Established in 1974 as the first undergraduate Environmental Toxicology program in the United States.
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A Message from the Chair...

Welcome to the Department of Environmental Toxicology, the first of its kind anywhere in the world! We actually pre-date Rachel Carson and the birth of the environmental movement. Our roots extend back to the late 1950s, and the seeds of our undergraduate major were first sewn in the late 1960s. Today, UC Davis is known as the world’s leader in the field of environmental toxicology. While we are a relatively small department of some 12 faculty, our class sizes are also small and personalized attention from both the faculty and staff is a tradition.

Environmental toxicology encompasses the study of the toxic properties of virtually all chemicals (both natural and man made), including their effects on humans and other species as well as their movement and fate in the environment. As a graduate from our program you would be an expert on the properties of pesticides, solvents, natural toxins, PCBs, dioxins and other chemicals and on processes of environmental scope such as global warming, acid rain and ozone depletion as well as those at the molecular level such as the chemical mechanisms of cancer and other toxic actions.

Our graduates are well versed in chemistry, biochemistry, molecular biology and toxicology — and are very unique! Thus, they have a tremendous selection of career opportunities — and multiple job offers — upon graduation. Typically, our alumni pursue graduate degrees in pharmacology, toxicology, nutrition, food science and environmental chemistry as well as professional degrees in medicine, veterinary medicine, pharmacy and dentistry. They also entertain a wide range of opportunities in the chemical industry (Chevron, Exxon, Dow, DuPont, etc.), pharmaceutical industry (Eli Lilly, Merck, etc.), biotechnology (Genentech, etc.) and environmental consulting firms, and are highly sought by governmental agencies such as the US Environmental Protection Agency, Cal-EPA, the California Department of Food & Agriculture and the California Department of Pesticide Regulation.

I hope you will consider a major in environmental toxicology. With the growing environmental problems we face today, you will obtain the cutting-edge education to make a significant impact on the future of the world!

With Best Wishes,

Ronald S. Tjeerdema, Chair
Department of Environmental Toxicology
Whether you need information or just some advice, advisers in the Department of Environmental Toxicology are available to speak with you.

The Academic Program Adviser and Peer Advisers are available to answer any questions that you may have, and faculty advisers are available to help you plan out a specific course of study.

To speak with an adviser, make an appointment or drop by during office hours.

For additional information, log on to the Environmental Toxicology Web Site at www.envtox.ucdavis.edu.
Areas of Emphasis

Ecotoxicology & Environmental Chemistry

Topics include chemical fate, transport and degradation as well as ecology, wildlife, and aquatic toxicology.

Forensic Science & Regulatory Toxicology

Topics include forensic science, environmental policy and management, and public health.

Molecular & Biomedical Toxicology

Topics include medicine, pharmacology, veterinary medicine, food toxicology, and biotechnology.

Student Designed Option

Students can construct their own area of emphasis under the explicit direction of their faculty advisers.

Related Areas of Study

- Aquatic Toxicology
- Biology (Marine Biology, Biochemistry, etc.)
- Chemistry
- Environmental Science
- Epidemiology
- Food Science
- Forensic Science
- Hydrology
- Pharmacology
- Soil Science

Frequently Asked Questions

What is Environmental Toxicology?

Environmental Toxicology—the science of toxic chemicals, the useful as well as the deleterious—is a relatively new academic field. However, its historical roots are ancient and its application, significance, and importance are in evidence daily.

Hardly a week goes by without hearing about a chemical that may potentially threaten our health—pesticides and other toxic substances in the food we eat, pollutants in the air we breathe, chemicals in the water we drink. How do these chemicals work? Are these chemicals really dangerous? What are the effects of chemicals? Cancer? Birth defects? Finding scientifically sound answers to these very important questions is what toxicologists do using the most modern chemical and biological techniques available.

Environmental Toxicology combines elements of biology and chemistry with many other disciplines to help us understand the impact chemicals have on environmental systems and in living organisms. The basic science of toxicology studies the cellular, biochemical, and molecular mechanisms by which a chemical produces toxic effects, but also uses chemicals as tools to study basic biological processes important to the health and well-being of humans and the environment. The applied science of toxicology evaluates the effects of potentially toxic chemical and physical substances in whole animals and target cells and uses the knowledge gained to extrapolate potential effects on humans and other organisms of concern.

Who should major in Environmental Toxicology?

With the diversity of majors available to undergraduates at UC Davis, the choice can be overwhelming. This major generally attracts individuals with a desire to study both chemistry and biology. It is not, however, simply a biochemistry major; rather students will apply their knowledge of biology and chemistry to real-life issues. Environmental Toxicology students learn to approach science and its affiliated social problems (eg, chemicals in the environment and the consequences of exposure to people and other organisms) with scientifically and socially integrative perspectives, rather than from just theoretical and microscopic perspectives.

The Environmental Toxicology major is not limited to just those interested in the environment. The flexibility of this major gives students a biochemical background from which they can focus on their own areas of interest, whether it is law, forensic science, medicine, more chemistry or more biology.
Career Opportunities

Think of Environmental Toxicology and you may wonder what types of careers are open to environmental toxicology graduates. There are no specific career paths Environmental Toxicology graduates must follow. Because of the flexibility of this major and the diversity of courses available, past graduates have entered a variety of fields, including medicine, law, industrial, and environmental chemistry, aquatic toxicology, and pharmacology. Rather, career paths depend on one’s creativity, specific interests, and motivation. All students are required to complete a set of core courses, yet the curriculum also allows students the flexibility to pursue individual interests, including the study of the environment, environmental regulations, or the health of living organisms, including humans.

Research and Advanced Degrees

University graduates interested in adding to the body of scientific knowledge or in pursuing specialized areas of interest opt to obtain advanced degrees (M.S., Ph.D.). Often, advanced degrees increase an individual’s ability to advance in a field and to compete in the job market. Past graduates have entered a variety of post-baccalaureate programs

- Agricultural & Environmental Chemistry
- Aquatic Toxicology
- Biochemistry
- Biomedical Science
- Chemistry
- Environmental Toxicology
- Forensic Sciences
- Epidemiology
- Food Science
- Molecular Biology
- Pharmacology & Toxicology

THE ROAD LESS TRAVELLED

Many students do not realize that Environmental Toxicology can prepare them for professional study.

- dentistry
- law
- medicine
- nursing
- pharmacy
- veterinary medicine
- forensic science

Often, degrees outside of more traditional majors can help pre-professional students stand out from the rest of the crowd.

For a sampling of the diverse career paths of past graduates visit the alumni pages on the department website: www.envtox.ucdavis.edu/Friends/mentors.htm
Environmental Toxicology

Career Development and Internship Opportunities

- The campus hosts annual career fairs in environmental, biological, and physical sciences.
- Internship and career information are available at the Internship and Career Center (see page 24).
- The Internship and Career Center also offers a variety of workshops on writing resumes and on interviewing skills.
- Graduate and Professional school information (national and international) is available in the Environmental Toxicology advising office and from UC Davis Advising Services (http://bunny.ucdavis.edu/advising/).

For information on post-baccalaureate degrees (M.S./Ph.D.) and programs, please meet with your faculty adviser and obtain information on electives.

Professional Degrees

Although often overlooked as potential career paths, students interested in careers in public service may go on to pursue professional degrees in:

- Dentistry
- Law
- Medicine
- Nursing
- Pharmacy
- Public/occupational health
- Veterinary medicine

Due to the major’s interdisciplinary nature and flexibility, students are prepared to excel in a variety of professional fields. Students pursuing professional degrees are strongly advised to speak with both pre-professional and academic advisers to ensure full fulfillment of pre-professional course requirements.

Government Agencies

As technology changes and as the population continues to grow, anthropogenic pollution in the environment will become increasingly problematic. Environmental Toxicology graduates can play vital roles in mediating these effects. With an Environmental Toxicology degree, individuals can work in governmental and regulatory agencies including, but not limited to:

Federal Agencies
- Army Corps of Engineers (USACE)
- Department of Agriculture (USDA)
- Department of Energy (DOE)
- Drug Enforcement Agency (DEA)
- Environmental Protection Agency (USEPA)
- Federal Bureau of Investigation (FBI)
- Fish and Wildlife Service (USFWS)
- Food and Drug Administration (FDA)
- Geological Survey (USGS)

State Agencies
- California Environmental Protection Agency (Cal/EPA)
- Department of Fish & Game (DFG)
- Department of Food & Agriculture (DFA)
Those interested in utilizing research skills may choose to become forensic toxicologists, environmental chemists or laboratory technicians. Others utilize their skills to set and enforce environmental regulations.

