



*UNIVERSIDAD CENTRAL DEL CARIBE*

# Graduate Program in Biomedical Sciences

## Catalog 2011-2012



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## **CORRESPONDENCE**

For information on the Graduate Program in Biomedical Sciences (GPBS) please contact:

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NOTE: The information in this catalog is subject to change without notice. The Universidad Central del Caribe reserves the right to make changes as deemed necessary in calendars, fees, policies, academic requirements, regulations, programs, and other subjects, after its publication date.

## **AFFIRMATIVE ACTION POLICY**

The Universidad Central del Caribe (UCC) recognizes the right of all persons to work and to advance on the basis of their merit, ability and potential, and is therefore committed to taking any and all steps necessary to identify and alter policies, practices, or other institutional barriers which cause or perpetuate inequality. It is the policy of this university to recruit, employ, and promote staff and to admit and serve students without regard to race, color, religion, sex, sexual orientation, age, national origin, or disability.

## **RIGHTS AND RESPONSIBILITIES OF GRADUATE STUDENTS**

Students have the responsibility to familiarize themselves with the policies and procedures of the University, the Graduate School, and their department or program. Students are primarily responsible for knowing the degree requirements and following the policies that govern their academic program. If students have concerns or doubts about individual policies and procedures, they may contact their advisor, their program or department chairperson, or the Office of the Associate Dean for Research and Graduate Studies.

## **GENERAL INFORMATION**

The Universidad Central del Caribe was founded in 1976, in Cayey, Puerto Rico, as a private non-profit institution, incorporated under the laws of the Commonwealth of Puerto Rico. The first educational units established were the School of Medicine, with a four-year program leading to the M.D. degree, and the Radiologic Technology Program. Both programs have been duly authorized by the Puerto Rico Council on Higher Education. The program leading to the M.D. degree holds full accreditation from the Liaison Committee on Medical Education (LCME). Graduate medical education is accredited by Accreditation Council Graduate Medical Education (ACGME). The Radiologic Technology Program holds full accreditation from the Joint Review Committee on Education in Radiologic Technology.

In 1989, the PRCHE authorized the Graduate Program in Biomedical Sciences (GPBS) within the School of Medicine. This program offers a Doctor of Philosophy in Cellular and Molecular Biology and Masters in Science or in Arts in Anatomy and Cell Biology, Physiology, Biochemistry, Pharmacology, and Microbiology and Immunology.

In 1984, the university began its relationship with the Health Department of the Commonwealth of Puerto Rico. Since September 1990, all university facilities have been integrated into one campus at the grounds of the Dr. Ramón Ruiz Arnau University Hospital in the city of Bayamón. As a result, the Dr. Ramón Ruiz Arnau Hospital was established as the University Hospital. In addition, the network of municipal health centers that provide primary care services within the Northeastern Health Region became a site for clinical teaching.

Other academics programs authorized by the PRCHE include: the Certificate Program in Diagnostic Medical Sonography, the Substance Abuse Counseling Program, the Certificate Program in Mammography, and the bachelors in Medical Imaging.

The Substance Abuse Program offers the Post-Baccalaureate Certificate in Substance Abuse Counseling and the Master of Health Sciences in Substance Abuse Counseling.

## **MISSION AND GOAL OF THE UNIVERSIDAD CENTRAL DEL CARIBE**

### **Mission of the Universidad Central Del Caribe**

To prepare high-quality and committed health professionals to meet the health needs of the community in its biological, physical and social context with a humanistic focus and a high sense of moral obligation. It is characterized by its emphasis on the excellence of its educational programs, research activities and services of health maintenance, prevention, and early detection of illness. It is committed to improving the quality of life of the Puerto Rican community through its services, as well as to developing health care professionals.

### **Goal of the UCC**

What distinguishes UCC from other institutions in Puerto Rico is its unwavering goal to prepare high quality health professionals who can offer preventive care, promote healthy lifestyles, and provide excellent services with humanism, compassion and the highest ethical values. Particular characteristics of the institution are its intensive and extensive program of practical experiences in clinical settings in the community, regardless of their program of study, and its longstanding record of public/private partnerships and service-linked education.

## **GOVERNANCE AND ADMINISTRATION**

The Board of Trustees outlines the general policies and supervises the operations of the university. Prestigious members of our community volunteer their participation in this governing body. The president of the university is appointed by the Board of Trustees and is the Chief Executive Officer of the university. The deans are appointed by the Board of Trustees upon the president's recommendation and are responsible to the president. The board, upon the recommendation of the president, approves appointments of all administrative officials and faculty, after consultation with the deans and faculty.

The Dean for Academic Affairs is the university's Chief Academic Officer. The Dean for Admissions and Student Affairs supervises all student services and the admissions process of all university programs. The Dean of Administration oversees all administrative and support services.

The School of Medicine is divided into basic sciences and clinical departments, and their chairs respond directly to the Dean of Medicine.

The Associate Dean for Research and Graduate Studies also responds to the Dean of Medicine.

The Medical Images Technology Program, including the specialties of Diagnostic Sonography and Mammography, has a program director who in turn responds to the Dean for Academic Affairs.

The Certificate in Substance Abuse Counseling and the Master of Health Sciences in Substance Abuse Counseling programs are supervised by a program director.

## **MISSION OF THE GRADUATE PROGRAM IN BIOMEDICAL SCIENCES**

The mission of the Graduate Program in Biomedical Sciences is to provide a rigorous and stimulating research and training environment for UCC students.

Our students provide the intellectual resources needed to advance the research and educational goals of the institution and to provide a new generation of scientists. The faculty is committed to excellence in interdisciplinary research training for qualified candidates who will continue to advance the fundamental knowledge needed to conquer disease and promote health and improved quality of life for all people. The knowledge and skills acquired will enable the graduate to be successful in biomedical research conducted at universities, government and private industry laboratories, as well as in education.

## **PROGRAM ADMINISTRATIVE PROCEDURES**

### **ADMISSION TO THE PROGRAM**

Applicants must fulfill the following requirements and submit the indicated documents in order to be considered eligible for admission to the Graduate Program in Biomedical Sciences:

1. Application form and non-refundable application fee.
2. A bachelors degree or its equivalent from an accredited institution of higher education with a minimum grade point average of 2.75 overall and of 3.0 or above in science subjects.
3. Official transcripts from each college or university attended for all undergraduate and graduate work.
4. Official scores of the Graduate Record Examination (GRE) General Test.
5. An essay indicating why the student is interested in a graduate degree in biomedical sciences.
6. Three letters of recommendation, including at least two from former professors in the student's area of specialization of the last completed degree.
7. Interview with the department to which the student is applying or the Graduate Program in Biomedical Sciences Admissions Committee.
8. Completion of the following undergraduate courses or its equivalents
  - a) 2 courses in biology
  - b) 2 courses in chemistry
  - c) 2 courses in physics
  - d) 2 courses in mathematics
9. Certificate of Penal Antecedents issued by the Police Department of the pertinent state or country.

### **Recommended Undergraduate Course Work**

It is recommended that candidates complete the following course work at the undergraduate level: calculus I, statistics, general and organic chemistry, general biology, biochemistry, cell biology, molecular biology or genetics, general physics, microbiology, immunology and/or other courses related to the area of specialization.

It is the applicant's responsibility to ensure that the Admissions Office receives all the documentation required, including the completed application form, no later than April 1 or May 1, as late admission for applicants enrolling in the Fall Semester (August). For those applying for the Spring Semester, the deadline will be October 1. The Biochemistry Program does not accept spring applications.

Once admitted to the Program, but before enrolling, the candidate must submit a Health Certificate which includes a physical examination by a licensed physician, TB test or chest X rays, and copies of the following tests: VDRL, urinalysis and a complete blood count (CBC), and a Certificate of Immunization, if under 21 years old. Federal law requires the submission of a certificate of recent vaccination against the hepatitis B virus.

**The student must complete all the admission requirements before the beginning of the incoming semester.**

Once the student is admitted to the Program, he/she must pay a non-refundable deposit to assure a place in the Program. This deposit of \$100.00 will be credited to his/her tuition payment.

## **STUDENT CATEGORIES**

### **Auditing Students**

Those students, who wish to audit some courses, may do so if they have the approval of the Chairperson of the Department offering the course(s) and if they register during the registration period. They must also pay the corresponding fees. Auditing students are authorized to participate in all educational activities of the course; however, they will not take course exams or receive a grade. They can take non-graded quizzes, as an evaluation tool.

### **Special Students**

If a candidate does not meet one of the admission requirements he/she may be admitted to the Program as a "special student" after a careful evaluation and recommendation of the department concerned and/or of the Graduate Program in Biomedical Sciences Admissions Committee. The student must comply with the conditions stipulated for admission to be reclassified as a regular student. The student will have an academic year to complete the minimum admission requirements.

### **Non-degree Students**

A non-degree student is a student who attends classes at UCC, but who has not been admitted into the Graduate Programs in Biomedical Sciences. Anyone may take courses as a non-degree student.

### **Admission Requirements for non-degree students**

Non-degree enrollment status does not require a formal admission process or formal entrance requirements. Students must complete an Application for Admissions and pay the non-refundable application fee. Enrollment as a non-degree student does not guarantee regular admission to the University. Students wishing to apply for full admission should refer to the Graduate Programs in Biomedical Sciences admissions requirements.

### **Tuition and Fees for non-degree students**

Non-degree students' enrollment requires tuition and fee assessment at the rate as a regularly enrolled, fully admitted student.

### **Financial Aid for non-degree students**

Non-degree students are not eligible to receive financial aid.

### **Grade and Transcript Information**

Non-degree students are given grades, reviewed according to the University standards of good academic progress, and provided with academic records.

### **Non-degree registration**

Non-degree students must complete a Non-Degree Student Registration Form. THIS MUST BE COMPLETED FOR EACH SEMESTER THAT YOU WISH TO ENROLL AS A NON-DEGREE STUDENT. The Associate Dean for Research and Graduate Studies must approve the enrollment.

### **Transient Students**

Students who are enrolled in a graduate program at another university and want to take course work at UCC and transfer it to their home institution are considered transient students by UCC.

### **Admission Requirements for Transient Students**

Transient students enrollment status does not require a formal admission process or formal entrance requirements. Students must complete an Application for Admissions, pay the non-refundable application fee and submit a letter from their home institution stating that they are in good academic standing and that the home institution will accept the UCC course work. The Associate Dean for Research and Graduate Studies must approve the enrollment.

## **REGISTRAR'S OFFICE**

The Registrar's Office is responsible for the registration of students, for the filing of the student's academic record and for the preparation and/or remittance of transcriptions and certificates dealing with the fulfillment of the requirements for the degrees conferred by the University.

At the end of each semester, the Registrar's Office will mail course grades. Students who do not receive their grades by the beginning of the next term should notify the Registrar's Office.

Official transcripts and other certified documents would be sent directly to the concerned college, university, industrial firm, or other parties upon payment of the corresponding fee. Students may obtain non-official copies of their academic record upon payment of the corresponding fee.

Students, who consider that there are errors in their transcripts, shall communicate those concerns to the Registrar's Office within 30 days after receipt of the document in question.

### **Registration**

All students must register according to the time schedule prepared by the Registrar's Office. A student who satisfies all admission requirements and is admitted to the Program becomes a regular student. Failure to obtain a grade index of at least 2.5 during the first calendar year automatically drops the student from the Program. A student with a grade index above 2.5 but below 3.0 will be on probation for the next academic year, at the end of which he/she will be dismissed if his/her grade index is not 3.0 or better.

No one may be enrolled as a regular or special degree-seeking student in the Graduate Program in Biomedical Sciences without the approval of the Associate Dean for Research and Graduate Studies.

### **Diplomas**

The diplomas will be distributed by the Registrar's Office. All claims pertaining to the diplomas should be made no later than one year after the commencement date.

### **Change in Address**

All changes in address should be registered with the Registrar's Office. Otherwise, the Registrar's Office will not be responsible for the student not receiving pertinent information from the University.



## TUITION AND FEES

Payments of tuition and other fees are due at the time of registration, unless otherwise indicated pursuant to the Rules and Regulations of the University dealing with postponement of payment of tuition and other fees.

Admission, with application	\$ 50.00 non-refundable
Late admission	\$ 150.00 non-refundable
Readmission, with application	\$ 50.00 non-refundable
Seat Reservation upon admittance	\$ 100.00 non-refundable

### Tuition

Regular students, per credit	\$ 300.00
Auditing students	\$ 200.00

### Other fees

General Fee	\$ 400.00 annual
Technology Resources	\$ 600.00 annual
Activities	\$ 50.00 annual
Laboratory Fee	\$ 500.00 annual
Endowment Fee	\$ 550.00 annual
Software Fee	\$ 30.00 annual
CPR course	\$ 50.00 per course
Rent of student locker	\$ 10.00 annual non-refundable
Student ID	\$ 15.00
Student ID Replacement	\$ 15.00
Late registration	\$ 150.00
UCC insignia	\$ 10.00 each
Parking	\$ 40.00 annual
Parking permit replacement	\$ 40.00
Accident insurance	\$ 12.00 annual
Graduation	\$ 250.00
Thesis printing and binding (3 copies)	\$ 200.00

### Fees for other services

Affidavit	\$ 55.00 each
Certifications	\$ 10.00
Copy of Diploma	\$ 50.00
Translation of Diploma	\$ 25.00
Copy of student record	\$ 2.00 per sheet
Transcripts	\$ 5.00 each
Fax transmission	\$ 1.00 per sheet
Health Insurance Plan	Cost Vary
Comprehensive Exam	\$ 50.00
NBME exam reposition fee	\$ 225.00 per exam

### Reimbursement of Tuition fees

The policy for reimbursement of tuition fees is determined by the Office of Financial Affairs. Please refer to the appropriate manual.

## **FINANCIAL AID**

### **Loans**

#### **Emergency Loans**

This fund was created by donations from Merck, Sharp and Dohme Corp., other institutions and private sponsors. It consists of an amount up to \$500 per semester.

#### **Federal Family Education Loan Program**

The Federal Family Education Loan Program (FFELP) is authorized in Part B of Title IV of the Higher Education Act of 1965, as amended on July 23, 1992. Under FFELP, students and their parents can obtain low-cost education loans to help pay for the cost of higher education. FFELP loans are made to students and parents by lenders. To protect the lender from loss in the event of the borrower's death, disability, bankruptcy, or default, the loan is guaranteed by a guarantor. The guarantor is reinsured by the U.S. Department of Education.

#### **Types of loans**

There are several types of education loans currently offered by lenders under the FFELP. Contact the Financial Aid Office for updated information.

### **Financial Support from the Graduate Program in Biomedical Sciences**

The following only applies for Tuition and Fee Waiver and financial assistance from the OADRGS. Faculty members are encouraged to use this guide if compatible with their source of funding.

The Graduate Program in Biomedical Sciences offers different financial assistance mechanisms to qualified graduate students, as funds allow. The awards may be in the form of fellowships and/or tuition waivers. In addition to the above, graduate students may qualify and apply for other forms of financial aid (loans, etc.) through the University's Financial Aid Office, private foundations and government agencies.

### **Graduate Fellowships**

Graduate fellows support faculty in classrooms, research or administrative endeavors. Fellowships are awarded on the basis of a student's demonstrated academic achievement and promise. Recipients are required to maintain strong academic records and a good academic standing status. The good academic standing status will be evaluated once during the academic year, in July for those students that started in August or December for students that started in January.

Fellowships are generally available from the Office of the Associate Dean for Research and Graduate Studies (OADRGS) and those departments/faculty that have government, foundation, business and industrial research grants and contracts. Institutional funds available to departments and faculty members can be used to support domestic or international students.

### **Tuition and Fee Waiver**

Tuition and fee waivers are awarded on the basis of a student's demonstrated academic achievement and promise.

Recipients are required to maintain strong academic records and a good academic standing status. The good academic standing status will be evaluated once during the academic year, in July for those students that started in August or December for students that started in January.

### **Eligibility**

Eligibility requirements vary and are established by the funding source.

To be eligible a graduate student must remain in good academic standing. Students are awarded support on the basis of academic potential.

To be eligible a student must:

1. Be admitted to the Ph.D. Program in Cellular and Molecular Biology or Neurosciences without any provisions.
2. Be enrolled.
3. Be in good academic standing.
4. Must provide evidence of a current and valid visa if international student before receiving payment. The Registrar's Office will be provided with a GPBSF 20 Notification Of Stipend / Tuition & Fees Payment to evidence that the student will be financially supported as part of the I-20 issuance process.

### **Selection Process**

The Office of the Associate Dean for Research and Graduate Studies will make offers to the most outstanding candidates. Each candidate will be evaluated on his/her: 1) academic excellence, 2) goals, 3) leadership potential, and 4) contribution to a diverse educational community.

Awards are granted on a competitive basis for a period of one (1) year, renewable up to a total support period of five (5) years. Automatic renewal within the academic year (from one semester to the other) will be granted as long as the student is enrolled and is in good academic standing.

### **Appointment and Notification**

Each academic year, the Graduate Program in Biomedical Sciences will notify graduate students with award letters that state the amount, term of appointment and conditions of the award.

Graduate students will sign an award contract to indicate acceptance of the award and its conditions.

### **Minimum Course Load**

All graduate students receiving support must enroll for at least eighteen (18) credit hours each year.

Courses taken for audit are not counted toward the enrollment requirement.

All students are subject to the continuous enrollment rules published in the Graduate Catalog.

### **Lost of Eligibility**

Academic standing (GPA, credit hours earned, etc.) of all students who have received financial awards will be reviewed annually. Students who are not in good academic standing will lose their eligibility for financial assistance from the OADRGS.

Students will lose their eligibility if any of the following occurs:

1. Fails to maintain a good academic standing.
2. Transfer from the Doctoral Program to the Master Program
3. Fails to register.
4. Fails to satisfactorily perform their teaching, research or administrative duties.

