
Microbiology and Molecular Biology

Brent L. Nielsen, Chair
775 WIDB, (801) 422-1102
Internet: <http://www.mmbio.byu.edu>

Department Advisement
Elaine Rotz
767 WIDB, (801) 422-4293

College of Biology and Agriculture Office of Academic Advisement
379 WIDB, (801) 422-3042

Admission to Degree Program

All degree programs in the Department of Microbiology and Molecular Biology are open enrollment. However, special limitations apply for clinical laboratory science.

The Discipline

The Microbiology and Molecular Biology Department offers degrees in microbiology, molecular biology, and clinical laboratory science. A wide range of courses may be incorporated into a program of study, including: ecology, genetics, immunology, microbial physiology, molecular biology, molecular evolution, parasitology, pathogenesis, and evolution.

Career Opportunities

Graduates are employed in a wide variety of positions in industry, hospitals, government agencies, and universities. Majors from this department are an excellent preprofessional course of study for those interested in medicine, dentistry, law, or business.

The following courses are recommended for those students interested in graduate and professional programs:

Chem 351, 352, 353, 481.
Math 119 or higher.
Phscs 105, 106, 107, 108.
Stat 221.

Graduation Requirements

To receive a BYU bachelor's degree a student must complete, in addition to all requirements for a specific major, the following university requirements:

- The university core, consisting of requirements in general and religious education (See the University Core section of this catalog for details. For a complete listing of courses that meet university core requirements, see the current class schedule.)
- A minimum of 30 credit hours in residence
- A minimum of 120 credit hours
- A cumulative GPA of at least 2.0

Undergraduate Programs and Degrees

BS Clinical Laboratory Science
BS Microbiology
BS Molecular Biology
Minors Microbiology
Molecular Biology

Students should see their advisor for help or information concerning the undergraduate programs.

Graduate Programs and Degrees

MS Microbiology
MS Molecular Biology
PhD Microbiology
PhD Molecular Biology

For more information see the BYU 2007–2008 Graduate Catalog.

BS Clinical Laboratory Science (62 hours*)

This is a limited-enrollment program requiring departmental admissions approval. Please see the department office for information regarding requirements for admission to this major.

Students who want to practice clinical laboratory science/medical technology in diagnostic laboratories or pursue related options choose this degree. The program in clinical laboratory science is accredited by the National Accrediting Agency for Clinical Laboratory Sciences (8410 West Bryn Mawr Avenue, Suite 670, Chicago, IL 60631, [773] 714-8880).

Admittance Requirements

1. Students must complete the following courses before applying to the program: Biol 240, 340; MMBio 151, 361.
2. Application deadlines are March 1 for fall semester and October 1 for winter semester admittance.

Major Requirements

1. Complete the following biology core requirements:
Biol 120, 220, 240, 241, 340, 360.
2. Complete the following chemistry courses:
Chem 105, 106, 107, 285.
3. Complete the following microbiology courses:
MMBio 102, 151, 361.
4. Complete the following:
MMBio 392, 393, 394, 395, 407, 417, 420, 421, 491.
5. Complete an internship experience. During one semester and one term, complete at least 2 hours from the following:
MMBio 399R.

Recommended Courses

Engl 316.
PDBio 220, 305.
Stat 221.

*Hours include courses that may fulfill university core requirements.

BS Microbiology (61–67 hours*)

This is the preferred degree for microbiology majors who desire an advanced degree (master's or doctorate) in microbiology.

Major Requirements

1. Complete the following biology core requirements:
Biol 120, 240, 241, 360.
2. Complete the following chemistry courses:
Chem 105, 106, 107, 351, 352, 353, 481.
3. Complete the following microbiology courses:
MMBio 151, 361.
4. Complete four courses from the following:
MMBio 460, 461, 462, 463, 464, 465.
Note: MMBio 465 can be taken with or without the MMBio 466 lab (1 hour).
5. Complete one of the following options:
Either Phscs 105, 106.
Or Stat 221.