Industry

Outside the arena of academia and government agencies, opportunities are abundant, and perhaps more lucrative. For those interested in working in the private sector, employment opportunities can be found in pharmaceutical corporations, biotechnology firms, and in environmental consulting firms.

Graduates can pursue careers as:

- Chemists
- Toxicologists
- Risk assessors
- Lab technicians
- Research managers

Job Placement

The careers and employment opportunities for graduates are not limited to those mentioned above. To develop a curriculum which will suit students’ career goals, it is recommended that they work closely with their major advisers and participate in extracurricular activities.
Environmental Toxicology

History of the Department

Long before Rachel Carson's book, *Silent Spring*, the University of California and the California Legislature recognized the negative impact that pesticides and other toxic chemicals might have on our environment. Until the mid-1950s, university research on such subjects was carried out within individual biology departments at Berkeley, Davis, Los Angeles, and Riverside. As the variety of pesticide uses grew, however, it became evident that their effects were interrelated and that the traditional academic approach often resulted in fragmentation rather than unity in our knowledge and understanding of them.

In 1957 the California legislature appropriated funds to establish a small pesticide residue research laboratory at Davis. By 1962 it had become an organized research unit known as the Agricultural Toxicology Laboratory. In 1968 this organization became the Department of Environmental Toxicology, responsible for a full range of teaching, research, and service functions.

In 1974 the department established the undergraduate major in Environmental Toxicology, the first of its kind in the world. Since then, the program has been a model for undergraduate toxicology majors and courses at other universities.

Research and teaching programs in the department are closely related, reflecting the close interdisciplinary cooperation required by our approach to the study of environmental toxicology. Thus, a blend of chemical and biological disciplines is brought to bear on problems in this science. Some of our strengths are analytical and environmental chemistry, metabolism, biochemical and cellular mechanisms of action, and the mammalian and environmental toxicology of natural and man-made poisons, industrial pollutants, and pesticides. This approach is both practical and scientifically rewarding, as evidenced by the many research accomplishments of department personnel and the demand for our graduates for positions of responsibility in industry, government, and universities throughout the world.

The Department of Environmental Toxicology today

The department is housed in the James H. Meyer Hall located on the Davis campus.

The 19,460 square foot space houses a dozen research laboratories, faculty/staff offices, modern small animal facilities for research and instruction, state of the art analytical laboratories and equipment, specialized solvent storage and distillation facilities, and instructional laboratory facilities.
**Faculty and Fields of Interest**

**Alexeeff, George**  
Adjunct Professor and Deputy Director for Scientific Affairs at Cal/EPA, OEHHA  
Risk assessment and research in the health impact of pollutants and toxicants in air, water, soil and other media; emergency planning and response, chemical carcinogenicity, child-specific chemical susceptibility. (4th Floor Meyer Hall, Fall/Winter, - (510) 622-3202, galexeeef@oehha.ca.gov)

**Cherr, Gary N.**  
Professor of Environmental Toxicology and Nutrition and Interim Director of Bodega Marine Lab  
Aquatic toxicology with emphasis on the impact of pollutants and natural stressors on the reproductive and developmental biology of marine organisms. Projects include studies on fertilization and development in Pacific herring, oysters, and sea urchins. Member of the Graduate Groups in Molecular, Cellular, and Integrative Physiology and Pharmacology & Toxicology. (Bodega Marine Lab, P.O. Box 247, Bodega Bay, CA 94923 - (707) 875-2051. Campus, 4245 Meyer- (530) 754-7254, gncherr@ucdavis.edu)

**Denison, Michael S.**  
Professor, Faculty Adviser, and Minor Adviser  
Molecular toxicology; biochemical and molecular mechanisms of action of halogenated aromatic hydrocarbons and related chemicals; mechanisms of induction of drug metabolizing enzymes; structure and function of receptors for hormones and xenobiotics; gene expression; bioassay systems for detection of environmental contaminants. Member of the Graduate Groups in Agricultural & Environmental Chemistry, Biochemistry & Molecular Biology, and Pharmacology & Toxicology. (4241 Meyer Hall- (530) 752-3879, msdenison@ucdavis.edu)

**Gaikwad, Nilesh**  
Assistant Professor of Nutrition and Environmental Toxicology  
Assistant Nutritionist in Agricultural Experiment Station  
Development of mass spectrometric analytical methods for comprehensive measurement of the small molecules in the cells/tissues/body fluids. Development of biomarkers by applying target/profile oriented metabolomic methods. Modulation of metabolic profile by using antioxidants, polyphenols, flavones and phytochemicals. (3209 Meyer, nwgaikwad@ucdavis.edu)

**Golub, Mari**  
Associate Adjunct Professor and Staff Toxicologist for California Department of Health Services and Cal/EPA, OEHHA  
Effects of nutrition, drugs and toxicants on brain development, principles and assessment of behavioral development, mice and monkeys as models for biomedical research; behavioral phenotyping of transgenic mice. Member of the Graduate Groups in Immunology, Nutrition, and Pharmacology & Toxicology. (CNRPC Rm. 1925- (530) 752-5119, msgolub@ucdavis.edu)

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**Active Emeriti Faculty**

**Crosby, Donald G.**  
Professor Emeritus and Faculty Adviser  
Chemical aspects of ecology, environmental photochemistry, marine chemistry and toxicology, water chemistry.

4143 Meyer Hall  
(530) 752-4529
Hengel, Matt
Assistant Adjunct Professor and IR-4 Laboratory Research Director
The IR-4/Trace Analytical Laboratory (TAL) focuses on the determination of pesticides in various environmental matrixes, including fruits, vegetables, air, water and soil. The majority of our research is directed to the registration of pesticides on specialty crops with the US EPA and is conducted under Good Laboratory Practices (GLP). Member of the Graduate Group in Agricultural & Environmental Chemistry (4419 Meyer Hall - (530) 752-2402, mjhengel@ucdavis.edu)

Holstege, Dirk
Assistant Adjunct Professor and Director of the ANR Analytical Laboratory
Development of analytical methodologies for chemical analysis in soil, plant tissue, biological materials, and water. Analysis for naturally-occurring toxins of plant origin. Trace metal analysis and trace organic analysis. Application of LC/MS/MS for trace analysis. Member of the Graduate Group in Agricultural & Environmental Chemistry (224 Hoagland Hall - (530) 752-0148, dmholstege@ucdavis.edu)

Kado, Norman Y.
Adjunct Professor
Integrated biological and chemical analyses of environmental complex mixtures; analyses of particle and vapor-phase toxins in environmental and source samples using a variety of techniques including supercritical fluid, bioassay, and GC/MS analyses. Environmental and occupational exposure analyses, mechanistic toxicological analyses of airborne toxicants. Member of the Graduate Group in Agricultural & Environmental Chemistry and the UC Davis Air Quality Research Center. (4149 Meyer- (530) 752-2457, nykado@ucdavis.edu)

Knezovich, John
Adjunct Professor, Director of UC Toxic Substances Research & Teaching Program, Lawrence Livermore National Laboratory
The environmental fate and toxicity of organic contaminants, heavy metals, and radionuclides. Emphasis on the application of ion-beam analytical techniques to assess the bioavailability of contaminants and their in vivo disposition. Use of accelerator mass spectrometry to assess the fate of low doses of contaminants through the application of isotopic tracers. Member of the Graduate Groups in Agricultural & Environmental Chemistry, Pharmacology, Toxicology.(4239A Meyer jknez@ucdavis.edu)

La Merrill, Michele
Assistant Professor
We investigate susceptibility to environmental diseases, particularly metabolic syndrome (obesity, elevated blood pressure, lipids, and glucose). These susceptibilities include environmental insults during the developmental period, poor diet, and genetic predispositions. We approach these questions with integrated experimental and epidemiological techniques. Member of the Graduate Group of Pharmacology and Toxicology. (4245 Meyer, (530)-754-7254, mlamerrill@ucdavis.edu)
Oteiza, Patricia  
Associate Professor of Nutrition and Environmental Toxicology  
Characterization of the effects of trace mineral deficiencies, trace mineral toxicities on early developmental processes, and the putative health benefits of flavonoids. (3109 Meyer - (530) 754-6074, poteiza@ucdavis.edu)

Rice, Robert H.  
Professor, Faculty Adviser, and Chair of Forensic Science Graduate Group  
Mechanisms of action of toxic and physiological agents affecting keratinocyte growth and differentiation; biochemistry and expression of specific keratinocyte markers; metabolic activation of toxic agents in keratinocytes. Member of the Graduate Groups in Biochemistry & Molecular Biology, Cell & Developmental Biology, Forensic Science, and Pharmacology & Toxicology. (4243 Meyer - (530) 752-5176, rhrice@ucdavis.edu)