The Graduate Program in Biomedical Sciences will notify graduate students in writing of a determination to suspend the award contingent to any of the previous situations.

## **Termination of Appointments**

Graduate fellowships normally end when the period of appointment is concluded and the term of the assistantship agreement is fulfilled. An appointment may also end when the grant or contract supporting the student expires, even if that occurs before the end of the student's current appointment. Otherwise, a graduate fellowship may be terminated for the following reasons:

1. Resignation by the student. Such resignation will be in writing.
2. Failure of the graduate student to perform assigned duties adequately. Such termination is to be recommended by the mentor to the Graduate Program in Biomedical Sciences.
3. Failure of the graduate student to remain in good academic standing or to adhere to enrollment policies.

Any funds remaining after termination of a graduate fellowship revert to the OADRGS and may be reallocated to another graduate student.

A graduate student who believes that his or her graduate fellowship has been terminated unjustly may appeal the decision in writing.

## **Appeals**

All appeals must be submitted to the Graduate Program in Biomedical Sciences Office. Students may appeal financial assistance rejections based on unsatisfactory academic standing. Appeals will be considered if one of the following has a bearing on their academic standing, for the term in which good academic standing requirements were not met, and can be documented in writing.

- Change of grades
- Death or serious illness of an immediate family member (parent, legal guardian, sibling, spouse or a family member residing at student's home). A copy of a death certificate and a notarized statement proving relative lived with the deceased are required.
- Serious illness or injury to the student or a dependent child (a physicians' affidavit signed by the attending physician is required).
- Other causes that may be determined (natural disaster, act of God, etc.)

An appeal must be submitted in writing within 30 days after notification of assistance termination. The decision of the Appeals Committee is final. The Appeals Committee will be composed of the Dean of Academic Affairs, the Dean of Student Affairs and the Associate Dean for Research and Graduate Studies.

All supporting documents (physician's affidavit, copy of death certificate, etc.) must accompany the student's written appeal that outlines his/her reasons for making an appeal.

The Associate Dean for Research and Graduate Studies will reconsider any student who is denied financial assistance at such time that their academic record improves to the minimum requirement. To be reinstated, a student must submit a letter requesting reinstatement to the Graduate Program in Biomedical Sciences Office.

## **Administrative Procedures**

- Students will be paid through fellowships.
- The Graduate Programs in Biomedical Science Form 20 will be completed not a PAAP.
- Students will be paid monthly, at the end of the month.

## **Exceptions**

The President of the University must approve any exceptions to the stipulated procedures.

## **LEAVES OF ABSENCE**

Students who wish or need to interrupt their study temporarily may request a leave of absence (LOA). There are three types of leave: personal, medical, and parental. Students will complete the request form at the Registrar's Office. The general policies that apply to all types of leave are:

All leaves of absence must be approved by the Associate Dean for Research and Graduate Studies on the recommendation of the mentor. Medical leaves also require the recommendation of a physician, as described below; see Medical Leave of Absence.

Students in the Program may be granted a leave for a maximum of one academic year. The expected last date of registration will be adjusted by one semester for each semester of the leave. In exceptional circumstances, a maximum total of two years of leave, may be granted for students in the Program. Students who fail to register for the term following the end of the approved leave will be considered to have withdrawn from the Graduate Program in Biomedical Sciences.

Students on leave may complete, by the appropriate deadline for the term in which the course was taken, outstanding work in courses for which they have been granted approved incompletes. They may not, however, fulfill any other degree requirements during the time on leave. Students who intend to work toward the degree while away from the University must request registration in absentia. Students who in fact make progress toward the degree while on leave will have their registration changed retroactively to in absentia for the period of the leave.

Students on leave of absence do not have to file a formal application for readmission. However, they must notify the Graduate Program in Biomedical Sciences Office in writing of their intention to return. Such notification should be given at least six weeks prior to the end of the approved leave.

### **Personal Leave of Absence**

A student who is current with his or her degree requirements and who wishes to interrupt study temporarily because of personal exigencies may request a personal leave of absence. The general policies governing leaves of absence are described above. Students are eligible for personal leaves after satisfactory completion of at least one year of study.

To request a personal leave of absence, the student must write to the Associate Dean for Research and Graduate Studies before the beginning of the term for which the leave is requested, explaining the reasons for the proposed leave and stating both the proposed start and end dates of the leave and the address at which the student can be reached during the period of the leave. If the Associate Dean finds the student to be eligible, the leave will be granted. In any case the student will be informed in writing of the action taken. Students who do not apply for a leave of absence, or who apply for a leave but are not granted one, and who do not register for any term, will be considered to have withdrawn from the Graduate Program in Biomedical Sciences.

Students on a personal leave of absence are not eligible for financial aid, including loans, or for the use of University facilities normally available to registered students. Students granted a personal leave may continue to be enrolled in the UCC health plan by purchasing coverage.

### **Medical Leave of Absence**

A student who must interrupt study temporarily because of illness or injury may be granted a medical leave of absence with the approval of the Associate Dean for Research and Graduate Studies, on the written recommendation of a physician. Final decisions concerning requests for medical leaves will be communicated to students in writing.

The Graduate Program in Biomedical Sciences (GPBS) reserves the right to place a student on a medical leave of absence when, on the recommendation of the director of the University Health Services, the GPBS determines that the student is a danger to self or others because of a serious medical problem. A student who is making satisfactory progress toward his/her degree requirements is eligible for a medical leave any time after matriculation. Before re-registering, a student on medical leave must secure written permission to return from a physician.

Students on medical leave of absence are not eligible for financial aid, including loans, or for the use of University facilities normally available to registered students.

#### **Leave of Absence for Parental Responsibilities**

A student who is making satisfactory progress toward his/her degree requirements and wishes to, or must, interrupt study temporarily for reasons of pregnancy, maternity or paternity care, may be granted a leave of absence for parental responsibilities. Any student planning to have or care for a child is encouraged to meet with the Associate Dean for Research and Graduate Studies to discuss leaves and other short-term arrangements. For many students short-term arrangements, rather than a leave of absence, are possible. A student who is making satisfactory progress toward his/her degree requirements is eligible for a leave of absence for parental responsibilities any time after matriculation.

Students on leave of absence for parental responsibilities are not eligible for financial aid, including loans, or for the use of University facilities normally available to registered students.

## **TECHNICAL STANDARDS**

The Universidad Central del Caribe is committed to full compliance with the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.

Qualified applicants to the GPBS must be able to complete all requirements leading to the degree. Applicants/graduate students are expected to carry out procedures involved in learning the biomedical sciences including the ability to participate fully in activities dealing with curriculum requirements in the classroom and the laboratory.

In addition to proven academic ability and other relevant personal characteristics, UCC expects its students to possess and be able to demonstrate the skills, attributes, and qualities listed below, without undue dependence on technology or intermediaries to a degree that compromises independent judgment. The use of a trained intermediary is not acceptable in many situations in that it implies that a student's judgment must be mediated by someone else's power of selection and observation.

Degrees from the Graduate Program in Biomedical Sciences imply that the recipient has demonstrated knowledge in the field and the ability to independently apply that knowledge to solve a particular problem by forming hypotheses, designing and conducting experiments, interpreting the experimental results, and communicating the results and their interpretation to the scientific community. Thus, students must demonstrate competence in those intellectual and physical tasks that represent the fundamentals of biomedical research and must possess abilities and skills that allow for observation, intellectual and conceptual reasoning, motor coordination, and communication.

The Graduate Program in Biomedical Sciences has specified the following technical standards that all students must meet to participate in the graduate education program. Technical Standards are non-academic requirements that are essential for meeting the academic requirements of the program.

The following technical standards will be applied to the selection of students and to students enrolled in the Graduate Program in Biomedical Sciences.

### **Observation**

Observation and information acquisition requires functional visual, auditory and somatic sensation and it is enhanced by the functional use of the sense of smell. The applicant/graduate student must be able to acquire knowledge by direct observation of demonstrations, experiments, and experiences within the laboratory and instructional setting. Examples are physiological or pharmacological responses in animals, studies of microbiological cultures and organisms, identification of normal and abnormal cells or tissues through a microscope, and interpretation of results obtained on various instrumentation. Acquire, assimilate, interpret, integrate, and apply information from direct observation and oral communication, written messages, films, slides, microscope, imaging science, readouts, and other media.

### **Intellectual/Conceptual Abilities**

The applicant/graduate student must be able to measure, calculate, analyze, reason, integrate, synthesize information to solve problems and comprehend three-dimensional and spatial relationships.

### **Motor Skills**

The applicant/graduate student must possess motor skills necessary to perform procedures required for experimentation and participate actively in all aspects of laboratory experimentation. These skills may include, but are not limited to, surgery in animals, handling of animals, transfer of microorganisms to various mediums, preparing chemical and often toxic materials and solutions, preparation of anatomical specimens for microscopic examination, manipulating electronic and other

complex equipment. Such actions require coordination of both gross and fine muscular movements, equilibrium and functional use of the senses of touch and vision.

### **Communication**

Required communication skills include verbal communication, reading, writing and the use of electronic communication devices. The applicant/graduate student must be able to communicate in settings where the time span available for communication is limited. The applicant/graduate student must be able to communicate and discuss his or her experimental hypotheses and results to the scientific community, both in scientific journals or directly at scientific meetings, seminars, or in the laboratory to the research team.

### **Behavioral and Social Attributes**

The applicant/graduate student must possess the emotional and mental health required for full utilization of his or her intellectual abilities, the exercise of good judgment, the prompt completion of responsibilities inherent in managing a scientific laboratory, the ability to function under the stress, and the ability to understand and comply with ethical standards for the conduct of research.

The applicant/graduate student must be able to tolerate physically taxing workloads. They must be able to adapt to changing environments, to display flexibility, and must be able to perform problem-solving tasks quickly and efficiently in an environment that may change rapidly, without warning, and/or in unpredictable ways.

The applicant/graduate student must be capable of developing mature, professional and effective relationships with others. Integrity, interpersonal skills, interest and motivation are all personal qualities that are assessed during the admissions and education processes.

UCC is committed to making its programs accessible to qualified individuals with disabilities. Reasonable accommodations may be provided to qualified individuals with disabilities in order to provide equal educational opportunity. In all circumstances, candidates must be able to meet the academic and technical standards requisite for admission and participation in the GPBS.



## **TEACHING AND RESEARCH FACILITIES**

### **Space and Equipment**

Modern, high quality equipment is available for teaching and research purposes. Service and administrative areas in each department support departmental research. One common instrumentation laboratory, a tissue culture laboratory, an electromechanical shop, an immunetrovirology laboratory core facility, an animal house, a biomedical proteomic facility and a radioisotope laboratory supplement the laboratories.

The Biomedical Sciences Building has five lecture rooms, four student laboratories and a Learning Resources Center. Students perform laboratory work in Gross Anatomy, Histology and Embryology, Neuroanatomy, Biochemistry, Microbiology, Pharmacology and Physiology. In addition, the School of Medicine operates three lecture rooms in the Ramón Ruiz Arnau Hospital.

### **Technical Assistance**

All the basic sciences departments have laboratory technicians and/or research assistants to help carry out the research work performed by the faculty. The School of Medicine through the RCMI program provides an electromechanical technician who also helps out in the research endeavors.

### **Research Centers**

#### **Cell and Molecular Biology Center (CMBC)**

The CMBC is an interdisciplinary group of researchers from all of the basic sciences departments at our Institution with common and interrelated research interests in cell and molecular biology. The CMBC coordinates seminars, workshops, and an annual research day for UCC researchers, where conceptual and technical advances in cell and molecular biology are presented and demonstrated by distinguished visiting scientists and commercial instrumentation representatives. Center researchers mainly work in the areas of signal transduction and functional genomics.

#### **Center for Addiction Studies (CAS)**

The CAS was established with the purpose of expanding scientific knowledge on substance abuse, HIV/AIDS, and related topics. The objectives of the center are: a) to estimate the prevalence of drug use, abuse, and dependence in the Puerto Rican population; b) describe the patterns of drug use and associated factors; and c) examine the relationship between substance abuse and other physical and mental health conditions. The CAS aims to provide empirical knowledge as the basis for the preparation of health professionals that provide substance abuse and drug treatment services. The center also maintains scientific databases that serve as reference for public policy making.

#### **Center for Translational Neuroscience Research**

The purpose of the CTNR is to facilitate research on translational neuroscience at UCC. The goal of the Center is to develop novel therapeutic agents and markers for the treatment and diagnostic of neurodegenerative diseases in collaboration with the Caribbean Primate Research Center and the Morehouse School of Medicine in Atlanta, Georgia.

The Center pursues this goal through basic neuroscience research and preclinical studies of candidate drugs for neuroprotection. Currently, the Center focuses on the role of neuronal nicotinic acetylcholine receptors (AChRs) and AChRs linked neuroprotective pathways to develop new approaches to the treatment of neurological disorders.

#### **Neuroscience Research Center (NRC)**

The NRC was established in 1990 for the purpose of promoting neuroscience research in Puerto Rico. Organized as an inter-institutional association of neuroscientists with headquarters at the UCC, it has enjoyed RCMI support since 1991. At present, NRC is composed of scientists from four Puerto

Rican universities, as well as associate and student members. Research projects address issues ranging from the basic mechanism of cocaine addiction, excitotoxicity and neuroprotection, to ion channel function and signal transduction pathways. Numerous collaborations with colleagues from many universities are in place. This center also organizes the Puerto Rico Neurosciences Conference, held annually since 1992.

### **Retrovirus Research Center (RRC)**

The RRC is a multidisciplinary research center for the study of HIV/AIDS and other retroviruses. Its general goal is to promote and facilitate HIV/AIDS and other retrovirus research in Puerto Rico. The RRC promotes the study of HIV infection as a multidisciplinary research arena in which the clinical features, immunological, and virological elements and the psychological and behavioral parameters need to be integrated into a coherent research strategy. The center brings together a coalition of multidisciplinary researchers whose interest is to describe and understand key elements that play a role in the progression and/or expression of HIV infection according to an ecological view of the problem.

The Retrovirus Research Center laboratory provides clinical laboratory service, under RCMI support and a fee-for-service system, as part of an institutionalizing plan. The laboratory provides the research community with: a) standardized methodology for the rapid detection, identification, and quantification of HIV infection; b) standardized methodology for the characterization of sexually transmitted diseases, viral hepatitis, and mycobacterium; c) immunological services and expertise in the analysis and delineation of lymphocyte populations; d) facility for the determination of cytokines, chemokines, and proliferative response; e) facility to continue a repository of lymphocyte, plasma, and serum from HIV-infected individuals registered in the Data Core Facility; f) anti-retroviral drug susceptibility genotyping pattern in the HIV-infected population; and g) organized clinical laboratory support to the Data Core Facility and individual pilot projects.

### **University Center for Integrative and Complementary Medicine (CUMIC)**

The CUMIC was founded in 2001 with the purpose of providing treatment and education about complementary and alternative medicine and fomenting research. The CUMIC coordinates seminars to stimulate the participation in alternative medicine research with special interest in the use of natural compounds for the treatment of disease. The center is currently active in cancer research.

### **Research Facilities**

UCC has research laboratories and specialized research facilities with the necessary equipment to perform the research according to the interest of the researcher. The average size of the laboratories is 180 square feet. The individual research laboratories are complemented with common instrumentation areas, a cell culture laboratory, a retrovirology laboratory, an electron microscope, and a radioisotope laboratory.

The specialized research facilities are:

### **Animal Resources Center (ARC)**

The Animal Resources Center is staffed with personnel specialized in animal care and handling to support research and education activities. The ARC houses small and large animals in its 7,700 square feet facility and provides information concerning purchasing, basic husbandry, quarantine, and veterinary medical care of laboratory animals.

The ARC also provides technical assistance and advice dealing with animal species used for investigation and supports the research programs by making animals, materials, and animal husbandry supplies readily available.

The ARC is equipped with specialized areas to provide the following services: necropsy, stock and treatment, quarantine, bedding, cage washing, and storage. The facilities also include an experimental surgery area with surgical, scrub, sterilizing, and recovery rooms.

### **Behavioral Testing Facility (BTF)**

The Behavioral Testing Facility was created to facilitate the development of neuroscience research at the Universidad Central del Caribe, recognizing the importance of behavioral testing. The BTF has two (2) major components: the equipment infrastructure and the technical support division. The facility offers equipment for remote behavior visualization (RBV).

### **Biomedical Proteomic Facility (BPF)**

The mission of the BPF is to accelerate discovery by giving UCC investigators access to cutting edge technologies in proteomics and in mass spectrometry. The facility stimulates the use of 2D gels and protein analysis, via a proteomic imaging software, by the faculty. The aim is to provide separation and mass spectrometry techniques for the quantitative analysis of the proteome. One major objective is to identify disease and other relevant biological markers.

### **Common Instrumentation and Technical Support Unit**

This core area houses major equipment such as ultracentrifuges, freezers, spectrophotometers, gamma counters, etc, as well as the centralized cell culture facility. It fosters equipment sharing, centralizes maintenance of equipment, and provides repair for the equipment of all the projects.

### **Data Management and Statistical Research Support Unit (DMSRSU)**

The DMSRSU provides study design, data management, quality assurance, and statistical analysis support for UCC researchers. The DMSRSU has a strong infrastructure which includes the following subunits: Data Abstraction and Management; Data Entry; Quality Control; Data Analysis and Consultant; and Administrative and Computer Systems. Each of these subunits consists of experienced professionals readily available to assist researchers and to provide data management and statistical research support to investigators. In addition, the DMSRSU counts on a highly experienced and reliable consulting team.

