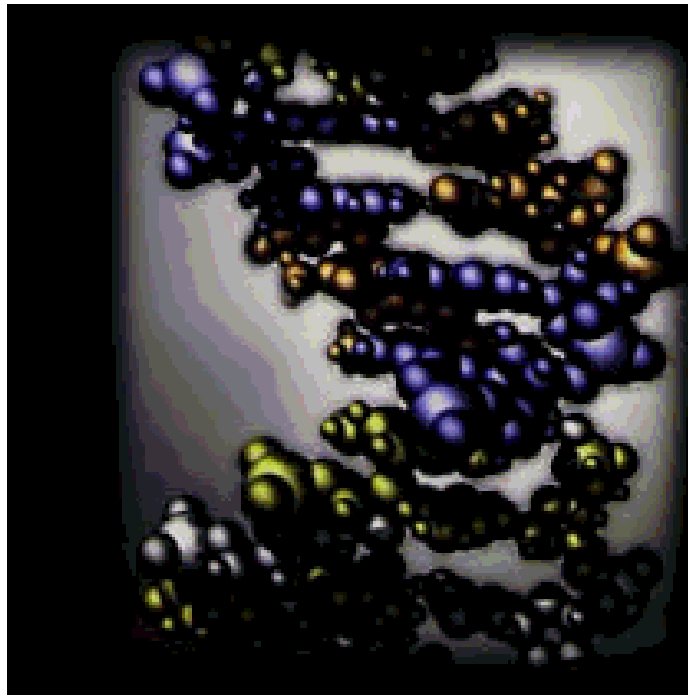


# Guide for Biochemistry & Molecular Biology Majors



**UMBC**  
Department of Chemistry & Biochemistry  
Department of Biological Sciences

*November 2002*

**GUIDE FOR UMBC  
BIOCHEMISTRY & MOLECULAR BIOLOGY MAJORS**

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*Please note that this guide is not an official statement of University requirements or policies. If anything in this Guide conflicts with the UMBC Catalog, the Catalog statement is binding.*

## A LETTER TO PROSPECTIVE BIOCHEMISTRY & MOLECULAR BIOLOGY MAJORS

The faculty and staff of the Departments of Biological Sciences and Chemistry & Biochemistry at UMBC are pleased to invite you to consider our program in Biochemistry & Molecular Biology.

We are pleased to announce that an Academic Advisor, Ms. Kate Fukawa-Connelly, has been hired to advise freshmen at the orientation sessions, and during the first year at UMBC. This will assure that every student gets the best advice possible when starting their education at UMBC.

This rigorous, laboratory-intensive program prepares undergraduates for a multitude of careers. Since 1978, the program has graduated several hundred majors, many of whom now work in the fields of science, medicine, and biotechnology. Our graduates work as physicians, dentists, veterinarians, nurses, medical technologists, molecular biologists, forensic pathologists, laboratory technicians and supervisors, environmental inspectors, software engineers, lawyers, and science writers. UMBC graduates are employed by government agencies, universities, and companies such as the National Institutes of Health, Environmental Protection Agency, Food and Drug Administration, Smithsonian Institution, University of Maryland Medical System, University of California at Berkeley, Martek Biosciences Corp., and Life Technologies, Inc.

The major program in Biochemistry & Molecular Biology, which the Biological Sciences and Chemistry & Biochemistry Departments offer jointly, leads to the B.S. degree. This program provides a comprehensive approach to Biochemistry & Molecular Biology. We encourage majors to seek laboratory internships with the faculty. Lab experience provides excellent preparation for graduate and professional schools and the job market by honing critical thinking skills and expanding scientific understanding of biological concepts. Extensive research facilities exist, including the Howard Hughes Medical Institute, a microscopy suite, cell sorter, recombinant DNA technology equipment, NMR imaging equipment, minicomputers, and greenhouses. Research strengths include biophysical, bio-organic and bio-inorganic chemistry; molecular, cellular, and developmental biology; genetics; immunology; neurobiology; and environmental biology and ecology. Faculty receive strong financial support from external federal, state and private sources.

Faculty are available to discuss a student's appropriate course of study depending upon the student's post-UMBC goals. A list of full-time faculty members including phone numbers and e-mail addresses follows at the end of this booklet. Please do not overlook this important resource as you plan your career.