Shibamoto, Takayuki  
Professor, Faculty Adviser, and Master Adviser  
Role of lipid peroxidation in diseases; inhibition of peroxidation by naturally occurring antioxidants; formation mechanisms of biologically active compounds in foods; analysis of pesticide residues in the environment; analysis of flavor and fragrance chemicals in cooked foods and in natural plants. Member of the Graduate Groups in Agricultural & Environmental Chemistry, Food Science, and Forensic Science. (4115 Meyer - (530) 752-4523, tshibamot@ucdavis.edu)

Tjeerdema, Ronald S.  
Department Chair, Professor and Faculty Adviser  
Research currently focused on investigating (1) the kinetics and biotransformation of pesticides, aromatic hydrocarbons, and natural toxins in aquatic animals; (2) the influence of surfactants on the bioavailability of petroleum hydrocarbons in aquatic systems; (3) the biochemical actions of pesticides in aquatic animals using nuclear magnetic resonance (NMR); (4) the fate of pesticides and petroleum hydrocarbons in marine mussels and sediments; (5) the toxic influence of surfactants and petroleum hydrocarbons on marine larval development; and (6) the mechanisms of stress protein induction by toxic chemicals. Member of the Graduate Groups in Agricultural & toxic influence of surfactants and petroleum hydrocarbons on marine larval development; and (6) the mechanisms of stress protein induction by toxic chemicals. Member of the Graduate Groups in Agricultural & Environmental Chemistry, Ecology, Forensic Science, and Pharmacology & Toxicology. (4138A Meyer - (530) 754-5192, rstjeerdema@ucdavis.edu)
Wilson, Barry W.
Professor of Avian Sciences and Environmental Toxicology
Cell and developmental biology; physiology; neurotoxicology, muscle and neurobiology; muscular dystrophies; toxicology and pharmacology; pesticide actions and ecotoxicology. Member of the Graduate Groups in Avian Sciences, Cell & Developmental Biology, Ecology, Pharmacology & Toxicology, and Physiology. (4209 Meyer - (530) 752-3519, bwwilson@ucdavis.edu)

Whitehead, Andrew
Professor of Environmental Toxicology
The Whitehead Lab revolves around Evolutionary and ecological Genomics research. This research seeks to understand how genomics integrate cues from, respond to and are shaped by the external environment. We examine genomic responses to stress that occur over physiological timescales and over evolutionary timescales. Many complementary approaches are integrated into our program, including genome expression, profiling, population genetics and phylogenetics, and physiology, to study how individuals are species respond to environmental stress. Stressors include those that are natural (temperature, salinity) or of human origin (pollutants). (4121 Meyer Hall, (530)-754-8982, awhitehead@ucdavis.edu)

Wong, Zachary
Adjunct Professor, Retired from Chevron Energy Technology Co.
Toxicology, health risk assessments, product stewardship, human impact assessments (HIAs), benzene, and product regulatory compliance.
(4th Floor Meyer -Spring Qtr. (510) 242-7011, zawong@ucdavis.edu)

Wood, Matthew J.
Assistant Professor and Faculty Adviser
Research is focused on defining the regulatory mechanisms involved in the perception of and protection against oxidative stress and other toxic compounds such as heavy metals and arsenic using the model organism, Saccharomyces cerevisiae. The laboratory seeks to use the understanding of the mechanisms by which oxidative stress and environmental toxicants alter cellular signaling pathways and gene expression, to develop new technologies for monitoring and remediation of environmental toxicants. Member of the Graduate Groups in Agricultural & Environmental Chemistry, Biochemistry & Molecular Biology, Cell & Developmental Biology, Forensic Science, and Pharmacology & Toxicology (4247 Meyer Hall- (530) 754-2271, mjwood@ucdavis.edu)

Zhang, Qi
Assistant Professor
Study the characterization, production, and environmental fates of atmospheric condensed phase pollutants and their impacts on climate and human health. Member of the Graduate Group in Pharmacology & Toxicology, Agricultural and Environmental Chemistry. (4251A Meyer Hall - (530) 752-5779, dkwzhang@ucdavis.edu )
Spotlight: ETX 127

This special Summer Session I course is a lecture/laboratory course at UCD’s beautiful Bodega Bay Marine Laboratory which emphasizes undergraduate research using state-of-the-art techniques. After two weeks of lectures and labs, students will conduct a research project of their own design.

The course focuses on the impacts of natural and human-derived environmental stressors on fertilization, embryo development, and larval survival in marine and estuarine organisms. The 10 unit course will address the question: How do embryos defend themselves against environmental insults?

Students will utilize key model species and employ approaches common to cell and developmental biology. Students will not only learn culture techniques for cells and embryos, but also advanced techniques, including quantitative fluorescence and scanning laser confocal microscopy, electrophoresis and western blotting, use of antibodies, and embryo cell isolation and culture.

Course Descriptions

Lower Division Courses

10. Introduction to Toxicology (3)

20. Introduction to Forensic Science (4)
Lecture—3 hours; discussion—1 hour. Basic principles of forensic science and the types of information on which investigations focus, how the information is obtained and how it is used in criminal investigations, types of scientific skills that are required to practice forensic science as a profession, and guidance on future training. Real cases will be discussed, and demonstrations of certain methods provided. GE credit: SciEng, Wrt|SE, SL, VL — II. (II.) Kanthaswamy

30. Chemical and Drug Use and Abuse (3)
Lecture—3 hours. An overview of chemical use and abuse in our society. The effects of chemicals (therapeutic drugs, pesticides, food additives, herbal remedies, environmental contaminants, and recreational drugs) on humans and other living systems. GE credit: SciEng|SE — III. (III.) Wood

92. Internship (1-12)
Internship—3-36 hours. Prerequisite: Lower division standing and consent of instructor. Students will participate in work experience either off or on campus in specific subject areas in the College of Agricultural and Environmental Sciences. Internships are supervised by a member of the faculty. GE Credit: SE. (P/NP grading only)

ETX 127 at Bodega Marine Lab, Summer 2007
Course Highlights:

**ETX 102A**

“Learning about the fate of chemicals in the environment strengthened my awareness of the interdependence of environmental and human health. In addition, this course is especially exciting for students interested in Aquatic Toxicology. Dr. Tjeerdema describes chemical interactions with aquatic systems, enhancing the student’s ability to predict how aquatic organisms will be exposed to toxicants.”

Shellie Kendall
Environmental Toxicology major
Peer Adviser 2001-2002

**ETX 103A**

“ETX 103A provides a picture of how different toxic substances affect organisms by combining elements of many of the science courses I have taken in college. This course showed me how complex and multifaceted toxic substances can be.”

Julia Quan

Upper Division Courses

101. Principles of Environmental Toxicology (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 88, 118B, or 128B and Biological Sciences 1A. Principles of toxicology with a focus on environmental, industrial, and natural chemicals. Topics include fate and effects of chemicals in organisms and the environment, air pollutants, insecticides, aquatic toxicology, endocrine disruptors, biomarkers and bioassays, and risk assessment. GE Credit: SE, SL —I. (I.) Denison

102A. Environmental Fate of Toxicants (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 88, 118B, 128B or consent of instructor. Properties of toxic chemicals influencing their distribution and transformations; action of environmental forces affecting toxicant breakdown, movement, and accumulation; sources and occurrence of major classes of environmental toxicants. Not open for credit to students who have completed course 102A. GE credit: QL, SE, SL, VL, WE —II. (II.) Tjeerdema

102B. Quantitative Analysis of Environmental Toxicants (5)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Chemistry 2C; course 102A; consent of instructor. Sample preparation methods for trace analysis of environmental toxicants. Concept and techniques of advanced analytical instrumentation. Interpretation and use of analytical data. Not open for credit to students who have completed course 102B. GE Credit: SE, VL —III. (III.) Shibamoto

103A. Biological Effects of Toxicants (4)
Lecture—3 hours. Prerequisite: Biological Sciences 102; course 101 and Neurobiology, Physiology, and Behavior 101 recommended. Students will learn about the biological effects of toxic substances in living organisms. Metabolism, cellular and tissue targets, mechanisms of action, and pathological effects. Not open for credit to students who have completed course 103A. GE Credit: SE —II. (II.) Rice

103B. Biological Effects of Toxicants: Experimental Approaches (5)
Lecture/discussion—2 hours; discussion/laboratory—4 hours. Prerequisite: Course 103A and consent of instructor if non-major. This course illustrates basic principles of toxicology and acquaints students with laboratory techniques for evaluating the potential toxicity of chemicals. The lectures and laboratory exercises are designed to illustrate the experimental approaches used in assessing the biological effects of toxicants and to acquaint the students with techniques used in toxicity testing. GE Credit: SE, VL, WE —III. (III.) Wood
104. Environmental and Nutritional Factors in Cellular Regulation and Nutritional Toxicants (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Biological Sciences 101; Biological Sciences 103 or Animal Biology 103. Cellular regulation from nutritional/toxicological perspective. Emphasis: role of biofactors on modulation of signal transduction pathways, role of specific organelles in organization/regulation of metabolic transformations, major cofactor functions, principles of pharmacology/toxicology important to understanding nutrient/toxicant metabolism. (Same course as Nutrition 104.) GE Credit: OL, SE, SL —III. (III.) Oteiza

110. Toxic Tragedies (2)
Lecture —2 hours. Prerequisite: Biological sciences 10 or the equivalent or consent of instructor; Chemistry 118A recommended. Examination of toxic tragedies, their origins, consequences, and effects on toxic regulation. GE credit: Wrt | OL, SE, SL, WE —II. (II). Rice.