Microbiology and Molecular Biology

6. Complete at least 10 hours from the following:
Biol 340, 350, 420, 421.
Chem 482.
MMBio 390R, 399R, 407, 417, 430, 441, 442, 466, 494R, 554.
MMBio 460, 461, 462, 463, 464, 465 (courses not chosen under item 4 above).
NDFS 361.
PAS 514.



Note: Only 3 hours of MMBio 399R and 494R combined will count toward major hours.

Recommended Course

Engl 316.
Math 119 or Math 112, 113.
Phscs 107, 108

Note: Students desiring a minor in chemistry must take Chem 223 and 2 hours of Chem 353.

*Hours include courses that may fulfill university core requirements.

BS Molecular Biology (64–68 hours*)

Major Requirements

1. Complete the following biology core requirements:
Biol 120, 240, 241, 340, 360, 420.
2. Complete the following chemistry courses:
Chem 105, 106, 107, 351, 352, 481.
3. Complete at least one hour from the following:
Chem 353.
4. Complete the following molecular biology courses:
MMBio 264, 390R, 441, 442, 490R.
5. Complete two registrations of the following (not same semester or term) for a total of 3 hours as approved by mentor:
MMBio 494R.
6. Complete one of the following options:
Either Math 119
Or Math 112, 113.
7. Complete the following:
Phscs 105, 106.
8. Complete at least 10 hours (one of which must include a lab) from the following:
Chem 461, 468, 482, 581, 584†, 586†.
InBio 465†.
MMBio 151†, 361, 399R, 430, 460†, 463†, 465, 466†.
PAS 486, 525, 580†.
PDBio 482†, 582.

Note: Only 3 hours of MMBio 399R will count toward major hours.



Note: † indicates a course with lab included.

Recommended Courses

Engl 316.
Phscs 107, 108.
Stat 221.

*Hours include courses that may fulfill university core requirements.

Minor Microbiology (14–16 hours, plus prerequisites in coupled major)

Minor Requirements

1. Complete the following:
MMBio 151, 361.
2. Complete two courses from the following (at least one must have a lab component):
MMBio 460, 461, 462, 463, 464, 465.

Minor Molecular Biology (11 hours, plus prerequisites in coupled major)

Minor Requirements

1. Complete the following:
MMBio 264, 441, 442.
2. Complete at least 3 hours from the following:
Biol 420.
Chem 461, 468, 482, 581, 584, 586.
InBio 465, 494R.
MMBio 151, 361, 399R, 430, 460, 461, 463, 465, 466, 494R.
NDFS 494R.
PAS 486, 494R, 525, 580.
PDBio 482, 494R, 582.

Note: Be aware of prerequisites for the above courses (usually filled in a coupled major).

Microbiology and Molecular Biology (MMBio)

Undergraduate Courses

102. Introduction to Clinical Laboratory Techniques. (1:0:3) F, W
Hospital laboratory techniques.

151. Introduction to Microbiology. (4:3:3) F, W Prerequisite: Biol 120, Chem 105, concurrent enrollment in Biol 240.

Principles of prokaryotic biology emphasizing cell structure, function, and metabolism. Introduction to bacterial genetics, microbial diversity, and microbial ecology.

221. General Microbiology. (3:3:0) F, W, Sp Independent Study also. Honors also. Prerequisite: any chemistry course and any biology course.

Microbial world, emphasizing communicable diseases, their causes, and control. Recommended for students seeking a liberal education in microbiology who do not have the prerequisites to take the more advanced courses.

222. General Microbiology Laboratory. (1:0:2) Prerequisite: MMBio 221 or concurrent enrollment.

264. (MMBio–InBio 265–PAS 265) Genomics. (3:2:1) F, W Prerequisite: bioinformatics major status or Biol 120.

Introduction to genomics and genome projects (human, plant, bacterial, yeast, parasites). Introduction to genes and genomes; computational and statistical approaches for analyzing genomic data, including genome sequencing and annotation, gene expression, and the transcriptome, proteomics and functional genomics, and genetic variation and SNPs.

