

Western University of Health Sciences

Graduate College of Biomedical Sciences

Master of Science in Biomedical Sciences (MSBS)

2015/2016 Catalog

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Graduate College of Biomedical Sciences

Master of Science in Biomedical Sciences (MSBS)

Accreditation

Western University of Health Sciences is accredited by the Senior College and University Commission of the Western Association of Schools and Colleges (WASC). WASC's statement of accreditation status can be found at: <http://www.wascsenior.org/institutions/western-university-health-sciences>. You may contact WASC at 985 Atlantic Avenue, Suite 100, Alameda, CA 94501. Phone: (310) 748-9001, Fax: (310) 748-9797, E-mail: wascsr@wascsenior.org. WASC is a non-profit organization that evaluates the quality and educational effectiveness of schools, colleges, and universities. WASC is one of six regional accreditation agencies in the United States. While it is not officially regulated by the government, it is regularly reviewed by the US Department of Education and the Council for Higher Education Accreditation.

Please refer to the specific college sections of this catalog for further information on program and professional accreditations.

Complaints Regarding WASC Accreditation Standards

Western University of Health Sciences is committed to meeting and exceeding the standards for accreditation of colleges and universities as described by the Accrediting Commission for Senior Colleges and Universities of the Western Association of Schools and Colleges (WASC). It is the policy of Western University of Health Sciences that a student, employee, or other constituent of the University that believes that they University may not be in compliance with the standards of accreditation has a right to file a complaint can view the complaint submission process at: <http://www.wascsenior.org/comments>.

General Information

Program Overview

A minimum of 40 semester credit hours is required for completion of the MSBS program. This includes 20 credit hours of core courses. The program emphasizes training in modern methodology in the biomedical sciences with a broad range of skills and expertise acquired through core courses, electives and research. The MSBS currently offers 6 separate concentrations with emphasis on different fields and career opportunities:

- Health and Nutrition Sciences
- Regulatory Sciences
- Translational Sciences
- Clinical Sciences
- Biomedical Intellectual Property
- Healthcare Bioinformatics

For each concentration, different types of formation will be offered based on student preferences and choices of career.

Program Goals

To train post-graduate students in the principles and experimental methodologies of biomedical sciences as they relate to human and animal health and disease. Graduates will develop the requisite critical thinking skills and knowledge to satisfy a goal of becoming leaders in biomedical research, in academia, or biomedical companies.

Program Faculty

Program faculty is from the Colleges of Biomedical Sciences, Osteopathic Medicine, Veterinary Medicine, Pharmacy, Dental Medicine, Optometry and Podiatry. Their areas of research emphasis include pharmacology, molecular biology, microbiology, biochemistry, structural biology, immunology, neuroscience, anatomy and physiology, genomics and bioinformatics.

Admissions Policies and Procedures

Non-Discrimination Policy

In accordance with all applicable federal, state and local laws, Western University of Health Sciences (WesternU) is committed to ensuring a campus community free from unlawful discrimination. Accordingly, Western prohibits unlawful discrimination on the basis of race, color, national or ethnic origin, religion or religious creed, sex or gender (including gender identity or expression), marital status, sexual orientation, disability, age, genetic information, military or veteran status, or any other characteristic protected under applicable law, in the administration of its programs or activities. WesternU also prohibits unlawful harassment, including Sexual Harassment. Lastly, WesternU is committed to providing equal access to and equal opportunities to all members of its campus community in accordance with all applicable laws.

This non-discrimination policy applies to applicants, students and alumni. Additional nondiscrimination information can be found in the Nondiscrimination, Anti-Harassment and Anti-Retaliation Policy, located in the University Catalog.

Admissions Requirements

The application requirements shown in this catalog apply to applicants who are seeking entry for the 2016/2017 academic year. Current admission and application requirements for the MSBS program, including prerequisite coursework requirements, can be located on the [Prospective Student website](#).

Applicants must possess a Bachelor of Science degree with a strong science component. For the Healthcare Bioinformatics concentration, a background in Computer Sciences is recommended. The minimum criteria to receive consideration for admission are listed below. Meeting these criteria, however, does not guarantee admission to the program.

- A completed Western University of Health Sciences Graduate Application form (including all supplemental information for international applicants).
- Official transcripts of all undergraduate and graduate coursework, with an overall Grade Point Average (GPA) of 2.5 or greater on a 4-point scale.
- Official test scores for the general aptitude portion (verbal, quantitative, and analytical) of the Graduate Record Examination (GRE) taken within the last five (5) years, with a score greater than or equal to 300 on the combined verbal and quantitative (alternatively, adequate MCAT or DAT scores will be accepted in lieu of GRE scores).
- Three letters of reference from individuals familiar with the applicant's scholarship and research potential.

Application Deadlines

Applications must be received (including all supporting application materials) no later than May 1st for the fall semester (August), and no later than October 1st for the spring semester (January). Completed applications that arrive before the deadline may be considered on a rolling basis.

Applicants with Foreign Coursework

Applicants who wish to use coursework completed outside the United States must submit their transcripts for evaluation to a [Western University of Health Sciences Approved Service](#) at the candidate's expense. A course-by-course evaluation is required and all coursework must be designated as undergraduate, graduate or professional. Western University of Health Sciences only honors evaluations from a WesternU-approved service. The official evaluation must be included with the supplemental application packet.

International Students

International students and any other applicants who are not U.S. citizens and who are living in the U.S. should be prepared to provide proof of legal U.S. residency at the time of interview. Proof of legal U.S. residency is required prior to any offer of acceptance. For more detailed information, please visit our web page for [International Students](#).

WesternU/Institut Polytechnique LaSalle Beauvais Exchange Program

Western University of Health Sciences has entered into an agreement with Institut Polytechnique LaSalle Beauvais to facilitate faculty and student exchange. To that end, WesternU will allow Institut Polytechnique LaSalle Beauvais students to matriculate as non-degree MSBS students for up to a total of 10 units.

The normal length of stay of exchange students shall be one semester. In exceptional cases and with the advance agreement of WesternU and LaSalle Beauvais, the length may be up to one academic year (two semesters). Students will pay tuition and fees at their home institution and are exempted from paying tuition and fees at their host university. Participating students shall be subject to the rules and regulations of the host university. For additional information regarding the exchange program, please contact the MSBS program.

Transfer Credit

A maximum of 10 graduate level credits in which the student has earned an "A" from an equivalent program from another university will be honored toward the Master of Science in Biomedical Sciences for non-WesternU students transferring to WesternU. A maximum of 15 graduate level credits in which the student has earned at least a "B" from an equivalent program from WesternU or from another university will be honored toward the Master of Science in Biomedical Sciences for WesternU students transferring to the MSBS. The Dean of GCBS must approve all transfer credit, and the decision of the Dean is final.

Registration

All WesternU students are required to register by the registration deadlines specified by the University Registrar. Registration dates are posted on the [Registrar's Office website](#). Failure to register by the deadline may be grounds for administrative withdrawal. All students registering after the posted deadline will be assessed a \$30.00 per business day late fee.

Full tuition and fees and all prior debts must be paid in full on or by posted deadlines each academic year. Matriculation is subject to the satisfactory completion of all academic requirements and payment of all outstanding debts to the University. The receipt of a final transcript(s) from all colleges/universities attended and a physical examination with documentation of required immunizations (if applicable) prior to registration are additional requirements for incoming students.

Registration Late Fee Appeals

If you are assessed late fees for a registration period, you may submit an appeal to the Registrar. For additional information on the appeal process, please see 'Registration Late Fee Appeals' in the University Catalog, General Academic Policies and Procedures section.

Student Health Insurance Requirement

All full-time students at Western University of Health Sciences are required to have active health insurance while enrolled. All students are automatically assessed half of the entire year's insurance premium until they submit proof of coverage that meets the University's requirements; however, students are not automatically enrolled in the plan until the deadline to submit proof of coverage has passed for your program/year. For additional information on student health insurance requirements and/or waiving out of the student health insurance plan, please see 'Student Health Insurance Requirement' in the University Catalog, General Academic Policies and Procedures section.