We welcome you to Biochemistry & Molecular Biology at UMBC. Please contact us should you wish to meet with a member of our faculty or take a tour of our state-of-the-art facilities.

Sincerely,

*Ralph M. Pollack*

Ralph M. Pollack, Ph.D.  
Chair, Dept. of Chemistry and Biochemistry

*Lasse Lindahl*

Lasse Lindahl, Ph.D.  
Chair, Dept. of Biological Sciences

# Biochemistry & Molecular Biology

## DEPARTMENT AND FACULTY OFFICES

The Biochemistry & Molecular Biology program is currently administered by a joint committee of faculty from the Departments of Biological Sciences and Chemistry & Biochemistry. The Program Coordinator is Dr. Richard Karpel of the Department of Chemistry & Biochemistry. Both departments participate in the course offerings and student advisement.

### Chemistry & Biochemistry

The office of the Department of Chemistry and Biochemistry is located in Room 109 of the Chemistry Building, and may be reached at 410-455-2491. See page seven for faculty phone and office numbers, e-mail addresses and research interests of the faculty. Notices of interest to undergraduates are posted on the office bulletin boards.

### Biological Sciences

The UMBC Department of Biological Sciences is located in the Biological Sciences Building and the adjoining Martin Schwartz Hall. Full-time faculty members can be contacted by visiting during office hours or leaving a message via voice mail or e-mail; the list of faculty members on page seven includes phone and office numbers, e-mail addresses and research interests. Graduate students who serve as teaching assistants for specific courses also have office hours when they meet with students. Part-time instructors may best be reached before or after class.

The department office, which includes mailboxes for faculty members and graduate students, is in room 480 of Schwartz Hall and may be reached at 410-455-2261. A bulletin board in the lobby of Schwartz Hall is reserved for notices of interest to biology undergraduates.

## MAJOR REQUIREMENTS (Also, see Table on Page 8)

As listed in the Appendix, the following courses are required for the B.S. in Biochemistry & Molecular Biology:

### *A. Biology Requirements*

Concepts of Biology Lecture and Lab (BIOL 100 and 100L), Molecular and General Genetics (BIOL 302), Cell Biology (BIOL 303), and either Molecular and General Genetics Lab (BIOL 302L) or Cell Biology Lab (BIOL 303L). Biochemistry majors must successfully complete at least 15 credits of biology.

### *B. Chemistry Requirements*

All Biochemistry & Molecular Biology majors must take at least 27 credits of chemistry, including Principles of Chemistry I and II (CHEM 101 and 102), Introductory Chemistry Laboratory I (CHEM 102L), Analytical Chemistry (CHEM 300), Physical Chemistry I (CHEM 301), Organic Chemistry I Lecture and Lab (CHEM 351 and 351L), and Organic Chemistry II Lecture and Lab (CHEM 352 and 352L).

### *C. Biochemistry Requirements*

Majors must take Comprehensive Biochemistry I and II (CHEM 437 and 438) and Biochemistry Lab (CHEM 437L) for a total of 12 credits.

#### *D. Physics and Math Requirements*

Biochemistry majors must complete Introductory Physics I and II (PHYS 121 and 122) and Calculus and Analytic Geometry I and II (MATH 151 and 152) for 16 total credits. Note: MATH 251 and CHEM 302 are recommended for those anticipating graduate study in chemistry, biophysical chemistry or biophysics.

