

**Handbook**  
**for the**  
**Master of Science**  
**in**  
**Health Sciences**

**West Virginia University**  
**Health Science Center**

**April, 2014**

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## I. GOALS AND OBJECTIVES OF THE PROGRAM

The M.S. program is a terminal degree program targeting students interested in developing their skills toward a career requiring basic science knowledge. The objectives of this program are to

- (1) provide integrative scientific education in the biomedical and public health sciences to graduates from an accredited undergraduate institution
- (2) provide the opportunity to explore career options in various health professional disciplines
- (3) develop integrative and critical thinking skills to allow application of scientific knowledge to traditionally non-scientific fields
- (4) train students in the rudiments of research on a basic science, public health or clinical topic; these include hypothesis testing, data collection, manuscript preparation
- (5) enhance competitiveness for admission to a health professional and/or Ph.D. program
- (6) enhance skills for job placement including resume and cover letter evaluation, and interviewing preparation.

To achieve these objectives, our program proposes two areas of emphasis: (1) advancement of basic science and public health knowledge for career enhancement and (2) partnering basic science with other disciplines. In the first area of emphasis, students will augment their scientific skills with advanced coursework emphasizing critical thinking and application of that knowledge to problems facing human health. This area targets students interested in pursuing professional or advanced academic degrees. In the second area of emphasis, the student can expand their knowledge to allow them to direct a non-scientific career toward one that relies on a scientific skill set. Students in this area of emphasis may be teachers wishing to teach science in secondary schools, individuals interested in eventually achieving other professional degrees such as a J.D. or M.B.A. to pursue patent law or a position in a biotech/pharmaceutical company, or as a scientific liaison translating scientific knowledge to the general public in a community organization or a for profit company, a position sometimes called a knowledge broker.

Proposed coursework is designed to build the foundation knowledge common to first-year curricula in medical and dental schools and biomedical and public health Ph.D. programs. The common core curriculum will include coursework in the basic and public health sciences, biostatistics, epidemiology, and social and behavioral theory. In addition to coursework, students will participate in a series of activities:

- Preparation of an independent development plan and evaluation/aid in implementation of this plan by a faculty mentoring team
- Training in reading and evaluation of the scientific literature
- Enhancement of career development skills, be it preparation to take entrance exams or preparation of resumes and cover letters, and interviewing skills
- Participation in seminars to learn cutting edge advancements in science
- Cross-disciplinary approach to the acquiring and application of scientific knowledge
- Summer skill development sessions allowing students to participate in career development activities

In addition to the information contained in this handbook, the student is urged to consult the current Graduate School Catalog for additional information regarding the requirements of the Graduate Council at West Virginia University.

## II. ADMISSION INTO THE M.S. PROGRAM

Prospective students must have an earned bachelor's degree from an accredited university with an overall GPA of at least 3.0<sup>1</sup> and should have satisfactorily (grade of "C" or above) completed all recommended prerequisites:

1. Biology or related coursework – 1 year
2. Chemistry – 2 years
3. Physics – 1 year
4. Math through Calculus
5. Coursework in the Social or Behavioral Sciences and English

This list reflects an undergraduate program for someone interested in a science major. These are also the prerequisites for admission to many Medical or Dental schools. Students interested in preparing for these professional degrees should consult schools of interest to learn their specific requirements. Depending on the intended area of emphasis, students lacking one of these prerequisites may be able to remediate that work through taking the relevant courses concurrently with the M.S. curriculum or during summer session.

Applicants must complete the Hobson's online application and submit the following:

1. official transcripts from all undergraduate and graduate institutions attended,
2. official GRE, MCAT, or DAT scores, if test has been taken,
3. TOEFL scores, if applicable
4. personal statement describing the applicant's reasons for pursuing a career in science or the application of science to another career, and describe any relevant clinical, community service or research experience<sup>2</sup>
5. three letters of recommendation

The Admissions Committee is composed of the following individuals: Program Director – biomedical scientist, Assistant Vice President for Health Sciences Graduate Education (or appointee), representatives from the Schools of Medicine, Public Health, and Dentistry, Director of the Health Careers Opportunity Program (HCOP), and 1 student representative from either the medical, dental, biomedical, or public health programs. Review of applications will begin on Feb. 1 and proceed until all slots are filled or suitable candidates have been identified. Each applicant will be interviewed by at least two members of the Admissions Committee. Only in rare circumstances will the in person interview be waived.

Admitted students are responsible for the payment of all tuition and fees. This program does not provide a stipend. Students in need of financial aid should consult the University office of Financial aid and the Health Science Center Office of Graduate Education.