New Student Orientation/Welcome Week

Attendance at all Welcome Week activities is mandatory for all incoming first-year students. For additional information on Welcome Week activities for the Graduate College of Biomedical Sciences, Master of Science in Biomedical Sciences program, please visit:
<http://www.westernu.edu/students/welcome-week/>.

Student Initiated Changes in Enrollment Status

Course Drop/Withdrawal

Students may voluntarily drop a class by completing the necessary paperwork. Course drops are processed as follows:

0-20% of Course Completed (Based on Course Start/End Dates)	Course is removed from student's registration and will not appear on student's academic transcript.
20-99% of Course Completed (Based on Course Start/End Dates)	Course is assigned a grade of 'W' to indicate the student withdrew from the course. 'W' grades will appear on the student's academic transcript, but will not be included in the student's GPA calculation.
100% of Course Completed (Based on Course Start/End Dates)	Course is assigned the grade earned.

Leave of Absence

A student may request a Leave of Absence (LOA) with the occurrence of a medical emergency or illness, personal issues, financial hardship, or military service. Students must be in good academic standing to be eligible for a Leave of Absence. For additional information on the University's Leave of Absence policy, please see 'Student Initiated Changes in Enrollment Status' in the University Catalog, General Academic Policies and Procedures section.

Withdrawal from University/Academic Program

Matriculation at the University is a privilege granted in consideration of specified levels of performance and of maintaining the established standards of scholarship and personal and professional conduct. The University reserves the right to require withdrawal at any time it deems necessary to safeguard its standards of scholarship, conduct and orderly operation. The student concedes this right by act of matriculation. For additional information on withdrawing from the MSBS program, please see 'Student Initiated Changes in Enrollment Status' in the University Catalog, General Academic Policies and Procedures section.

Full-Time/Part-Time Status

All MSBS students enrolled in at least 10.00 credit hours are considered full-time students. Students enrolled in 7.50 – 9.99 units are considered three-quarter-time students. Student enrolled in 5.00 – 6.59 units are considered part-time students.

Time Limits

The Master of Science in Biomedical Sciences program is designed to be completed in two (2) years of full-time study. The requirements for the degree must be fulfilled within three (3) years from the date of matriculation to the program. Students who are unable to meet the three year time limit for the MSBS program may be subject to administrative withdrawal.

Tuition and Fees

By action of the Board of Trustees, MSBS tuition and fees for the 2015-2016 academic year (subject to change) are as follows:

\$748.00	Per Credit Hour
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Other Fees and Expenses

\$30.00	Registration Late Fee (Per Business Day)
\$350.00	Graduation Fee
\$470.00	Annual Parking Permit (Auto)
\$25.00	Parking Permit Replacement Fee
\$40.00	Locker Key Replacement Fee
\$10.00	Official Transcript (Each)
\$21.00	Rush Transcript, First Class Mail (Each)
\$25.00	Rush Transcript, Federal Express (Each)
\$10.00	Student ID Replacement Fee
\$TBD	Breakage Fee (Replacement Cost)

Financial Support

Financial support, which includes scholarship and aid through a Federal Work Study program, is available to a small number of qualified applicants on a limited, competitive basis. Support is for 12 months (including summers) and is limited to a total of two consecutive years for any student.

General Academic Policies and Procedures

Attendance and Absences

Attendance is required at all scheduled instructional periods. Absence from instructional periods for any reason does not relieve the student from responsibility for the material covered during the periods missed.

Vacation and Emergencies

Students receive two weeks' vacation each year over the Christmas break. Students may not expect to take more time than this, and may not leave early or return late from the break. Vacations are not provided during academic semesters. Summers are the optimal time for focused research effort and as such no vacation time is allowed for this period. Under special circumstances, a student may arrange a brief 1-3 days off at the discretion of the program director and the faculty supervisor, and this must be discussed in advance. It is the Dean's and faculty supervisor's prerogative whether to grant the time off and it is not guaranteed. Students should not enter the program with the expectation of taking time off for other pursuits (i.e., interviews for other programs, leaving the country, hobbies, etc.).

Emergencies, including medical problems or serious personal/family issues, which result in less than 15 academic days (3 calendar weeks) away from campus, may be granted upon approval by a student's faculty mentor, in conjunction with the Dean, GCBS, or his/her designee. Any missed course material is the responsibility of the student, and students may be required to complete alternative assignments, at the discretion of course faculty.

Students with emergencies resulting in more than 15 academic days (3 calendar weeks) away from campus must apply in writing for a Leave of Absence to the Dean, GCBS, or his/her designee. Please see the University Catalog's "General Academic Policies and Procedures" for more specific information on Leave of Absence.

Graduation Requirements

Obtaining the Master of Biomedical Sciences Degree will be based on cumulative GPA (minimum of 3.0), and a portfolio of documents generated by the student over the 2-year program. These will include reports from internships, special assignments for some of the classes, national certificates for some of the tracks (in particular the health bioinformatics track), and research project reports. The faculty advisor and the student advisor committee will help the student select topics and mentor the student in his/her progress.

MSBS candidates are required to present their portfolio and present it to the Portfolio Advisory Committee for approval. In addition, students will be required to defend their portfolio during an oral presentation at the end of their program to the Defense Committee. The oral defense may also include questions based on the required course work completed by the student. The Defense Committee will consist of the Portfolio Advisory Committee and an external member from within the Western University of Health Sciences faculty whose role will be to ensure that the defense is conducted fairly.

All candidates must pass a comprehensive examination covering the major and minor field at the end of the first year of the program. This usually is a two-hour oral examination. Members of the university faculty not on the Portfolio Advisory Committee may attend any oral examination as visitors. The faculty advisor will schedule the oral examination not later than the date of the deadline set by the

Dean, GCBS, or his/her designee. Successful completion requires the unanimous support of all members of the Portfolio Advisory Committee.

If a student fails the oral examination, one re-examination may be accorded to the student based on a recommendation by the Portfolio Advisory Committee and approval by the Dean, GCBS, or his/her designee. Further re-examinations may be allowed only under exceptional circumstances and only with the approval of the Dean, GCBS, or his/her designee.

Upon satisfactorily passing all exams, students are to provide 7-8 professionally printed copies of their portfolio for: their Portfolio Advisory Committee members (3-4), the college (1 copy), the Dean's Office (1 copy) and the university library (2 copies).

A fee will be charged to the student for microfilming their portfolio.

Faculty Advisor and Research, Portfolio, and Internship

The faculty advisor serves as the Chair of the student's Research Advisory Committee and helps the student in his/her choice of electives and research project/portfolio topic. Further, the faculty advisor may also assist the student in obtaining a research assistantship if funds are available. The Chair is responsible for the satisfactory academic progress of the student, and must hold committee meetings with the student on a regular basis.

The Portfolio Advisory Committee consists of at least three faculty members (the faculty advisor plus two other faculty members). The Chair and at least two of the committee members must be full time faculty at Western University of Health Sciences. Upon approval by the Dean, GCBS, or his/her designee, a fourth member from within Western University of Health Sciences may be eligible for appointment to the committee.

Issues/Dispute Resolution Procedure

When an issue or dispute arises between students, the issue/dispute resolution process starts with communication among the involved students. If a satisfactory resolution is not arrived at that level, the matter should then be addressed with the course instructor or the faculty advisor. If the problem is not resolved at the faculty advisor/course instructor level, the matter should be brought to the Associate Dean for Academic Affairs, followed by the Dean and then the Provost/COO. If the matter has not been resolved at those levels, the final arbiter is the President.