### **HIV and Substance of Abuse Laboratory**

The laboratory supports research in the areas of HIV/AIDS and substances of abuse. Specialized facilities are made available to researchers for scientific studies in fields of immunology, drugs of abuse, HIV/AIDS, and related infectious diseases. This core laboratory provides researchers with assays for nucleic acids detection, virus genotyping, flow cytometric phenotyping, lymphocyte proliferation, cytotoxic and non-cytotoxic activity, cytokine and chemokine determinations, and drugs of abuse quantification.

### **Immunocytochemistry Laboratory**

The Immunocytochemistry Laboratory specializes in the qualitative identification and localization of cells bearing selective markers by employing specific antibodies to these molecules.

### **Integrated Research Information Support System (IRISS)**

IRISS provides a computer communications network environment, with related technology and resources, to support the acquisition and management of information by the faculty involved in research. The system provides faculty with connection and access to worldwide information resources to facilitate the expansion, strengthening, exchange, and dissemination of their biomedical research work and findings.

### **Neuronal Glia Culture Facility**

The goal of the facility is to assist UCC investigators in the use of cultured neurons, glia, and organotypic cultures. The cultures are used for patch clamping after in vitro treatments with drugs of

addiction or inhibitors and for in vitro models of neurodegenerative diseases. The core facility consists of a coordinator and a technician. Neuronal cultures are prepared from fetal cortex, hippocampus, or astrocytes from cerebral cortex.

### **Optical Imaging Facility**

The facility offers microscope-based systems that allow the assessment of cellular responses, such as calcium signaling with fast temporal resolution. The facility offers: a) confocal imaging services; b) brightfield, darkfield, phase contrast, Nomarski, and epi-fluorescence imaging; c) high spatial and temporal resolution imaging; d) collection of serial sections (deconvolution capabilities); and e) morphometric analysis.

### **Protein and Nucleic Acid Core Facility (PNACF)**

The PNACF aids in the transition from classical to molecular analysis of the problems being addressed by faculty members. The PNACF focuses on faculty training, seminars, training on specialized molecular biology techniques, protein expression, and protein purification and characterization.

### **Transmission Electron Microscopy Laboratory**

The TEM laboratory provides access to ultrastructural analysis of biological specimens via a Jeol 100 CX transmission electron microscope. The TEM is equipped with AMT 4 MP digital camera to facilitate image acquisition and 3D reconstruction from serial sections. In addition, to conventional EM procedures of in situ and cell culture specimens the laboratory also offers immunogold labeling and the visualization of fluorescent dyes after photoconversion.

## **Research Support Programs**

### **Extramural Associates Research Development Award (EARDA)**

The National Institute of Child Health and Human Development (NICHD) Extramural Associates Research Development Award (EARDA) provides support for the UCC Extramural Associate Program. The EARDA program aims to enhance faculty opportunities to conduct biomedical and behavioral research, develop skills in the fundamentals of preparing research grant applications, and develop collaborative arrangements with other academic institutions for the purpose of promoting biomedical and behavioral research.

### **Minority Biomedical Research Support (MBRS)**

The purpose of the MBRS programs is to increase the numbers of underrepresented minority faculty, investigators, and students engaged in biomedical or behavioral research and to broaden the opportunities for participation in biomedical or behavioral research of underrepresented minority faculty and students.

### **Minority Institutions' Drug Abuse Research Development Program (MIDARP)**

The overall goal of the MIDARP is to develop the capacity to support drug abuse research by providing under-represented minority faculty with drug abuse research knowledge and skill development through the conduct of research projects and other professional development activities; and strengthening the underlying institutional infrastructure needed to support drug abuse research.

### **Research Centers in Minority Institutions (RCMI)**

RCMI support is provided by the NCRR Division of Research Infrastructure (DRI). It provides funding to recruit established and promising researchers, acquire advanced instrumentation, modify laboratories for competitive research, fund core research facilities, and other research support. Because many investigators at RCMI institutions study diseases that disproportionately affect minorities, NCRR support serves the dual purpose of bringing more minority scientists into mainstream research and enhancing studies of minority health.

### **Specialized Neuroscience Research Programs (SNRP)**

The Specialized Neuroscience Research Programs at Minority Institutions strives to help minority institutions develop state-of-the-art neuroscience research programs; to increase ongoing research, stimulating academic and intellectual milieu that will inspire and prepare students and fellows to pursue research careers in neuroscience; and to provide support for the pilot research needed to show the skills and abilities of investigators by obtaining the preliminary data and publications that can help ensure successful competition for traditional research project grants during the performance period of the award.

### **Research Support Offices**

#### **Office of the Associate Dean for Research and Graduate Studies (OADRGS)**

The main goal of the OADRGS is to actively facilitate and promote interdisciplinary research enterprises and curriculum development within UCC's academic community. The OADRGS is devoted to establishing and implementing pre-and-post award procedures, assist researchers in the preparation of proposals and publications, establishing a strong profile for generation of external revenue and research grant funding, and fostering research collaborations.

#### **Research Development Office (RDO)**

The RDO provides technical assistance to faculty in the development and preparation of proposals, contracts, cooperative agreements, etc by performing program guideline review and analysis, preparation of complex budgets, processing of proposals, and electronic proposal submission.

The RDO manages the Sponsored Programs Information Network (SPIN) and Federal Grants and Contracts Weekly databases for identifying potential grant opportunities and makes available pilot project funding, to obtain preliminary data for grant applications.

#### **Sponsored Programs Office (SPO)**

The SPO facilitates the successful competition for external funding, assist in the management of and compliance in sponsored projects. The Office negotiates contracts and grants with a wide variety of sponsors, assist in the management of external funds.

#### **Scientific Resources Development Unit (SRDU)**

The SRDU is responsible for the professional development and continued education of junior and senior research faculty. The unit provides training programs that address the competencies that junior research faculty require to successfully develop into senior research faculty, including the development and management of research projects, the acquisition and management of grants and the communication of the results obtained.

## **STUDENT SERVICES**

### **Student Health Care Services**

It is a prerequisite for every student to have a physical examination prior to admission to the Graduate Program in Biomedical Sciences. This examination must include a TB test or chest X ray, urinalysis and a complete blood count. The examination may be performed by a physician selected by the student at his/her own expense or at any Public Health Unit or Health Center.

The Director of Student Health Care Services provides ambulatory services. These services and hospitalization are covered by health insurance financed by the student.

### **Counseling Program**

A counseling program is available through the Dean for Admissions and Student Affairs.

### **Student Tutoring Program**

This program provides academic tutorial assistance to students identified as academically deficient in course work.

### **Lodging Facilities**

Lodging facilities are available through individual arrangement in areas adjacent to the University. Information is available in a Directory published by the Office of the Dean for Admissions and Student Affairs.

### **Student ID Cards**

An identification card is issued to all registered students. The card is required for various services.

## **STUDY PROGRAMS IN THE BIOMEDICAL SCIENCES**

The Graduate Program in Biomedical Sciences offers four different study programs:

1. **Doctor of Philosophy in Cellular and Molecular Biology**  
Research Interest
  - Cellular and Molecular Biology
  - Biochemistry
  - Microbiology and Immunology
  - Neurosciences
  - Physiology
2. **Doctor of Philosophy in Neurosciences**
3. **Master of Science (MS) degree in:**
  - Anatomy and Cell Biology
  - Biochemistry
  - Microbiology and Immunology
  - Neurosciences
  - Pharmacology
  - Physiology
4. **Master of Arts (MA) degree with majors in:**
  - Anatomy and Cell Biology
  - Microbiology and Immunology
5. **Master of Arts (MA) degree in Biomedical Sciences**

## **GRADUATES' COMPETENCES**

### **Anatomy and Cell Biology M.A./M.S. Program in Biomedical Sciences Specialization in Anatomy and Cell Biology**

Graduates will be able to:

1. Demonstrate a general knowledge of the principal areas of anatomy: macroscopic anatomy, histology, embryology, and neuroanatomy.
2. Demonstrate a general knowledge of biochemistry and cell biology.
3. Apply knowledge in anatomy and cell biology to the development of scientific projects (M.S.).
4. Interpret the scientific literature to support hypothesis and project development (M.S.).
5. Apply the contemporary techniques used within the area of research (M.S.).
6. Apply current technology and scientific methodologies for problem solving (M.S.).
7. Conduct an experiment to test a hypothesis (M.S.).
8. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
9. Demonstrate the use of scientific literature required to continue their professional development throughout their career.
10. Demonstrate the required professional skills to collect, organize, and analyze scientific data.
11. Use scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Apply professional standards related to the publication and dissemination of research results.
13. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
14. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.



## **Biochemistry**

The Department of Biochemistry is involved in the study of the nicotinic acetylcholine receptor and neuroprotection. Department faculty utilize RNA aptamers, PCR and other cell and molecular biology techniques to study the trafficking of the nicotinic acetylcholine receptor and its active sites. Department faculty are also involved in the development of natural compounds as neuroprotectants against chemical weapons and cell death that results from stroke.

## **Ph.D. Program in Cell and Molecular Biology Research interest in Biochemistry**

Graduates will be able to:

1. Summarize the basic structures and fundamental processes of life at a molecular and cellular level.
2. Assess and recommend knowledge of related science specialties (chemistry for example) relevant to biochemistry research projects.
3. Devise a scientific project applying knowledge in cell and molecular biology and biochemistry.
4. Evaluate the scientific literature in cell and molecular biology and biochemistry to generate hypothesis and design scientific projects.
5. Assess contemporary techniques used within cell and molecular biology and biochemistry to determine which will best generate the necessary data to test a hypothesis.
6. Consider current technology and scientific methodologies for problem solving.
7. Design an experiment to test a hypothesis.
8. Support and articulate an idea or thought with an advanced degree of clarity and precision through written and oral means.
9. Monitor and compile the scientific literature required for professional development throughout the career.
10. Compile, organize, and assess scientific data need to compose research articles and design experiments.
11. Evaluate scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Compose research articles and disseminates research results according to professional standards.
13. Consider the correct professional attitude to utilize when interacting with individuals of diverse cultures, races, and genders in the development of scientific projects adjusting to the cultural needs and background of the individual.
14. Recommend professional attitudes, standards, and manners in the behavior towards peers, institutional staff, and faculty adjusting to the cultural needs and background of the individual.

**M.S. Program in Biomedical Sciences  
Specialization in Biochemistry**

Graduates will be able to:

1. Demonstrate a general knowledge of biochemistry and cell and molecular biology.
2. Apply knowledge in biochemistry to the development of scientific projects.
3. Interpret the scientific literature to support hypothesis and project development.
4. Apply the contemporary techniques used within the area of research.
5. Apply current technology and scientific methodologies for problem solving.
6. Conduct an experiment to test a hypothesis.
7. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
8. Demonstrate the use of scientific literature required to continue their professional development throughout their career.
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12. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
13. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.

## **Microbiology and Immunology**

The Department of Microbiology and Immunology focuses on the discovery of new therapies through the understanding of the molecular mechanisms of microbial and immune diseases. Research in the Department of Microbiology and Immunology utilizes a wide array of cell and molecular biology techniques to study HIV/AIDS pathogenesis. Current projects involve the identification of HIV replication inhibitors by proteomics, development of HIV vaccines through molecular biology techniques, and HIV antiviral resistance.

### **Ph.D. Program in Cell and Molecular Biology Research interest in Microbiology and Immunology**

Graduates will be able to:

1. Summarize the basic structures and fundamental processes of life at a molecular and cellular level.
2. Assess and recommend knowledge of related science specialties (chemistry for example) relevant to microbiology and immunology research projects.
3. Devise a scientific project applying knowledge in cell and molecular biology and microbiology and immunology.
4. Evaluate the scientific literature in cell and molecular biology and microbiology and immunology to generate hypothesis and design scientific projects.
5. Assess contemporary techniques used within cell and molecular biology and microbiology and immunology to determine which will best generate the necessary data to test a hypothesis.
6. Consider current technology and scientific methodologies for problem solving.
7. Design an experiment to test a hypothesis.
8. Support and articulate an idea or thought with an advanced degree of clarity and precision through written and oral means.
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14. Recommend professional attitudes, standards and manners in the behavior towards peers, institutional staff, and faculty adjusting to the cultural needs and background of the individual.

**M.A./M.S. Program in Biomedical Sciences  
Specialization in Microbiology and Immunology**

Graduates will be able to:

1. Demonstrate a general knowledge of the principal areas of microbiology and immunology: bacteriology, mycology, parasitology, virology and immunology.
2. Demonstrate a general knowledge of biochemistry and cell biology.
3. Apply knowledge in microbiology and immunology to the development of scientific projects (M.S.).
4. Interpret the scientific literature to support hypothesis and project development (M.S.).
5. Apply the contemporary techniques used within the area of research (M.S.).
6. Apply current technology and scientific methodologies for problem solving (M.S.).
7. Conduct an experiment to test a hypothesis (M.S.).
8. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
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11. Use scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Apply professional standards related to the publication and dissemination of research results.
13. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
14. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.

## **Neurosciences**

Neurobiology is an interdepartmental subspecialty intended for students who are primarily interested in applying cell and molecular techniques to study the nervous system. Research areas include synaptic neurotransmission, neuronal signaling, ion channels, and neurotransmitters and their receptors. Work in this area encompasses a broad range of approaches including electrophysiological characterization of channel properties, genetic analysis of animals with mutant receptors to study the receptor's role in epilepsy, and transmission electron microscopy to study vesicle trafficking.

### **Ph.D. Program in Cell and Molecular Biology Research interest in Neurosciences**

Graduates will be able to:

1. Summarize the basic structures and fundamental processes of life at a molecular and cellular level.
2. Assess and recommend knowledge of related science specialties (chemistry for example) relevant to neuroscience research projects.
3. Devise a scientific project applying knowledge in cell and molecular biology and neuroscience.
4. Evaluate the scientific literature in cell and molecular biology and neuroscience to generate hypothesis and design scientific projects.
5. Assess contemporary techniques used within cell and molecular biology and neuroscience to determine which will best generate the necessary data to test a hypothesis.
6. Consider current technology and scientific methodologies for problem solving.
7. Design an experiment to test a hypothesis.
8. Support and articulate an idea or thought with an advanced degree of clarity and precision through written and oral means.
9. Monitor and compile the scientific literature required for professional development throughout the career.
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12. Compose research articles and disseminates research results according to professional standards.
13. Consider the correct professional attitude to utilize when interacting with individuals of diverse cultures, races, and genders in the development of scientific projects adjusting to the cultural needs and background of the individual.
14. Recommend professional attitudes, standards and manners in the behavior towards peers, institutional staff, and faculty adjusting to the cultural needs and background of the individual.

## **Ph.D. in Neurosciences**

Graduates will be able to:

1. Summarize the basic structures and fundamental processes of the nervous system.
2. Assess and recommend knowledge of related science specialties (chemistry for example) relevant to neuroscience research projects.
3. Devise a scientific project applying knowledge in neuroscience.
4. Evaluate the scientific literature in neuroscience to generate hypothesis and design scientific projects.
5. Assess contemporary techniques used within neuroscience to determine which will best generate the necessary data to test a hypothesis.
6. Consider current technology and scientific methodologies for problem solving.
7. Design an experiment to test a hypothesis.
8. Support and articulate an idea or thought with an advanced degree of clarity and precision through written and oral means.
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14. Recommend professional attitudes, standards and manners in the behavior towards peers, institutional staff, and faculty adjusting to the cultural needs and background of the individual.

## **M.S. in Neurosciences**

Graduates will be able to:

1. Demonstrate a general knowledge of the principals areas of Neuroscience
2. Demonstrate a general knowledge of biochemistry and cell and molecular biology.
3. Apply knowledge in neuroscience to the development of scientific projects.
4. Interpret the scientific literature to support hypothesis and project development.
5. Apply the contemporary techniques used within the area of research.
6. Apply current technology and scientific methodologies for problem solving.
7. Conduct an experiment to test a hypothesis.
8. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
9. Demonstrate the use of scientific literature required to continue their professional development throughout their career.
10. Demonstrate the required professional skills to collect, organize, and analyze scientific data.
11. Use scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Apply professional standards related to the publication and dissemination of research results.
13. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
14. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.

## **Physiology**

Physiology is the study of function of the human body, its organs and cells. Specific areas of faculty research include: signal transduction, endothelial cell biology, and molecular physiology of ion channels. Faculty use a range of molecular and electrophysiological techniques to look at the structure and function of channels and receptors and their roles in cellular physiology.

### **Ph.D. Program in Cell and Molecular Biology**

#### **Research interest in Physiology**

Graduates will be able to:

1. Summarize the basic structures and fundamental processes of life at a molecular and cellular level.
2. Assess and recommend knowledge of related science specialties (chemistry for example) relevant to physiology research projects.
3. Devise a scientific project applying knowledge in cell and molecular biology and physiology.
4. Evaluate the scientific literature in cell and molecular biology and physiology to generate hypothesis and design scientific projects.
5. Assess contemporary techniques used within cell and molecular biology and physiology to determine which will best generate the necessary data to test a hypothesis.
6. Consider current technology and scientific methodologies for problem solving.
7. Design an experiment to test a hypothesis.
8. Support and articulate an idea or thought with an advanced degree of clarity and precision through written and oral means.
9. Monitor and compile the scientific literature required for professional development throughout the career.
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14. Recommend professional attitudes, standards and manners in the behavior towards peers, institutional staff, and faculty adjusting to the cultural needs and background of the individual.



**M.A./M.S. Program in Biomedical Sciences  
Specialization in Physiology**

Graduates will be able to:

1. Demonstrate a general knowledge of the principal areas of Physiology: cardiopulmonary, endocrine, gastrointestinal, neuromuscular, renal reproductive and reticuloendothelial physiology.
2. Demonstrate a general knowledge of biochemistry and cell biology.
3. Apply knowledge in physiology to the development of scientific projects (M.S.).
4. Interpret the scientific literature to support hypothesis and project development (M.S.).
5. Apply the contemporary techniques used within the area of research (M.S.).
6. Apply current technology and scientific methodologies for problem solving (M.S.).
7. Conduct an experiment to test a hypothesis (M.S.).
8. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
9. Demonstrate the use of scientific literature required to continue their professional development throughout their career.
10. Demonstrate the required professional skills to collect, organize, and analyze scientific data.
11. Use scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Apply professional standards related to the publication and dissemination of research results.
13. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
14. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.