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<sup>1</sup> Under certain circumstances, the admissions committee may waive the GPA requirement.

<sup>2</sup> Students considered for admission must demonstrate the intent, passion, drive, and potential for a career in the health professions, academics, research, or other science related career. A goal is to place all graduates in rewarding career positions, and it is imperative that only students with excellent career prospects are admitted.

### III. PROGRAM ACTIVITIES

#### A. Curriculum

At the time of enrollment the students will complete an individual development plan. This plan was developed by a team of scientists and is available nationally through the American Association for the Advancement of Science ([myidp.sciencecareers.org](http://myidp.sciencecareers.org)). The student will review the results of this survey with their faculty mentors and register for the relevant coursework and activities (a minimum of 36 credit hours).

##### A.1. Core Curriculum: 29 credits

The following courses provide the core knowledge recommended for all students. Students with demonstrated ability in one or more of these courses may substitute an elective with permission of their mentors. Detailed descriptions are in Appendix B.

Courses	Code	Credits	Semester
Fundamentals of Physiology	PSIO 743 <sup>1</sup>	5	Fall
Public Health Epidemiology	EPID 601	3	Fall
Applied Biostatistics	BIOS 601	3	Fall
Applied Biostatistics Lab	BIOS 602	1	Fall
Graduate Seminar in the Basic Sciences	BMS 796	2	Fall/Spring
Graduate Seminar in Public Health Sciences	PUBH 696	2	Fall/Spring
Independent Study	BMS 795	2	Fall
General Biochemistry or Applied Pharmacology	BIOC 531 <sup>1,2</sup> PCOL 549	4 4	Spring Spring
Social & Behavioral Theory	SBHS 601	3	Spring
Independent Study	BMS 795	2	Spring
Independent Study	BMS 795	2	Summer

<sup>1</sup>PSIO 743 and BIOC 531 are part of the School of Dentistry curriculum. Students interested in admission to the WVU School of Dentistry will want to consider alternate courses or these would need to be repeated during Dental School.

<sup>2</sup>AGBI610 (Agricultural Biochemistry) offered in the Fall can be substituted based on recommendation of the mentoring team.

##### A.2. Approved Electives: 7 to 9 credits

Courses	Code	Credits	Semester
Clinical Research Methods	PUBH 662	3	Spring
Drugs: Bench to Market	PHAR 779	3	Spring
Environmental Health	OEHS 601	3	Spring
Ethical & Regulatory Aspects of Clinical Trials	PHAR 758	2	Fall
Immunology & Biotechnology	PHAR 709	3	Spring
Molecular Diagnosis in Public Health	OEHS 770	3	Spring
Pathology & Anatomy	PATH 603	6	Spring
Principles of Clinical Trials	EPID 625	3	Spring
Public Health Toxicology	OEHS 622	3	Spring
Cardiovascular (Respiratory) Sciences	BMS 793	3	Summer

### **A.3. Seminars and Journal Clubs**

Seminars and journal clubs are the easiest way to stay abreast of the latest research. In this M.S. program, they will also provide an opportunity to build critical thinking skills. Students will attend 15 (approximately 8 - BMS 796 and 7-PUBH 696) seminars over the course of the semester. Seminars will be selected from those offered weekly throughout the basic science and public health departments. These schedules are published well in advance facilitating student choice. An additional part of this course is a bi-weekly journal club. The students will meet as a group to discuss an article selected from the scientific or public health literature and relevant to the seminars occurring that semester. All students will be expected to have read the article and be prepared to discuss it as a group. The journal club will be facilitated by a member of the faculty or an advanced graduate student. Attendance of the seminars and journal clubs is mandatory. The student may have one excused absence from journal club over the course of the semester; however, the absence must be requested prior to the date, and the student will be expected to provide a one page typed summary of the paper within one week of the missed journal club. More than one absence may result in a decrease of 1 letter grade for each additional absence. Students who fail to attend a suggested seminar can make this up by attendance of another seminar and providing a one page typed summary of the seminar within one week of the make-up seminar.

### **A.4. Training in ethics:**

All students will be required to complete the online course in scientific ethics developed by CITI and available on the website for the WVU Office of Research Integrity. In addition to the core module in this training, students will also complete the optional module on plagiarism.

### **A.5. Independent study**

Each student will also design and carry out an independent research project under the guidance of his/her faculty mentors. The topic of the project should align with career interests. Examples can be found in appendix A. The end of July marks the conclusion of this project. Each student will summarize the project in manuscript format and submit it to his/her mentors for evaluation and present their project orally (12-min talk, 3-min for questions) to the other students and faculty in the program.