120. Perspectives in Aquatic Toxicology (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 8B, 118B or 128B, Biological Sciences 1A, or consent of instructor. Toxic substances, their fate in marine and freshwater systems, and their effects on aquatic organisms, populations, and ecosystems. Emphasis on substances and issues of current concern. Offered in alternate years. GE Credit: OL, SE, SL, VL, WE —II. Cherr, Whitehead

127. Environmental Stress and Development in Marine Organisms (10)
Lecture—4 hours; discussion—2 hours; Laboratory—12 hours. Prerequisite: Environmental Toxicology 101; Biological Sciences 102 or 104 or equivalent; consent of instructor; Environmental Toxicology 103A or Nutrition 114 recommended. Course taught at Bodega Marine Laboratory. Effects of environmental and nutritional stress, including pollutants, on development and function in embryos and larvae of marine organisms. Emphasis on advanced experimental methods. (Same course as Nutrition 127). GE credit: SciEng|OL, SE, SL, QL, VL, WE —IV. (IV.) Cherr

128. Food Toxicology (3)
Lecture—3 hours. Prerequisite: Biological Sciences 102 and 103. Chemistry and biochemistry of toxins occurring in foods, including plant and animal toxins, intentional and unintentional food additives. The assessment of food safety and toxic hazards. (Same course as Food Science and Technology 128). GE credit: SciEng|SE—III. (III.) Shibamoto, Mitchell
130. The Role and Applications of Toxicology in Modern Industry (3)
Lecture—3 hours. Prerequisite: Course 101 required; course 103A recommended. Role of toxicology in industry research and development, human health and environmental protection, hazard and risk evaluations, risk management and communications, product stewardship, and regulatory compliance. Scientific principles and methods of toxicology in chemical, energy, pharmaceutical, pesticide biotechnology industries. GE Credit: OL, SE, SL, VL, WE —III. (III.) Wong

131. Environmental Toxicology of Air Pollutants (3)
Lecture—3 hours. Prerequisite: Chemistry 8B (may be taken concurrently) or the equivalent; Biological Sciences 102 recommended. Field trip required. Toxicology of air pollutants in the ambient, indoor, and occupational environments. Health effects, sources, environmental fates, pulmonary responses, sampling and analyses, and air-quality criteria and standards. GE Credit: SE, VL —I. (I.) Kado

135. Health Risk Assessment of Toxicants (3)
Lecture—3 hours. Prerequisite: Course 101; course 103A recommended. Students will learn about the current practices of health risk assessment of environmental chemicals using toxicological principles and their application to regulatory control of these chemicals. GE credit: SciEng|QL, SE, SL, VL —I. (I.) Marty

138. Legal Aspects of Environmental Toxicology (3)
Lecture—3 hours. Prerequisite: Consent of instructor; courses 10 and 101 recommended. Students will become familiar with Federal and California legislation concerning air and water pollution, pesticide use, food and feed additives, consumer protection, and occupational exposure to toxic substances; roles of Federal regulatory agencies; and alternatives to governmental control. GE Credit: SE, VL, WE —II. (II.) Alexeeff

146. Exposure Assessment (3)
Lecture—3 hours. Prerequisite: Course 102A; course 135 recommended. Students will learn about the exposure component of risk assessment; specifically, the presence and/or formation of toxic substances in environmental media, their movement within and between contaminated media, and the contacts of human populations with those media. GE credit: SciEng| SE, QE, SL, VL —(III.) Bennett

190. Seminar (1)
Seminar—1 hour. (P/NP grading only) GE Credit: SE.

190C. Research Group Conference (1)
Discussion—1 hour. (P/NP grading only) GE Credit: SE.

190S. Environmental Toxicology Career Seminar (1)
Seminar—1 hour. (P/NP grading only) GE Credit: SE.
192. Internship (1-12)
Internship—3-36 hours. Prerequisite: Completion of 84 units and consent of instructor. Students will participate in work experience either off or on campus in specific subject areas in the College of Agricultural & Environmental Sciences. Internships are supervised by a member of the faculty. (P/NP grading only)

194HA-194HB. Honors Research (3-3)
Discussion—1 hour; laboratory—6 hours. Prerequisite: senior standing, minimum GPA of 3.25, consent of instructor. Specific research project conducted under the supervision of a faculty sponsor. Experience to include experimental design, learning new techniques, data analysis and interpretation of findings. (P/NP grading only; deferred grading pending completion of sequence.)

194HC. Honors Research (3)
Discussion—1 hour; laboratory—6-9 hours. Prerequisite: Senior standing, minimum GPA of 3.25, and consent of instructor. Continuation of course 194HA-194HB. (P/NP grading only)

197T. Tutoring in Environmental Toxicology (1-5)
Hours and duties will vary depending upon course being tutored. Prerequisite: Advanced standing in Environmental Toxicology, a related major, or the equivalent experience and consent of instructor. Students will be teaching toxicology and conducting discussion groups for regular departmental courses under direct guidance of staff. May be repeated for credit up to a total of 5 units. (P/NP grading only)

198. Directed Group Study (1-5)
Prerequisite: Consent of instructor. (P/NP grading only)

199. Special Study for Advanced Undergraduates (1-5) (P/NP grading only)

Graduate Courses

203. Environmental Toxicants (4)
Lecture—3 hours; discussion—1 hour. Prerequisite: Chemistry 128C (or the equivalent), or Chemistry 8B and consent of instructor. Students will be exposed to selected topics on toxic chemicals which illustrate their occurrence, structure, and the reactions underlying the detection, toxicity, fate, and ecological importance of these chemicals. Offered in alternate years. —I.I. Matsumura

214. Mechanisms of Toxic Action (3)
Lecture—3 hours. Prerequisite: Biological Sciences 102, 103, and consent of instructor. Students will become acquainted with the biochemical and physiological mechanisms underlying toxicity and detoxification. Students are required to write a grant proposal and participate in a grant review panel. Offered in alternate years. —(III.) Denison, Hammock
Join the ETOX Club!

Do you want to find out more about this major and the contributions you can make to this field?? If so, the Environmental Toxicology Club is a great way to make that happen. It’s also an excellent way to meet students and faculty in the major. The club sponsors a number of events - social, academic, and service oriented - each quarter.

Some events that the ETOX Club have organized are:

- Student & Faculty Events
- Bowl-Off @ the MU
- Hiking Trips
- Brown Bag Lunches
- Game and Movie Nights
- ETOX Club Holiday Party
- Ski Trip
- Field Trip to Bodega Bay
- Field Trip to Environmental Consulting Firm
- Alumni/Career Night
- Study and Review Sessions

For more information, e-mail Eva Loredo, 2012-2013 Club President: elloredo@ucdavis.edu

Be sure to put ETOX CLUB in the subject line

220. Analysis of Toxicants (3) Lecture—3 hours. Prerequisite: Course 101 and consent of instructor; course 203 recommended. This course provides students with knowledge of the principles of the microanalysis of toxicants and theoretical considerations regarding separation, detection, and quantitative determination of toxicants using chemical and instrumental techniques. —I. (I.) Zhang

220L. Analysis of Toxicants Laboratory (2) Laboratory—6 hours. Prerequisite: Course 220 (may be taken concurrently) and consent of instructor. Laboratory techniques for microanalysis of toxicants. Separation, detection, and quantitative determination of toxicants using chemical and instrumental methods. —I. (I.) Wood

228. Gas Chromatography/Mass Spec. of Toxic Chemicals (3) Lecture—1 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: Course 220 and Chemistry 129C; or consent of instructor. Application of GC/MS techniques to investigate toxic chemicals. Mass spectral elucidation and their application to the structural elucidation. Practical application of GC/MS in current research. Preference given to environmental toxicology graduate students. —II. (II.) Holstege