## **Pharmacology**

### **M.S. Program in Biomedical Sciences Specialization in Pharmacology**

Graduates will be able to:

1. Demonstrate a general knowledge of pharmacology.
2. Demonstrate a general knowledge of biochemistry and cell biology.
3. Apply knowledge in pharmacology to the development of scientific projects.
4. Interpret the scientific literature to support hypothesis and project development.
5. Apply the contemporary techniques used within the area of research.
6. Apply current technology and scientific methodologies for problem solving.
7. Conduct an experiment to test a hypothesis.
8. Demonstrate the necessary written and oral skills to effectively articulate an idea or thought.
9. Demonstrate the use of scientific literature required to continue their professional development throughout their career.
10. Demonstrate the required professional skills to collect, organize, and analyze scientific data.
11. Use scientific information including primary research articles, mass media sources, and World Wide Web information.
12. Apply professional standards related to the publication and dissemination of research results.
13. Demonstrate a professional attitude when interacting with individuals of diverse cultures, races, and genders.
14. Demonstrate a professional attitude and manners in the behavior towards their peers, institutional staff, and faculty.

## **GRADUATION REQUIREMENTS**

### **Ph.D. Degree**

Early in the doctoral work, a dissertation subject is chosen in the major field of study and approved by the research committee. The dissertation must represent original investigation that contributes new knowledge to the candidate's field. Upon completion of at least four (4) years of graduate study and a dissertation, the candidate must pass a dissertation defense.

- a. Grade index: 3.0 or above
- b. Credits: As stipulated by the program of study, 72 credits minimum.
- c. Residence: A minimum of two year of full-time work must be completed at UCC
- d. Time limitations: A maximum of 7 years to satisfy all the requirements.
- e. Qualifying examination: Required of all students
- f. Dissertation defense: Required of all students
- g. Authorship: Co-author in at least one (1) manuscript accepted for publication

### **MS/MA Degree**

- a. Grade index: 3.0 or above
- b. Credits: As stipulated by the program of study, 34 credits minimum.
- c. Residence: A minimum of two year of full-time work must be completed at UCC
- d. Time limitations: A maximum of 4 years to complete all the requirements
- e. Comprehensive examination: Required of all MS and MA candidates
- f. Thesis defense: Required of all MS candidates

A MS/MA student must complete all the requirements and have defended his/hers dissertation/thesis in order to participate in the Commencement Ceremony.

The student must deliver the approved dissertation/thesis in a CD-ROM, according to the Dissertation/Thesis Manual, to complete the graduation requirements and receive his/hers diploma. The Graduate Programs in Biomedical Sciences will print and bind three (3) copies of the thesis (one for the student, one for the department and one for the library).

## **Checklist of Graduation Requirements**

### **Ph.D./MS Degrees**

- Pay printing and binding (3 copies) fees to Cashier's Office
- Pay graduation fees to Cashier's Office.
- Completed Exit Survey.

### **MA Degrees**

- Pay graduation fee to Cashier's Office.
- Completed Exit Survey.

## **Time Limitations**

### **Ph.D. Degree**

Students will be allowed a maximum of seven years to complete the degree requirements.

### **MS/MA Degree**

Students will be allowed a maximum of four years to complete the degree requirements.

The student must complete all requirements by June 30 of his fourth year, the last day of the academic year. Under exceptional circumstances, the Graduate Program in Biomedical Sciences Committee may extend these periods for one (1) year.

### **Extension Request Procedure**

The student will write a letter explaining the need for the extended period and the reasons why he/she could not complete the degree in the allowed time. The mentor will write a letter agreeing to continue being the mentor of the student and detailing a plan for the student to complete the graduation requirements in a year period. The Graduate Program in Biomedical Sciences Committee will examine the documents presented and render a decision.

## GRADING POLICY

Grades at the end of each term are assigned according to the following letter system:

Grade	Points	
A	4	Excellent
B	3	Good
C	2	Satisfactory
F	0	Failure
I	--	Incomplete coursework
N	--	Non reported
W	--	Authorized withdrawal
U	--	Unauthorized withdrawal
WP	--	Withdrawal passing
WF	--	Withdrawal failing
P	--	Passed without credit*
H	--	Passed with honors
NC	--	Noncredit course
IP	--	In Progress

\*Each department may propose through the Graduate Program in Biomedical Sciences Committee graduate courses for pass/fail (P/F) designation.

A grade of "I" indicates assigned work yet to be completed in the term. The grade of "I" becomes an "F" if not removed by the end of the following term according to the following schedule: "I" grades from the first semester become "F" if not removed by the end of the second semester; "I" grades from the second semester and for the summer session become "F" if not removed by the end of the first semester of the incoming academic year. An "I" grade cannot be changed to a W under any circumstances. The grade of "I" on the thesis does not become an "F" at the beginning of the next term or session and will remain as such until the evaluation of the thesis is submitted.

## Academic Honors

Academic honor will be given to those students who have obtained the following cumulative averages, after completing the Program's requirements.

HONOR	CQPI
Summa Cum Laude	3.75 to 4.00
Magna Cum Laude	3.50 to 3.74
Cum Laude	3.25 to 3.49

## **STUDENT STATUS IN THE PROGRAM**

The Graduate Program in Biomedical Sciences Committee will review students' records in May, for those students admitted in August of the previous year, and in December for students admitted in January (completion of two semesters in the program).

The resulting action depends upon the grade point average (GPA) on a four-point scale, as follows:

1. To be in good academic standing, the student must have a GPA of 3.0 or higher.
2. Students attaining a GPA below 2.5 will be dismissed from the Program.
3. If the grade index is below 3.0 but above 2.5, the student will be placed on probation for the following academic year, at the end of which he/she will be dismissed if his/her grade index has not improved to 3.0. Students on probation are not eligible for financial aid.
4. Students obtaining a failing grade (F) on a course will be dismissed from the program.
5. A student may repeat a course once, after withdrawing. If the student does not approve the course during his/her second attempt the student will be dismissed from the program.

A student that has been dismissed from the Program may appeal their cases to the Graduate Program in Biomedical Sciences Committee. The Committee will review the student's record and will make the pertinent decision on whether to readmit the student. Once dismissed from the program a student will not enroll in graduate courses under any student classification, for example non-degree student.

All grades and repeats will be included in the calculation of the grade point average (GPA). All grades on courses not offered at the institution but approved by the Thesis Committee as part of the program of study will also be included in the GPA calculation. Withdrawals, pass/fail credit and transfer courses are not included in the calculation of the GPA. Transferred courses are defined as those completed while not enrolled at UCC.

Grade reports are sent to students at the end of each semester.

A certified letter is mailed to each student placed on probation or dismissed.

## **WITHDRAWAL PROCEDURES**

1. The deadline for withdrawal from a course with a grade of "W" may be any date prior to 50% to completion of the course, afterwards the student will be assigned a grade of WF or WP (if evaluated).
2. The deadline for withdrawal without "W" will be before 10% after the beginning of the course.
3. The procedure for withdrawal is as follows: the student must provide written notification to the graduate program coordinator of the program he/she is enrolled in advising what course(s) he/she intends to withdraw. The student should file the withdrawal application at the Registrar's Office.
4. Authorized withdrawals will be allowed before the course final exam.
5. Unauthorized withdrawals constitute grounds for dismissal from the Program.

**READMISSIONS**

Students who have previously been enrolled in the Program and withdrawal without authorization, withdrawal with authorization or have not maintained their active status in the Program and desire to continue or complete the degree requirements must apply for readmission to the Program through the Office of Admissions. All readmission applications must be received 30 calendar days before the start of the session in which the student wants to continue his/her studies. Interested candidates must submit transcripts of any other course work taken outside UCC during the time of absence from the Program.

The maximum interruption allowed in the program of study is two years and only one readmission will be granted to the student.

## **PROGRAM ACADEMIC REQUIREMENTS**

### **Academic Program Advice**

The Coordinator for the Graduate Program in Biomedical Sciences in each department will be responsible for the academic advice to the graduate students in his/her department. The mentor or graduate program coordinator will prepare the student's program of study. The Coordinator will help the student in attaining his/her educational goals. To this end, the Coordinator will participate in the preparation, supervision and evaluation of the student's academic program.

### **Language Requirements**

Knowledge of English and Spanish is a basic requirement for study in the Program. The student is expected to possess verbal and written proficiency in both languages.

A working knowledge of English and Spanish is a basic requirement for study in the Ph.D. Program in Cell and Molecular Biology. Student's language abilities will be assessed during the interview. If a student is not able to participate in the interview in person, (s)he must include an official report of their Test of English as a Foreign Language (TOEFL) scores with their application.

### **Course Load**

#### **PhD Degree**

A full-time load consists of no less than eighteen (18) credits per year. UCC non-teaching personnel enrolled in the Program are allowed to take no more than six (6) credit hours per semester and/or three (3) during the summer session, unless a course carries a weight of more than the maximum allowed in a semester or in the summer session, in which case the student will be allowed to register for such courses. Students must register every term; failure to do so will automatically result in the student being dropped from the Program. If the student is dropped and wants to reenter in the Program, the student must reapply and go through the admissions process. Courses of the doctoral program are valid for seven years.

#### **MS/MA Degree**

A full time load consists of not less than nine (9) credits per academic year. A student enrolled in Thesis work is considered a full-time student. UCC non-teaching personnel enrolled in the Program are allowed to take not more than six (6) credit hours per semester and/or three (3), during the Summer session, unless a course carries a weight of more than the maximum allowed in a semester or in the Summer session, in which case the student will be allowed to register for such courses. Students must register every term; failure to do so will automatically withdraw the student from the Program. In the event of withdrawal, a new application must be submitted if the student desires to continue in the Program.

### **Class Attendance**

According to the Rules and Regulations of the UCC, attendance to classes and all other academic activities is compulsory. Students that do not present to class will be consider as unauthorized withdrawals.

### **Graduation**

Students must apply and pay the corresponding graduation fee no later than the date set in the Academic Calendar. Application forms for this purpose are obtained from the Registrar's Office, and must be mailed or delivered together with a copy of the receipt of payment of the \$200.00 non refundable graduation fee to the Bursar's Office. Non compliance with these requirements may postpone the conferring of the degree.



## **Maintenance of Active Status**

### **PhD Degree**

Students are required to enroll in a minimum of eighteen (18) credits each year in order to maintain an active status in the Program for a period not exceeding the time allowed for the completion of the degree.

### **MS/MA Degree**

Students that have fulfilled all the requirements for the Masters degree except for the Comprehensive Examination and/or Thesis Defense are required to enroll in Thesis work each semester in order to maintain an active status in the Program for a period not exceeding the remainder of the time allowed for the completion of the degree, four years.

### **Programs of Study**

The program of study must be filed with the Graduate Program in Biomedical Sciences Office. Students may enroll in the courses they understand are relevant to their degree, with the approval of their mentor, within the time limit to complete the program. These programs of study are designed to meet the specific requirements of each student. Once the designated program of study is approved, a student must comply with the course requirements established in his/her program of study to graduate.

### **Residency**

A minimum of two year of full-time work must be completed at the Universidad Central del Caribe.

### **Research Mentor**

By the end of the first year, each student will choose a research mentor. The mentor will be the chair of the Thesis / Dissertation Committee and will be selected by the student. The mentor must have a Doctoral degree and must be actively engaged in research in the case of Ph.D. and M.S. students. The mentor will be responsible for direct supervision of the student's research and will coordinate the comprehensive / qualifying exam.

### **MA Mentor**

By the end of the first year, each student will choose a mentor. The mentor will be in charge of organizing evaluation committees for the student's biographical reports according to the reports discipline. The mentor will be selected by the student with the advice of the chairperson of the department. The mentor will be responsible for direct supervision of the student's academic work and will coordinate the comprehensive exam.

### **Dissertation / Thesis Committee**

After selecting their research advisor, the student, in consultation with the advisor, will select a committee no later than the first semester of the second academic year. The committee will be composed of three (3) or five (5) members, including the research advisor who will chair the committee. The members of the committee will be UCC faculty members or faculty from other institutions with similar programs, but the majority of the committee must be UCC full-time faculty members. One (1) member of the committee must be a graduate faculty member from outside the advisor's department. The advisor will keep written records of the meetings. The committee and the program of study must be approved by the Graduate Program in Biomedical Sciences Office and should be on file at that Office by the end of the first semester of the second year.

An intensive period of full-time research is the central element of the Ph.D. / M.S. degree. It is the dissertation committee's responsibility to provide an objective evaluation of the project as well as contribute to the selection of specific research directions. While the dissertation committee often has useful suggestions on specific approaches to a particular protocol, a more vital function is to help focus and limit the scope of the research so that the student has, as early as possible, a clear concept of the overall design of the dissertation proposal. Although this concept will change in response to specific experimental findings, it is critical for the student to be guided to define, both in scope and quality, an appropriate research project.

The committee must meet at least once per academic year.

### **Bibliographical Reports**

For those students enrolled in the M.A. Program in the Biomedical Sciences, the Associate Dean for Research and Graduate Studies together with the student will select the Bibliographical Reports and his/her mentor.

### **Seminars**

The seminars provide coverage of subjects not included in other graduate courses and serves as a forum for presentation of research proposals, work in progress and completed work by the staff and graduate students. Visiting scientists also participate in the seminars.

Each seminar will be worth 1 credit hour. All faculty members present during the seminar may evaluate the student's seminar presentation. Students will present a maximum of one seminar per day. A minimum of three faculty members must be present in order for a grade to be awarded for the seminar presentation. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

### **Dissertation / Thesis**

Under the supervision of his/her mentor and of the Thesis Committee, the candidate shall prepare a thesis embodying the results of his/her investigative efforts in his/her selected major field or area of expertise. The candidate will submit a draft of the thesis to the mentor and the members of the Thesis Committee at least six (6) weeks prior to the commencement date. The members of the committee will be allowed two (2) weeks after the receipt of the draft to propose in writing any changes, deletions, corrections and criticism to the draft. The Thesis Committee and the student will meet to discuss the recommendations. The candidate will then have ten (10) days to prepare the final draft of the thesis based on the changes, corrections, etc. submitted by each member of the Thesis Committee. The Committee will have two (2) weeks to reexamine the thesis and determine the acceptability of the thesis and the date of the thesis defense. Following your public defense, you have 10 days in which to make changes required by your committee. Your committee will have 2 weeks to reexamine the thesis and either approved it or disapproved.

The student must deliver the approved thesis in a CD-ROM, according to the Thesis / Dissertation Manual, to complete the graduation requirements and receive his/hers diploma. The Graduate Programs in Biomedical Sciences Office will print and bind three (3) copies of the thesis (one for the student, one for the department and one for the library). Make sure that the Graduate School has your current contact information so you can be notified when the bound copies arrive at the Graduate School.

## **Dissertation / Thesis Defense**

In order to be eligible to perform the defense, the candidate must have approved all graduation requirements excluding the thesis defense and must have been notified by the Dissertation / Thesis Committee that his/her thesis is approved and defensible. The defense will consist of a public presentation of the results and conclusions of the dissertation / thesis research. The defense is an oral defense and the candidate will be examined on the content of the thesis by the Dissertation / Thesis Committee. Other members of the academic community may attend the final examination and participate in the questioning. Once the public portion of the defense is completed, the Dissertation / Thesis Committee will meet privately with the candidate for further evaluation of the student's knowledge of the contents of the dissertation / thesis. A representative of the Graduate Program in Biomedical Sciences will be appointed by the Director and will act as an evaluator of the process. This representative will be from outside the student's department. The result of the defense will be notified orally and in writing to the candidate. In case of failure, the panel may recommend that the candidate be dismissed from the program or that a second opportunity to defend the thesis be allowed no later than six (6) months from the date of the first defense. A student may defend only twice.

The Graduate Program in Biomedical Sciences Office will make the official announcement for the defense after prior notification; the notification must receive no later than fourteen (14) days prior to the intended thesis defense date.

Dissertation / Thesis Defense Approval Form:

The Request for Permission for Dissertation / Thesis Defense form must be completed and submitted to the Graduate Programs in Biomedical Sciences at least two weeks prior to the final defense. A ballot for the final examination will be sent to the research advisor. After the defense, the original signed ballot must be returned to the Graduate Programs in Biomedical Sciences.

## **Specific Requirements for the Ph.D. Degree**

### **Qualifying Examination**

All Ph.D. students must pass the qualifying examinations by the end of their third year. Successful completion of this requirement is a necessary condition for advancement to doctoral candidacy and must be accomplished at least six (6) months prior to the dissertation defense. The dissertation committee is responsible for recommending advancement to candidacy to the Graduate Program in Biomedical Sciences Office. A graduate program representative will represent the Program at the dissertation defense and assure all regulations are followed.

The goal of the qualifying examination is for the faculty to assess the adequacy of the students' background knowledge in their chosen field and their ability for problem solving and for interpretation of important cell and molecular biology concepts before formally permitting them to begin their doctoral research. The dissertation committee will prepare the qualifying exam. A student who is in good academic standing but who fails the examination is allowed one (1) opportunity to retake the exam. In case of failure, the student will be reexamined no later than six (6) months from the date of the first examination. In case of a second failure, the student will be dismissed from the Ph.D. program. Students will be allowed to apply to the MS/MA program if dismissed from the Ph.D. program.

Students in the PhD program can be awarded the MS or MA degree once they have completed all of the MS or MA graduation requirements. The qualifying examination will serve as the thesis defense.

