

# Toxicology

University Park, College of Agricultural Sciences (TOX)

PROFESSOR JAMES ENDRES HOWELL, Program Coordinator

Toxicology addresses adverse effects of chemicals on animals and humans and includes exposure assessment, hazard identification, dose–response analysis, and risk characterization. This discipline relies on cutting–edge biotechnological approaches to gain insight into drug and toxicant action at the molecular level. Students enrolled in the Toxicology program will develop an understanding of the principles by which chemicals affect the health of humans and animals either adversely, as toxic agents, or beneficially, as therapeutic agents. Students will learn about: 1) mechanisms of action of drugs and toxicants on organ systems of the body; 2) general principles for assessing the safety of chemicals and therapeutic efficacy of drugs; and 3) state–of–the–art molecular, biological, and genetic approaches to understanding drugs, toxicants, and disease through a combination of laboratory and lecture experiences. The B.S. degree in Toxicology provides a strong foundation for graduate work leading to a Ph.D. in most biomedical fields. Students may choose to pursue a Ph.D. degree in Pharmacology, Toxicology, Biochemistry, Physiology, Pathobiology, Oncology, or Molecular Biology. Alternatively, students prepare for employment as research technicians, drug/toxicant specialists, or pharmaceutical sales representatives.

In order to be eligible for entrance to the Toxicology major, a student must have: (1) attained at least a 2.00 cumulative grade point average and (2) completed BIOL 110 GN (4), BIOL 230W(4), CHEM 110 GN(3), CHEM 111 GN(1), CHEM 112 GN(3), CHEM 113 GN (1), MATH 140 GQ(4), MATH 141 GQ(4) and earned a grade of C or better in each of these courses.

For the B.S. degree in Toxicology, a minimum of 124 credits is required.  
Scheduling Recommendation by Semester Standing given like (Sem: 1–2)

**GENERAL EDUCATION:** 45 credits

(18 of these 45 credits are included in the REQUIREMENTS FOR THE MAJOR)

(See description of General Education in this bulletin.)

**FIRST–YEAR SEMINAR:**

(Included in ELECTIVES or GENERAL EDUCATION course selection)

**UNITED STATES CULTURES AND INTERNATIONAL CULTURES:**

(Included in ELECTIVES or GENERAL EDUCATION course selection)

**WRITING ACROSS THE CURRICULUM:**

(Included in ELECTIVES, GENERAL EDUCATION course selection, or REQUIREMENTS FOR THE MAJOR)

**ELECTIVES:** 10–11 credits

**REQUIREMENTS FOR THE MAJOR:** 86–87 credits

(This includes 18 credits of General Education courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses.)

**PRESCRIBED COURSES** (64 credits)

BIOL 110 GN(4), CHEM 110 GN(3), CHEM 111 GN(1), CHEM 112 GN(3), CHEM 113 GN(1), MATH 140 GQ(4), MATH 141 GQ(4) (Sem: 1–2)

BIOL 230W GN(4), CHEM 210(3), CHEM 212(3), CHEM 213(2), PHYS 250 GN(4), PHYS 251 GN(4), VB SC 231(3)[1] (Sem: 3–4)

B M B 401(3), B M B 402(3), VB SC 330(3)[1] (Sem: 5–6)

VB SC/E R M 431(3)[1], VB SC 430(3)[1], VB SC 433(3)[1], VB SC 451(3)[1] (Sem 7–8)

**ADDITIONAL COURSES** (13–14 credits)

Select 3 credits from AG BM 101 GS(3), ECON 102 GS(3), ECON 104 GS(3) (Sem: 1–2)

Select 4 credits from BIOL 220W GN(4) or BIOL 240W GN(4) (Sem: 3–4)

Select 3–4 credits from STAT 200 GQ(4), STAT 240 GQ(3), or STAT 250 GQ(3) (Sem: 3–4)

Select 3 credits from AN SC 423(3)[1] or BIOL 472(3)[1] (Sem: 5–6)

**SUPPORTING COURSES AND RELATED AREAS** (9 credits)

Select 9 credits of 400–level courses from department list[1] (Sem: 5–8)

[1] A student enrolled in this major must receive a grade of C or better, as specified in Senate Policy 82–44.