## **B. Summer Skill Development Activities:**

Summer semester activities will involve choices of career development activities extending over a 12-week period. Activities 1-3 listed below are on-line and self-paced. Activities 4-6 are conducted at the HSC.

1. an MCAT, DAT, or GRE pre-test to help identify areas of deficiency
2. formal MCAT or DAT preparation with targeted remediation where needed, using one of the currently available on-line courses offered by Gold Standard or Kaplan. Remediation will involve repeating the relevant portions of the test preparation course, and, for those students taking the MCAT, a review of additional materials provided by HCOP. Tutors will be made available to students.

*Note 1: In 2015, the MCAT will change to incorporate more questions pertinent to biochemistry (less organic chemistry), biostatistics, psychology, and cultural sociology. In fact, for the MCATs a fourth category will be added – psychosocial sciences – along with verbal, physical sciences, and biological sciences. With these changes in the MCAT format, options for remediation will change accordingly.*

*Note 2: The student will be responsible for a portion of the cost of the commercial test preparation course, with the remainder paid by the Program.*

3. a second MCAT, DAT, or GRE practice test to evaluate the effectiveness of any remediation
4. in-house instruction on preparing a competitive application for job placement or to medical, dental, or graduate school, with emphasis on writing a cover letter or personal statement. Faculty mentors and faculty participating in HCOP will serve as facilitators for this instruction.
5. in-house sessions on study skills, professional behavior, and effective interview skills organized by HCOP and facilitated by faculty mentors
6. opportunities for shadowing of health care providers, facilitated by HSC faculty. For students interested in medical or dental school, shadowing opportunities will be arranged by the HCOP staff and tailored to the interests of the student where possible.

#### **IV. ACADEMIC AND PROFESSIONAL STANDARDS**

##### **A. Grades**

It is expected that students will perform satisfactorily on all required courses. To remain in good standing in the program a student is required to maintain the following standards:

- a. An overall grade point average of 3.0 in graduate level coursework.
- b. Removal of any incomplete grades within one semester or summer session of their occurrence, unless special permission is granted by the Graduate Studies Committee.
- c. BMS 795 Independent Study will be graded S/U. The student should consult the course syllabus to determine what is required to achieve an S. A U in BMS 795 will result in the student being placed on probation. A second U will result in dismissal from the program.

Failure to comply with these standards will result in the student being placed on academic probation. Academic probation must be removed within one semester or it may result in dismissal from the graduate program.

##### **B. Evaluation of the Student's Progress**

The progress of each student will be reviewed by the faculty at the end of each semester. A member of the mentoring team will be responsible for presenting the progress of their respective student(s). Evaluation will include grades in academic coursework, the reports on independent study progress, and any written accolades or concerns by the advisor.

## **B.1. Student Code of Academic and Professional Integrity**

Developing and practicing high standards for professional conduct are critical for the scientist. Students should read and abide by the Student Conduct Code found at the website below. Both the University Graduate Council and the Graduate Faculty consider maintaining scientific integrity to be of utmost importance. All students are also required to complete the CITI training in Scientific Ethics. All students are directed to be familiar with the University's policy on this subject. This can be found at:

[http://oric.research.wvu.edu/rcr\\_train](http://oric.research.wvu.edu/rcr_train)

Students should pay particular attention to the avoidance of plagiarism in all writing. The University's definition of plagiarism is:

" The term "plagiarism" includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials. " (from: The Student Conduct Code;  
[http://studentlife.wvu.edu/office\\_of\\_student\\_conduct/student\\_conduct\\_code](http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code))

Students who have any questions regarding what constitutes plagiarism should request clarification from the faculty before embarking on any writing assignment. Failure to adhere to these standards of scientific integrity will result in disciplinary action by the graduate faculty and may jeopardize the student's status in the graduate program.

## **C. Vacations, Sick Leave, and Work Schedules**

The students will adhere to the University calendar and break schedule for their coursework. Because the independent study project is ongoing throughout the year, the student should expect to spend the breaks between the fall and spring semester and the spring semester and summer session, to move this project forward.

There is no plan for sick leave for students. Students who are sick will need to inform course faculty of this and arrange to get notes and make up the work. Any policies that instructors have for absences from their courses will apply to the students in this program. The student is cautioned that the degree is granted based on completion of all components and thus frequent absences can jeopardize the completion of the independent study project. As part of the student's professional training, they are advised to adopt habits that promote health, such as proper nutrition, hygiene, regular exercise, and sufficient sleep.