Within six (6) months of passing the qualifying examination, the student is expected to present a research proposal to the dissertation committee. The dissertation committee will monitor his/her research progress on a regular basis, meeting at least once a year. A week prior to each meeting, the student will present a written summary of research progress to the committee for review.

## **Requirements for the Masters Degree**

### **Comprehensive Examinations**

All students enrolled in the MS and MA Programs must pass a written examination covering the student specialization subjects described in their program of study. In case of failure, the student will be reexamined no later than six months from the date of the first examination. In the event of a second failure, the department's faculty may recommend that the candidate be dismissed from the program or re-examined for a third and final time. The comprehensive examination is normally given near the end of the student's second year of graduate studies, or after the satisfactory completion of the scheduled courses. The student mentor is responsible for the coordination and administration of the comprehensive examination.

## **Specific Requirements for the Master of Science (MS) Degree with Departmental Specialization**

### **Course Requirements**

All candidates for the MS degree must approve their program of study with a minimum grade point average of 3.0 (scale of 4.0). Specific course requirements, minimum passing grades and programs of study will be determined by each department.

### **Research Proposal**

A written and oral presentation of a research proposal will be required from all MS candidates. In preparing the proposal the student should follow the guidelines set forth by the National Institutes of Health. The Thesis Committee must approve the proposal.

## **Specific Requirements for the Master of Arts (MA) Degree with Departmental Specialization**

### **Course Requirements**

All candidates for the MA degree with departmental specialization must approve their program of study with a minimum grade point average of 3.0 (scale of 4.0). Written bibliographic reports included in their program of study will be assigned, supervised, and evaluated by a faculty member appointed by the mentor. Each bibliographic report will not carry a value of more than one (1) credit hour. Bibliographic Reports will be evaluated with GPBSF 19. Specific course requirements, minimum passing grades and programs of study will be determined by each department.

## **Specific Requirements for the Master of Arts (MA) Degree in the Biomedical Sciences**

The Universidad Central del Caribe offers the M.A degree in the Biomedical Sciences to those students who wish to obtain a general knowledge but who do not want to specialize in any particular area of the Biomedical Sciences.

### **Course Requirements**

All candidates for the M.A. degree in the Biomedical Sciences must complete the program with a minimum grade point average of 3.0 (scale of 4.0). Written bibliographic reports included in their program of study will be assigned, supervised, and evaluated by a faculty member appointed by the mentor. Each bibliographic report will carry a value of no more than one (1) credit hour. Bibliographic Reports will be evaluated with GPBSF 19.

## **TRANSFERS**

### **Transfer Students**

Students who desire admission into the Graduate Program in Biomedical Sciences as transfer students from another graduate program of an accredited institution will be considered for admission if they fulfill all admission requirements. The applicants must request that the institution from which they wish to transfer submit all pertinent documentation. The Graduate Program in Biomedical Sciences Committee will evaluate the student academic record and will recommend to the Registrar's office the transfer of course work as follows:

A maximum of thirty (30) credit hours will be accepted for the Ph.D. degree provided the grades in those courses transferred are of a B or higher and the courses are equivalent in content and depth to those offered by the UCC Graduate Program in Biomedical Sciences.

A maximum of 9 credits hours of approved course work will be accepted for the MS/MA degree, provided the grades in those courses are B or better, the courses are equivalent to those offered by the Graduate Program in Biomedical Sciences, and they satisfy departmental requirements.

Students in the Program who are authorized to take courses outside of UCC must submit transcripts of any course work taken to be included in their UCC transcript.

No credits used for a completion of a BS or PhD degree will be transferred.

### **Transfer of Credits**

A maximum of thirty (30) credit hours will be accepted for the Ph.D. degree provided the grades in those courses transferred are of a B or higher and the courses are equivalent in content and depth to those offered by the UCC Graduate Program in Biomedical Sciences.

A maximum of 9 credits hours of approved course work will be accepted for the MS/MA degree, provided the grades in those courses are B or better, the courses are equivalent to those offered by the Graduate Program in Biomedical Sciences.

All transfer credits must be verified by an official transcript from the institution at which the work was completed.

All credits transferred to UCC must have been completed at an accredited institution.

Acceptance of graduate credit for work done at other graduate institution must be approved by the student's advisory committee and the Associate Dean of Graduate Studies. Courses to be considered for transfer credit must have been completed within five years.

Valid transfer credits will appear on the student's transcript as credits earned.

Under no circumstances will transfer credit be awarded for courses in which a grade lower than B, or its equivalent, has been received or for courses graded on a pass/fail basis, for continuing education units, courses completed outside the five-year time limit, correspondence, extension, or in-service courses.

Procedure:

To have courses considered for transfer, students must discuss their plan to use specific courses from other institutions with their major advisor and/or advisory committee. Students will complete GPBSF 18 to request approval.

Within the guidelines established by the Graduate Program in Biomedical Sciences, the advisory committee will identify courses acceptable for transfer and will record these courses on the student's Program of Study, GPBSF 1.

The student must have an official transcript sent from the institution(s) where credit was earned to the UCC Registrar's Office. Only when courses have been verified by the OADRGS will they be approved for application toward the degree.

Under no circumstances will transfer credit be awarded for research, internships, master's thesis or doctoral dissertation work performed outside of UCC. While, at the discretion of a program faculty, a student's research project from another institution might be accepted for continuation once enrolled at UCC, the required number of credit hours must be enrolled in and successfully completed to meet the requirements for graduation with a master's or a doctorate degree, respectively.

### **Transfer between Programs**

Students may transfer between the PhD and MS/MA programs or between MS/MA programs by completing Graduate Programs in Biomedical Sciences Form 8. The signature of the losing department chair is not required, but performed as a courtesy. In case the losing department chair does not agree with the transfer, the Associate Dean for Research and Graduate Studies can approve the transfer of the student.

Students transferring from the MS to the MA may transfer up to 3 credits of research. For the credits to be transferred the student must have presented the research at a scientific meeting, write a report about the research performed and have the approval of the research mentor.

## Courses for the Ph.D. in Cell and Molecular Biology Program

### Core Courses

Course Code	Course Title	Credits
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS	Seminar	1
BMS 860	Scientific Methodology	2
BMS 861	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
	Electives	9-19
BMS 899	Graduate Research	30-42
<b>Total</b>		<b>72</b>

### Sample Elective Courses

Course Code	Course Title	Credits
φ BMS 530B	Physiology	6
* BMS 580A	Neurosciences	6
* BMS 580B	Advance Neurosciences	3
BMS 580C	Medical Neurosciences	6
BMS 800	Seminar in Cell and Molecular Biology	1
BMS 815	Protein Structure and Function	2
BMS 816	Gene Expression and Protein Synthesis	2
BMS 817	Signal Transduction	2
§ BMS 819	Seminar in Biochemistry	1
◆ BMS 820C	Medical Bacteriology	2
◆ BMS 821B	Immunology	3
◆ BMS 822	Parasitology	2
BMS 823	Cell Culture	2
◆ BMS 824B	Cellular and Molecular Microbiology	3
◆ BMS 825	Mycology	2
◆ BMS 826A	Virology	3
◆ BMS 829A	Diagnostic Bacteriology	3
BMS 831	Membrane Transport	2
BMS 832	Cardiovascular Physiology	2
BMS 833	Renal Physiology	2
φ* BMS 830	Neurophysiology	5
φ BMS 839	Seminar in Physiology	1
◆ BMS 859	Seminar in Microbiology and Immunology	1
BMS 870-874	Topics in (Specify)	1 each
BMS 879	Seminar in Neurosciences	1

§ Required course for Biochemistry

◆ Required course for Microbiology and Immunology

\*Required course for Neuroscience

φ Required course for Physiology

## **SAMPLE PROGRAMS OF STUDY**

### **Ph.D. in CELLULAR and MOLECULAR BIOLOGY**

Sample program of study for a student with a research interest in  
**BIOCHEMISTRY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS 815	Protein Structure and Function	2
BMS 816	Gene Expression and Protein Synthesis	2
BMS 817	Signal Transduction	2
BMS 819	Seminar in Biochemistry	1
BMS 823	Cell Culture	2
BMS 831	Membrane Transport	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 899	Graduate Research	39

Completion of at least 72 credit hours is required for graduation.

### **Ph.D. in CELLULAR and MOLECULAR BIOLOGY**

Sample program of study for a student with a research interest in  
**MICROBIOLOGY AND IMMUNOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS 820C	Medical Bacteriology	2
BMS 821B	Immunology	3
BMS 822	Parasitology	2
BMS 824B	Cellular and Molecular Microbiology	3
BMS 825	Mycology	2
BMS 826A	Virology	3
BMS 829A	Diagnostic Bacteriology	3
BMS 859	Seminar in Microbiology and Immunology	1
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 899	Graduate Research	31

Completion of at least 72 credit hours is required for graduation.



### **Ph.D. in CELLULAR and MOLECULAR BIOLOGY**

Sample program of study for a student with a research interest in  
**NEUROSCIENCES**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS 580A	Neurosciences	6
BMS 580B	Advance Neurosciences	3
BMS 830	Neurophysiology	5
BMS 879	Seminar in Neurosciences	1
BMS 831	Membrane Transport	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 899	Graduate Research	33

Completion of at least 72 credit hours is required for graduation.

### **Ph.D. in CELLULAR and MOLECULAR BIOLOGY**

Sample program of study for a student with a research interest in  
**PHYSIOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS 530B	Physiology	6
BMS 817	Signal Transduction	2
BMS 830	Neurophysiology	5
BMS 831	Membrane Transport	2
BMS 832	Cardiovascular Physiology	2
BMS 833	Renal Physiology	2
BMS 839	Seminar in Physiology	1
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 899	Graduate Research	30

Completion of at least 72 credit hours is required for graduation.

**Courses for the Ph.D. in Neurosciences**  
**Core Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 512	Critical Thinking	1
BMS 580A	Neurosciences	6
BMS 580B	Advance Neurosciences	3
BMS 860	Scientific Methodology	2
BMS 861	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 879	Seminar in Neurosciences	1
BMS	Electives (Depending on the program of study)	8
BMS 899	Graduate Research (Depending on the program of study)	36
Total		72

**Sample Elective Courses**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 830	Neurophysiology	5
BMS 580C	Medical Neurosciences	6

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
ANATOMY AND CELL BIOLOGY  
ANATOMY TRACK**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 801	Teaching in Anatomy	2
BMS 802	Neuroanatomy	4
BMS 803	Anatomy of the Back & Limbs	3
BMS 804	Anatomy of the Thorax, Abdomen & Pelvis	4
BMS 805	Anatomy of the Head & Neck	5
BMS 806	Developmental Anatomy	2
BMS 807	Microanatomy	5
BMS 809	Seminar in Anatomy and Cell Biology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 899	Graduate Research	6

This sample program of study requires completion of at least 39 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
ANATOMY AND CELL BIOLOGY  
CELL BIOLOGY TRACK**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 817	Signal Transduction	2
BMS 809	Seminar in Anatomy and Cell Biology	2
BMS 823	Cell Culture	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	2
BMS 899	Graduate Research	6
	Electives	4

This sample program of study requires completion of at least 34 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
BIOCHEMISTRY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 819	Seminar in Biochemistry	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	2
BMS 899	Graduate Research	8
	Electives	6

This sample program of study requires completion of at least 34 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
MICROBIOLOGY AND IMMUNOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 820C	Medical Bacteriology	2
BMS 821B	Immunology	3
BMS 822A	Parasitology	2
BMS 824B	Cellular and Molecular Microbiology	3
BMS 825A	Mycology	2
BMS 826A	Virology	2
BMS 829	Diagnostic Bacteriology	2
BMS 859	Seminar in Microbiology and Immunology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	2
BMS 899	Graduate Research	6

This sample program of study requires completion of at least 42 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
Neurosciences**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 580A	Neurosciences	6
BMS 580B	Advanced Neurosciences	3
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratory Rotations	1
BMS 879	Seminar in Neurosciences	2
BMS 899	Graduate Research	6

This sample program of study requires completion of at least 34 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
PHARMACOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 540	Medical Pharmacology	6
BMS 842	Advanced Topics in Pharmacology	2
BMS 849	Seminar in Pharmacology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 899	Graduate Research	6
	Elective	2

This sample program of study requires completion of at least 34 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MS DEGREE:  
PHYSIOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 530B	Physiology	6
BMS 830	Neurophysiology	5
BMS 839	Seminar in Physiology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	1
BMS 899	Graduate Research	6

This sample program of study requires completion of at least 36 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MA DEGREE:  
ANATOMY AND CELL BIOLOGY  
ANATOMY TRACK**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 801	Teaching in Anatomy	2
BMS 802	Neuroanatomy	4
BMS 803	Anatomy of the Back & Limbs	3
BMS 804	Anatomy of the Thorax, Abdomen & Pelvis	4
BMS 805	Anatomy of the Head & Neck	5
BMS 806	Developmental Anatomy	2
BMS 807	Microanatomy	5
BMS 809	Seminar in Anatomy and Cell Biology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 868	Bibliographic Report(s)	2

This sample program of study requires completion of at least 35 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MA DEGREE:  
ANATOMY AND CELL BIOLOGY  
CELL BIOLOGY TRACK**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 817	Signal Transduction	2
BMS 819	Seminar	2
BMS 823	Cell Culture	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	2
BMS 868	Bibliographic Report(s)	2
	Electives	8

This sample program of study requires completion of at least 34 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MA DEGREE:  
MICROBIOLOGY AND IMMUNOLOGY**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 820C	Medical Bacteriology	2
BMS 821B	Immunology	3
BMS 822A	Parasitology	2
BMS 824B	Cellular and Molecular Microbiology	3
BMS 825A	Mycology	2
BMS 826A	Virology	2
BMS 829	Diagnostic Bacteriology	2
BMS 859	Seminar in Microbiology and Immunology	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	2
BMS 868	Bibliographic Report(s)	3

This sample program of study requires completion of at least 39 credit hours for graduation.

**SAMPLE PROGRAM OF STUDY FOR THE MA DEGREE:  
BIOMEDICAL SCIENCES**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>
BMS 500	Responsible Conduct of Research	1
BMS 510F	Biochemistry and Cell Biology	10
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 868	Bibliographic Reports	3
BMS 869	Seminars	2
	Elective Courses	19

This sample program of study requires completion of at least 40 credit hours for graduation.

## **INTERDISCIPLINARY COURSES**

BMS 500	Responsible Conduct of Research	1
BMS 512	Critical Thinking	1
BMS 523	Molecular Biology I	2
BMS 524	Molecular Biology II	2
BMS 580A	Neurosciences	6
BMS 580B	Advanced Neurosciences	3
BMS 580C	Medical Neurosciences	6
BMS 800	Seminar in Cell and Molecular Biology	1
BMS 823	Cell Culture	2
BMS 831	Membrane Transport	2
BMS 860	Scientific Methodology	2
BMS 861A	Biostatistics	3
BMS 862	Research Laboratories Rotations	1
BMS 863	Cancer Biology	1
BMS 864	Cancer Molecular Biology	1
BMS 867	Glial-Neuronal Cell Interactions in Biology and Disease	1
BMS 868	Bibliographic Report(s)	1
BMS 869A/B	Seminar in Biomedical Science	1
BMS 870-874	Topics in (Specify)	1
BMS 875	Cell Growth And Death	1
BMS 876	Immunopathology	1
BMS 877	Molecular Immunology	1
BMS 878	Cytoskeleton And Cell Motility	1
BMS 879	Cell Membranes	1
BMS 880	Adult Learning and Evaluation Techniques	1
BMS 881	Effective Teaching Techniques	1
BMS 882	Supervised Teaching	1
BMS 899	Graduate Research	Variable

## **ADDITIONAL COURSES OFFERED BY DEPARTMENT**

### **DEPARTMENT OF ANATOMY AND CELL BIOLOGY**

BMS 801	Teaching in Anatomy	2
BMS 502	Human Gross and Developmental Anatomy	8
BMS 503	Histology	5

### **DEPARTMENT OF BIOCHEMISTRY**

BMS 813	Enzymology and Kinetics	2
BMS 814	Advanced Topics in Metabolism	2
BMS 815	Protein Structure and Function	2
BMS 816	Gene Expression and Protein Synthesis	2
BMS 817	Signal Transduction	2

### **DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY**

BMS 850	Special Topics in Microbiology and Immunology	1
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DEPARTMENT OF PHARMACOLOGY

BMS 841	Biochemical Pharmacology	3
BMS 842	Advanced Topics in Pharmacology	2
BMS 843	Principles of Chemotherapy	2

DEPARTMENT OF PHYSIOLOGY

BMS 832	Cardiovascular Physiology	2
BMS 833	Renal Physiology	2
BMS 830	Neurophysiology	5
BMS 834B	Advanced Neurophysiology	2



## **INTERDISCIPLINARY COURSES DESCRIPTIONS**

### **BMS 500 RESPONSIBLE CONDUCT OF RESEARCH**

1 Credit Hour

On December 1, 2000, the US Public Health Service announced final PHS Policy for Instruction in the Responsible Conduct of Research (RCR) for extramural institutions receiving PHS funds for research. This policy required covered institutions to have in place, a program of instruction that complied with the policy. This course will cover the nine core instructional areas mandated by the PHS policy: Data acquisition, management, sharing, and ownership; Mentor/trainee responsibilities; Publication practices and responsible authorship; Peer review; Collaborative science; Human subjects; Research involving animals; Research misconduct; and Conflict of interest and commitment. The teaching strategies used are lectures, individualized learning and small group discussion. Student performance will be measured through exams and attendance.

### **BMS 512 CRITICAL THINKING**

1 Credit Hour

The purpose of this course is to train students in the art of reasoning and critical thinking in the pursuit of answers to biological questions. The course encourages the active practice of critical reasoning, evaluation, and discussion. Students learn how to construct, defend, and criticize arguments; identify and assess tacit assumptions; and gather and evaluate evidence. The teaching strategies used are individualized learning and small group discussion. Student performance will be assessed through oral presentations and exams.