#### *E. Advanced Electives*

To complete the major, students must take any two of the following electives for a total of 6-8 credits: Bacterial Physiology (BIOL 411), Eukaryotic Genetics and Molecular Biology (BIOL 414), Advanced Topics in Cell Biology (BIOL 420), Immunology (BIOL 425), Approaches to Molecular Biology (BIOL 426), Computer Applications in Molecular Biology (BIOL 428), Microbial Molecular Genetics (BIOL 434), Advanced Topics in Developmental Biology (BIOL 443), Neurobiology (BIOL 451), Signal Transduction (BIOL 445), Vision Science (BIOL 454), Plant Molecular Biology (BIOL 456), Biology of Bacteria (BIOL 475), Evolution: From Genes to Genomes (BIOL 483), Bioinorganic Chemistry (CHEM 406), Chemistry of Proteins (CHEM 431), Advanced Biochemistry (CHEM 432), Biochemistry of Nucleic Acids (CHEM 433), Biochemistry of Complex Carbohydrates (CHEM 435), Physical Chemistry of Macromolecules (CHEM 441), Physical Biochemistry (CHEM 442), Spectroscopy of Biopolymers (CHEM 443), Molecular Modelling (CHEM 444), Chemistry of Heterocyclic Compounds (CHEM 450), Mechanisms of Organic Reactions (CHEM 451), Organic Chemistry of Nucleic Acids (CHEM 453), Biomedical Chemistry (CHEM 455), Total Synthesis of Natural Products (CHEM 457), Toxicological Chemistry (CHEM 470), Enzyme Reaction Mechanisms (CHEM 472), Organic Synthetic Methodology (CHEM 490A), Advanced NMR Spectroscopy (CHEM 601), Special Topics in Molecular Structure (CHEM 640), Seminar in Biophysical Chemistry (CHEM 680), or Current Topics in Biochemistry (CHEM 682), Special Topics: Organic Spectroscopy (CHEM 684A).

The following courses which have variable topics, may be approved as biochemistry electives in those years when their topic is appropriate (subject to confirmation in each case by the Biochemistry & Molecular Biology Undergraduate Committee: Special Topics in Chemistry (CHEM 490), Current Topics in Chemistry (CHEM 601), Special Topics in Chemistry (CHEM 684) and Special Topics in Dynamics and Mechanics (CHEM 670).

#### *F. Grade Requirements*

In fulfilling major requirements, CHEM 437, CHEM 438, and CHEM 437L must be completed with a grade of "C" or better. An overall "C" average must be maintained in required courses. Note that prerequisites for all chemistry and biology courses must be satisfied with no less than a grade of "C."

#### *G. Course Exemptions/Advanced Placement*

As stated in the undergraduate catalog, a score of 5 or 4 on the Advanced Placement Chemistry Exam is worth 4 credits and exemption from CHEM 101. A score of 5 or 4 on the AP Biology exam is worth 8 credits and exemption from BIOL 100 and 100L.

#### *H. Substitution of non-UMBC courses for major requirements*

Only the Biological Sciences faculty and/or Chemistry and Biochemistry faculty can approve requests to substitute courses transferred from an institution with which UMBC has no course articulation agreements for courses required for the major. Check with the departmental offices for details and the appropriate forms.

## **INDEPENDENT RESEARCH**

Biochemistry & Molecular Biology majors are encouraged to participate in independent research. Those working with a Biological Sciences faculty member may register for BIOL 399 or 499. Those working in a Chemistry or Biochemistry departmental faculty laboratory may register for CHEM 399 or 499. The department offices for Biological Sciences and Chemistry & Biochemistry have brochures describing the research interests of their faculty. This information can also be found on the web sites.

Biological Sciences: <http://www.umbc.edu/biosci/Faculty>

Chemistry & Biochemistry: <http://research.umbc.edu/~smith/chem/faculty/faculty.html>

## **CHEMISTRY TUTORIAL CENTER/CHEMCOM**

The Chemistry & Biochemistry Department's tutorial center provides free tutoring for freshmen and sophomore chemistry courses; maintains a file of old quizzes, homework problems, and exams as study aids; and houses a library of undergraduate chemistry and biochemistry texts and graduate program brochures. The Center (Room 201, University Center, 455-2504) is staffed by a full-time faculty instructor and 30 advanced undergraduates each weekday and selected evenings. It also serves as the gathering place for the Chemistry/Biochemistry Council of Majors (CHEMCOM), which presents outside speakers from business, industry, and other chemistry/biochemistry-oriented fields, gives demonstrations to neighborhood elementary schools, and sponsors an annual "Undergraduate Research Day" in which students involved in research projects in faculty laboratories present their work to incoming science majors.

## **BIOLOGY COUNCIL OF MAJORS**

The Biology Council of Majors is devoted to promoting the academic and social interests of undergraduates majoring in biology. The council provides information on graduate programs, summer internships, and job offers; keeps past exams on file for students to use as study guides; works with the multimedia center to provide lecture tapes for student use; offers some tutoring; and organizes study groups for biology classes.