When an incident arises involving a faculty member, the first step in the issue/dispute resolution process is discussion with the faculty member. If the matter is not satisfactorily resolved at that level, then the matter should be referred to the Associate Dean for Academic Affairs, Dean, and Provost/COO, in that order. The final arbiter is the Board of Trustees.

When an incident arises involving a staff member, the dispute resolution process begins with the Associate Dean for Academic Affairs, followed by the Dean. The Office of Human Resources is the final arbiter.

Failure to follow this sequence of steps will only serve to delay the appropriate resolution of the issue or dispute, as the matter will only be referred back to the correct level in this chain of responsibility.

Standards of Academic and Professional Conduct

Academic Integrity

Complete confidence in the honor and integrity of the biomedical sciences student and research scientist is essential. Such confidence depends entirely on the exemplary behavior of the individual student in his/her relations with peers, faculty and colleagues. Strict honesty as a personal way of life should be nurtured during the period of study. The student shall conduct all aspects of his/her life with honor and integrity. This includes accountability to oneself and to relationships with fellow students, future colleagues, faculty and staff, who contribute to his/her training and growth, and members of the general public. This applies to personal conduct that reflects on the student's honesty and integrity in both academic and non-academic settings, whether or not involving a University sponsored activity. Upon accepting admission to the University, each student subscribes to and pledges complete observance to the Standards of Academic and Professional Conduct, as outlined in the University Catalog. A violation of these standards is an abuse of the trust placed in every student and could lead to suspension or dismissal.

GCBS Honor Code

Honesty and integrity are among the most valued traits of academic researchers and health care professionals. Each student is expected to assume personal responsibility for those traits. Academic dishonesty includes cheating, plagiarism, using unauthorized resources during examination(s), sabotaging other students and mentors' research as well as signing another person's name to an attendance or examination document. Matters of academic dishonesty and professional misconduct will be handled consistently with the University's guidelines for Hearings involving alleged violations of the standards of professional conduct as described in the University's General Academic Policies and Procedures. Any individual who witnesses or becomes aware of a possible violation of the Honor Code is bound to report the incident. Staff or students must report the incident to a faculty member and faculty members must report the incident to the GCBS Dean.

Violations

Upon receipt of an allegation of misconduct, the GCBS Dean will either address the matter directly or will appoint an ad-hoc committee of the Faculty and student(s) of the program to investigate the allegation and forward a recommendation on a course of appropriate action to the GCBS Dean. Potential sanctions could include placing the student on probation; require the student to undertake specific remedial activities, suspension for a defined period of time, or dismissal from the program. Decisions of the Dean in matters of conduct may be appealed following the procedure outlined in the 'Student Appeal Process' section of the University Catalog.

Standards of Academic Progress

MSBS students must maintain a cumulative GPA of 3.00 or higher on a semester basis to be considered making satisfactory academic progress (SAP).

Student Performance Committee

The Graduate College of Biomedical Sciences Student Performance Committee is charged with the following responsibilities: (a) to review at the end of each term the academic achievement and comprehensive evidence of progress of all students who are pursuing the Master of Science in Biomedical Sciences and give recommendations to the Dean, GCBS, or his/her designee, regarding academic progress matters. Particular attention will be given to students in academic difficulty as their grades are made available to the Student Performance Committee by the Registrar and/or course faculty; and (b) to consider violations of the Standards of Academic and Professional Conduct, if asked by the Dean, GCBS. Appropriate professional and personal conduct is defined by the University's and College's codes of academic and professional conduct.

Graduation

A student will be recommended for the Master of Science in Biomedical Sciences degree provided that he/she:

1. Is not on probation or suspension and has completed all prescribed academic requirements with a cumulative grade point average of 3.00 or higher and has no outstanding grade of "I," "NCR," or "U." A 2.00 (C) grade earned in any class may be applied toward graduation only if the cumulative grade point average at the time of application for graduation continues at a minimum of 3.00 (B).
2. Has satisfactorily completed and orally defended a written portfolio.
3. Has demonstrated no serious deficiencies in ethical, professional, or personal conduct, as defined in the University Catalog, General Academic Policies and Procedures section, which would make it inappropriate to award the degree of Master of Science in Biomedical Sciences.
4. Has complied with all the legal and financial requirements of the University, as stated in the University Catalog.
5. Has attended in person and participated in the Commencement ceremony at which time the Master of Science in Biomedical Sciences degree is conferred. Unless special permission has been granted by the Dean, each student must participate in their respective commencement ceremony. If the Dean grants special permission for excusal from commencement, the graduate may be required to present him/herself to the Dean, GCBS or his/her designee, at another specified date to take their profession's oath before their diploma will be released. Requests for excusal will only be granted for extenuating circumstances, such as a prior military commitment, or death in the family.

Students may participate in commencement activities provided they will complete all requirements of the program by December 31st of that calendar year. No student will receive his or her degree until

he/she has completed all requirements for graduation. Degrees will be dated as appropriate to completion date.

Adverse Actions

Probation

Students may be placed on Probation for the following reasons (these are in addition to the reasons listed in the Standards of Academic Progress section of the University Catalog).

1. Inadequate academic progress as determined by the Student Performance Committee. This includes, but is not limited to, receiving a “U” grade in any course or system.
2. A semester or cumulative grade point average below 3.00.
3. When directed to repeat a year for academic reasons.
4. Failure to perform in a professional manner.
5. Serious deficiencies in ethical or personal conduct.

A student placed on probation for receiving a grade of “U” or for a semester or cumulative GPA less than 3.00 in a given semester will be removed from probation after one semester provided he/she has regained a cumulative GPA of at least 3.00 and/or has remediated the failed course. Students on probation are to remove themselves from all leadership roles in co-curricular activities associated with the University and/or with professional associations.

Financial Aid Warning Policy

If a student is not achieving satisfactory academic progress (SAP) they may be placed on “Financial Aid Warning” status for the next payment period and continue to receive Title IV aid for that period. Students who fail to make SAP by the end of that payment period lose Title IV aid eligibility.

It is the policy of the Financial Aid Office (FAO) that once a student has been placed on academic probation for not meeting SAP standards as defined by the college, the FAO will automatically place the student in a Financial Aid Warning status. During the next academic term if the student does not meet SAP standards and the college places the student on academic suspension the student will no longer be eligible for financial aid. If the student appeals the academic suspension and the appeal is approved, financial aid will be reinstated. If the student is directed to audit courses those courses may not be covered by financial aid.

Tutorial Assistance Program

A Tutorial Assistance Program (TAP) has been established to assist students experiencing academic difficulty. Students will be recommended for this program by a faculty advisor or professor. Students may self-identify to TAP to receive assistance. The tutors will be chosen on the recommendation of the faculty in each discipline. Group tutoring is the methodology most used by the TAP department. For assistance, contact the Learning Enhancement and Academic Development Office (LEAD).

Remediation

Where deemed appropriate, the Student Performance Committee, after consultation with the course instructor and/or the Dean (or his/her designee) may recommend any one of the following options:

1. Take a comprehensive examination.
2. Complete special projects or studies in the deficient area(s).
3. Repeat the course, system, or rotation.
4. Repeat the academic year.
5. Dismissal from the University.

The score/grade achieved by remediation will be the score/grade recorded except that the highest score/grade a student may earn by options 1 or 2 (above) is a score of "C." The grade achieved by remediation will be recorded on the transcript next to the original grade.

If a student is directed to repeat a course (option 3); the grade for the repeated course will be recorded on the official transcript. Only the most recent grade received for a repeated course will be included in the student's GPA calculation. Students will be charged full tuition for repeated coursework.

Academic Suspension

Students may be placed on Academic Suspension if there is a period of non-enrollment caused by the need to repeat a failed course.

No student is eligible for Title IV, HEA programs if they are placed on Academic Suspension. Students on Academic Suspension are not registered as an active matriculant and should use this time to remediate the deficiency for which the Academic Suspension was levied.