# Justification

We are submitting proposals for refinements to the bachelors degree requirements in our programs in Toxicology and Immunology and Infectious Disease (IID) in order to achieve two major objectives: (1) to bring the two programs into parity with respect to Entrance-to-Major (ETM) and graduation requirements and credits; and (2) to distinguish the degree requirements of the two programs such that students must complete a higher number of credits in order to complete both degrees concurrently.

The revised program (section A, above) reflects the following proposed changes to the degree requirements for Toxicology:

1. Introducing ETM requirements and adding C or better requirements for upper-level courses.
2. Eliminating the 6.0 credit organic chemistry sequence CHEM 202, 203 as a selection (leaving only the 8.0 credit sequence CHEM 210, 212, 213).
3. Eliminating the 200-level biochemistry sequence B M B 211, 212, 221 as a selection (leaving only the 400-level sequence B M B 401, 402).
4. Adding an economics selection.

The Immunology and Infectious Disease degree already includes those requirements; those four changes will bring parity between the two programs.

In addition, we propose to change the current 12.0 credit requirement for the 200-level ecology/evolution, molecular/cellular, and development/physiology sequence (BIOL 220W, 230W, 240W) to an 11.0 credit requirement for BIOL 230W, a choice between BIOL 220W or 240W, and a requirement for VB SC 231 "Introduction to Cancer Research and Medicine," a sophomore-level introduction to topics in toxicology, pharmacology, and carcinogenesis. Paralleling the requirement in IID for VB SC 211 "The Immune System and Disease," the aim of the course and its timing in the curriculum is to allow first and second year students to evaluate their major choice informed by an introductory course completed before ETM. We note that this change eliminates the common route for students to earn the W (writing across the discipline) general education requirement, by taking all three BIOL courses in the sequence. However, that situation is already common, as many students switch into the program after their third semester, making various substitutions for those courses, and

subsequently complete the W requirement with a 400-level selection that also fulfills the “supporting courses and related areas” requirement (most often our courses VB SC 402W “Biology of Animal Parasites” and VB SC 423W “Pathology of Nutritional and Metabolic Diseases,” but including many others in the college and across the University). Thus we anticipate accommodating this emergent demand with existing mechanisms.

Finally, we propose to add the requirement for VB SC 451 “Immunotoxicology of Drugs and Chemicals” on the basis of its strengthening the curriculum with relevant content, as well as bringing the number of credits required for both programs into closer parity (and increasing the number of credits required for students to complete the programs concurrently).

The remaining changes reflect routine substitutions that we approve so commonly that they merit explicit inclusion in the curriculum (STAT 240 for STAT 200, 250), or mere clerical changes (E R M 431 is now crosslisted as VB SC 431).

# Immunology and Infectious Disease

University Park, College of Agricultural Sciences (IID)

PROFESSOR JAMES ENDRES HOWELL, Program Coordinator

Immunology is the study of how animals and humans protect themselves from pathogens. Understanding basic mechanisms of immunity provides insights into how blood cells develop and how pathogens are recognized and attacked. Furthermore, understanding the concepts behind immunology is necessary for drug and vaccine design. Dysregulation of the processes that regulate immunity can contribute to uncontrolled inflammation, tissue destruction, autoimmunity, immunodeficiencies, leukemia and related cancers. Immunology includes a broad range of disciplines including but not limited to microbiology, virology, animal health, genetics, biochemistry, molecular and cell biology. Students enrolled in the Immunology and Infectious Disease Major will develop and understanding of normal immune responses to bacterial, fungal, and viral agents and appreciate the potential pathological outcomes of these responses. Students will learn about events that shape the immune response; the general biology of pathogens and the mechanisms by which they cause disease. In addition, basic skills in microbiology, molecular biology and biochemistry will be acquired. Students completing a B.S. degree in Immunology and Infectious Disease will be well prepared for veterinary, medical or other professional schools, Ph.D. graduate training in a wide variety of areas including immunology, microbiology, virology, molecular medicine, animal science, molecular biology and biochemistry or highly competitive jobs as research technicians, laboratory assistants or sales representatives with a pharmaceutical company.