## **MASTER OF SCIENCE IN APPLIED MOLECULAR BIOLOGY**

Students interested in a Master's degree in Applied Molecular Biology (AMB) will be considered for admission to the program on a competitive basis. Students can use up to two courses from their undergraduate degree in Biochemistry & Molecular Biology, and in doing so save money and reduce their graduate course work.

Students should consult with the Director of the Applied Molecular Biology Program for advisement as to which courses will be appropriate for both degrees. Application for admission should be submitted in the final semester of the senior year. For more information see the AMB web site (<http://www.umbc.edu/biosci/Graduate/amb.html>).

# General Information

## ADVISING

Incoming freshmen will be advised during the orientation period that is arranged by the Advisement Center. The Biochemistry & Molecular Biology academic advisor, Ms. Kate Fukawa-Connelly, will be available at orientation to advise new Biochemistry & Molecular Biology majors. After orientation, freshmen who have further questions should see Ms. Fukawa-Connelly in her office, Biological Sciences room 456. Please send her an e-mail (k8fc@umbc.edu), or call her at 410-455-1718 to make an appointment.

After the freshman year, students will be assigned to a member of the Biological Sciences or Chemistry & Biochemistry faculty for advisement until graduation. Contact Ms. Audrey Mahoney, Room CH 109 (Ext. 2491) for the name of your advisor.

Advisors may be contacted at any time to discuss questions or problems regarding academic progress or course requirements. Every major must meet with his or her advisor at least once each semester to be advised. During the advance registration period (at the end of the semester), advisors may post a sheet outside their offices with time slots for their advisees to schedule an appointment. Alternatively, you may need to call or e-mail your advisor for an appointment. Please be there on time with an updated transcript and any other relevant paperwork (e.g., a course schedule for the current semester).

When you apply for graduation, the advisor makes the final and binding decision on whether you have met the requirements for the major. However, *throughout your residence at UMBC it is your responsibility to ensure that you meet all requirements for your major or minor*. If an advisor has permitted you to modify the major in any way, such as by transferring required courses or waiving requirements, you should obtain written confirmation. Departmental advisors have no authority to approve or disapprove courses used to satisfy the General Education Requirements or General Foundation Requirements; that is done by the Advisement Center.

## COURSES IN OTHER DISCIPLINES

Majors are encouraged to complement their training with related courses in other liberal arts and professional fields. Writing skills are particularly important; courses such as Science Writing (ENGL 383) and Technical Writing (ENGL 393) can be very helpful to science majors. Your advisor will be glad to discuss your particular interests with you. You may also want to consider the cooperative education and internship programs offered by the Shriver Center, the Center for Learning Through Work and Service, the Provost's Undergraduate Research Awards Program, and the Honors College, which are listed in the UMBC campus directory.

## PLANNING FOR GRADUATE SCHOOL

Although UMBC's Biochemistry & Molecular Biology requirements meet the admission criteria for many graduate schools, some schools may have additional requirements. The Department of Biological Sciences, the Department of Chemistry & Biochemistry, the Kuhn Library, and the Career Development and Placement Center each have the latest edition of *Peterson's Guide to Graduate Programs* which provides information on all U.S.-accredited graduate and professional programs in biochemistry in the U.S., Canada, Mexico, Europe, Africa, and U.S. territories. For questions regarding admission requirements, check the *Peterson's Guide* for addresses to write directly to specific schools.

Graduate schools require letters of recommendation from faculty members, so it is important to make contacts early. Independent Research can help you get a strong recommendation. Many graduate schools also require scores on the general and/or subject Graduate Record Exam (GRE) or other standardized tests. Advance planning and preparation are essential. For example, a December graduate school application deadline means you must take the GRE in October, which in turn means you should register and study for the GRE the summer before your senior year. By the second half of your junior year, your graduate school search should be well underway.

The Career Development and Placement Center (Math/Psychology Building, room 202; 455-2216) has helpful books and computer software to search graduate programs linked to GRE selector programs.

### PLANNING FOR HEALTH PROFESSIONAL SCHOOL

Students interested in attending medical, dental, podiatric, optometry, or veterinary school should contact the Advisement Center (Academic Services Bldg, Room 102) as early as possible. Most health professional schools require special admissions tests, which are normally taken during the junior year. The Advisement Center has up-to-date application calendars, offers workshops and a recommendation mailing service, and maintains a Health Professions Resource Library.