Dismissal

If the cumulative grade point average remains below 3.00 after the student completes a total of nine (9) graded credit units subsequent to being placed on academic probation, the student will be dismissed from the program. The student may be readmitted only after completion of a remediation plan recommended by the Portfolio Advisory Committee. No course work taken as part of that remediation plan will be counted toward the MSBS degree or incorporated into the student's cumulative grade point average. Graduate level courses for which grades below "C" were earned may not be repeated during that remediation period.

Students who receive a "U" grade for GCBS 6999 (Research and Portfolio and Internship) will be dismissed regardless of GPA or academic standing in the program.

Student Appeal Process

At the conclusion of each academic term, the Student Performance Committee will review whether students have met the established Standards of Academic Progress in the curriculum. Recommendations by the Student Performance Committee for repeat of an academic year or dismissal from the MSBS

program are advisory to the Dean of the Graduate College of Biomedical Sciences, who will make the final decision.

In the event that the Student Performance Committee has made a preliminary determination to recommend an adverse action, such as dismissal or the repeat of an academic year, the student is offered an opportunity to meet in person with the Student Performance Committee, prior to the Committee forwarding its final recommendation to the Dean of the Graduate College of Biomedical Sciences. At such time, the student may present any information relative to the preliminary recommendation. The student may also be accompanied by a representative for support; however, the representative may not be an attorney. The Student Performance Committee will have an opportunity to review the additional information, if presented, and will then make a final recommendation to the Dean.

In accordance with WesternU policy, the Dean's decision may be appealed by the student to the Provost of Western University of Health Sciences. The Provost may convene an advisory panel, and the decision of the Provost is final. For additional information, please see 'Student Appeal Process' section of the

Evaluation and Grading

Program Outcomes

Critical Thinking

The MSBS graduate will be able to identify and understand critical issues in biomedical sciences. They should possess the ability to challenge and evaluate information using evidence-based research principles, as well as synthesize and integrate knowledge in the discipline, leading to new ideas, approaches and research.

Breadth and Depth of Knowledge

The MSBS graduate will understand the current and historical theories, concepts, and models of biomedical sciences. They should possess the ability to access and evaluate the literature of the discipline and understand the major issues in the current state of knowledge. They should also possess an ability to transcend traditional disciplinary boundaries and effectively conduct original, discovery-based or applied research in biomedical sciences under the direct guidance of a faculty member.

Interpersonal Skills

The MSBS graduate will possess the ability to write and speak about the current issues of biomedical sciences to peers, practitioners and the public. They should be able to articulate and demonstrate knowledge of the discipline and write and present scholarship information to professionals.

Collaboration Skills

The MSBS graduate will be able to collaborate with other members of the research team, with colleagues (both within the discipline and across related disciplines), and if appropriate, with other communities of interest in the conduct of a research program.

Ethical and Moral Decision Making (Humanistic Skills)

The MSBS graduate will understand and exhibit the professional standards for responsible and ethical conduct of research in biomedical sciences.

Life-Long Learning

The MSBS student should be able to engage in life-long, self-directed learning to maintain and expand competence in the discipline, including staying abreast of current issues, methods and approaches in biomedical sciences.

Evidence-Based Research

The MSBS student will have a solid grounding in the literature pertaining to a particular question and be able to understand and appropriately use the methods and techniques used for advancing knowledge in their field of study. They should be capable of designing, working within, and coordinating multi-disciplinary research programs.

Grading Scale

Final course grades are given based upon the traditional 4-point letter system, as follows:

<u>Grade</u>	<u>Equivalent</u>	<u>GPA Points</u>
A	Excellent	4.00
B	Good	3.00
C	Satisfactory	2.00
U	Unsatisfactory	0.00
CR	Credit	N/A
NCR	No Credit	N/A

Administrative Grades

<u>Grade</u>	<u>Equivalent</u>	<u>GPA Points</u>
AU	Audit	N/A
I	Incomplete	N/A
W	Withdrawal	N/A
M	Missing	N/A

Audit

An “AU” (Audit) is assigned to a student who pays tuition for the course and attends class activities but does not complete examinations and does not receive course credit. However, under certain circumstances, at the discretion of the College Dean, a student who is repeating or undergoing remediation may be required to complete course examinations and/or other required work products while auditing the course for no grade.

Missing Grades

A grade of ‘M’ for Missing will be input by the Office of the Registrar if a student’s grade is not available by the deadline for grade submission. An ‘M’ grade is not included in the GPA calculation and will be replaced by the grade earned in the course once submitted by the course director/instructor. ‘M’ grades should not be used by the program in place of an Incomplete (I) grade.

Incomplete

An Incomplete grade (“I”) will only be assigned to students whose professional commitments and/or personal responsibilities prevent him or her from completing the requirements of the course. A student may remove an incomplete by completing course requirements within the following six calendar months or the final grade will be permanently recorded as a “U.” This rule applies regardless of the student’s enrollment status. A student not enrolled during the following six months must still successfully remove the “I” grade. The instructor must certify any grade changes. The “I” grade will remain on the student’s transcript, along with the final grade assigned by the instructor.

Grade Reports

Official grades are turned in to the Registrar by the Graduate College of Biomedical Sciences, at which time the online student records system, BanWeb, is updated. Official grade reports and unofficial transcripts will be available on the BanWeb student records system throughout the academic year.

Grade Appeals Process

If a student believes there is just cause to dispute a grade for a course, the procedure is as follows: Within five (5) days of receipt of the course grade, the student must make an appointment with the course instructor who issued the grade. Upon written request from the student, the course instructor shall review the case with the student, and a decision shall be made by the course instructor to affirm or modify the grade. Within ten (10) working days of the student's written request, the course instructor shall notify the student in writing of the decision. A copy of the Grade Change Form shall be sent to the student and to the GCBS Associate Dean for Academic Affairs.

Within five (5) working days following written notification to the student regarding the instructor's decision, the student may appeal the decision in writing to the GCBS Associate Dean for Academic Affairs. The appeal request must be accompanied by a narrative explaining the basis for the appeal. The narrative should fully explain the student's situation and substantiate the reason(s) for advocating a review of the prior decision of the instructor. The Associate Dean for Academic Affairs may grant an appeal only if a claim of (1) bias, (2) the appearance of new material and documentable evidence that was not available at the time of the instructor's decision, or (3) procedural error that unfairly affected the decision-making process is substantiated by the Associate Dean for Academic Affairs. Upon written request from the student with a valid appeal rationale, the Associate Dean for Academic Affairs shall review the case and within seven (7) working days shall issue a decision in writing to the student, which may affirm, modify, or reverse the previous action of the instructor.

The Associate Dean for Academic Affairs' decision is final in all course grade appeals except when the Associate Dean for Academic Affairs is the official instructor of the course in question. In such a case, the student will direct his or her appeal to the Dean of the Graduate College of Biomedical Sciences, following the same guidelines for an appeal to the Associate Dean for Academic Affairs. The decision of the Dean in this instance is final.

Credit Hour Calculation

The Graduate College of Biomedical Sciences defines one credit hour for every 12 contact hours.

Curriculum Organization (Fall 2015 Forward)

For students entering in fall 2015 and beyond.

To graduate, students must complete a minimum of 40 credit hours, including 14 credit hours of the six core courses, 20 credit hours of technical skill, content specialization, and/or elective courses, and 6 credit hours of Research and Internship.

For the specialized concentrations, students will be required to complete, after discussion with their portfolio advisor, 8-12 credit hours from technical skill courses and 8-12 credit hours from content specialization courses the most adapted to their selected concentration.