361. Infection and Immunity. (4:4:0) F, W Prerequisite: MMBio 151 or 221 or equivalent.

Principles of infectious organisms (principally bacteria and viruses), the diseases they cause, and the role of host immune responses in health and disease.

362R. Survey of Careers in Microbiology. (1:Arr:Arr. ea.) F, W Lectures and field trips surveying career choices.

390R. Readings in Molecular Biology. (1:1:0 ea.) F, W Prerequisite: Biol 360.

Selected readings in molecular biology.

392. Hematology. (2.5:2.5:1) W Prerequisite: clinical laboratory science program acceptance.

Normal and abnormal hematology.

393. Immunohematology and Coagulation Theory. (2.5:2.5:1) W Prerequisite: clinical laboratory science program acceptance.

Theory and practice of bloodbanking and coagulation theory.

394. Practical Hematology. (2:0:7) W Prerequisite: MMBio 392 or concurrent enrollment.

Laboratory to accompany MMBio 392; medical laboratory techniques in hematology.

395. Practical Immunohematology and Coagulation Theory. (2:0:7) W Prerequisite: MMBio 393 or concurrent enrollment.

Laboratory to accompany MMBio 393; medical laboratory techniques in immunohematology and coagulation theory.

399R. Academic Internship. (1–9:0:40 ea.) F, W, Sp, Su Prerequisite: mentor's consent.

Approved experiential learning.

407. Clinical Microbiology. (4:2:6) W Prerequisite: MMBio 453. Approaches to laboratory diagnosis of infectious diseases.

417. Medical Parasitology. (3:2:3) F Prerequisite: Biol 100 or equivalent.

Pathogenesis, diagnosis, and epidemiology of human parasitic diseases. Laboratory included.

420. Pathophysiology and Laboratory Diagnosis in Clinical Chemistry. (5:4:2) F Prerequisite: clinical laboratory science program acceptance.

Laboratory diagnosis of disorders involving the major systems of the human body.

421. Laboratory Techniques in Clinical Chemistry and Diagnostic Molecular Biology. (4:0:14) F Prerequisite: concurrent enrollment in MMBio 420.

Medical laboratory techniques in urinalysis, clinical chemistry, and diagnostic molecular genetics.

430. Advanced Cell Biology. (3:3:0) F Prerequisite: Biol 360; bioscience major status.

Molecular genetics, cell biology, and developmental biology.

441. Advanced Molecular Biology. (3:3:0) W Prerequisite: Biol 240, Chem 352.

Molecular biology of gene structure and expression in prokaryotic and eukaryotic organisms.

442. Advanced Molecular Biology Laboratory. (2:0:6) W Prerequisite: Biol 241; MMBio 441 or concurrent enrollment.

Laboratory to accompany MMBio 441.

460. Microbial Genetics. (4:3:3) F, W Prerequisite: MMBio 151.

How DNA governs complex bacterial functions. Classical and modern approaches to gene discovery, including genetic screens, gene mapping, targeted genetic manipulations, and analyzing gene activity.

461. Advanced Bacterial Physiology. (3:3:0) W Prerequisite: Chem 481, MMBio 151.

Principles of prokaryotic physiology, including cell structure and function, gene regulation, and biochemical processes; focusing on the unique aspects of prokaryotic biology.

462. Microbial Ecology. (3:2:3) F Prerequisite: Biol 240, MMBio 151.

Natural history of a microbe; its distribution and abundance. Critical influence of scale and perspective in determining underlying mechanisms.

463. Immunology. (4:3:3) F, W Prerequisite: Biol 240, MMBio 361. Advanced concepts of immunological processes.

464. Medical Microbiology. (4:3:3) F, W Prerequisite: MMBio 361. Pathogenesis of diseases in humans caused by bacteria.

465. Virology. (3:3:0) F, W Prerequisite: MMBio 361 or equivalent.

Basic principles of virology, emphasizing selected molecular aspects of virus life cycles and disease processes.

466. Virology Laboratory. (1:0:3) F, W Prerequisite: MMBio 361; 465 or concurrent enrollment.

Laboratory exercises illustrating in vitro behavior of selected viruses. Developing laboratory skills for virus studies.