234. Neurotoxicology (3) Lecture—3 hours. Prerequisite: Neurobiology, Physiology, and Behavior 101 or the equivalent; basic understanding of neurophysiology. Mechanisms of action at the cellular and systemic level of a number of different neurotoxins and toxicants. Examples of ways toxins may act on the nervous system and techniques for the study of neurotoxicology. (Same course as MCP 234 and VMB 234). —I. (I.) Lein

240. Ecotoxicology (3) Lecture—3 hours. Prerequisite: Elementary course in toxicology and ecology or the equivalent, or consent of instructor. Students will learn about the principles of toxicology as applied to chemical action on natural populations, communities, and ecosystems and the physical, chemical, and biological characteristics which influence ecotoxic effects, modeling, and field research. This course emphasizes toxicity at the cellular and sub cellular level. Also, the biochemical and physiological mechanisms underlying toxicity and detoxification are presented in considerable depth for a number of toxic substances. Selected case histories will be analyzed and presented in class in order to expose students to a variety of different mechanisms. —III. (III.) Johnson, Miles

250. Reproductive Toxicology (3) Lecture—1.5 hours; lecture/discussion—1.5 hours. Prerequisite: Physiology 220 or Pharmacology & Toxicology 203. This course will present the application of toxicological principles in reproductive studies. The effects of toxicants on the male, female, and developing embryo/fetus will be included as will the critical evaluation of reproductive toxicity studies and development of mechanistic approaches to understanding how chemical exposure can adversely affect reproduction. Offered in alternate years. —(II.) Miller, Golub
Filing for Graduation

- File for Candidacy online at http://registrar.ucdavis.edu/graduation/
- File for Commencement online at http://case.ucdavis.edu/
- Meet with Faculty and Academic Advisers to complete the Major Certification form
- Complete a degree check at the College of Agricultural and Environmental Science Dean’s Office.
- Order Cap and Gown http://ucdbookstore.ucdavis.edu/graduation/

Deadlines vary each quarter, however, as a general rule, students should begin filing for graduation at the end of the quarter prior to the quarter of graduation.

260. Immunotoxicology (3) Lecture—3 hours. Current research and regulatory information relevant to the impact of environmental toxicants on immunological function in human and wildlife populations. The goal is to provide advanced students with tools for evaluating research findings in this area and applying them to human and ecological health issues. The format uses initial presentations by the instructor followed by group discussion based on readings, individual student presentations and ending with small group presentations focused on health related themes. Offered in alternate years.—I. Golub

270. Toxicology and Pesticides (3) Lecture—3 hours. Prerequisite: One course each in (a) Organic Chemistry, (b) Biochemistry, (c) Toxicology (course 101 or equivalent), or consent of instructor; graduate standing. Classification and chemical properties of pesticides, their mode of action, metabolism and disposition, pesticide resistance, effects on human health and ecological health and methods of risk benefit analyses. Offered in alternate years.—II. Matsumura

278. Molecular Techniques (3) Lecture—3 hours. Prerequisite: Graduate standing or consent of instructor. Recombinant DNA technology and its applications. (Same course as Forensic Science 278.) Offered in alternate years.—(I.) Denison, Rice.

280. Forensic DNA Analysis (3) Lecture—3 hours. Prerequisite: Coursework in genetics and molecular biology. Foundation in theory and practice of forensic DNA analysis; past, present, and emerging technologies; legal and quality assurance issues. DNA extraction, DNA quantitation, multiplex amplification of STR loci, capillary electrophoresis of amplified products, and analysis of STR typing data. (Same course as Forensic Science 280.) —III. (I.) Von Beroldingen


290C. Advanced Research Conference (1) Lecture/discussion—1 hour. Prerequisite: Consent of instructor. Presentation and critical discussion of advanced research methods and interpretation of research. Designed primarily for graduate students. (S/U grading only)—I, II, III. (I, II, III.)

297T. Tutoring in Environmental Toxicology (1-5) Hours and duties will vary depending upon course being tutored. Prerequisite: Graduate standing in Environmental Toxicology, a related major, or the equivalent experience, and consent of instructor. Teaching toxicology including conducting discussion groups for regular departmental courses under direct guidance of staff. May be repeated for credit up to a total of 5 units. (S/U grading only)

298. Group Study (1-5)

299. Research (1-12)
(S/U grading only)

Professional Course

396. Teaching Assistant Training Practicum (1-4)
Prerequisite: Graduate standing. This course may be repeated for credit. (S/U grading only)—I, II, III. (I, II, III.)
Transfer Student Information

Transfer students have more complex scheduling needs and should see the staff adviser right away to verify articulations and to plan a workable class schedule.

Things to Remember:

- For immediate assistance on articulation agreements, please visit the following web site: www.assist.org

- Completion of the Bachelor of Science degree in Environmental Toxicology takes an average of three years. With the proper planning and preparation, it is possible to finish in two years.

- Because Environmental Toxicology courses are offered once a year, it is extremely important to complete prerequisite courses. In order to graduate on time, it is strongly recommended that students complete the core chemistry, math and biology courses prior to transferring to UC Davis.

- In order to fulfill the English requirement, the English courses taken at a junior college must articulate to courses at UC Davis.

The Bachelor of Science Degree

The Bachelor of Science degree in Environmental Toxicology is awarded to students completing a rigorous four year program encompassing the physical sciences, biology, and mathematics, along with specialized courses in toxicology. During the first two years, students take course work in physics, calculus, inorganic and organic chemistry, statistical and computer analysis, and the biological sciences. After the second year, students begin a series of upper division courses in biochemistry, physiology, and environmental toxicology, along with electives tailored to fit the area of specialization within the major selected by the students and their academic advisers.

Among the Environmental Toxicology offerings are (1) an introductory principles course that discusses the biological and environmental occurrence and significance of pollutants, pesticides, food additives, and natural poisons; (2) a two-quarter sequence emphasizing toxicant transport, accumulation, breakdown, and analysis, including, in the second quarter, a laboratory on techniques of sampling, sample preparation, and identification of toxic substances; and (3) a two-quarter sequence on the biological effects, metabolism, and disposition of poisons within living organisms, including a second-quarter laboratory to demonstrate techniques for identifying and quantifying harmful effects of chemicals. Other courses emphasize the legal aspects of environmental toxicology, air pollutants and inhalation toxicology, chromatography, health risk assessment, exposure assessment and other special topics.

Further practical experience can be gained by participating either in research projects or in internships with government agencies and private laboratories (for which University credit is available). Courses in written and oral expression, social sciences, humanities, and unrestricted electives round out the program.
### Degree Requirements

2012-14 UCD Catalog

Preparatory and Core course requirements for the ETX major were revised, effective Fall 2012.

All incoming Freshman are required to follow the updated requirements.

Transfer students’ preparatory work will be evaluated on a case by case basis.

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### Major Program

<table>
<thead>
<tr>
<th>Preparatory Subject Matter</th>
<th>72-73 Quarter Units</th>
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<tbody>
<tr>
<td>Biological Sciences</td>
<td></td>
</tr>
<tr>
<td>Biological Sciences 2A-2B-2C</td>
<td>14-15</td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>Mathematics - Calculus</td>
<td></td>
</tr>
<tr>
<td>Mathematics 17A-17B-17C or 21A-21B-21C</td>
<td>9-12</td>
</tr>
<tr>
<td>Physics</td>
<td></td>
</tr>
<tr>
<td>Physics 7A-7B-7C</td>
<td>12</td>
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<tr>
<td>Statistics</td>
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</tr>
<tr>
<td>Choose one course:</td>
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<tr>
<td>Statistics 100, 102, 103, 104, 106, or 108</td>
<td>4</td>
</tr>
<tr>
<td>University Writing Program</td>
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<tr>
<td>Upper Division Writing 101 or 104(A-I)</td>
<td>4</td>
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<table>
<thead>
<tr>
<th>Depth Subject Matter</th>
<th>37-47 Quarter Units</th>
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</thead>
<tbody>
<tr>
<td>Genetics and/or Biochemistry</td>
<td></td>
</tr>
<tr>
<td>Biological Sciences 101-102 or 102-103</td>
<td>6-7</td>
</tr>
<tr>
<td>(ABI 102 and 103 are interchangeable with BIS 102 and 103)</td>
<td></td>
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<tr>
<td>Environmental Toxicology</td>
<td></td>
</tr>
<tr>
<td>101, 102A-102B, 103A-103B</td>
<td>22</td>
</tr>
<tr>
<td>Choose 3 upper division ETX courses from the following list: 104, 120, 127, 128, 130, 131, 135, 138 or 146</td>
<td>9-18</td>
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<table>
<thead>
<tr>
<th>Area of Emphasis</th>
<th>24-26 Quarter Units</th>
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</thead>
<tbody>
<tr>
<td>Electives selected for area of specialization with Adviser approval</td>
<td>24-26</td>
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</tbody>
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<table>
<thead>
<tr>
<th>CA&amp;ES Written/Oral Expression</th>
<th>0-8 Quarter Units</th>
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<tbody>
<tr>
<td>See College of Agricultural &amp; Environmental Sciences English Composition Requirement</td>
<td></td>
</tr>
</tbody>
</table>

### General Education/Breadth Subject Matter | 36 Quarter Units

Satisfaction of General Education requirements to include courses selected to complement the major; courses in agricultural economics, environmental studies, political science, psychology, and sociology are particularly recommended. Additional breadth in humanities and social sciences | 12 |

### Minor Program

Minor courses may not be taken on P/NP grading option.