- Health and Nutrition Sciences
- Regulatory Sciences
- Translational Sciences
- Clinical Sciences
- Biomedical Intellectual Property
- Healthcare Bioinformatics

Core Required Courses

Subject/Course #	Course Title	Credit Hours
GCBS 5040	Molecular and Cellular Basis of Life	2.00
GCBS 5060	Introduction to Biotechnology	2.00
GCBS 5080	Biological Systems in Human and Animal Disease I	2.00
GCBS 5081	Biological Systems in Human and Animal Disease II	2.00
GBCS 5086	Bioinformatics Part I	4.00
GBCS 5090	Biomedical Statistics and Research Design Part I	2.00
Total Required Credit Hours:		14.00

Research, Portfolio, and Internships

Subject/Course #	Course Title	Credit Hours
GCBS 7000	Research and Internship	1.00 – 6.00
Total Required Credit Hours:		6.00

Elective Courses

Subject/Course #	Course Title	Credit Hours
GCBS 6000	Graduate Seminar	2.00 – 8.00
GCBS 6101	Advanced Topics in Immunology	2.00
GCBS 6201	Advanced Topics in Pharmacology	2.00
GCBS 6301	Advanced Topics in Virology	2.00
GCBS 6303	Advanced Topics in Genetics	2.00
GCBS 6401	Advanced Topics in Structural Biology	2.00
GCBS 6501	Advanced Topics in Neurobiology	2.00
GCBS 6601	Special Research Experience	2.00 – 4.00
GCBS 6701	Directed Reading	1.00 – 5.00
Total Optional Credit Hours:		14.00

Technical Skill Courses

Genomics/Bioinformatics/Statistics/Data Management and Analysis		
Subject/Course #	Course Title	Credit Hours
GCBS 5012	Computer Sciences Foundation	4.00
GCBS 5087	Medical Informatics Part I	4.00
GCBS 5091	Biomedical Statistics and Research Design	2.00
Laboratory Animal Care/Biosafety/Preclinical/Clinical Study		
Subject/Course #	Course Title	Credit Hours
GCBS 5031	Small Animal Mixed Practice	2.00
GCBS 6700	Path for FDA Approval of New Drugs and Devices	3.00
GCBS 6900	Preclinical and Clinical Studies	4.00
IP/Regulatory Process/Legal/Communication/Writing		
Subject/Course #	Course Title	Credit Hours
GCBS 5025	Utility Patent Law Fundamentals	4.00
GCBS 5026	Biotech/Pharm Invention Patenting, Licensing, Dev	4.00
Total Required Credit Hours:		8.00 – 12.00

Content Specialization Courses

Food and Nutrition Sciences		
Subject/Course #	Course Title	Credit Hours
GCBS 5032	Food and Feed Safety	2.00
GCBS 5034	Gastrointestinal System and Nutrition	3.00
GCBS 5201	Nutrient Metabolism: Macro and Micronutrients	4.00
GCBS 6800	Nutritional Sciences Exchange Program	8.00
Human/Animal Medical Sciences		
Subject/Course #	Course Title	Credit Hours
GCBS 5030	Intensive Summer Anatomy (MS-ISAC)	8.50
GCBS 5110	Population Health	2.00
GCBS 5111	Veterinary Issues	2.00
GCBS 5112	Laboratory Animal and Research	2.00
Regulatory Sciences		
Subject/Course #	Course Title	Credit Hours
GCBS 5501	Drug Regulatory Affairs	4.00
GCBS 5502	Healthcare Quality Systems and Standards	2.00
GCBS 5503	Advanced Toxicology	3.00
Translational Sciences		
Subject/Course #	Course Title	Credit Hours
GCBS 5602	Pharmaceuticals/Biopharmaceuticals	3.00
Healthcare Bioinformatics		
Subject/Course #	Course Title	Credit Hours
GCBS 5088	Medical Informatics II	2.00
Total Required Credit Hours:		8.00 – 12.00

Curriculum Organization (Prior to Fall 2015)

For students who entered the program prior to fall 2015.

To graduate, students must complete a minimum of 40 credit hours, including 14 credit hours of the six core courses, 20 credit hours of Electives, and 6 credit hours of Research and Thesis.

Core Required Courses

Subject/Course #	Course Title	Credit Hours
GCBS 5040	Molecular and Cellular Basis of Life	2.00
GCBS 5060	Introduction to Biotechnology	2.00
GCBS 5080	Biological Systems in Human Disease I	2.00
GCBS 5081	Biological Systems in Human Disease II	2.00
GBCS 5085	Research Laboratory Rotations	4.00
GBCS 5090	Biomedical Statistics and Research Design Part 1	2.00
Total Required Credit Hours:		14.00

Non-Core Required Courses

Subject/Course #	Course Title	Credit Hours
GCBS 6999	Research and Thesis	2.00 – 6.00
Total Required Credit Hours:		6.00

Elective Courses

Subject/Course #	Course Title	Credit Hours
GCBS 6000	Graduate Seminar	2.00
GCBS 6101	Advanced Topics in Immunology	2.00
GCBS 6201	Advanced Topics in Pharmacology	2.00
GCBS 6301	Advanced Topics in Virology	2.00
GCBS 6302	Advanced Topics in Genetics	2.00
GCBS 6401	Advanced Topics in Structural Biology	2.00
GCBS 6501	Advanced Topics in Neurobiology	2.00
GCBS 6601	Specialty Research Experience	2.00 – 4.00
GCBS 6701	Directed Reading	1.00 – 5.00
Total Required Credit Hours:		20.00

Course Descriptions

All courses are awarded letter grades, except when indicated otherwise.

GCBS 5012 Computer Sciences Foundations (4 credit hours)

This course will offer students an overview of core computer science topics including networks, databases, and programming. The networking component will introduce students to network architectures, layers and protocols, as well as client-server concepts, network security, and web computing. The database component will provide an introduction to fundamentals such as database theory, the relational database model, database design, data manipulation, and SQL programming language. The programming component will cover essentials of programming and problem solving including design, implementation, documentation and testing of programs in an object oriented language. Students will learn the concepts of modularization and reusability of software as well as file I/O and exception handling. Students who successfully complete this course will have the foundation to apply basic concepts in computer science to questions and projects in biomedical informatics. Only open to students entering the MSBS program in fall 2015.

GCBS 5025 Utility Patent Law Fundamentals (4 credit hours)

This course provides in-depth discussion and interactive learning focused on the requirements for obtaining a Utility Patent. Students will gain a thorough understanding of novelty, non-obviousness, Wands analysis, written description, enablement, claim construction, legal standards for patent validity and enforceability, and many other topics related to utility patent law fundamentals. The ultimate goal is obtaining a valid and enforceable utility patent that will not only withstand challenges by competitors, but will also bring maximum value for the inventors and owners of the utility patent. Only open to students entering the MSBS program in fall 2015.

GCBS 5026 Biotechnology and Pharmaceutical Invention Patenting, Licensing, and Development (4 credit hours)

This course will provide students with in-depth coverage of the requirements for obtaining valid and enforceable biotechnology and pharmaceutical patents. These topics include, but are not limited to, claim construction and interpretation, genus-species issues, Markush claims, critical requirements for meeting the written description and enablement requirements, and legal standards for patent validity and enforceability. Students will also gain a thorough understanding and appreciation of the requirements, provisions, and legal and commercial significance of licensing biotechnology and pharmaceutical Inventions. This includes a discussion of exclusivity versus non-exclusivity terms, royalty provisions, and other license terms. The course will also provide in-depth coverage of the numerous benefits of developing comprehensive biotechnology and pharmaceutical patent portfolios that are broad in scope and of course valid, enforceable and designed to withstand challenges by competitors. Only open to students entering the MSBS program in fall 2015.

GCBS 5030 Intensive Summer Anatomy Course (8.5 credit hours)

The Intensive Summer Anatomy Course (ISAC) is an accelerated equivalent of the post-cranial portion of DO 5030, given in 6.5 weeks. Material covered in this regional approach includes the shoulder and upper limb, thorax and its viscera, abdomen and its viscera, the pelvis, its viscera, the male and female perineum and lower limb. The objectives include the mastery of nomenclature and spatial relationships of human anatomical systems. It is expected that students will understand the anatomical portion of selected clinical correlations. Course consists of didactic and practical components, and includes dissection of human cadavers. Assessment is by means of written and laboratory practical examinations, as well as regular quizzes.