### **BMS 523 MOLECULAR BIOLOGY I**

Prerequisite: BMS 510F

2 Credit Hours

Throughout the course, students will discuss experiments that define the field and examine the experimental design, the results, and the interpretations of the results. Current topics will be based on the literature of recent advancements in the field and will also highlight experiments. Topics include: methods in molecular biology, DNA replication, recombination, transposition, and transcription in prokaryotes. The teaching strategy used is lectures. Student performance will be assessed through exams and written report.

### **BMS 524 MOLECULAR BIOLOGY II**

Prerequisite: BMS 510F and BMS 523

2 Credit Hours

Throughout the course, students will discuss experiments that define the field and examine the experimental design, the results, and the interpretations of the results. Current topics will be based on the literature of recent advancements in the field and will also highlight experiments. Topics include: transcription in eukaryotes, RNA processing, translation, and "omics". The teaching strategy used is lectures. Student performance will be assessed through exams and written report.

### **BMS 580A NEUROSCIENCES**

Prerequisite: BMS 510F

6 Credit Hours

An introduction to fundamental aspects of nervous system function. Topics will include neurosignaling, neuroplasticity, neuroanatomy and brain function. Introduction to fundamental aspects of nervous system development, including neural determination, axon guidance, and neuron-target interactions, and overview of basics of integrative neural function, including sensory, motor and

limbic systems, and computational neuroscience. The teaching strategies used in the course are lectures, individualized learning and oral presentations. Student performance will be evaluated by exams and oral presentations.

### BMS 580B ADVANCED NEUROSCIENCES

3 Credit Hours

Prerequisite: BMS 580A

The objective of Advanced Neurosciences is to deepen knowledge in neurosciences and to learn how to identify current frontiers in a field. To become a successful scientist in a research field one needs to know where the 'field is going'. For the development of a vision of the current direction in a research field several skills are required: 1) knowledge of the literature, 2) critical thinking, and 3) communication skills.

Introductory lectures will be given by faculty members for each topic. The topics will be further deepened during interactive group discussion. During group discussions original research papers and review articles are presented by students and discussed by the group. Student performance will be assessed through an exam and oral presentations.

### BMS 580C MEDICAL NEUROSCIENCES

6 Credit Hours

The course covers topics ranging from neuronal structure and function, communication at the synapse, membrane receptors and intra- and intercellular signaling systems, to the gross organization of the brain and spinal cord, the processing of sensory information, the programming of motor responses, and higher functions such as learning, memory, cognition, and speech. During the course, the student will become acquainted with the use of monoclonal antibodies, gene cloning, cell labeling and tracing, patch clamping and radioligand binding methods which have shed light into the structure and function of the basic unit of brain tissue, the neuron.

The student will also be introduced to noninvasive approaches and instruments for the in-vivo study and analysis of brain tissue, NMR, CAT and PET scans. Finally, this knowledge shall lead the student to a better understanding of the principles underlying the rational pharmacological therapy of diseases related to the nervous tissue, and the new perspectives in therapy of these pathological conditions. The course includes a practical laboratory component.

The course goals are reached through diverse educational strategies such as: lectures, laboratories, small and large group discussions. Evaluation is based on written exams and practical computer-based examination using the LXR testing program. In addition, written, and quizzes using the Personal Response System (PRS) are incorporated both as formative as well as summative strategies.

## BMS 800 SEMINAR IN CELL AND MOLECULAR BIOLOGY

1 Credit Hour

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

## BMS 823 CELL CULTURE

2 Credit Hours

The requirements for a cell culture laboratory, from the standpoint of cell protection and control of biohazards for personnel are discussed, including special laboratory practices and equipment. Aseptic techniques specific to the tissue culture laboratory will be presented. The specific nutritional requisites for different types of cells are considered and how these specific nutrient requirements vary according to the type of cell, use, applications, purpose of the culture and its functions. Within culture conditions the physical requisites for gas exchanges, buffering systems and characteristics and uses are also considered, including adherent and non-adherent cultures; primary, long-term and transformed cell cultures. Sources of cells, initiation of cultures and storage techniques are considered. Principles of good cell keeping are stressed, including routine record keeping, routine inspection of laboratory equipment. The most frequent applications of cell cultures, as well as procedures for cell phenotyping are studied. Laboratory practices include the preparation of media, cell passages and splitting of cultures, initiation of primary cultures, working with cell lines, cell storage techniques, phenotyping by immunofluorescence and lymphocytes cultures. The teaching strategies used are lectures and laboratory exercises. Student performance will be assessed through exams and laboratories.

## BMS 831 MEMBRANE TRANSPORT

Prerequisite: BMS 510F

2 Credit Hours

This course discusses fundamental concepts involving the transport of molecules and ions across biological membrane, including discussion of passive and active transport, as well as other transport processes. Examples from selected papers will be presented to illustrate the above concepts. Clinical correlations will also be presented in order to illustrate the importance of the basic concepts on clinical situations. The teaching strategy used in this course is small group discussion. Student performance will be evaluated through class participation and an oral presentation.

## BMS 860 SCIENTIFIC METHODOLOGY

2 Credit Hours

This course will introduce basic concepts of scientific methods commonly used in biomedical research. All students will be required to actively participate in theoretical and practical discussions of scientific research and procedures. They will be given assignments of different topics to help them deepen their understanding of the material. The teaching strategy used in this course is lectures. Student performance will be evaluated through class participation and exams.

## BMS 861A BIostatistics

3 Credit Hours

This is essentially a two-part introductory course. Initially, there will be lectures to familiarize the students with the basic concepts of statistics, statistical analysis, and data manipulation. Depending on student background, the lectures will begin with fundamental explanations of means, modes, normal distribution, variance standard deviation, continuing with hypothesis testing, confidence levels, standard error, regression line, correlation, multiple regression, students T-test chi-square, and ANOVAs. Following the didactic portion of the course, students will be exposed to demonstrations on the use of the computer for accessing statistical and database programs. Small projects will be assigned or devised by the students to demonstrate proficiency in experimental design and data interpretation. The teaching strategies used in this course are lectures and laboratories. Student performance will be evaluated through class participation and exams.

## BMS 862 RESEARCH LABORATORIES ROTATIONS

1 Credit Hours

Research laboratory rotations are intended to introduce students to the laboratory opportunities available through the Graduate Program in Biomedical Sciences. Students will rotate through not less than three different active research laboratories in such a way that the experience they acquire during these rotations will help them decide their area of interest and the mentor under whose supervision he/she will train. Eight weeks of rotation will be equivalent to 1 credit hour. Students are expected to work six hours a week in the laboratory. The teaching strategy used in this course is laboratory work. Student performance will be evaluated through their performance in the research laboratory.

## BMS 863 CANCER BIOLOGY

Prerequisite: BMS 510F

1 Credit Hour

This course presents the principles of cancer biology. The topics that will be covered in the course include growth factors, control of the cell cycle, multistep tumorigenesis, invasion and metastasis, among others. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

## BMS 864 CANCER MOLECULAR BIOLOGY

Prerequisite: BMS 510F and BMS 863

1 Credit Hour

This course is designed to provide students with a thorough and in-depth understanding of fundamental concepts in cancer biology at the cellular and molecular levels. The topics that will be covered in the course include oncogenes and tumor suppressor genes, cell cycle regulation, signal transduction pathways, apoptosis, DNA repair mechanisms, tumor immunology, animal models for human cancers, cancer therapy and cancer epigenetics, among others. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 867 GLIAL-NEURONAL CELL INTERACTIONS IN BIOLOGY AND DISEASE**

Prerequisite: BMS 510F, and BMS 580A or BMS 580C

1 Credit Hour

This course is designed to provide students with a thorough and in-depth understanding of glial-neuronal cell interactions. The topics that will be covered in the course include morphology of glial cells, glial development, physiology of glial cells, among others. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 868 BIBLIOGRAPHIC REPORT**

1 Credit Hour

A library review of a topic assigned by the student's mentor or the Committee. Required of all students registered for the MA degree. See the Bibliographic Report Formatting section for details on how to prepare the document. Bibliographic Reports will be evaluated with GPBSF 19.

**BMS 869A/B SEMINAR IN THE BIOMEDICAL SCIENCES**

1 Credit Hour

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

MS/MA students are required to present two seminars. BMS 869A will be used for the first seminar offered and BMS 869B for the second.

**BMS 870-874 TOPICS IN (SPECIFY)**

1 Credit Hour

The topics course has been designed to provide the graduate student with the theoretical background and practical experience required for the in-depth understanding of specialized topics of interest to the student. A maximum of five topics courses can be taken. The teaching strategy used in the course is small group discussion. Student performance will be assessed by either presentations, exams, written reports and/or class participation. The student and faculty member will determine their meeting schedule.

**BMS 875 CELL GROWTH AND DEATH**

Prerequisite: BMS 510F

1 Credit Hour

This course cover in-depth mechanisms related to cell growth and death. The topics that will be covered in the course include apoptosis, autophagy, necrosis, intrinsic and extrinsic apoptotic signal cascades, caspase-independent cell death, mitochondrial death effectors, anti-apoptotic proteins, and intracellular proteases. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 876 IMMUNOPATHOLOGY**

Prerequisite: BMS 510F, BMS 821B

1 Credit Hour

This course covers in-depth immune mechanisms of disease including immunodeficiencies, hypersensitivity disorders and autoimmunity. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 877 MOLECULAR IMMUNOLOGY**

Prerequisite: BMS 510F, BMS 821B

1 Credit Hour

This course covers in-depth the molecular mechanisms involve in mounting an immune response. Topics include generation of antibodies, antigen processing and presentation, lymphocyte activation and immune regulation. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 878 CYTOSKELETON AND CELL MOTILITY**

Prerequisite: BMS 510F

1 Credit Hour

This course focuses on the components of the cytoskeleton and actin-based cell motility. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 879 CELL MEMBRANES**

Prerequisite: BMS 510F

1 Credit Hour

This course focuses on the organization of cellular membranes. Topics include membrane lipids, membrane proteins, and membrane related structures. The course consists of lectures given by the participating faculty and presentations and discussions of current research and review papers by students. Active student participation is expected at all times. Student performance will be evaluated by exams and participation in class discussions.

**BMS 880 ADULT LEARNING AND EVALUATION TECHNIQUES**

1 Credit Hour

The course provides an overview of basic principles of learning theory, characteristics of adult learners, what motivates adults to learn, evaluation of performance, effective methods of giving feedback, grading practices, types of exams, construction of effective exams and alternative testing methods. Teaching strategies include lecture, individualize learning, discussion, and practical exercises. Student performance will be assessed through exams and evaluation of exercises.

**BMS 881      EFFECTIVE TEACHING TECHNIQUES**

Prerequisite: BMS 880

1 Credit Hour

The course provides an overview of basic methodology of effective teaching techniques. Topics will include strengths and limitations of teaching methods, advantages and disadvantages of different types of visual aids, selection of delivery strategy, how to improve retention of information, positive and negative transference, positive reinforcement vs. negative reinforcement. The teaching strategies include lecture and practical exercises. Student performance will be assessed through exams and evaluation of exercises. Prerequisite: Adult Learning and Evaluation Techniques

**BMS 882      SUPERVISED TEACHING**

Prerequisite: BMS 880 and BMS 881

1 Credit Hour

This elective is designed to provide students with experience in teaching and improve the students' teaching skills. Students will serve as instructors to new graduate students providing a laboratory safety lecture and introducing new graduate students to the use of laboratory equipment, including a laboratory exercise. Following the teaching format of an undergraduate laboratory course, the students will prepare an introductory lecture to a laboratory exercise that will be followed with a laboratory session. The student's course grade will be based on the evaluation of the two lectures and the laboratory exercise. Prerequisite: Adult Learning and Evaluation Techniques, Effective Teaching Techniques

**BMS 899      GRADUATE RESEARCH**

Variable

Grading is Pass or Fail

The student will perform faculty-supervised research in the laboratory with a faculty member who will serve as the student's research advisor. This research will be the basis for the written dissertation, which is required for the Ph.D. The main objective is to develop a specific research project and produce meaningful data, which can contribute further knowledge in the area. The data should be publishable in a peer-reviewed journal and acceptable for presentation as a written dissertation as partial fulfillment of the requirement for the Ph.D. degree. Upon completion, the student will present his/her research in seminar form to the academic community as a final defense of the dissertation. The teaching strategies used in this course are individualized learning and laboratory work. Student performance will be assessed through their performance in the research laboratory and dissertation defense.

## **DEPARTMENT OF ANATOMY AND CELL BIOLOGY**

JIMENEZ, SOFIA

Professor, Department Chair

Ph.D. University of Puerto Rico School of Medicine, 1984

BAKSI, KRISHNA

Associate Professor

Ph.D., All India Institute of Medical Sciences, 1977

CUBANO, LUIS

Associate Professor / Joint Appointment

Ph.D., Kansas State University, Manhattan, Kansas, 2000

DHARMAWARDHANE, SURANGANIE

Adjunct Associate Professor

Ph.D., University of Massachusetts, 1987

HAIFFE, ROSA M.

Associate Professor (joint appointment in the Department of Pathology and Laboratory Medicine)

M.D., Universidad Autónoma de Santo Domingo, 1968

DE LEON, ELIZABEL

Associate Professor

M.D., Universidad Autónoma de Santo Domingo, 1996

VERAS, WILSON

Associate Professor

M.D., Universidad Autónoma de Santo Domingo, 1989

OLIVER, JOSE LUIS

Assistant Professor

DDS, University of Puerto Rico MSC, 2002

WASHINGTON, ANTHONY

Adjunct Assistant Professor

Ph.D., Southern Methodist University, 1998



## **GRADUATE COURSES**

### **BMS 801      TEACHING IN ANATOMY**

2 Credit Hours

This course will provide students with an overview of basic principles and methodology in education as well as the opportunity to utilize these concepts while serving as teacher aids in the morphology courses taught throughout the academic year by the Department of Anatomy. All the first year Biomedical Sciences Morphology Courses are pre-requisites.

### **BMS 802      NEUROANATOMY**

4 Credit Hours

This course deals with the general organization and meaning of the nervous system, its embryology and histological structure. The organization and segmental distribution of the peripheral nerve elements and the architectonics of the Central Nervous System are studied by levels. The main sensory (ascending) and motor (descending) pathways are discussed in relationship to cortical organization. Topics in neurophysiology are included to integrate structural and functional features of the CNS. Currently, this course is based on the medical sciences course on Neurosciences which is offered during the second semester; however, the student will benefit from attending other sections of this course besides the Neuroanatomy component to get an insight into the physiology, biochemistry and pharmacology pertinent to this area. The course also includes a practical laboratory component.

### **BMS 803      ANATOMY OF THE BACK & LIMBS**

3 Credit Hours

This course represents a block of the survey of the regional and functional anatomy of the human body. The course includes lectures by the faculty, case study presentations by students and laboratory work. The laboratory work will include a dissection lab and a concurrent applied clinical anatomy lab geared to the study of radiological anatomy, cross-sectional anatomy, surface-projection anatomy as well as the biomechanics of the locomotion apparatus.

### **BMS 804      ANATOMY OF THE THORAX, ABDOMEN & PELVIS**

4 Credit Hours

This course represents a block of the survey of the regional and functional anatomy of the human body. The course includes lectures by the faculty, case study presentations by students and laboratory work. The laboratory work will include a dissection lab and a concurrent applied clinical anatomy lab geared to the study of radiological anatomy, cross-sectional anatomy, surface-projection anatomy as well as the morphological principles of respiration, circulation, digestion and reproduction.

### **BMS 805      ANATOMY OF THE HEAD & NECK**

5 Credit Hours

This course represents a block of the survey of the regional and functional anatomy of the human body. The course includes lectures by the faculty, case study presentations by students and laboratory work. The laboratory work will include a dissection lab and a concurrent applied clinical anatomy lab geared to the study of radiological anatomy, cross-sectional anatomy, surface-projection anatomy as well neuroanatomy.

BMS 806      DEVELOPMENTAL ANATOMY  
2 Credit Hours

This course provides a current account of the human embryonic development taking into account (1) normal morphology and function, (2) the new technology that allows the manipulation and study of the human embryo and fetal development, (3) the developmental basis for the more important congenital abnormalities, and (4) clinical correlations to further emphasize the practical implications of such malformations.

Part one of the course covers in detail the early development, the function of the structures and tissues, and the relationship between the mother and fetus. An overview of the main changes from the third month to birth introduces the student to the next section of the course, bringing together the entire process of embryonic development to result in the birth of the fetus. Part two discusses in detail the development of the body systems, both normally and in the development of anomalies, emphasizing the immediate and normal adaptations in each system, necessary for life outside the womb.

New tools and techniques such as ultrasound and other imaging modalities have provided new ways of visualizing living embryos; however, these techniques are presented in the discussion of specific systems due to the time constraints of the course.

BMS 807      MICROANATOMY  
5 Credit Hours

The first part of the course - cell and basic tissues will prepare those who have no experience in histology with the background necessary to understand the normal morphological adaptations and modifications of tissues in the formation of organs; and enable the student to understand why these adaptations and modifications provide the body with the basic and fundamental functions to have and maintain a general well-being.

Outlining the principal methods employed in the microscopic study of cells, tissues, and organs, will set the stage for the subsequent detailed study of the cells and tissues of the body in other basic sciences courses. The course requires a general knowledge of cellular and molecular biology as well as familiarity in the usage of the bright field binocular microscope.

BMS 809A/B   SEMINAR IN ANATOMY AND CELL BIOLOGY  
1 Credit Hour

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

The course is composed of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore each seminar is worth one credit hour. Each student is required to present two seminars. BMS 809A will be used for the first seminar offered by the student and BMS 809B for the second.

## DEPARTMENT OF BIOCHEMISTRY

HANN, RICHARD M.