490R. Molecular Biology Seminar. (1:1:0 ea.) F, W Prerequisite: MMBio 441; senior status.

Critical examination of current literature and research in molecular biology.

491. Concept Applications in Laboratory Medicine. (1:1:0) F Prerequisite: acceptance into clinical laboratory science program. Case presentations of various medical disorders.

494R. Mentored Research. (1–3:Arr.:Arr. ea.) F, W, Sp, Su Prerequisite: mentor's consent.

Mentored research.

499R. Senior Honors Thesis. (1–3:Arr.:Arr. ea.) F, W, Sp, Su Prerequisite: topic to be cleared with Honors Program and Department of Microbiology and Molecular Biology.

500-Level Graduate Courses (available to advanced undergraduates)

518. Select Pathogens. (2:2:0) F odd yr. Prerequisite: MMBio 453 or equivalent.

Current literature in special pathogens.

551R. Current Topics in Microbiology and Molecular Biology. (1–3:Arr.:0 ea.) On dem.

Readings from current literature on a specific topic; student presentations and discussion.

554. Molecular Virology. (2:2:0) Prerequisite: MMBio 354, 454; or equivalents.

Molecular mechanisms of virus architecture, attachment and entry pathways, replication strategies, oncogenesis, evolution, and mechanisms of pathogenesis.

557. Genes and Cancer. (2:2:0) W odd yr. Prerequisite: MMBio 441 or equivalent.

Molecular basis of human cancers, emphasizing oncogenes, tumor suppressor genes, chromosomal instability, hereditary cancers, chemical and physical carcinogens, and viral carcinogenesis.

Graduate Courses

For 600- and 700-level courses, see the BYU 2007–2008 Graduate Catalog.

Microbiology and Molecular Biology Faculty

Professors

Anderson, Shauna C. (1974) AS, Ricks Coll., 1965; BS, Brigham Young U., 1967; MS, U. of Utah, 1973; PhD, U. of Washington, 1984.

Bradshaw, William S. (1970) BA, Harvard U., 1963; PhD, U. of Illinois, 1968.

Harker, Alan R. (1994) BS, PhD, U. of Utah, 1976, 1982.

Johnson, F. Brent (1972) BS, MS, PhD, Brigham Young U., 1966, 1967, 1970.

Murray, Byron K. (1983) AS, Ricks Coll., 1964; BS, MS, PhD, Brigham Young U., 1966, 1969, 1971.

Nielsen, Brent L. (2000) BS, Brigham Young U., 1980; PhD, Oregon State U., 1985.

O'Neill, Kim L. (1992) BSc, DPhil, New U. of Ulster, Northern Ireland, 1984, 1986.

Robison, Richard A. (1991) BS, MS, PhD, Brigham Young U., 1978, 1980, 1988.

Associate Professors

Bridgewater, Laura C. (1999) BS, Brigham Young U., 1989; PhD, George Washington U., 1995.

McCleary, William R. (1995) BS, Brigham Young U., 1982; PhD, U. of California, Berkeley, 1990.

Military Science (Army ROTC)

Assistant Professors

Adams, Byron J. (2003) BS, Brigham Young U., 1993; PhD, U. of Nebraska, 1998.
Erickson, David (2006) BS, Lethbridge U., Canada, 1999; PhD, U. of Calgary, Canada, 2003.
Evans, R. Paul (1987) BS, Brigham Young U., 1995; PhD, Medical Coll. of Virginia, 1983.
Griffitts, Joel (2006) BS, Stanford U., 1999; PhD, U. of California, San Diego, 2004.
Lin, Chin-Yo (2005) BS, Brigham Young U., 1995; PhD, Harvard U., 2001.
Wilson, Eric (2004) BS, MS, Utah State U., 1990, 1994; PhD, Montana State U., 2000.

Teaching Professor

Cockayne, Susan (1982) BS, MS, U. of Utah, 1972, 1979; PhD, Brigham Young U., 1990.

Associate Teaching Professor

Breakwell, Donald P. (2001) BS, Brigham Young U., 1986; MS, PhD, Purdue U., 1988, 1992.