GCBS 5031 Small Animal Practice I (2 credits)

Supervised clinical education in the academic and practical aspects of small animal (canine, feline, pet birds, reptiles) medicine and surgery carried out in carefully selected high quality and high volume private practices. Students see a wide variety of cases and directly manage medical and surgical examinations, diagnosis and management. Students are active participants in the diagnostic and therapeutic management of patients, and, as such, perform physical diagnosis and actively manage or participate in diagnostic problem-oriented decision-making. Students have the opportunity to observe clinicians as role models and become familiar with how clinicians apportion their time spent with clients, staff and other hospital matters. Students also consult with hospital managers to learn issues including records, inventories, and client billing. Only open to students entering the MSBS program in fall 2015.

GCBS 5032 Food and Feed Safety (2 credits)

The primary aim of the course is to provide students with the basic knowledge regarding the role of veterinary medicine in the production of safe foods of animal origin (meat, dairy products, and eggs) and safe needs for companion animals, poultry, livestock, and other species. The continuum from pre-harvest food and feed safety will be covered with emphasis on the physical, chemical and biological aspects of food safety. Principles of cleaning, disinfection, sterilization and radiation as it applies to food production will also be discussed. Students should understand the concepts of developing a Hazard Analysis Critical Control Points (HACCP) program at both the pre-harvest and post-harvest stages. Only open to students entering the MSBS program in fall 2015.

GCBS 5033 Gastrointestinal System and Nutrition (3 credit hours)

Students work as teams in small groups to address a variety of clinical cases involving important diseases of the gut, hepato-biliary, and pancreatic systems that manifest as alterations in nutrient assimilation and waste evacuation. Each case allows for integration of basic and clinical science concepts. Large-group interactive sessions provide guidance and expert facilitation regarding the clinical application of embryology, histology, physiology, pharmacology, biochemistry, microbiology, and pathology as well as epidemiology and evidence-based approaches to diagnosis and management of gastrointestinal disorders. Only open to students entering the MSBS program in fall 2015.

GCBS 5040 Molecular and Cellular Basis of Life (2 credit hours)

This course covers a wide range of topics in molecular and cellular basis of life. The goal of this course is to provide an integrative view of the general principles in molecular biology, genomics, biochemistry, cellular physiology, metabolism and basic histology.

GCBS 5060 Introduction to Biotechnology (2 credit hours)

This course will provide theoretical knowledge, hands-on laboratory experience and practical computer skills necessary and sufficient to start practical work in biotechnology projects.

GCBS 5080 Biological Systems in Animal and Human Disease I (2 credit hours)

The purpose of this course is to provide the first year biomedical graduate student with a foundation in human and animal biological systems and their diseases. This one semester course will meet for two hours per week over 17 weeks (12 weeks of instruction, and 5 weeks of assessment and holidays). The primary goal of this course is to provide an integrative view of the general principles in human and animal systems biology and related diseases, in the context of homeostasis and related phenomena. A secondary goal of this course is to foster student-centered learning skills and the confidence to pursue self-directed study using a variety of academic and scientific resources including textbooks, primary literature, review papers, scholarly online databases, and peer group discussions.

GCBS 5081 Biological Systems in Human and Animal Diseases II (2 credit hours)

The course is designed to provide the first year biomedical graduate student with a comprehensive foundation in biological systems, microbial pathogens and the immune response. The primary goal of this course is to provide an integrative view of the general principles of systems biology, microbiology and immunology.

GCBS 5085 Research Laboratory Rotations (4 credit hours)

This rotation provides students with a research experience. The student will learn principles of experimental design and good laboratory practices. Early in the rotation, the student will develop a specific hypothesis and design a protocol to test the hypothesis. The student will maintain a laboratory notebook, documenting the procedures and assays that are performed on a daily basis, as well as define and explain the scientific questions that each assay is addressing and the underlying mechanisms by which the assay operates. Depending upon the rotation, the student may participate in laboratory meetings, seminars, and/or journal clubs. At the end of the rotation, the student will prepare a one-page summary of their research experience, which will be written in abstract form that contains both a title and an author(s) section, with the body of the abstract addressing the background, objectives, methods, results, and conclusions of the experience. Additionally, a four-to-five page technical summary of the research experience will be prepared. This document is to be written in manuscript format, including an abstract (same as above), introduction, methods, results, and conclusions/discussion sections. Only open to students who entered the MSBS program prior to fall 2015.

GCBS 5086 Bioinformatics Part I (4 credit hours)

This course will introduce students to concepts, methods and tools in the analysis of biological information and genomic data. Bioinformatics is an inter-disciplinary field that lies at the intersection of biology, mathematics and computer science. As this is an introductory course, no programming experience is required and most of the analysis of data will leverage online tools and resources. Students are expected to enter the class with a strong background in molecular biology, biochemistry, cell biology and genetics. The course is designed to facilitate student-centered learning of core bioinformatics concepts such as literature searching, ontology development and applications, biological sequence analysis, pairwise and multiple sequence alignments, sequence database searching, homology detection, protein domain identification, protein structure modeling, structural genomics, functional genomics, comparative analysis of gene/protein function, phylogenetic analysis, and gene expression analysis. Students who successfully complete this course will be able to apply basic bioinformatics reasoning and methods to specific research questions and projects. Only open to students entering the MSBS program in fall 2015.

GCBS 5087 Medical Informatics I (4 credit hours)

This course will provide students with the technical skills necessary to use informatics technology and tools in clinical practice, medical records, data storage, retrieval and interpretation. It will also provide skills and knowledge to evaluate biomedical decision-making, and how cognitive methods can be used to develop and implement clinical practice guidelines. It will train students to use database management systems for the management, analysis and interpretation of datasets using a variety of existing software tools. Students will work on one or more informatics projects throughout the duration of the class and will acquire the necessary computational proficiency and bioinformatics knowledge needed to complete the project(s). As part of the class, students will be expected to identify, read and understand resources required to complete the project such as software manuals and previously published papers. An important theme in bioinformatics is collaboration across multiple disciplines, subsequently this class will require students to demonstrate proficiency in writing, discussing and presenting various aspects of their project to different audiences ranging from biological scientists and medical doctors to computer scientists. Students who successfully complete this class will be able to apply advanced bioinformatics reasoning and methods to specific research questions and projects. Prerequisite: GBCS 5086 (Introduction to Bioinformatics). Recommended: GBCS 5090 (Biomedical Statistics and Research Design Part I). Only open to students entering the MSBS program in fall 2015.

GCBS 5088 Medical Informatics II (2 Credit Hours)

This course will focus on the health informatics infrastructure with an emphasis on the applications and responsibilities associated with electronic medical records. The course will cover natural language processing in biomedical sciences, medical imaging informatics, ethics in medical informatics, methods for evaluating and assessing technology, electronic health records, and the management of clinical information in health care organizations. Additionally, the course will explore aspects of consumer health informatics and the application of medical informatics to public health. Prerequisite: GBCS 5087 (Medical Informatics I). Only open to students entering the MSBS program in fall 2015.

GCBS 5090 Biomedical Statistics and Research Part I (2 credit hours)

This course will introduce students to the key concepts in descriptive and inferential statistics required for the successful independent analysis of large clinical and/or biological datasets. Various topics will include central tendency, variability, statistical power, hypothesis testing, conditional probability, correlation analysis, analysis of variance, and regression analysis. An important goal of this class is to transform the student into a competent and proficient statistician who can carry out a detailed statistical analysis of real world data and explain the analysis and its significance to others. In order to achieve this goal the course will be taught in a manner that facilitates student-centered learning and requires students to work together to learn, explain and communicate statistical concepts. Students will learn to identify, understand, discuss and evaluate the statistical methods and findings presented in published research papers. Students will apply their knowledge of statistics to problem sets and projects throughout the course. Because the application of statistics requires access to powerful and scalable statistical software, this course requires students to become proficient with the freely available software package R, which is widely used in applications ranging from clinical trials to genomic analysis. Students who successfully complete this class will be able to apply statistical reasoning and methods to specific research questions and projects.