UMBC's requirements for pre-medical and pre-dental students (see Table 1) meet most schools' admission criteria, but you should check the specific requirements of your desired schools in the Association of American Colleges' *Medical School Admission Requirements: United States and Canada* or the American Association of Dental Schools' *Admission Requirements of U.S. and Canadian Dental Schools*. The Health Professions Resource Library owns the latest editions of both.

The Pre-Med Society meets every Wednesday at 1:00 p.m. to discuss the health professions; see the bulletin board outside the Chemistry Tutorial Center (CP 125) for topics and locations.

**Table 1. UMBC Pre-Medical and Pre-Dental Requirements.**

<i>Requirement</i>	<i>Credit</i>	<i>Course</i>
English	6	ENGL 100 and one ENGL literature
Biology	12	BIOL 100, 100L, 302, 302L
Chemistry	19	CHEM 101, 102, 102L, 351, 351L, 352, 352L
Mathematics	8	MATH 150, 151
Physics	8	PHYS 111, 112 or PHYS 121, 122
Other	37-67	Includes general and major requirements
TOTAL CREDITS: 90-120		

## CHEMISTRY & BIOCHEMISTRY FACULTY AND RESEARCH INTERESTS

**Brad Arnold** (455-2503, barnold@umbc.edu, CH 204D): ultrafast spectroscopy of biological molecules  
**C. Allen Bush** (455-2506, bush@umbc.edu, CH 204E): biophysical chemistry of complex carbohydrates  
**Donald Creighton** (455-2518, creighto@umbc.edu, CH 131): enzyme chemistry of sulfur  
**Brian M. Cullum** (455-2833, cullum@umbc.edu, CH 303A): optical nanosensors for cellular analyses  
**Daniele Fabris** (455-3053, fabris@umbc.edu, CH 102): bioanalytical chemistry, mass spectrometry  
**James C. Fishbein** (455-2491, jfishbein@umbc.edu, CH 132): organic chemistry  
**Colin W. Garvie** (455-2512, garvie@umbc.edu, CH127): Crystallographic studies of transcription factors  
**Susan K. Gregurick** (455-86998, greguric@umbc.edu, CH 133): Computational studies on biological macromolecules  
**Ramachandra S. Hosmane** (455-2520, hosmane@umbc.edu, CH 104): Organic synthesis; biomedical chemistry  
**Richard Karpel** (455-2510, karpel@umbc.edu, CH 129): protein-nucleic acid interactions  
**Lisa Kelly** (455-2507, lkelly@umbc.edu, CH 103): mutagenesis of biological redox reactions.  
**William R. LaCourse** (455-2105, lacourse@umbc.edu, CH 204F): Pulsed electrochemical detection techniques  
**Mark Perks** (455-2789, perks@umbc.edu, CH 105): Organic and environmental chemistry  
**Ralph Pollack** (455-2529, pollack@umbc.edu, CH 135): bio-organic chemistry, enzymatic catalysis  
**Vera R. da Silva** (455-2514, dasilva@umbc.edu, CH 323): Biochemistry Laboratory; health science chemistry  
**Paul J. Smith** (455-2519, pjsmith@umbc.edu, CH 130): DNA binding by small molecules  
**Michael Summers** (455-2527, summers@umbc.edu, CH 122): nuclear magnetic resonance bioinorganic chemistry  
**Veronika Szalai** (455-1576, vszalai@umbc.edu, CH 101): amyloid association; multi-stranded nucleic acid structures