Total Unit Requirement | 18-26 Quarter Units

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>12 Quarter Units</th>
</tr>
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<tbody>
<tr>
<td>ETX 101 Principles of Environmental Toxicology</td>
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</tr>
<tr>
<td>ETX 102A Toxicants in the Environment</td>
<td>4</td>
</tr>
<tr>
<td>ETX 103A Biological Effects of Toxicants</td>
<td>4</td>
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</table>

<table>
<thead>
<tr>
<th>Elective Courses (2 chosen from list below)</th>
<th>6-14 Quarter Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETX 104 Nutritional Toxicants</td>
<td>4</td>
</tr>
<tr>
<td>ETX 120 Aquatic Toxicology</td>
<td>4</td>
</tr>
<tr>
<td>ETX 127 Env. Stress &amp; Marine Organisms</td>
<td>10</td>
</tr>
<tr>
<td>ETX 128 Food Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>ETX 130 Toxicology in Modern Industry</td>
<td>3</td>
</tr>
<tr>
<td>ETX 131 Air Pollutants and Inhalation Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>ETX 135 Health Risk Assessment of Toxicants</td>
<td>3</td>
</tr>
<tr>
<td>ETX 138 Legal Aspects of Environmental Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>ETX 146 Exposure &amp; Dose Assessment</td>
<td>3</td>
</tr>
</tbody>
</table>
Choosing Restricted Electives

See the list of emphases on pages 25-28 for ideas.

- In contemplating areas of interest, it is helpful to gather ideas by browsing through the catalog. You’ll often find interesting courses in places you never would have considered. Keep a list of courses that attract your attention.

- When you have an area of interest in mind, search the catalog for related courses. They may or may not be in locations immediately identifiable by department name. Use your intuition to search in all likely departments. Ask friends about courses they found useful. Consult our Academic Adviser.

- When you find courses of interest, note the quarters they are given and any prerequisites. If prerequisites need to be added to your list, note their availability also. Read the descriptions carefully. If you are in doubt about the content of a given course, the department can provide an expanded outline.

- Meet with your Faculty Adviser to decide and approve your Restricted Elec-

The Environmental Toxicology Curriculum

These samples are just a few of the many ways you can plan your program. All required courses and those usually taken to satisfy requirements are included in each program. Substitutions and all Restricted Electives must be approved by your faculty adviser (see the ETOX Web page at: envtox.ucdavis.edu for ideas about choosing Restricted Electives). Any waivers must be approved by the major adviser.

Minimum Progress Standards require that you complete an average of 13 units per quarter each regular school year; Minimum Quarter Requirements are 12 units. Breadth subject matter (including General Education) and un-restricted electives should be taken where possible to round out your schedule. See the College of A&ES advisers for all advising related to General Education requirements.

It should be noted that the College of Agricultural & Environmental Sciences requires that you: 1) have an approved quarter by quarter plan of courses to be taken in satisfaction of all degree requirements and 2) that you file a Study Plan Approval and Major Certification form with them prior to completion of 120 units. Contact a peer adviser, the staff adviser or your faculty adviser for assistance in planning your schedule.

Things to Think About When Planning Your Schedule

ETX Classes

ETX Classes are offered one time per year. A few are offered in alternate years as noted in the UCD Catalog.

All students must take either (BIS 101 + 102) OR (BIS 102 + 103). Note: BIS 102 & 103 are prerequisites to ETX 128.

See pages 25-28 for suggested courses that satisfy the Restricted Elective requirement.

When planning your schedule, keep in mind that some Restricted Electives may have prerequisites.

For Community College Transfer Students

Ideally, all preparatory biology, chemistry, calculus, and physics coursework should be completed at the community college level prior to transferring to UC Davis. For science and math students, it is more important to concentrate on these prerequisites than to complete your G.E. requirements or IGETC.

For Students Applying to Graduate or Professional Schools

We recommend that you go the “Advising” page of the UC Davis Academic Success Center website for information about entrance requirements to graduate and professional schools: http://success.ucdavis.edu/grad-prof/

We also recommend that you make an appointment with a Pre-Graduate or Pre-Professional School Adviser at UC Davis Academic Success Center in follow-up.

Further, it is a good idea to check the Web site of specific schools in which you are interested in applying for their specific admission requirements. Many upper division courses required for admission may be woven into your ETX restricted electives choices with faculty adviser approval.
### Sample Schedules

The sample schedules are designed to give students an idea of the timing of required and elective coursework. It is only a guide, not a substitute for a meeting with your adviser to plan your schedule. Remember, your faculty adviser is a valuable resource and can be a mentor as well as a connection to opportunities for lab work, internships, and coursework to support your area of interest.

### Guide to Symbols / Bolding

Course **Bolded** in sample schedule = requirement for major

* = Sample Restricted Electives (all of which must be approved by Faculty Adviser)

** = Sample Core Elective

**GE** = Pick a class which satisfies one or more general education requirements. Consult the course catalog or the Dean’s office for specific general education requirements.

**W** = Pick a GE which satisfies the university writing requirement

**WD** = Pick a GE which satisfies the university writing requirement and the university social diversity requirement

**BR** = Breadth Subject Matter

† = Do not pick a course with a writing component

---

### Sample Program 1

<table>
<thead>
<tr>
<th>First Year</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 2A (5)</td>
<td>CHE 2B (5)</td>
<td>CHE 2C (5)</td>
<td></td>
</tr>
<tr>
<td>MAT 17A/21A (3/4)</td>
<td>MAT 17B/21B (3/4)</td>
<td>MAT 17C/21C (3/4)</td>
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<tr>
<td>ETX 10 (3)</td>
<td>GE (4)</td>
<td>ETX Seminar (1)</td>
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<tr>
<td>ETX: Fresh. Sem. (2)</td>
<td>GE (4)**</td>
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<table>
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<th>Second Year</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>CHE 118A (4)</td>
<td>CHE 118B (4)</td>
<td>CHE 118C (4)</td>
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</tr>
<tr>
<td>BIS 2A (5)</td>
<td>BIS 2B (5)</td>
<td>BIS 2C (5)</td>
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</tr>
<tr>
<td>STA 100 (4)</td>
<td>ETX 110 (2)**</td>
<td>GE (4)**</td>
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<tr>
<td>GE (4)</td>
<td>ETX 190-003 (1)*</td>
<td>ETX 128 (3)*</td>
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<table>
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<th>Third Year</th>
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<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETX 101 (4)</td>
<td>ETX 102A (4)</td>
<td>ETX 102B (5)</td>
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<tr>
<td>PHYS 7A (4)</td>
<td>PHY 7B (4)</td>
<td>PHY 7C (4)</td>
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<tr>
<td>BIS 101 (4)</td>
<td>ETX 138 (3)**</td>
<td>BIS 102 (3)</td>
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<tr>
<td>BIS 101D (1)</td>
<td>UWP 104E/F(4)</td>
<td>BR: Arts &amp; Hum. (4)†</td>
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<tr>
<td>HYD 122 (3)*</td>
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<th>Fall</th>
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</thead>
<tbody>
<tr>
<td>NPB 101 (5)*</td>
<td>ETX 103A (4)</td>
<td>ETX 103B (5)</td>
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<tr>
<td>ETX 131 (3)**</td>
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<td>ETX 128 (3)*</td>
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</table>

### Sample Program 2 (Medical Emphasis / Pre-med)

(For information on professional school advising, please see notes on page 22.)