GCBS 5091 Biomedical Statistics and Research Design Part II (2 credit hours)

This course will provide students the technical skills necessary to design, manage, analyze and interpret biomedical research projects with large and complex data sets. Students will work on one or more statistical projects throughout the duration of the class and will acquire the necessary statistical and computational proficiencies needed to complete the project(s). As part of the class, students will be expected to identify, read and understand resources required to complete the project such as software manuals and previously published papers. An important theme in biomedical statistics is collaboration across multiple disciplines, subsequently this class will require students to demonstrate proficiency in writing, discussing and presenting various aspects of their project to different audiences ranging from biological scientists and medical doctors to statisticians and grant reviewers. Students who successfully complete this class will be able to apply advanced statistical reasoning and methods to specific research questions and projects. Prerequisite: GBCS 5090 (Biomedical Statistics and Research Design Part I). Only open to students entering the MSBS program in fall 2015.

GCBS 5110 Population Health & Production (2 credits)

This course will be administered by on-campus WesternU faculty and will include student derived off-campus field trips. On-campus activities will involve in depth discussions of population health and production topics including, but not limited to: biosecurity, preventive medicine programs, disease monitoring and surveillance, disease eradication and/or control in a population, evaluation and application of diagnostic tests in a herd, production record analysis as a diagnostic tool, management related health issues in populations, disease dynamics in a population, disease outbreak investigation, cost/benefit analysis of disease interventions, and timely topics or current events impacting population health and production. Each student will prepare a defensible proposal for a preventive medicine or herd health program in an animal population of their choice. These populations could include a livestock herd or flock, a stable, a kennel, a cattery, an animal shelter, a pet store, a zoo, an aquarium, etc. Students will present their proposals in written format to faculty for critical evaluation. Only open to students entering the MSBS program in fall 2015.

GCBS 5111 Veterinary Issues I (2 credits)

This course introduces the student to significant issues facing the veterinary profession, which may include public policy, biomedical ethics, and legislation affecting animals or the veterinary profession, animal welfare, public health, and veterinary career opportunities. The format includes invited presentations, small group discussions and assigned readings and projects. This and subsequent courses include material on the California Veterinary Medical Practice Act. Only open to students entering the MSBS program in fall 2015.

GCBS 5112 Laboratory Animal & Research (2 credits)

This course provides an introduction to laboratory animal veterinary medical practice. Primary laboratory animal species are identified as rodents, ferrets, rabbits, and non-human primates. Students are expected to understand individual and population based medical aspects for these species. This includes basic husbandry, bi methodology (handling, restraint, injection sites and diagnostic sample collection), assessment of animal well-being and major diseases (etiology, pathogenesis, diagnosis, treatment, health surveillance methods, prevention and zoonotic risks). Animal facility management relating to animal care, biosecurity, occupational health and safety will be addressed. Students will become familiar with local, state, and Federal regulations governing research animal care and use to understand the critical role the veterinarian plays in ensuring regulatory compliance. Only open to students entering the MSBS program in fall 2015.

GCBS 5201 Nutrient Metabolism: Macro and Micronutrients (4 credit hours)

Nutritional Biochemistry covers biochemical molecules and metabolic pathways that are essential for nutritional homeostasis, with a focus on macronutrient and micronutrient metabolism. Energy metabolism, bioenergetics, advanced metabolism of carbohydrates, lipids and proteins, vitamins, trace elements and major minerals will be covered. The influence of nutrients in these reactions will be emphasized. The relationship between energy expenditure, energy uptake, and weight loss or gain will be studied. Students will read original literature in nutrition research. Recent studies on gene expression and nutrients, free-radicals, leptins, and integration of metabolism will be discussed. Students also will become acquainted with current concepts, knowledge, and strategies for understanding nutritional genomics. Only open to students entering the MSBS program in fall 2015.

GCBS 5501 Drug Regulatory Affairs (4 credit hours)

This course will cover the structure and process of the FDA review of an IND/NDA/BLA. The course will focus on practical applications for ensuring regulatory compliance as required by FDA regulations for biologics and drug approval. Practical information and background on the structuring and assembly of INDs, NDAs and current FDA guidelines for the content of safety and efficacy data at the IND and the NDA/BLA submission stage will be covered, as well as suggestions for establishing and maintaining productive relationships with FDA. The goal is to provide a basis for understanding submission requirements and practical guidelines for compiling and submitting an IND. Actual case studies will be presented and discussed. Only open to students entering the MSBS program in fall 2015.

GCBS 5502 Quality Systems and Standards (2 credit hours)

This course will expose students to current management practices using Quality Systems Management Tools and Methodologies use to improve performance in Healthcare organizations. Students will build a foundation of knowledge to understand and discuss current societal, economic, legal and ethical issues affecting quality in the Healthcare Sector. The course will also provide the knowledge and skills needed to comply with FDA's process validation requirements while offering information on how to implement an effective validation program. In particular, it will teach students how to of implement a program that meets FDA's design control requirements while ensuring a fast and efficient flow of new products. Finally, it will provide students with an understanding of safety assurance cases and how they can be used to demonstrate the validity of safety claims made for medical devices. Only open to students entering the MSBS program in fall 2015.

GCBS 5503 Advanced Toxicology (3 credit hours)

This course will focus on the principles of toxicology and mechanisms of toxicity. Toxicology is the study of poisons. Examples of major toxic spills and human exposures will be discussed to illustrate the major adverse health effects associated with environmental toxins. Only open to students entering the MSBS program in fall 2015.

GCBS 5602 Pharmaceuticals/Biopharmaceutics (3 credit hours)

This block introduces the student to physicochemical principles and their applications in order to develop an understanding of the formulation, manufacturing, compounding, and proper use of solid dosage forms (tablets and capsules), liquid dosage forms (homogeneous and disperse systems), topicals, suppositories, aerosols, parenterals, radiopharmaceuticals, novel drug delivery systems, and veterinary products. The course includes a laboratory component in which students are required to compound various dosage forms and perform analytical studies related to them. Only open to students entering the MSBS program in fall 2015.

GCBS 6000-6501 (Advanced Topics)

This series of courses consists of a number of advanced topics courses offered in several biomedical disciplines. These courses may be seminar-style or lecture-based and/or may consist of problem-solving activities. The courses are designed to enhance the student's knowledge and understanding of specific disciplines at a more advanced level than is accomplished in the basic survey courses. No more than 6 units may be counted toward satisfaction of unit requirements for the MSBS degree.

GCBS 6000 Graduate Seminar (2-8 credit hours)

Students will select a research paper and present it to faculty members and students enrolled in the MSBS program.

GCBS 6101 Advanced Topics in Immunology (2 credit hours)

This advanced course will address concepts and principles of immunology as they relate to disease and/or disease prevention. Topics will include cells, organs, and effector systems involved in cell-mediated, humoral-mediated and innate immunity. Examination of the regulatory interactions among different components of the immune system and the deleterious effects of aberrant immune processes will occur.

GCBS 6201 Advanced Topics in Pharmacology (2 credit hours)

This advanced elective will address concepts and principles of neuronal identity and function that are germane to pharmaceutical sciences. Principles will be introduced followed by experimental applications. The course will integrate molecular, cellular, and behavioral concepts when applicable. Course topics include chemical and electrical transmission, neurotransmitter chemistry, neuroreceptor pharmacology and signal transduction mechanisms, structure and function of ion channels and ligand binding sites, synaptic plasticity with an introduction to electrophysiology. Relevant and recent primary literature articles will be introduced for reading and subsequent group discussion.