## BIOLOGICAL SCIENCES FACULTY AND RESEARCH INTERESTS

**Charles Bieberich** (455-3125, bieberic@umbc.edu, BS 222): molecular biology of development  
**Mauricio Bustos** (455-2769, bustos@umbc.edu, BS 416): plant molecular biology  
**Nessly Craig** (455-2248, craig@umbc.edu, BS 315): molecular biology of mammalian cells  
**David Eisenmann** (455-2256, eisenman@umbc.edu, BS 316): developmental & molecular biology; genetics  
**Philip Farabaugh** (455-3018, farabaug@umbc.edu, BS 324): molecular genetics  
**Lasse Lindahl** (455-2996, lindahl@umbc.edu, BS 478): molecular biology; ribosome synthesis  
**Paul Lovett** (455-2249, lovett@umbc.edu, BS 211): microbiology; molecular biology; gene expression  
**Patricia McGraw** (455-3484, mcgraw@umbc.edu, BS 425): molecular biology; molecular & cell biology of metabolic regulatory systems  
**Stephen M. Miller** (455-3381, stmiller@umbc.edu, BS 417): plant molecular biology  
**Kevin E. Omland** (455-2243, omland@umbc.edu, BS 455): ecology and evolution  
**Michael O'Neill** (455-2269, moneill@umc.edu, BS 470): computer modeling; genetic regulation  
**Suzanne Ostrand-Rosenberg** (455-2237, srosenbe@umbc.edu, BS 221): immunology  
**Phyllis Robinson** (455-2977, probinso@umbc.edu, BS 466): neurobiology  
**Harold J. Schreier** (234-8874, schreier@umbi.umd.edu): microbiology, gene regulation  
**Richard Wolf** (455-2268, wolf@umbc.edu, BS 325): genetics  
**Janice Zengel** (455-2876, zengel@umbc.edu, BS 251A): molecular biology; ribosome synthesis  
**J. Lynn Zimmerman** (455-3486, zimmerma@umbc.edu, BS 415): plant molecular biology & plant development.

**Appendix: BACHELOR OF SCIENCE in Biochemistry & Molecular Biology [as appearing in the 2000-2002 UMBC Undergraduate Catalog] for students who enter UMBC Fall 1994 or later.**

Required Courses		Course name	Credit	Pre-requisite(s) and/or Co-requisite(s)	Semester offered*
BIOL	100	Concepts of Biology	4	---	FSZ
	100L	Concepts of Biology Lab	2	(100 co-req)	FSZ
	302	Molecular and General Genetics	4	100 & CHEM 101	FSZ
	303	Cell Biology	3	302 & CHEM 102	FS
	302L	Molecular and General Genetics Lab	2	100L (302 co-req)	F
TOTAL			15 Credits of Biology		
<b>NOTE: A majority of the required BIOLOGY credits must be completed in residence at UMBC.</b>					
CHEM	101	Principles of Chemistry I	4	---	FSZ
	102	Principles of Chemistry II	3	CHEM 101	FSZ
	102L	Introductory Chemistry Lab I	2	CHEM 101 (102 co-req)	FSZ
	300	Analytical Chemistry	4	CHEM 102 AND 102L	FZ
<b>Either or</b>	<b>301</b>	Physical Chemistry I	4	CHEM 102, MATH 152, PHYS	FZ
	<b>303</b>	Phys. Chem. for the Biochem. Sci.	3	CHEM 102, MATH 152, PHYS	S
	351	Organic Chemistry I	3	CHEM 102	FS
	351L	Organic Chemistry Lab I	2	CHEM 102L (351 co-req)	FS
	352	Organic Chemistry II	3	CHEM 351	SZ
	352L	Organic Chemistry Lab II	2	CHEM 351L (352 pre- or co-req)	SZ
TOTAL			26-27 Credits of Chemistry		
CHEM	437	Comprehensive Biochemistry I	4		F
	437L	Biochemistry Lab	4		FS
	438	Comprehensive Biochemistry II	4		S
TOTAL			12 Credits of Biochemistry		
PHYS	121	Introductory Physics I	4	MATH 151	FSZ
	122	Introductory Physics II	4	PHYS 121 & MATH 152	FSZ
MATH	151	Calculus and Analytic Geometry I	4	MATH 150	FSZ
	152	Calculus and Analytic Geometry II	4	MATH 151	FSZ
TOTAL			16 Credits of Physics and Math		
BIOL and/or CHEM	4xx	Any of the following two electives: <b>BIOL</b> 411, 414, 420, 425, 426, 428, 434, 443, 451, 454, 456, 475, 483 <b>CHEM</b> 406, 431, 432, 433, 435, 441, 442, 443, 444, 450, 451, 453, 455, 457, 470, 472, 640, 680. Also 490, 601, 670, 682 & 684 topics with prior approval.	5 to 8		
<b>TOTAL SCIENCE/MATH CREDITS REQUIRED FOR B.S. DEGREE = 74-78</b>					

\* F = Fall; S=Spring; Z=Summer

**Note: Courses marked with a Z are traditionally given in the summer. However, Please check the summer catalog for availability in any given year.**