<table>
<thead>
<tr>
<th>First Year</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
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<tbody>
<tr>
<td>CHE 2A (5)</td>
<td>CHE 2B (5)</td>
<td>CHE 2C (5)</td>
<td></td>
</tr>
<tr>
<td>MAT 17A/21A (3/4)</td>
<td>MAT 17B/21B (3/4)</td>
<td>MAT 17C/21C (3/4)</td>
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<td>ETX 10 (3)</td>
<td>BIS 2A (5)</td>
<td>BIS 2B (5)</td>
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<tr>
<td>GE (3)</td>
<td>GE (4)**</td>
<td>CMN 1 (4)</td>
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<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 118A (4)</td>
<td>CHE 118B (4)</td>
<td>CHE 118C (4)</td>
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<tr>
<td>BIS 2C (5)</td>
<td>BIS 102 (3)</td>
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<tr>
<td>PHY 7A (4)</td>
<td>PHY 7B (4)</td>
<td>PHY 7C (4)</td>
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<td>STA 100 (4)</td>
<td>GE (4)</td>
<td>GE (4)**</td>
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<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
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<tbody>
<tr>
<td>ETX 101 (4)</td>
<td>ETX 102A (4)</td>
<td>ETX 102B (5)</td>
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<tr>
<td>GE (4)</td>
<td>GE (3)**</td>
<td>MIC 102 (4)†</td>
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<td>ETX 138 (3)**</td>
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<td>ETX Internship (2)*</td>
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<th>Fourth Year</th>
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<th>Winter</th>
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<tr>
<td>ETX 135 (3)**</td>
<td>ETX 103A (4)</td>
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<td>PMI 126 (3)*</td>
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</tbody>
</table>
Internships & Special Study

Internships are an important part of the career development process, because they allow you to put a potential profession to the test. An internship may confirm a career match and may even clarify specialization within a field.

Students can opt for an internship or research units depending on the nature of the work. Both internship and research units are variable and can only be taken pass/no pass. They are subject to the same Academic Senate Guidelines for awarding academic credit for internships. A brief description of both follows:

Internships

92/192: These internships provide the student an opportunity to enrich their academic preparation through experiential education. The internship will take place in a professional work setting and provide the student with work and experience. The academic value of the internship and the units awarded will be determined by the faculty sponsor upon completion of Form D788-1 (Request for Approval of Internship for Academic Credit), which can be obtained from the ETOX Advising Office (4111 Meyer Hall) or at the Internship and Career Center (second floor, South Hall). A CRN will be given to the student ONLY after the student and faculty sponsor have completed the form.

Special Study

99/199: Environmental Toxicology students interested in lab research should consult the “Faculty Fields of Interest” section on page 9 of this document to determine their area of interest and should contact the corresponding faculty person to determine if an internship is available. The academic value of the research and the units awarded will be determined by the faculty sponsor upon completion of Form D574-2 (Request to Teach an Undergraduate Variable-Unit Course), which can be obtained from the ETOX Advising Office (4111 Meyer Hall) or at the Internship and Career Center (second floor, South Hall). A CRN will be given to the student ONLY after the student and faculty sponsor have completed the form.

Remember to follow the Internship and Career Center guidelines for transcript notation: http://iccweb.ucdavis.edu/employer/whatisTN.htm

Where can I find a list of available Internships?

Students can find out about on-campus and off-campus internship and research opportunities by using the Internship and Career Center (ICC) search engine.

The Environmental Toxicology Department submits all internship listings it receives to the ICC so that students have a central location to search (excluding ETOX lab research opportunities).

To review the many listings (which are updated daily) visit:

www.icc.ucdavis.edu

**Hint: when searching the ICC database, do not limit yourself. Remember, ETOX is a broad field and there are many more keywords than “Environmental.”

Use the word that best describe the type of internship you want. For example, if you want an internship studying pesticide use in food crops, you could use the keyword “Agriculture”. Some additional ETOX keywords could include: Aquaculture, Biological Science, Chemistry, Community Education, Consulting, Field Work, Government, Health Sciences, Nutrition, Pharmacy, Public Health, Teaching, Veterinary, and Wildlife/Fisheries.
**ETX Emphases**

The ETX Emphases are designed to give you a chance to explore a chosen area of the major more thoroughly and give you a broader sense of the material covered in the core ETX courses. Upper division courses from both ETX and other departments on campus are recommended with these goals in mind.

ETX majors are required to choose 24 units of Restricted Elective courses in an Emphasis area. Each student meets with his/her faculty advisor to discuss these choices and obtain approval prior to taking the classes. Courses other than those listed below may be used with faculty advisor approval.

Six Pass/No Pass units may be used toward the Restricted Electives requirement including one or more of the following type courses: ETX 199 (special study in a lab), ETX 192 (internship), ETX 190 (seminar). Similar courses in other departments may also be approved by your faculty advisor.

Note: Each student must obtain the approval signature on his/her Restricted Elective Course list and turn it into the Advising Office, 4111 Meyer Hall, by no later than the first quarter of his/her senior year.

**Ecotoxicology & Environmental Chemistry**

Courses in Biology, Environmental Science and Policy; Wildlife, Fish, Conservation Biology; Chemistry; Hydrology; and other areas are brought together in this emphasis to give a better understanding of how different environments function, how chemicals move through them, and what organisms those chemicals affect.

### Aquatic Toxicology:

- BIS 122/122P—Population Biology and Ecology—3 units (III) / 5 units (III)
- ESP/GEL 116N—The Oceans (Offered in Alternate Years)—3 (II)
- ESP 151/151L—Limnology—4 (III) / 3 (III)
- ESP 124—Marine and Coastal Field Ecology—3 (IV) Bodega Marine Lab
- ESP 155/155L—Wetland Ecology—4 (I) / 3 (I)
- ETX 120—Perspectives in Aquatic Toxicology—4 (II) (alternate years)
- ETX 127—Environmental Stress & Development in Marine Organisms—10 (IV)
- EVE 112—Biology of Invertebrates—3 (II)
- NPB 141/141P—Physiological Adaptation of Marine Organisms (Bodega)—3 (III) / 5 (III)
- WFC 120—Biology and Conservation of Fishes—3 (I)
- WFC 121—Physiology of Fishes—4 (II)
- WFC 122—Population Dynamics and Estimation—4 (III)
- WFC 157—Coastal Ecosystems (offered even years only)—4 (III)

### Ecology:

- ESP 100—General Ecology—4 units (I, II)
- ECL 200A/B—Principles and Application of Ecological Theory—5 (I) / 5 (II)
- EVE 101—Introduction to Ecology—4 (I, II, III)
- EVE 104—Community Ecology—4 (II)
- GEL 130—Non-Renewable Natural Resources—3 (III)
- PMI 127—Medical Microbiology—5 (III)
- WFC 151—Wildlife Ecology—4 (I)
- WFC 153—Wildlife Ecotoxicology—4 (alternate years)
- WFC 154—Conservation Biology—4 (I)

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**Key to Course Abbreviations**

- ABI = Animal Biology
- ANT = Anthropology
- ATM = Atmospheric Science
- ANG = Animal Genetics
- ANS = Animal Science
- APC = Anatomy, Physiology and Cell Biology
- BIS = Biology
- BIT = Biotechnology
- CHA = Cell Biology and Human Anatomy (School of Medicine)
- CHE = Chemistry
- ECL = Ecology
- EME = Mechanical Engineering
- ENG = Engineering
- ENT = Entomology
- EPI = Epidemiology (Graduate Group)
- EPP = Epidemiology and Preventive Medicine (School of Medicine)
- ERS = Environmental Resource Science
- ESP = Environmental Science and Policy
- EVE = Evolution and Ecology
- FSP = Fiber and Polymer Science
- FST = Food Science and Technology
- GEL = Geology
- HYD = Hydrology
- IDI = Internal Med-Infectious Diseases
- MCB = Molecular and Cellular Biology
- MIC = Microbiology
- MMI = Medical Microbiology and Immunology
- NPB = Neurobiology, Physiology, and Behavior
- NUT = Nutrition
- OBG = Obstetrics and Gynecology (Med)
- PHR = Population Health & Reproduction
- PLB = Plant Biology
- PLP = Plant Pathology
- PMI = Pathology, Microbiology, and Immunology (School of Vet. Med.)
- PSC = Psychology
- SSC = Soil Science
- VEN = Viticulture and Enology
- VMD = Veterinary Medicine
- WFC = Wildlife, Fish, & Conservation Biology

Note: The quarter (fall, winter, or spring) of classes being offered is subject to change every academic year.
**Chemical Fate:**
ATM/ENG 149—Introduction to Air Pollution—4 units (I)
ATM 160—Introduction to Atmospheric Chemistry—4 (II)
CHE 100—Environmental Chemistry of Water (II)
CHE 107 A/B—Physical Chemistry for the Life Sciences—3 (I) / 3 (II)
CHE 115—Instrumental Analysis—4 (I, II)
ERS 100—Principles of Hydrologic Science—4 (I)
ERS 136—Chemistry of the Hydrosphere—3 (III)
ESP 116—The Oceans—3 (II)
HYD 134—Aqueous Geochemistry—6 (III)
HYD 141—Physical Hydrology—4 (I)
HYD/ENG 144—Groundwater Hydrology—4 (I)
HYD 146—Hydrogeology and Contaminant Transport—5 (II)
MIC 102/102L—General Bacteriology—4 (I, III) / 3 (I, III)
MIC 105—Microbial Diversity—3 (II)
SSC 100—Principles of Soil Science—5 (I)
SSC 102—Soil and Water Chemistry—5 (II)
SSC 107—Soil Physics—5 (I)
SSC 111—Soil Microbiology—4 (II)
VEN 123—Analysis of Musts and Wines—2 (I)

**Forensic Science and Regulatory Toxicology**
Courses in Environmental Science and Policy, Physiology, Law, Psychology, and other areas are brought together in this emphasis to give a better look into the legal and regulatory side of toxicology with focus on environmental law, forensic science, and public health.