Students who need an extended absence (greater than 1 week) from the program due to illness, pregnancy, or personal issues will need to request a formal leave of absence from the program. The Health Science Center Guidelines need to be followed to apply for this.



## **V. STUDENT MENTORING TEAM**

### **A. Selection of the team**

At the admission's interview, the student and interviewers will work to identify an initial interest in an area of emphasis. Admitted students will be assigned faculty mentors based on this interview and the results of their individual development plan. The mentoring team will be 2 members of the graduate faculty that can provide advice relevant to student's interest and career goals.

### **B. Schedule for Mentoring Team Meetings**

The first meeting with the team should occur within the first week of the fall semester. After that, the student should have some form of interaction with the team (in person or email) at least once every 2 weeks. Face-to-face meetings should occur no less than twice a semester and every 2 weeks during the summer session.

## **VI. COMPLETION OF THE DEGREE**

### **A. Timetable for completion (from the University Catalog)**

Master's degree students are permitted to continue in a program for a maximum of eight years under their original application. Students who have been inactive for two or more years, or who do not enroll for one year after initial admission, are required to apply for, and be accepted for readmission. The application fee is assessed for reapplication. Graduate work planned with the student's advisory committee (e.g., plan of study) must be satisfactorily completed within a period of eight years immediately preceding the conferring of the degree. A course taken more than eight years previously must be revalidated if it is to be used towards meeting degree requirements. Revalidation can be accomplished by submitting the following information for approval to the Office of Graduate Education and Life:

- A letter from the course instructor listing the criteria used to revalidate the course material
- A copy of the student's performance on the student's revalidation examination
- A letter from the college/school graduate coordinator and/or dean supporting the revalidation

### **B. Admission to graduate and professional degree programs**

This course of study is designed to enhance the student's competitiveness and preparedness for admission to advanced degree programs. Students are encouraged to discuss this thoroughly with their mentoring team. Completion of the MS in Health Sciences does not guarantee admission to any program or attainment of any position.

## Appendix A. Potential Independent Study Projects

The independent study project involves 6 credits of the core curriculum and will be a research project involving either bench science, clinical research or population/public health research. The project will be with one of the mentors or heavily supervised by the mentor. The outcomes will be summarized in manuscript format as well as presented orally. Examples of potential projects are:

1. Testing of a hypothesis in a research laboratory. This would involve a hands-on experience in a research laboratory.
2. Retrospective analysis of clinical outcomes. Such projects are routinely done by medical students as research rotations or summer activities.
3. Testing of a hypothesis using existing community interventions. We have a number of projects in the HSC that involve interacting with groups in the community for specific health related interventions.
4. Secondary analysis of a national database, e.g., NHANES.
5. Participation in data management for an existing clinical or community study, e.g., the CARDIAC project.

## Appendix B. Course Descriptions

### *Core Curriculum*

Applied Biostatistics (BIOS 601). Introduces parametric and nonparametric statistical methodology, including descriptive measures, elementary probability, estimation, hypothesis testing, confidence intervals, common nonparametric methods, and base contingency table analysis. Empirically demonstrates underlying theory. *Required course for Social & Behavioral and Occupational & Environmental Health Sciences tracks of WVU Public Health Sciences Ph.D. program.*

Applied Biostatistics Lab (BIOS 602). Introduces the use of statistical software (SAS, R) to perform basic analyses. *Required course for Social & Behavioral and Occupational & Environmental Health Sciences tracks of WVU Public Health Sciences Ph.D. program.*

Applied Pharmacology (PCOL 549). Effect of drugs in humans with emphasis on application of drugs relevant to health professionals.

Fundamentals of Physiology (PSIO 743). Normal, with appropriate pathological deviations, of human biological function at molecular, cellular, organ, organ system, and whole organism levels.

General Biochemistry (BIOC 531). General introduction to biochemical compounds, processes, and concepts. Specific topics such as the biochemistry of various diseased states, enzyme mechanisms, therapeutic use of enzyme inhibitors, effects of drugs on various metabolic pathways, signal transduction, drug biotransformation, and drug resistance provide basic biochemical information for subsequent, more in-depth courses.

Graduate Seminar in Basic Sciences (BMS 796). Seminars will be selected from those offered weekly throughout the basic science departments. Students must attend 8 seminars over the course of the semester. These schedules are published well in advance facilitating student choice. An additional part of this course is bi-weekly journal club. The students will meet as a group to discuss an article selected from the scientific literature and relevant to the seminars occurring that semester. This activity will build their critical thinking skills.

