist, a mass spectrometry expert in the Chemistry department and Dr. Raz Shaikh, from our department. Dr. Shaikh has submitted an NIH grant in response to an RFA for development of mass spec capabilities. This grant is in collaboration with Dr. Sandquist’s previous mentor, Dr. Nichole Reisdorph at the University of Colorado. If the grant if funded, personnel from the Shaikh lab will travel for 5-6 weeks to the University of Colorado for extensive training and data analyses. The Shaikh lab will then work with Dr. Sandquist in developing LC-MS and GC-MS technologies, particularly for metabolomics analyses that are not available in the state of North Carolina. Dr. Shaikh is currently talking to industry and academic partners to recruit samples to ECU for mass spec analyses in order to generate revenue. Ultimately, we plan to establish a state-of-the-art facility that will lead to better recruitment of faculty and a source of revenue.
Several Biochemistry and Molecular Biology faculty (Keiper, Shewchuk, Pekala, Mansfield) supported the acquisition of Life Technologies Ion Proton sequencing instrument for the Sequencing Core Facility (Biology Department, http://www.ecu.edu/cs-cas/biology/Nextgen_Seq.cfm). The Instrumentation supports next generation high throughput sequencing and was funded in part by a grant from the North Carolina Biotechnology Center. Prior to the advent of this technology at the ECU Core Facility, Drs. Keiper, Mansfield and Shewchuk each contracted with Beckmann Coulter Genomics to conduct RNA deep sequencing (RNAseq) at substantial cost ($750 per RNA sample, averaging $7500 per experiment). The RNAseq studies generated important preliminary data for grant proposals to NIH and NSF by each investigator. NextGen sequencing is now online at ECU to support RNAseq, which is fundamental to the research projects of these investigators. However, the setup and experiment costs remain somewhat prohibitive even with the ECU Facility. Resource funds to allow pilot RNAseq experiments for preliminary data would be a strong support for new competitive grant applications.

6. Resources

6.1 adequacy of the resources provided and required for maintaining program quality.
Because of reversions to the state we are in a difficult financial situation. Future cuts will require cuts in staff unless we are more successful in attracting external research grants and contracts. If our projections are correct, we will have about $5,000 for departmental operating expenses this year. The amount of F&A that is available to the department is $32,368. That amount will not be increased significantly over the next 3 years as most of the F&A from the larger grants in the department will be invested in the expansion of our largest program. Of course, if we are successful in obtaining additional grants, as we historically have been able to do, we will be in a stronger position.

6.2 Quality, scope, and projected needs for space to support the program.
The department has several space issues. First, amount of space available in the 5th floor of the Brody Building is more than adequate now that several faculty have moved to the Heart Center. We are lacking good classroom space. (We recently learned that our conference room will be upgraded so that it will serve as a small lecture room.) Furthermore, the laboratories are not well designed. The laboratories lack air lines, vacuum lines and other standard facilities. The lab benches, for the most part, are made of fiber board. The bench tops that were originally fiberboard have largely been replaced. One of our laboratories has makeshift tables to support equipment. The space is functional but not ideal. The space at the ECDOI institute (Heart Center) is excellent for the most part.

Another space issue is that we now have 3 empty laboratories on the 5th floor of Brody. Our research would benefit from having those labs occupied with research scientists doing similar kinds of work. It is possible that the new chair of our department will need more than the standard amount of research space. In that case, these empty laboratories will be an asset. In the short term, we should consider reorganizing the Brody space to make it more attractive to new students and faculty and to increase the efficiency of our work.

7. Other Operational or Programmatic Outcomes
7.1 Describe other assessed outcomes that enable the program/department to achieve its objectives, e.g., academic advising, graduate student support, operational efficiency, structural re-organization, etc. Summarize strengths and weaknesses identified in the assessment and actions taken to improve these outcomes.
The graduate director of the BMB PhD program, Dr. Keiper, has conducted thorough educational assessments of current student outcomes for the academic years ending in 2009, 2010, 2012, 2013, 2014 and 2015 (See ECU Assessment Reports, Appendix 6). These Reports evaluated parameters such as the students’ seminar presentation skills, candidacy exam proposal writing, knowledge of health issues, research ethics, and current literature. Each Report outlines not only the assessment criteria and the performance of students in the PhD program at that time, but also new Action Plans for improving those outcomes. The reader is invited to review the Educational Assessment Reports for details.

**Academic advising**

The mission of East Carolina University is to: **Foster Inquiry, Research and Engagement**

*Develop Leadership Capacity Connect Values and Action*

The mission of the Department of Biochemistry is consistent with those of the university and our academic advising conveys these values to our graduate students. Student advising begins during orientation with the new incoming students. We attempt to instill in the students a sense of family and a sense of camaraderie from day on.

Students are provided a diverse array of academic and personal development services. Academic services include individual academic assessments and interventions such as: time management, learning and test taking strategies, reading skills, learning assistance and peer facilitators for academic achievement. Personal development services include: stress management, personal counseling, relationship counseling and support services for significant others, anxiety management and communication skills training.

Students are required to give seminars twice a year. Incoming students are exempt from giving a seminar their first semester. We provide the students with detailed critiques (Document of evaluation form is in Appendix 7.) of their presentation in an effort to help them develop their skills. These critiques are both oral and written. We have consistently seen improvement in their skills over time.

We have recently instituted a grant writing course along with several faculty members from other departments to prepare the students for the task of writing grants once they graduate.

Each semester, the entire department under the direction of our Graduate Program Committee chair reviews the performance of each graduate student to ensure that he or she is making sufficient progress towards graduation. Also, we monitor the integrity of the students in order to ensure that they understand the importance of reporting their data without bias.

**7.2 Action Plans: What does the department plan to do to improve these outcomes? What resources will it need?**

We plan to institute a program to assist the graduating students to identify postdoctoral positions or jobs in industry. Also included will be guidance on how to prepare a CV and a cover letter as well as assistance on preparing a job seminar. In this way, we will create leaders in various disciplines of science. In addition, visitors from industry have indicated that the inability to meet deadlines was the primary cause of demotion and tenure. We will look for opportunities to help graduate students develop this skill by adhering to agreed deadlines.