**Environmental Policy and Management:**
ETX 135—Health Risk Assessment of Toxicants—3 units (I)
ETX 138—Legal Aspects of Environmental Toxicology—3 units (II)
ETX 146—Exposure Assessment—3 (III) every other year
ESP 160—The Policy Process—4 (II)
ESP 161—Environmental Law—4 (III)
ESP 164—Ethical Issues in Environmental Policy—3 (III)
ESP 179—Environmental Impact Assessment—4 (II)
POL 150—Judicial Politics and Constitutional Interpretation—4 (I, II)
PSC 153—Psychology and Law—4 (III)

**Forensic Science:**
ANT 153—Human Biological Variation—5 units
CHA 101/101L—Human Gross Anatomy—4 (II) / 3 (II)
EME 161—Combustion and the Environment—4 (III)
ENT 158—Forensic Entomology—3 (III)
ETX 110—Toxic Tragedies—2 (II)
FPS 161—Structure and Properties of Fibers—3 (I)
FPS 161L—Textile Chemical Analysis Laboratory—1 (I)
NPB 101—Systemic Physiology—5 (I, II, III)
NPB 101L—Systemic Physiology Lab—3 (I, II, III)
NPB 168—Neurobiology of Addictive Drugs—4 (III)
PLB 102—California Floristics—5 (III)
PSC 153—Psychology and Law—4 (III)

*Note: The quarter (fall, winter, or spring) of classes being offered is subject to change every academic year.*
Public Health:
EPI 205A—Principles of Epidemiology—4 units (I)
EPI 205B—Integration of Epidemiology Concepts—2 (I)
EPI 251—Environmental Epidemiology—3 (I)
SPH 101—Perspectives in Community Health—3 (III)
SPH 160—General Health Education and Prevention —5 (P/NP) (IV)
SPH 262—Environmental Health—3 (I)
ETX 110—Toxic Tragedies—2 (II)
IDI 141—Infectious Diseases in Humans—1 (I)
MMI 130—Medical Mycology—2 (II) (alternate years)
PMI 126—Fundamentals of Immunology—3 (II)
PMI 127—Medical Microbiology—5 (III)

Molecular and Biomedical Toxicology

Courses in Biology, Microbiology, Biotechnology, Nutrition, Food Science, Physiology, Biochemistry, and other areas are brought together in this emphasis to give a better foundation in the biological effects of toxicants, effects and behavior of pharmaceuticals, and medicine.

Biotechnology:
ANG 111—Molecular Biology Laboratory Techniques (Animal Genetics)—4 units (I)
BIS 102—Structure and Function of Biomolecules—3 units (I, II, III)
BIS 103—Bioenergetics and Metabolism—3 (I, II, III)
BIS 104—Regulation of Cell Function—3 (I, II, III)
BIT 160—Principles of Plant Biotechnology—3 (II)
BIT 161A/B—Plant Genetics and Biotechnology Labs—6 (II) / 6 (III)
BIT 171—Professionalism and Ethics in Genomics and Biotechnology—3 (I, II, III)
NPB 101—Systemic Physiology—5 (I, II, III)
MCB 126—Plant Biochemistry—3 (II)
MCB 161—Molecular Genetics—3 (II)
MIC 102/102L—General Microbiology—4 (I, III) / 3 (I, III)
MIC 140/155L—Bacterial Physiology—3 (I) / 4 (III)
MIC 150—Bacterial Genetics—3 (II)
MIC 162—General Virology—4 (II)
PLP 140—Agricultural Biotechnology, Public Policy—4 (III)
PLS 152—Plant Genetics—4 (I)
PMI 128—Biology of Animal Viruses—3 (I)
PMI 126/126 L—Fundamentals of Immunology—3 (II) / 2 (II)

Food Toxicology:
ETX 128—Food Toxicology—3 units (III)
FST 100 A/101 A—Food Chemistry—4 (I) / 2 (I)
FST 100 B/101 B—Food Properties—4 (II) / 2 (II)
FST 103—Physical and Chemical Methods for Food Analysis—4 (II)
FST 104/104L—Food Microbiology—3 (II) / 4 (III)
MIC 102—General Bacteriology—4 (I, II, III)
MMI 130—Medical Mycology—2 (II) (alternate years)
NUT 111AV—Introduction to Nutrition and Metabolism—3 (III)
NUT 111B—Recommendations and Standards for Human Nutrition—2 (III)
NUT 112—Nutritional Assessment—3 (III)
NUT 114—Developmental Nutrition—4 (II)
PLB 111—Plant Physiology—3 (I)

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Medicine:
CHA 101/101L—Human Gross Anatomy—4 units (II) / 3 units (II)
IDI 141—Infectious Diseases of Humans—1 (I)
NPB 100—Neurobiology—4 (I, II, III)
NPB 101/101L—Systemic Physiology  5 (I, II, III ) / 3 (I, II )
NPB 102—Animal Behavior—3 (II, III)
NPB 113—Cardiovascular, Respiratory, and Renal Physiology—4
NPB 114—Gastrointestinal Physiology—3 (I)
NPB 121/121L—Physiology of Reproduction—4 (II) / 1 (II)
NPB 140—Principles of Environmental Physiology—3 (II)
NPB 168—Neurobiology of Addictive Drugs—4 (III)
PMI 126—Fundamentals of Immunology—3 (I)
PMI 127—Medical Microbiology—5 (III)

Pharmacology:
BIS 103—Bioenergetics and Metabolism—3 units (I, II, III)
BIS 104—Regulation of Cell Function—3 (I, II, III)
CHA 101/101L—Human Gross Anatomy—4 (II) / 3 (II)
CHE 130A/B Pharmaceutical Chemistry—3 (II) / 3 (III)
EVE 112—Biology of the Invertebrates—3 (II)
IDI 141—Infectious Diseases of Humans—1 (I)
MCB 120L—Biochemistry Laboratory—6 (I, II, III)
MIC 102/102L—General Microbiology/lab—4 (I, III) / 3 (I, III)
MCB 121—Molecular Biology of Eukaryotic Cells—3 (II, III)
MCB 123—Behavior and Analysis of Enzyme and Receptor Systems—3 (I, III)
NPB 101—Systemic Physiology—5 (I, II, III)
NPB 160—Molecular and Cellular Neurobiology—3 (III)

Veterinary Medicine:
ABI 102—Animal Biochemistry and Metabolism (not open for credit to students who have completed BIS 103)—5 units (I)
ABI 103—Animal Biology—5 (II)
ANG 107—Genetics and Animal Breeding—5 (I)
ANG 111—Molecular Biology Laboratory Techniques—4 (I)
APC 100 —Comparative Vertebrate Organology—4 (II)
MCB 150—Developmental Biology—4 (I)
MMI 116—Parasitology for Wildlife Biologists—3 (III)
NPB 101—Systemic Physiology— 5 (I, II, III)
NPB 121—Physiology of Reproduction—4 (II)
NUT 123—Comparative Animal Nutrition—3 (III)
PMI 126—Fundamentals of Immunology—3 (I)
PMI 127—Medical Microbiology—5 (III)
WFC 153—Wildlife Ecotoxicology—4 (alternate years)

Student Designed Emphases
Students may construct their own area of emphasis under the explicit direction of their faculty advisers

This document is produced by the Department of Environmental Toxicology, Academic Advising Office (4111 Meyer Hall, UC Davis, One Shields Avenue Davis, CA 95616). Please direct all questions/comments to Susan Kancir, Student Affairs Officer, at sgkancir@ucdavis.edu.

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