1. Students lacking background equivalent to the following courses should enroll in these courses which they could have taken as an undergraduate.

**099:110 Biochemistry** 3 s.h.
Chemistry, metabolism, molecular biology of living systems. Prerequisites: two semesters of general chemistry, one semester of organic chemistry, and one of the following: a life science course, an additional organic chemistry course, or consent of instructor.

**or**

**099:120 Biochemistry and Molecular Biology I** 3 s.h.
Structures of nucleic acids, proteins, carbohydrates, lipids, and their participation in cellular transport, catalysis, oxidative reactions; first course of two-semester course that concludes with 099:130. Prerequisites: two semesters of general chemistry and one of organic chemistry.

**and**

**099:130 Biochemistry and Molecular Biology II** 3 s.h.
Molecular dynamics of biological systems, metabolism of lipids and nitrogen-containing compounds; information transfer in prokaryotes, eukaryotes; recombinant DNA techniques; chemistry and enzymology of replication, transcription, translation, cell transformation, regulation of gene expression. Prerequisite: 099:120.

2. At least 6 s.h. from the following courses (3 s.h. from Group A and 3 s.h. from Group B).

**Group A**

**002:171 Molecular Genetics** 4 s.h.
Mechanism, regulation of RNA, DNA, protein biosynthesis, with emphasis on methods of genetic analysis; application of modern recombinant DNA techniques to basic problems. Open only to undergraduates and first-year graduate students. Prerequisite: 002:128 or 099:120.

**156:201 Fundamentals of Gene Expression** 1 s.h.
This course will cover topics of DNA and RNA structure, nuclear organization, DNA replication, RNA production and processing, small RNAs, RNAi and genetic and epigenetic regulation. Instruction will include didactic and small group sessions, with discussion of primary research publications.

**156:202 Fundamentals of Protein Regulation** 1 s.h.
This course will cover topics of protein structure, purification, analysis, production, post-translation modification and cellular trafficking. Instruction will include didactic and small group sessions, with discussion of primary research publications.

**156:203 Fundamentals of Dynamic Cell Processes** 1 s.h.
This course will give an overview of the following topics: actin, microtubules, motors, intermediate filaments, cell-cell junctions, G-coupled signaling, wnt-jak/stat signaling, ion channels, cell cycle, and stem cells.

Group B

002:170 Bioinformatics 3 s.h.
Basics of genetics and molecular biology; overview of bioinformatics and genome science, including genome projects, functional genomics, phylogenetics, proteomics, microarrays, DNA polymorphisms, data-mining algorithms; experimental methods, analytical approaches. **Prerequisite:** 002:128 or 099:120 or graduate standing or consent of instructor. Same as 055:121, 127:170.

002:168 Genes and Development 3 s.h.
Mechanisms by which genes control development; methodology of scientific research applied to developmental genetics. Open only to seniors and graduate students. Offered spring semesters. **Prerequisite:** 002:128.

002:162 Population Genetics and Molecular Evolution 3 s.h.
Nucleotide sequences, genes, and mutation; rates and patterns of nucleotide substitution; selection at the molecular level and the neutral theory; population genetics theory; genome evolution. **Prerequisite:** grade of C- or higher in 002:128 or consent of instructor.

3. During the first two years in residence, all Ph.D. students are required to take at least two 2 s.h. seminar courses with a significant writing and oral presentation component, one of which must be 002:234 Writing in Natural Science 2 s.h.

and the 2nd seminar can be the following:

002:191 Topics in Molecular Genetics 2 s.h.

Following comprehensive examinations, Ph.D. students must take at least two additional 2 s.h. seminar courses. Seminar courses from other departments require approval by the Graduate Affairs Committee in consultation with the faculty advisor to satisfy the requirement. All M.S. candidates are required to take one 2-s.h. seminar course with a significant writing and oral presentation component. After completing the minimum requirement, students are strongly encouraged to continue to take one 1-s.h. seminar (oral presentation only) each year.