Professor, Department Chair

M.D., University of Oklahoma, 1974

EATON, MISTY

Professor

Ph.D., University of Texas Southwestern Medical Center, 1990

ETEROVIC, VESNA A.

Professor

Ph.D., Universidad Nacional de Córdoba (Argentina), 1971

FERCHMIN, PEDRO

Professor

Ph.D., Universidad Nacional de Córdoba (Argentina), 1971

SKATCHKOV, SERGUEI

Professor (Joint Appointment in the Dept. of Physiology)

Ph.D., Leningrad State University, 1991

VÉLEZ-CARRASCO, WANDA

Associate Professor

Ph.D., Tufts University, 1998

KUCHERYAVYKH, LILIA

Assistant Professor

Ph.D., St. Petersburg State University, 2001

KUCHERYAVYKH, YURIY

Assistant Professor

Ph.D., St. Petersburg State University, 2003

MARTÍNEZ, MICHELLE

Assistant Professor

Ph.D., Michigan State University, East Lansing, 2004

MARTINS, ANTONIO HENRIQUE BACCIN

Assistant Professor

Ph.D., University Federal of São Paulo, Brazil, 2006

SZETO, ADA C.

Assistant Professor

Ph.D., University of Puerto Rico, Medical Science Campus, 2005

## GRADUATE COURSES

### BMS 510F BIOCHEMISTRY AND CELL BIOLOGY

10 credit hours

Biochemistry and Cell Biology is an interdisciplinary, foundation course that is designed to introduce graduate students to the most important concepts of biochemistry, molecular genetics, genetics, cell biology and nutrition. It is a core course in the graduate school curriculum because most of the subsequent courses that the graduate student will take and most of the research that the graduate student will perform both require a sound fund of knowledge in these basic disciplines. In lectures, the course faculty present and discuss the most important course concepts and include clinical correlations carefully chosen to illustrate these concepts. The course also features active-learning exercises with smaller groups. In addition, the student is required to participate in journal club activities in order to acquire skills in reading, analyzing and summarizing scientific literature. Student knowledge is evaluated with 3 unit examinations.

### BMS 813 ENZYMOLOGY AND KINETICS

Prerequisite: BMS 510F

2 Credit Hours

The course emphasizes concepts and current methods of enzyme structure and kinetics. These concepts are applicable to the general field of receptor-ligand interactions. The use of mathematical models to help understand the kinetic behavior of a particular compound will also be discussed.

### BMS 814 ADVANCED TOPICS IN METABOLISM

Prerequisite: BMS 510F

2 Credit Hours

Topics in this course will cover metabolism of carbohydrates, lipids, amino acids and other important metabolites. The topics will be covered in depth and the relationships among them will be pointed out. Specific topics presented and discussed in this course will depend on the participating faculty and the interests of the enrolled students. Abnormalities in the pathways of each will be emphasized. Along with the lectures there will be reading assignments of journal articles related to the specific topic. Student performance will be assessed by either presentations, exams, written reports and/or class participation. The student and faculty member will determine their meeting schedule.

### BMS 815 PROTEIN STRUCTURE AND FUNCTION

Prerequisite: BMS 510F

2 Credit Hours

Topics in this course emphasize the physical and chemical bases for protein structure and function. The relationships between amino acid sequence, secondary structure, tertiary structure and activity will be discussed. Topics will include the use of site-directed mutagenesis to deduce protein function and principles of protein-protein interactions. The teaching strategies used are lectures and laboratories. Student performance will be evaluated through exams and class participation.

### BMS 816 GENE EXPRESSION AND PROTEIN SYNTHESIS

Prerequisite: BMS 510F

2 Credit Hours

This course is an advanced study of important recent literature dealing with the structure and function of nucleic acids, biosynthesis of proteins, and the control of gene expression. The teaching strategies used are journal article discussions, oral presentations and individualized learning. Student performance will be assessed through class participation and oral presentations.

## BMS 817 SIGNAL TRANSDUCTION

Prerequisite: BMS 510F

2 Credit Hours

A variety of topics in signal transduction will be covered, including the general principles of cellular communications, surface and intracellular receptors, secondary messengers and effectors, and integration of signaling pathways for physiological processes. The first half of the course will examine the mechanism of action for enzyme-linked receptors, G-Protein Coupled or Heptahelical receptors and associated proteins, and intracellular/lipid signaling. The second half of the course will integrate specific signaling pathways with important biological processes such as stem cell differentiation, abnormal cell growth, neuroprotection, and other neuronal processes.

Classes will meet for 2 hours on a weekly basis for 12 sessions. Weekly reading assignments will consist of current research article(s). Students will be evaluated on the basis of a mid-term exam, class participation in the discussion of the paper, and an oral presentation on a topic of their choice.

## BMS 819A/B SEMINAR IN BIOCHEMISTRY

Prerequisite: BMS 510F

1 Credit Hour

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

MS students are required to present two seminars. BMS 819A will be used for the first seminar offered by the student and BMS 819B for the second.

## DEPARTMENT OF MICROBIOLOGY & IMMUNOLOGY

RIOS-OLIVARES, EDDY O.

Professor, Department Chair

Ph.D., University of Puerto Rico, Medical Science Campus, 1976

MPH, University of Minnesota, Minneapolis, Minnesota, 1967

BOUKLI, NAWAL M.

Associate Professor

Ph.D., University of Geneva, Geneva, Switzerland, 1999

Engineering of State in Agronomy, National Institute of Agronomy in Algiers, 1994

CUBANO, LUIS

Associate Professor / Joint Appointment

Ph.D., Kansas State University, Manhattan, Kansas, 2000

RIOS-ORRACA, ZILKA

Associate Professor,

MS, University of Puerto Rico, Mayagüez, 1978

RODRIGUEZ, JOSE W.

Associate Professor

Ph.D., Morehouse School of Medicine, Atlanta, Georgia, 1999

OTERO, MIGUEL

Assistant Professor

Ph.D., University of Puerto Rico-Rio Piedras, 1998

RAMIREZ-RONDA, CARLOS

Associate Professor, Ad Honorem

M.D., Northwestern University, 1967

RODAS, ARCADY R., MD., MPH.

Visiting Professor

M.D., University of Zulia School of Medicine, Maracaibo, Venezuela, 1985

MPH., University of Puerto Rico Medical Sciences Campus, 2007

ESPINO, ANA M.

Visiting Professor

Ph.D., Instituto de Medicina Tropical Pedro Kouri, Havana, Cuba, 1997

## GRADUATE COURSES

### BMS 820C MEDICAL BACTERIOLOGY

Prerequisite: BMS 510F

2 Credit Hours

This course will introduce students to the relationship between microorganisms and human health. Principles and processes by which these microorganisms cause disease, their virulence factors, transmission, consequences and the signs and symptoms of the diseases they produce will be discussed. In addition, the methods used for the identification of pathogenic organisms as well as for their prevention and treatment will be introduced. Specific laboratory exercises and review of recently published scientific manuscripts will be included. The teaching strategies used in the course include lectures laboratories and small group discussions. Student performance will be evaluated through exams, laboratory exercises and small group discussion.

### BMS 821B IMMUNOLOGY

Prerequisite: BMS 510F

3 Credit Hours

This course provides graduate students with a working knowledge of the immune system and the specialized vocabulary that describes it. Topics to be covered include: (1) the structure, function, and genetics of immunoglobulins, (2) T-lymphocyte antigen receptors, and major histocompatibility complex-encoded proteins, (3) the development and differentiation of lymphocytes, (4) cell-to-cell interactions in the immune system, and (5) the regulation of immune responses. It also will include laboratory exercises and discussion of scientific papers that are used to illustrate experimental approaches to current questions. The teaching strategies used in the course include lectures, laboratories, small group discussion and individualized learning. The students will be evaluated by exams and small group discussion.

### BMS 822A PARASITOLOGY

Prerequisite: BMS 510F, BMS 821B

2 Credit Hours

This course encompasses the presentation and discussion of parasitic organisms of medical and veterinary importance, with emphasis on life cycles, host-parasite relationships, epidemiology, diagnostic procedures, pathogenesis, treatment, and control methods. Practical laboratory experience is included. The teaching methods utilized in the course are lectures, laboratories, small group discussions and individualized learning. Student performance will be assessed by exams, laboratories, oral and written presentations, and quizzes.

### BMS 824B CELLULAR AND MOLECULAR MICROBIOLOGY

Prerequisite: BMS 510F

3 Credit Hours

An advanced course designed for graduate students in biomedical sciences. The course emphasizes the function of microbial structures and the metabolism and control of microorganisms. The course includes the study of gene structure, genetic variations, metabolic regulation and regulation of gene expression, and recombinant DNA techniques. The basic mechanisms of action of antimicrobial agents are also considered. The laboratory exercises include techniques used, DNA extraction, protein extraction and separation, 2-D gel analysis, protein identification, genomics and proteomics. The teaching strategies used in the course include lectures, problem solving, individualized learning and oral presentations. Student performance will be measured by exams and presentations.

### BMS 825A MYCOLOGY

Prerequisite: BMS 510F, BMS 821B

2 Credit Hours

This course deals with fungi of industrial and medical importance. The course will give emphasis on: morphology, structures, physiology, genetics, growth and nutrition, classification, life cycles, host-parasite, identification, pathogenesis, contaminants and diagnostic of different mycoses, ecology, and economic importance of fungi. In laboratories, the fundamentals of general mycology and the procedures used for isolation and identification of fungi will be included. The course consists of lectures, laboratory, and critical readings of the primary literature and student presentations. Heavy emphasis will be placed on student participation. The students will be evaluated through exams, laboratories, class presentations and term papers.

### BMS 826A VIROLOGY

Prerequisite: BMS 510F, BMS 821B

3 Credit Hours

This course consists of the study of viruses and their interaction with humans and animals. The course consists in five main units: 1) Fundamental principles of virology, detection methods and genetics; 2) Genome structure and replication; 3) Host response to viral infection; 4) Pathogenesis, prevention and control of specific virus, and emerging viruses, 5) Discussion on recent scientific articles. The teaching strategies include lectures, laboratories, small group discussion and individualized learning, and small group discussion. The students will be evaluated by exams, laboratories, oral and written presentations.

### BMS 829 DIAGNOSTIC BACTERIOLOGY

Prerequisite: BMS 510F, BMS 821B, BMS 820C

2 Credit Hours

The course acquaints the student with microorganisms with emphasis on the bacteria in diseases of man. Theory and principles of isolation, identification, biochemical reaction, growth requirement and susceptibility testing will be considered. Theory and practical application will include lecture, demonstration, laboratory practice, audiovisual presentations, written reports/journals, and small group activities. The teaching strategies are lectures and laboratories. Student performance will be assessed by exams, laboratory reports and student presentations.

### BMS 850 SPECIAL TOPICS IN MICROBIOLOGY AND IMMUNOLOGY

1 Credit Hour

This specific topic course has been designed to provide the graduate student with the theoretical background and practical experience required for the in-depth understanding of a specialized topic as it applies to basic and clinical Immuno-Microbiology. The topic is selected considering the Department's academic objectives and student's educational needs. Student performance will be assessed by either presentations, exams, written reports and/or class participation. The student and faculty member will determine their meeting schedule.

### BMS 859A/B SEMINAR IN MICROBIOLOGY AND IMMUNOLOGY

1 Credit Hours

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar



and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

MS/MA students are required to present two seminars. BMS 859A will be used for the first seminar offered by the student and BMS 859B for the second.

## **DEPARTMENT OF PHARMACOLOGY**

MALDONADO, HECTOR M.  
Associate Professor, Department Chair  
Ph.D., University of California Davis, 1992

TORRES, JOSE L.  
Associate Professor  
Ph.D., University of Puerto Rico-Medical Sciences Campus, 2011

BYTCHKOV, ROSTISLAV  
Assistant Professor  
Ph.D., University of St. Petersburg, 1993

SILVA, WALTER  
Adjunct Professor  
Ph.D., Mount Sinai School of Medicine, NY, 1984

## **GRADUATE COURSES**

### **BMS 540 MEDICAL PHARMACOLOGY**

Prerequisite: BMS 510F

6 Credit Hours

The course aims to present the basic knowledge of the way drugs act upon the body; provide the essential knowledge for the understanding of drug therapy; and provide for the rational use of different drugs in clinical situations. It includes the chemistry of drugs, structure-activity relationship of different kinds of drugs, pharmacokinetics, absorption, distribution, excretion, metabolism, pharmacological actions, mechanism of action, clinical uses, side effects toxicity, adverse reactions, and interactions of substances used in the diagnosis, prevention and treatment of disease. It also emphasizes the effect of endogenous and exogenous substances at the cellular level.

The course involves lectures and conferences on blocks of material such as general pharmacological principles, autonomic pharmacology, cardiovascular drugs, CNS pharmacology, pharmacology of chemotherapeutic agents, endocrine pharmacology, gastrointestinal pharmacology, autacoids and anti-histamines, prostaglandins, drug interactions and clinical toxicology.

### **BMS 841 BIOCHEMICAL PHARMACOLOGY**

Prerequisite: BMS 510F, BMS 540 (or concurrently enrolled)

3 Credit Hours

In this course the fundamental and basic pharmacological concepts are integrated with Biochemistry. The following topics are presented in detail: pharmacokinetics, pharmacodynamics, mechanisms of drug metabolism (cytochrome P-45- systems, transferases, etc.), ions and amino acids transport, metabolism of biogenic amines, neuronal receptors, etc.

#### BMS 842 TOPICS IN PHARMACOLOGY

Prerequisite: BMS 510F, BMS 540 (or concurrently enrolled)

2 Credit Hours

In this course various special topics will be covered in a tutorial manner, among them such topics as receptor theory, principles of chemotherapy, neuropeptides and neuronal receptors. Student performance will be assessed by either presentations, exams, written reports and/or class participation. The student and faculty member will determine their meeting schedule.

#### BMS 843 PRINCIPLES OF CHEMOTHERAPY

2 Credit Hours

This course encompasses such topics as general pharmacological and pharmacokinetic principles, discussion and presentation of the agents used in the treatment of infectious disease, such as antibiotics, antifungal, antiviral, antihelminthic drugs and antimalarials, cancer chemotherapy, immunotherapy and principles of drug interactions. This course is specifically designed for those students not majoring in the area of Pharmacology and whose interests are met by studying specific topics in Pharmacology.

#### BMS 849A/B SEMINAR IN PHARMACOLOGY

1 Credit Hours

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

The course is composed of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore each seminar is worth one credit hour. Each student is required to present two seminars. BMS 849A will be used for the first seminar offered by the student and BMS 849B for the second.

## **DEPARTMENT OF PHYSIOLOGY**

SANABRIA, PRISCILA

Professor, Department Chair

Ph.D., University of Puerto Rico, Medical Sciences Campus, 1986

ASENSIO, STANLEY

Professoris Emeritus (joint appointment in the Department of Obstetrics and Gynecology)

M.D., University of Puerto Rico, 1958

ROJAS, LEGIER

Professor,

Ph.D., University of Puerto Rico, Medical Sciences Campus, 1987

SKATCHKOV, SERGUEI

Professor (Joint Appointment in the Dept. of Biochemistry)

Ph.D., Leningrad State University, 1991

RIVERA, AMELIA

Associate Professor,

Ph.D., University of Puerto Rico, Medical Sciences Campus, 1982

INYUSHIN, MIKHAIL

Assistant Professor

Ph.D., Leningrad State University, 1986

## **GRADUATE COURSES**

**BMS 530      PHYSIOLOGY**

Prerequisite: BMS 510F

6 Credit Hours

This course offers a detailed presentation of the currently accepted concepts dealing with the manner in which the individual cells and organs are integrated into the complex functions by the living organisms as well as the processes which compose the activities of living cells and organ systems. Clinical correlations are held for the presentation and discussion of cases pertaining to each of the systems studied. Group discussions are held in which students prepare and present a case study for each system. The topics covered include the physiology of the major organ systems (neuromuscular, reticuloendothelial, cardiopulmonary, renal, gastrointestinal, endocrine and reproductive). The teaching strategies used in the course include lectures and individualized learning. Student performance will be assessed through exams and student presentations.

**BMS 830      NEUROPHYSIOLOGY**

Prerequisite: BMS 530

5 Credit Hours

The course introduces students to the basic principles of neuroscience that all physiology graduate students are expected to know before embarking on their specialized research programs. Several topics will be discussed, ranging from cellular aspects of neuronal signaling to cortical mechanisms of perception and motor control. A discussion-based format with a focus on original papers, exercises and demonstrations will allow students to familiarize themselves in the fundamental issues at the heart of contemporary neuroscience. Emphasis will be given to the critical evaluation of neuronal theories of brain function. The teaching strategies used in the course are lectures, individualized learning and oral presentations. Student performance will be evaluated by exams and oral presentations.

**BMS 832      CARDIOVASCULAR PHYSIOLOGY**

Prerequisite: BMS 530

2 Credit Hours

This course provides detailed discussion on the physiology of the cardiovascular system, such as electrophysiology of the myocardium, cardiac work, control of cardiac function, peripheral circulation, cardiac output, pathogenesis of atherosclerosis, atrial natriuretic peptide, and inter-cellular communication in the myocardium. The teaching strategies used in the course are lectures and individualized learning. Student performance will be assessed by exams and oral presentations.

**BMS 833      RENAL PHYSIOLOGY**

Prerequisite: BMS 530

2 Credit Hours

This is a combined lecture-seminar course emphasizing special topics in renal physiology and the physiology of body fluids. Topics in renal physiology will include initially an overview of the renal physiology to then review specific mechanism of the normal function or during pathological situation to be discussed using specialized publications in the area. Students are expected to present two seminars during the course. The teaching strategies used in this course are lectures and individualized learning. Student performance will be assessed through student presentations and exams.