In order to be eligible for entrance to the Immunology and Infectious Disease major, a student must have: (1) attained at least a 2.00 cumulative grade point average and (2) completed BIOL 110 GN(4), BIOL 230W(4), CHEM 110 GN(3), CHEM 111 GN(1), CHEM 112 GN(3), CHEM 113 GN(1), MATH 140 GQ(4), MATH 141 GQ(4) and earned a grade of C or better in each of these courses.

For the B.S. degree in Immunology and Infectious Disease, a minimum of 124 credits is required.

Scheduling Recommendation by Semester Standing given like (Sem: 1-2)

**GENERAL EDUCATION:** 45 credits

(18 of these 45 credits are included in the REQUIREMENTS FOR THE MAJOR)

(See description of General Education in this bulletin.)

**FIRST-YEAR SEMINAR:**

(Included in ELECTIVES or GENERAL EDUCATION course selection)

**UNITED STATES CULTURES AND INTERNATIONAL CULTURES:**

(Included in ELECTIVES or GENERAL EDUCATION course selection, or REQUIREMENTS FOR THE MAJOR)

**ELECTIVES:** 5–8 credits

**REQUIREMENTS FOR THE MAJOR:** 89–92 credits

(This includes 18 credits of GENERAL EDUCATION courses: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses.)

**PRESCRIBED COURSES** (63 credits)

BIOL 110 GN(4), CHEM 110 GN(3), CHEM 111 GN(1), CHEM 112 GN(3), CHEM 113 GN(1), MATH 140 GQ(4), MATH 141 GQ(4) (Sem: 1–2)

BIOL 230W GN(4), CHEM 210(3), CHEM 212(3), CHEM 213(2), PHYS 250 GN(4), PHYS 251 GN(4), VB SC 211 GN(3) [1] (Sem: 3–4)

B M B 401(3), B M B 402(3), MICRB 201(3), MICRB 202(2), MICRB 410(3) [1], VB SC 444 (3) [1] (Sem: 5–8)

VB SC 448W(3) [1] (Sem: 7–8)

**ADDITIONAL COURSES** (17–20 credits)

Select 3 credits from AG BM 101 GS(3), ECON 102 GS(3), ECON 104 GS(3) (Sem: 1–2)

Select 4 credits from BIOL 220W GN(4) or BIOL 240W GN(4) (Sem: 3–4)

Select 3–4 credits STAT 200 GQ(4), STAT 240 GQ(3), or STAT 250 GQ(3) (Sem: 3–4)

Select 7–9 credits VB SC 418(2) [1], VB SC/MICRB/B M B 432(3) [1], VB SC/MICRB 435 (2), VB SC 445(3) [1], VB SC 451(3) [1] (Sem: 5–8)

**SUPPORTING COURSES AND RELATED AREAS** (9 credits)

Select 9 credits of 400-level courses from departmental list[1] (Sem: 5–8)

[1] A student enrolled in this major must receive a grade of C or better, as specified in Senate Policy 82–44.

# Justification

We are submitting proposals for refinements to the bachelors degree requirements in our programs in Toxicology and Immunology and Infectious Disease (IID) in order to achieve two major objectives: (1) to bring the two programs into parity with respect to Entrance-to-Major (ETM) and graduation requirements and credits; and (2) to distinguish the degree requirements of the two programs such that students must complete a higher number of credits in order to complete both degrees concurrently.

The revised program (section A, above) reflects the following proposed changes to the degree requirements for Immunology and Infectious Disease:

Presently, students complete two selections from among VB SC 418 “Bacterial Pathogenesis,” VB SC 432 “Advanced Immunology: Signaling in the Immune System,” and VB SC 435 “Viral Pathogenesis.” Meanwhile we are not able to offer VB SC 445 “Molecular Epidemiology of Infectious Diseases” (a laboratory course with limited space) often enough to satisfy demand, so we recommend that students complete all three of VB SC 418, 432, and 435 and substitute one (usually 432) for 445. Finally, we recently added VB SC 451 “Immunotoxicology of Drugs and Chemicals” to the catalog. Thus we propose to broaden the requirement to three selections from these five courses.

Please note also that the order of the “Prescribed Course” was changed somewhat, and scheduling recommendations by semester standings added, in order that the logic and sequence of these requirements be more obvious (and similar to the entry for Toxicology).

The remaining changes reflect routine substitutions that we approve so commonly that they merit explicit inclusion in the curriculum (BIOL 240W for BIOL 220W).