Graduate Seminar in Public Health Sciences (PUBH 696). Seminars will be selected from those offered throughout the Public Health departments. Students must attend 7 seminars over the course of the semester. An additional part of this course is bi-weekly journal club. The students will meet as a group to discuss an article selected from the scientific literature and relevant to the seminars occurring that semester. This activity will build their critical thinking skills.

Independent Study (BMS 795). The faculty mentors will supervise the student in an independent research project developed based on the results of their individual development plan and their area of emphasis. Student projects will be completed during the summer semester.

Public Health Epidemiology (EPID 601). Examines mortality and morbidity trends, disease and injury models, data sources classification, measures of frequency and association, research

design, causal assessment, data interpretation, and screening from an epidemiological perspective.

Social and Behavioral Theory (SBHS 601). Role of individual behavior in attaining health. Integration of the concepts of health education and behavioral science to facilitate changes in health behavior.

*Suggested Electives:*

Clinical Research Methods (PUBH 662). Work with faculty and staff in the Emergency Department of Ruby Memorial Hospital and participate in a variety of research projects. Has a didactic component that focuses on clinical research design and clinical “shifts” in the Emergency Department where students learn how to identify, approach, consent, and enroll patients into clinical studies. Stresses data collection methods, research design, professional responsibility, and independent thinking. Research techniques that can be applied to a wide variety of cardiovascular, neurological, trauma and social services emergency care research, and experience developing practicum projects.

Drugs: Bench to Market (PHAR 779). Process of drug discovery to the development of new forms for therapeutic use. Topics covered include drug design/discovery, pharmacokinetics and dynamics, pharmaceuticals, and industry pharmacy.

Environmental Health (OEHS 601). Responsibilities and roles of public health work force in identifying, managing and preventing casualties from environmental causes in air, water, soil, food, pesticides, and related subjects. WV policy dilemmas.

Ethical and Regulatory Aspects of Clinical Research (PHAR 758). History, guidance, and framework for ethical clinical research; IRB review, informed consent and investigator panel; subject selection, coercion and undue inducement and ethics of research with children; risks and benefits, research with adults who cannot consent and participant panel; ethics and international research; ethics of randomized clinical trials, the use of placebo in trials and conflicts of interest; research use of stored tissue and data and incidental findings, and RCR sessions covering topics such as mentoring and research misconduct. *Ethics is emphasized in medical and dental curricula and graduate curricula.*

Immunology and Biotechnology (PHAR 709). Basic functions of the immune system, pharmaceutical applications of biotechnology, and introduction to chemotherapy of infections.

Molecular Diagnosis in Public Health (OEHS 770). Overview of interdisciplinary approaches in molecular diagnosis and prognosis for personalized patient care. Knowledge of genome-wide association studies. Description of methodologies in applying gene profiling for personalized therapy. Latest advances in molecular biology, cell biology, pharmacology, high throughput microarrays, translational and pre-clinical research, and commonly used biostatistics techniques and bioinformatics tools. Techniques for research design, data retrieval from public databases (i.e., GEO, NCBI, SEER, and ONCOMINE), and experimental analysis and interpretation.

Pathology and Anatomy (PATH 603). Gross and microscopic human anatomy including embryology, histology and microanatomy lab. *Anatomy is taught in the 1<sup>st</sup>-year curricula to medical and dental students.*

Principles of Clinical Trials (EPID 625). Core elements of clinical trials and critical evaluation of clinical trial literature; designing original clinical trials and developing grant proposals in clinical trial research.

Public Health Toxicology (OEHS 622). Principles of toxicology that pertain to human health and the environment and integration of these principles into public health practice.

Translational Cardiovascular/Respiratory Science (BMS 793). This course was implemented in the summer of 2013 and was designed to integrate knowledge in both disciplines. The course last summer focused on cardiovascular disease. Examples of topics covered included vascular tone and arterial pressure for the physiology sessions, cardiomyopathy and stroke for the clinical applications, and socio-economic determinants and health policy of cardiovascular disease for the public health sessions.

## Signature Page

I have read and understand the Handbook of the Master of Science in the Health Sciences. I agree to abide by the requirements outlined in this document as well as the University requirements governing these degrees.

Signature: \_\_\_\_\_

Name (printed): \_\_\_\_\_

Date: \_\_\_\_\_

I pledge to adhere to the Student Code of Academic and Professional Integrity for the Ph.D. and M.S. degree programs:

[http://studentlife.wvu.edu/office\\_of\\_student\\_conduct/student\\_conduct\\_code](http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code)

and to maintain the highest standard of scientific integrity in all that I do.

Signature: \_\_\_\_\_

Name (printed): \_\_\_\_\_

Date: \_\_\_\_\_