**BMS 834B     ADVANCED NEUROPHYSIOLOGY**

Prerequisite: BMS 530, BMS 830

2 Credit Hours

Combined lecture-seminar course emphasizing special topics in Neurophysiology. Students, the instructor in charge of the course and invited scientists are expected to participate in seminar presentations during the course.

**BMS 839A/B   SEMINAR IN PHYSIOLOGY**

1 Credit Hours

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

MS/MA students are required to present two seminars. BMS 839A will be used for the first seminar offered by the student and BMS 839B for the second.

## **NEUROSCIENCE DEPARTMENT**

BYKHOVSKAIA, MARIA  
Professor, Department Chair  
Ph.D., Russian Academy of Sciences, 1992

SCHIKORSKI, THOMAS  
Associate Professor  
Ph.D., Johann-Wolfgang-Goethe University, 1993

NUROWSKA, EWA  
Assistant Professor  
Ph.D., Polish Academy of Science, 1996

## **GRADUATE COURSES**

BMS 879 SEMINAR IN NEUROSCIENCES  
1 Credit Hour

This course consists of an oral presentation in a seminar format of a relevant topic within the area of specialization. The student upon consultation with the mentor or other academic advisor will select the topic. The topic may be from directed readings or from the student's research. The faculty will provide assistance to the student in preparing for the seminar presentation. The student's course grade will be based on faculty evaluation of the seminar. The course consists of a one-hour seminar and a minimum of 23 hours of preparation including readings to prepare for the seminar, therefore the course is worth one credit hour. The seminar will be announced and open to the academic community. GPBSF 14 Seminar Presentation Evaluation Form will be used to evaluate students' presentations.

## **GRADUATE PROGRAM IN BIOMEDICAL SCIENCES FORMS**

GPBSF1	Master's Degree Program of Study
GPBSF2	Modification to the Program Study
GPBSF3A	Mentor Registration Form
GPBSF3B	Advisory committee Registration
GPBSF4	Advisory Committee Modification
GPBSF5A	Request of the Comprehensive Examination
GPBSF5B	Results comprehensive Examination
GPBSF6A	Notification of Research Proposal
GPBSF6B	Results Research Proposal Defense
GPBSF7A	Notification of Thesis Defense
GPBSF7B	Results Thesis Defense
GPBSF8	Application for Transfer
GPBSF11	Alumni Contact Information
GPBSF12	Graduate Program in Biomedical Sciences Exit Survey
GPBSF13	Graduate Program In Biomedical Sciences Catalog Receipt
GPBSF14	Seminar Presentation Evaluation Form
GPBSF15	Laboratory Rotation Agreement
GPBSF16	Laboratory Rotation Evaluation Form
GPBSF17	MS/MA Graduate Student Annual Progress Report
GPBSF17A	Ph.D. Graduate Student Annual Progress Report
GPBSF18	Request to Take a Course at Another Institution
GPBSF19	Evaluation of Bibliographic Report
GPBSF20A	Notification of Stipend / Tuition & Fees Payment
GPBSF20B	Student Stipend Agreement
GPBSF21	Student Registration Form

## **BIBLIOGRAPHIC REPORT FORMATTING**

The bibliographic report should be based on information provided and synthesized from primary contemporary literature. The report is meant to provide an overview of a topic. It should be 15-25 pages in length with at least 25 references.

### **Font/Spacing/Formatting**

Must be printed on 8.5" x 11" paper on one side of the page only. They should be printed double space, on standard Ariel 11 point font size.

### **Numbering Pages**

The title page is not to be numbered. Beginning with the Introduction every page of the text must be numbered consecutively in Arabic numerals (1,2,3, etc.). Page numbers should appear at the center bottom of each page and should lie within the margin requirements.

### **Margins**

Margins must be 1.0 inch on all sides.

### **References**

References should be cited parenthetically in the text by author and year of publication, example of citation format: (Catalucci et al., 2009)

References should be listed alphabetically by first author's last name. The authors must be cited in the order in which they appear in PubMed, even in cases where more than one author contributed equally to the work. Include all authors' names (do not use "et al."). Use the PubMed format, example: Nitrooxymethyl-Substituted Analogues of Rofecoxib: Synthesis and Pharmacological Characterization. Boschi D, Cena C, Di Stilo A, Rolando B, Manzini P, Fruttero R, Gasco A. Chem Biodivers. 2010 May 20;7(5):1173-1182.

Abbreviate the names of journals according to PubMed. Spell out the names of unlisted journals.



## DISSERTATION / THESIS FORMATTING

### Final Copies

The student must deliver the approved document in a CD-ROM, according to the Dissertation / Thesis Manual, to complete the graduation requirements and receive his/hers diploma. The Graduate Programs in Biomedical Sciences will print and bind three (3) copies of the thesis (one for the student, one for the department and one for the library).

### Information on Dissertation / Thesis

A thesis should be sufficiently complete to allow an independent investigator or scholar to repeat or verify the work leading to the author's results and conclusions. In certain cases, when manuscripts prepared for publication are to be used, the terseness required by the page restrictions of professional journals may prevent authors from meeting this condition with their publishable manuscripts alone. In such cases, the thesis or report must include additional materials (in appendices, if desired) that will ensure independent reproducibility; e.g., tables, descriptions of methods of unproductive or unsuccessful explorations, derivations, and so forth.

### Abstract

An abstract is a summary of the thesis or report to inform prospective readers about its contents. As a brief summary of the candidate's principal research findings, the abstract should state the problem being investigated and outline the method of investigation, the results obtained, and the conclusions reached. In writing the abstract, candidates should keep in mind that it functions chiefly as a guide to students and scholars surveying research in their field. As such, it should provide a concise guide to the entire study it represents. **The abstract should not include internal headings or parenthetical citations of items listed in the bibliography/list of references. Figures and tables should not appear in the abstract.**

### Style and Content

A thesis should be written in a style appropriate to the discipline represented. The faculties of individual departments may establish policies regarding style for their students. In the absence of detailed specifications, the student's committee is responsible for defining the style used. Form, organization, and bibliographical style may be that of pertinent professional publications.

### Manuscript Formatting

Each thesis must have a title page, an abstract, and a table of contents, in addition to the text. Manuscripts should contain the following, unless noted as optional, in the order listed:

**All headings with asterisk (\*) beside them must be centered and in uppercase lettering.**

Title Page

ABSTRACT\*

TABLE OF CONTENTS\*

ABBREVIATION

LIST OF FIGURES\*

LIST OF TABLES\*

ACKNOWLEDGMENTS\* (Optional)

DEDICATION\* (Optional)

PREFACE\* (Optional)

Introduction

Text/Chapters

Conclusion

References and/or bibliography

Appendices as needed

## **Title Pages**

The title must be in uppercase letters and meet margin requirements. All three title pages must contain the typed name of the major professor(s) and space for the original signature of the major professor(s).

## **Abstract**

An abstract is a required part of the graduate degree manuscript. The abstract should not contain a page number and should be no more than 350 words.

## **Physical Requirements**

Submission of the original manuscript is not required, but photocopying should be done with care to ensure that margins on all copies are accurate and consistent and the reproduction service provides clean, spot-free copies. Typographical or other errors must be corrected before making copies.

## **Font/Spacing/Formatting**

Copies must be printed on one side of the page only and must be distinct and of uniform quality throughout the document. They should be printed on high-quality, 50% - 100% white cotton bond paper and 8.5" x 11" in size. Standard 11 point font size is preferred, but non-standard fonts and size may be used if they are fully legible and acceptable to the Advisory Committee. The font and size should be consistent throughout the document. Standard double spacing for the text is preferred. Long quotations, footnotes, multi-line captions, and bibliographic entries may be single-spaced. Double spacing should be used between footnotes and bibliographic entries.

## **Numbering Pages**

**The title pages and abstract pages are not to be numbered.** Beginning with the Table of Contents, the List of Figures, List of Tables, Acknowledgments (optional), Dedication (optional) and Preface (optional), use lower case Roman numerals (i,ii,iii, etc.). Beginning with the Introduction or Chapter I, **every page** of the text must be numbered consecutively in Arabic numerals (1,2,3, etc.). Page numbers should appear at the center bottom of each page and should lie within the margin requirements.

## **Margins**

Margins on all pages must allow for binding and trimming. Margins must be 1.5 inches on the left and 1 inch at the top, right side, and bottom. Tables and figures should be reduced photographically to meet margin requirements. Illustrations/maps that cannot be reduced to fit within these margins may be expanded to the right by means of a foldout sheet. In such instances, margins must be 1" inch on the left side and the fold placed 1" inch from the right side of the page.

## **Footnotes and Endnotes**

Use Arabic numerals to indicate a note in the text. Notes may be numbered in one of two ways: either consecutively throughout the entire manuscript or consecutively within each chapter and must be consistent throughout the document. Notes can be placed at the bottom of the page (footnotes), at the end of a chapter, or at the end of the document (endnotes). Once chosen, the notation style must be consistent throughout the document. Notes to information within tables should be placed directly below the table to which they apply, not at the bottom of the page along with notes to the text.

## **Photographs/Tables/Graphs**

Pictures, tables, and graphs may be done in color if approved by the committee. There must be a page number on each page containing photographs.

**Author's Published Manuscripts**

If approved by the student's committee, previously published manuscripts in the author's name may be incorporated, if it meets the general requirements for permanence, copying, and binding. Such printed material may be incorporated with supplementary typed or reproduced copy as needed. Any tables or figures in the previously published materials must be numbered in accordance with the rest of the thesis, report, or dissertation. It must be paginated consistently with the rest of the document. Only one page number may appear on each page and that is the page number within the final document. Documents must not include material restricted from publication.

**Sequestration**

In unusual circumstances, a student may request the university act to protect the author's rights in the dissertation by temporarily sequestering the work. If a dissertation or thesis contains material believed to be patentable, the student or major professor should send a letter to the Graduate Programs in Biomedical Sciences, requesting sequestration and offering a brief justification for the delay in publication. If the request is approved, all required copies of the manuscript will be kept in the Graduate Programs in Biomedical Sciences until the sequestration period has ended.

**Where the guidelines in this publication are not sufficient, students should contact the Graduate Programs in Biomedical Sciences staff for more detailed information.**

**CEMBRANOID-INDUCED CALCIUM SIGNALING**

**by**

**Juan del Pueblo**

**B.S., Universidad de Puerto Rico, 2000**

**A THESIS**

**Submitted in partial fulfillment of the**

**requirements for the degree**

**MASTER OF SCIENCE**

**Department of Pharmacology  
Graduate Programs in Biomedical Sciences**

**Universidad Central del Caribe  
Bayamón, PR**

**2002**

**Approved by:**

**Major Professor  
Juan Rodríguez  
Department of Pharmacology**

**CEMBRANOID-INDUCED CALCIUM SIGNALING**

**by**

**Juan del Pueblo**

**B.S., Universidad de Puerto Rico, 2000**

**A DISSERTATION**

**Submitted in partial fulfillment of the**

**requirements for the degree**

**DOCTOR OF PHILOSOPHY**

**Department of Biochemistry  
Graduate Programs in Biomedical Sciences**

**Universidad Central del Caribe  
Bayamón, PR**

**2002**

**Approved by:**

**Major Professor  
Juan Rodríguez  
Department of Biochemistry**

**Grievances**

The Associate Dean for Research and Graduate Studies is ultimately responsible for grievances regarding policies and procedures related to graduate education. A grievance properly begins within the student's own department by an appeal to the graduate program coordinator or department chair. If this does not resolve the grievance, the student can present the grievance in writing to the Associate Dean for Research and Graduate Studies. Grievances must state clearly and precisely the basis for appeal and provide supporting evidence that a student's rights have been jeopardized. The Associate Dean may recommend that the grievance be reviewed by the Graduate Program in Biomedical Sciences Committee. The Associate Dean is the final arbiter of Graduate School regulations. Students retain the right to appeal the Associate Dean's decision to the Dean of Medicine.

**Exam Questions**

Students will have 10 working days to request points from questions in exams that they believe they have answered correctly. They must request the revision from the faculty member that prepared the question.

## **DEFINITIONS**

### **Course Credits**

The value used to calculate the total credit hours for each course is equal to the assigned period of contact hours allotted to a course and defined as lecture, laboratory, discussion, research, or supervised independent study.

The total credit hour value for each course will be determined using the following criteria:

- 1 credit equals 12 contact hours of lecture, discussion or examination or
- 24 contact hours of supervised independent study or
- 48 contact hours of laboratory or research

### **Semester**

One semester will consist of 18 working weeks comprised of 90 days (5 days/week) of academic work. Twelve contact hours of lecture, irrespective of the days or weeks used to cover them, will receive the value of one credit. Other activities (i.e., laboratories, etc.) will be evaluated by using the conversion stated in the Credit Hour definition.

### **Academic Year**

1 July to June 30

## TABLE OF CONTENTS

Correspondence .....	2
Affirmative Action Policy .....	2
Rights and Responsibilities of Graduate Students .....	2
General Information .....	3
Mission and Goal of the UCC .....	4
Mission of the UCC .....	4
Goal of the UCC .....	4
Governance and Administration .....	4
Mission of the Graduate Program in Biomedical Sciences .....	5
Program Administrative Procedures .....	6
Admission to the Program .....	6
Recommended Undergraduate Course Work .....	6
Student Categories .....	7
Auditing Students .....	7
Special Students .....	7
Non-degree Students .....	7
Admission Requirements for Non-degree Students .....	7
Tuition and Fees for Non-degree Students .....	7
Financial Aid for Non-degree Students .....	7
Grade and Transcript Information .....	7
Non-degree Registration .....	7
Transient Students .....	7
Admission Requirements for Transient Students .....	7
Registrar's Office .....	8
Registration .....	8
Diplomas .....	8
Change in Address .....	8
Tuition and Fees .....	9
Tuition .....	9
Other Fees .....	9
Fees for other services .....	9
Reimbursement of Tuition Fees .....	9
Financial Aid .....	10
Loans .....	10
Financial Support from the Graduate Program in Biomedical Science .....	10
Graduate Fellowships .....	10
Tuition and Fee Waiver .....	10
Eligibility .....	10
Selection Process .....	11
Appointment and Notification .....	11
Minimum Course Load .....	11
Lost of Eligibility .....	11
Termination of Appointments .....	12
Appeals .....	12
Administrative Procedures .....	12
Exceptions .....	12
Leaves of Absence (LOA) .....	13
Personal Leave of Absence .....	13
Medical Leave of Absence .....	13
Leave of Absence for Parental Responsibilities .....	14



Technical Standards .....	15
Observation .....	15
Intellectual/Conceptual Abilities .....	15
Motor Skills .....	15
Communication .....	16
Behavioral and Social Attributes .....	16
Teaching and Research Facilities .....	17
Space and Equipment .....	17
Technical Assistance .....	17
Research Centers .....	17
Research Facilities .....	18
Research Support Programs .....	20
Research Support Offices .....	21
Student Services .....	22
Student Health Care Services .....	22
Counseling Program .....	22
Student Tutoring Program .....	22
Lodging Facilities .....	22
Student ID Cards .....	22
Study Programs in the Biomedical Sciences .....	23
Graduates' Competences .....	24
Anatomy and Cell Biology .....	24
Biochemistry .....	25
Microbiology and Immunology .....	27
Neurosciences .....	29
Physiology .....	32
Pharmacology .....	34
Graduation Requirements .....	35
Checklist of Graduation Requirements .....	35
Time Limitations .....	36
Grading Policy .....	37
Academic Honors .....	37
Student Status in the Program .....	38
Withdraw Procedures .....	38
Readmissions .....	39
Program Academic Requirements .....	40
Academic Program Advice .....	40
Language Requirements .....	40
Course Load .....	40
Class Attendance .....	40
Graduation .....	40
Maintenance of Active Status .....	41
Programs of Study .....	41
Residency .....	41
Research Mentor .....	41
MA Mentor .....	41
Dissertation/Thesis Committee .....	41
Bibliographical Reports .....	42
Seminars .....	42
Dissertation/Thesis .....	42
Dissertation/Thesis Defense .....	43
Specific Requirements for the Ph.D. Degree .....	43
Requirements for the Masters Degree .....	44

Specific Requirements for the Masters of Science (MS) Degree with Departmental Specialization.....	44
Specific Requirements for the Masters of Arts (MA) Degree with Departmental Specialization.....	44
Specific Requirements for the Masters of Arts (MA) Degree in the Biomedical Sciences....	44
Transfers.....	45
Transfer Students .....	45
Transfer of Credits.....	45
Transfer between Programs .....	46
Courses for the PhD in Cell and Molecular Biology Program .....	47
Sample Programs of Study.....	48
PhD in Cellular and Molecular Biology - Biochemistry.....	48
PhD in Cellular and Molecular Biology - Microbiology and Immunology.....	48
PhD in Cellular and Molecular Biology - Neurosciences.....	49
PhD in Cellular and Molecular Biology - Physiology .....	49
Courses for the PhD in Neurosciences.....	50
Sample Program of Study for the MS Degree .....	51
Anatomy and Cell Biology .....	51
Biochemistry .....	51
Microbiology and Immunology .....	52
Neurosciences .....	52
Pharmacology.....	52
Physiology .....	53
Sample Program of Study for the MA Degree .....	53
Anatomy and Cell Biology .....	53
Microbiology and Immunology .....	54
Biomedical Sciences.....	54
Interdisciplinary Courses .....	55
Additional Courses Offered by Department.....	55
Course Descriptions	
Interdisciplinary.....	57
Department of Anatomy and Cell Biology.....	64
Department of Biochemistry .....	67
Department of Microbiology and Immunology .....	70
Department of Pharmacology .....	74
Department of Physiology.....	76
Department of Neuroscience .....	78
Graduate Program in Biomedical Sciences Forms.....	79
Bibliographic Report Formatting .....	80
Dissertation / Thesis Formatting.....	81
Grievances.....	86
Definitions .....	86