GCBS 6301 Advanced Topics in Virology (2 credit hours)

Advanced discussions on topics in virology. Classes are organized around recent papers in the virological literature. Topics include HIV, Hantavirus infection, prions, and the hepatitis viruses.

GCBS 6302 Advanced Topics in Genetics (2 credit hours)

This course is designed to focus on how genetic and molecular mechanisms influence multiple aspects of biological life. The course will cover physical and chemical properties of genes, transmission mechanisms, and processes by which genes are manifested as physical characteristics in a whole organism. The control of gene expression is an important concept covered in this course. Only open to students who entered the MSBS program prior to fall 2015.

GCBS 6303 Advanced Topics in Genomics (2 credit hours):

This course will explore genetics topics through the lens of genomics data and analysis. The course will begin with an exploration of sequenced genomes across vertebrates and the resulting knowledge about how chromosomes and genomes are organized across species. The second topic will transition into the role of genetic variation in health and disease across human, veterinary and model organism genomics data sets. Next the course will delve into whole genome expression data sets and the picture that is emerging about the role of gene expression signatures in health and disease. Finally, the last topic will consider the impact of artificial selection on animal genomics, and in particular will focus on the footprints of domestication as reported in a number of domesticated species including dogs, horses, cattle and poultry. Only open to students entering the MSBS program in fall 2015.

GCBS 6401 Advanced Topics in Structural Biology (2 credit hours)

The course will focus on understanding structure-based drug discovery. Time will be spent studying principles of macromolecular crystallization (protein, RNA, DNA), X-ray diffraction theory, data collection and processing, and macromolecular structure determination and refinement. The course will additionally review major principles of macromolecular structure determination. This advanced elective will address concepts and principles of structural biology with an emphasis on molecular structure and supramolecular assemblies, and other methods of macromolecular structure determination (Nuclear Magnetic Resonance, Electron Microscopy, Atomic Force Microscopy), as well as topics in structural genomics and modeling. Relevant and recent papers from the primary literature including industrial examples of structure based drug discovery will be introduced for reading and subsequent discussion.

GCBS 6501 Advanced Topics in Neurobiology (2 credit hours)

This advanced elective course will discuss concepts in neurobiology. It will be based in critical evaluation and discussion of recently published papers in a variety of fields in neurobiology.

GCBS 6601 Specialty Research Experience (2-4 credit hours)

Assigned laboratory experiences introducing students to the research techniques and protocols under the guidance of faculty members at Western University of Health Sciences.

GCBS 6700 Path for FDA Approval of New Drugs and Devices (3 credit hours)

This course will provide a scientific, regulatory and organizational review of the FDA drug and device approval process in the US. In addition, this course will examine the rationale underlying the agency's formation, its enforcement authority, its continued reevaluation of measures to ensure public health and ways in which this impacts the premarket approval process and post-approval marketing of new drugs. This course will also detail the logic and scientific rationale underlying requirements for preclinical, clinical testing and post market surveillance required by the FDA for drug approval and the post-marketing process. Topics covered will be FDA organization and operations; the pharmaceutical/device product development process; product characterization and pre-clinical evaluation; pharmacology/toxicology for new drugs; INDs, (Investigational New Drug Applications), clinical investigations, bioresearch monitoring; GxPs (Good xPractices) and CMC (Chemistry, Manufacturing and Control) requirements. Only open to students entering the MSBS program in fall 2015.

GCBS 6701 Directed Reading (1-5 credit hours)

This course is an independent study course consisting of individualized readings in various topics in the biomedical sciences. Directed readings allow detailed study of topics pertinent to research encountered in laboratory rotations or subjects that are not otherwise addressed in the MSBS curriculum. The student will be expected to work with an instructor to develop a reading list and to define course objectives. No more than 10 units may be counted toward satisfaction of unit requirements for the MSBS degree.

GCBS 6702 Advanced Biotechnology (2 credit hours)

This course covers advanced topics in biotechnology and their application in biomedical sciences. This is a techniques-focused course, emphasizing hands-on laboratory and computational training. Only open to students who entered the MSBS program prior to fall 2015.

GCBS 6800 Nutritional Sciences Exchange Program (8 credit hours)

Students will better understand the complex relationships between food chain, dietary habits, and human health as consumer and public health issue. Course work includes human physiology, nutrition, nutrigenomics, and nutraceuticals with emphasis on European or Mediterranean nutrition and health. Course offered January – May; language of Instruction is English. Prerequisite: Approval of Dean, GCBS or designee. Only open to students entering the MSBS program in fall 2015.

GCBS 6900 Preclinical and Clinical Studies (4 credit hours)

This course will present a detailed overview of nonclinical experimental design, current issues and trends surrounding animal use, cost/benefit considerations in preclinical planning, and strategies underlying *in vitro* and *in vivo* testing for small molecules and biologics drug development. An overview of the fundamentals of Good Laboratory Practice (GLP), Good Clinical Practice (GCP), and Good Manufacturing Practice (GMP) will be presented. The goal is to understand and emphasize the underlying scientific and regulatory principles involved in FDA's drug approval requirements, and to learn how Sponsors apply these principles when formulating successful preclinical and clinical planning strategies for drug approval. This course will also cover new and innovative models for completing preclinical and clinical requirements for drug approval; including preclinical and clinical outsourcing models, integrative development models, academic contract research models and public-private partnership models. Only open to students entering the MSBS program in fall 2015.

GCBS 6999 Research and Thesis (1-5 credit hours, CR/NCR)

Completion of a thesis is mandatory for the Master of Science in Biomedical Sciences degree program. The thesis will be based on a research project that the student will work on during their enrollment in the MSBS program. The faculty advisor (thesis advisor) will help the student select a topic and mentor the student in his/her progress. Students are expected to prepare a thesis proposal, attend regular meetings with course instructors and his/her thesis/faculty advisor. Submission and oral defense of the written thesis is required to complete the program. The last part of the thesis defense includes a comprehensive examination. Repeatable to a maximum of 6 credit hours. Only open to students who entered the MSBS program prior to fall 2015.

GCBS 7000 Research and Internship (1-6 credit hours, CR/NCR)

Completion of a portfolio is mandatory for the Master of Science in Biomedical Sciences degree program. The portfolio will be based on a research project that the student will work on during their enrollment in the MSBS program. The faculty advisor (portfolio advisor) will help the student select a topic and mentor the student in his/her progress. Students are expected to prepare a portfolio proposal, attend regular meetings with course instructors and his/her portfolio/faculty advisor. Submission and oral defense of the written portfolio is required to complete the program. The last part of the portfolio defense includes a comprehensive examination. Repeatable to a maximum of 6 credit hours. Only open to students entering the MSBS program in fall 2015.

Honors and Awards

The following awards are considered for presentation to MSBS students annually:

Dean' List

Who's Who Among Students in American Colleges and Universities

Academic Calendar

Fall 2015	
August 3-7, 2015	Orientation/Welcome Week (Year 1)
August 8, 2015	Convocation/White Coat Ceremony (Year 1)
August 10, 2015	Fall Classes Begin
September 7, 2015	Labor Day – No Classes
October 12, 2015	Columbus Day – No Classes
November 25, 2015	Thanksgiving Recess Begins @ 5:00 p.m.
November 30, 2015	Fall Classes Resume
December 18, 2015	Fall Classes End
December 21, 2015	Winter Recess Begins
Spring 2016	
January 4, 2016	Spring Classes Begin
January 18, 2016	Martin Luther King Day – No Classes
February 15, 2016	President’s Day – No Classes
March 21, 2016	Spring Break Begins
March 28, 2016	Spring Classes Resume
May 13, 2016	Spring Classes End
May 18-20, 2016	Commencement