Assistant Teaching Professor

Burnett, Sandra (2004) BA, MS, Utah State U., 1992, 1993; PhD, U. of Kentucky, 2000.

Part-time Faculty

Gordon, Jan Poulsen, Keila
Hodson, Kristine Seeley, Deborah

Adjunct Assistant Professors

Jackson, Paul Nelson, Jerry

Adjunct Clinical Professors

Freestone, Steven Thorn, Willes
Lovell, Robert Urie, Paul

Adjunct Clinical Instructors

Cram, Kelly
Jackson, Patricia
Lindsley, Sherilyn
McMullin, Vivian

Laboratory Support Services

Lee, John D. (1972) BS, MS, Brigham Young U., 1972, 1976.

Emeriti

Beck, Jay V. (1951) BA, MA, Brigham Young U., 1933, 1936; PhD, U. of California, Berkeley, 1940.
Bradshaw, Willard H. (1961) BS, MS, Brigham Young U., 1952, 1953; PhD, U. of California, Berkeley, 1957.
Donaldson, David M. (1955) BS, MS, PhD, U. of Utah, 1950, 1952, 1954.
Jensen, James (1994) BS, MS, Brigham Young U., 1970, 1972; PhD, Auburn U., 1975.
Jensen, Marcus M. (1969) BS, MS, Utah State U., 1952, 1954; PhD, U. of California, Los Angeles, 1961.
North, James A. (1965) BS, MS, Brigham Young U., 1958, 1960; PhD, U. of Utah, 1964.
Sagers, Richard D. (1958) BS, MS, Brigham Young U., 1954, 1955; PhD, U. of Illinois, 1958.
Wright, Donald N. (1969) BS, U. of Utah, 1958; PhD, Iowa State U. of Science and Technology, 1964.

Military Science (Army ROTC)

Major Theodore M. Leblow, Chair
320 ROTC, (801) 422-3601

Admission to Program

Students must be accepted by the Department of Military Science into the program.

The Discipline

The Army Reserve Office Training Corps (ROTC) Leadership Excellence Program is designed to produce highly qualified commissioned officers in the U.S. Regular Army, the U.S. Army Reserve, or the U.S. Army National Guard. Students specialize in the major field of their choice and graduate with the ability to function as a junior executive.

Career Opportunities

Officer in the U.S. Army in the career field of:

Adjutant General's Corps
Air Defense Artillery
Armor
Aviation
Chemical Corps
Engineers
Field Artillery
Finance Corps
Infantry
Judge Advocate General's Corps
Medical Service Corps
Nurses, doctors, and administrators
Military Intelligence
Military Police
Ordnance Corps
Quartermaster Corps
Signal Corps
Transportation Corps

General Information

Textbooks, Uniforms, and Allowances. All textbooks, uniforms, and training materials are furnished by the U.S. Army. Those in the advanced course receive a \$450 to \$500 monthly allowance and approximately \$800 for participation in the national Leadership Development and Assessment Course for five weeks during the summer between the junior and senior year.

Army ROTC Scholarship Program. Tuition assistance is available on a competitive basis. Senior students in high school may qualify for a four-year scholarship. College students may also qualify for a four-, three-, or two-year scholarship. The scholarship provides for tuition, fees, a textbook allowance, and from \$300 to \$500 per month (up to ten months per year) for the period of the scholarship. Students who qualify must complete their degree program prior to their thirty-fifth birthday. Contact the Military Science Department for application procedures and specifics.

SMP Program (Simultaneous Membership Program). Students already members of the Army Reserve or National Guard may concurrently participate in ROTC and qualify for additional pay and benefits, to include tuition assistance.

Extracurricular Activities. Army ROTC cadets extend academic and laboratory associations into a variety of extracurricular ROTC activities. Among these are the Ranger Challenge, Army Color Guard, Cannon Crew, annual Military Ball, and many school service projects performed by the corps of cadets.

LDS Missions. Students, including scholarship recipients, who wish to serve a two-year LDS mission may do so most conveniently between their freshman and sophomore years. This