The course work requirements for Chemical Oceanography graduate students are outlined below. An individual student's program is the result of consultation with their faculty adviser and the Graduate Program Coordinator, to assure that course work not only meets School and option requirements, but also reflects the student's background and areas of interest within Chemical Oceanography. Waivers for School requirements should be referred to the Graduate Program Coordinator; waivers for Chemical Oceanography requirements may be granted by the faculty adviser.

**CHEMICAL OCEANOGRAPHY COURSES**

Chemical Oceanography students are expected to complete the following course:

**OCEAN 520  MARINE CHEMISTRY (3)** Processes controlling the chemical composition of seawater. Chemical distributions in the ocean, marine physical chemistry, chemical equilibrium and concepts of mass balance. Mechanisms and models used to explain distributions of stable and radioactive isotopes, gases, trace metals, and biochemicals in the world's oceans.

Students are required to take three of the following seven courses for a Master's degree; six of the seven must be completed for a Ph.D. Courses not on this list may also be taken with the approval of your committee.

**OCEAN 521  AQUATIC CHEMISTRY (3)** Application of physical chemistry and thermodynamics to processes that control chemical composition of natural waters. Equilibrium approach. Acid/base chemistry, the carbonate system, dissolution and precipitation, metal ions in solution, oxidation-reduction chemistry, silicate mineral reactions. Offered alternate years. Prerequisite: 520 or permission of instructor.

**OCEAN 529  OCEAN BIOGEOCHEMICAL MODELING (3)** Introduction to ocean biogeochemical modeling with an emphasis on the carbon, oxygen and nitrogen cycles. Offered alternate years.

**OCEAN 529  TRACE METAL BIOGEOCHEMISTRY (3)** Sources, sinks, internal cycling, and applications of trace metal distributions and isotopes to problems in chemical oceanography. This course covers the cycling of trace metals in the marine environment, their use in biological processes, their applications as tracers, and their role as important paleo proxies. Offered alternate years.

**OCEAN 522  MARINE ORGANIC GEOCHEMISTRY (3)** Sources, reactions, and fates of organic molecules in the marine environment. This course comprehensively covers the major molecular and isotopic constituents of natural organic materials in contemporary aquatic environments and processes which affect their distributions. Offered alternate years.
OCEAN 554 PALEOCLIMATE PROXIES (3) Provides a critical evaluation of the most commonly applied paleoclimate proxies from the ocean, land, and ice sheets. Offered jointly with ATM 554/ESS 554. Offered alternate years.

OCEAN 583 ISOTOPE BIOGEOCHEMISTRY (3) The use of stable isotopes to study biogeochemical cycles in the oceans and atmosphere; specifically carbon, nitrogen, and sulfur cycles. Isotopic effects during photosynthesis, respiration, organic matter degradation, CaCO₃ dissolution, methanogenesis, nitrification/denitrification, and sulfate reduction. Offered alternate years.

OCEAN 588 THE GLOBAL CARBON CYCLE AND CLIMATE (3) Oceanic and terrestrial biogeochemical processes controlling atmospheric CO₂ and other greenhouse gases. Records of past changes in the earth's carbon cycle form geological, oceanographic and terrestrial archives. Anthropogenic perturbations to cycles. Develop simple box models, discuss results of complex models.

OTHER COURSES

There are many other courses available inside and outside of the department that may give students a broader perspective on other facets of oceanography, data processing, science communication, or analytical techniques. Examples of additional courses that are common for chemical oceanography students to take are listed below.

FISH 552: INTRODUCTION TO R PROGRAMMING
FISH 553: ADVANCED R PROGRAMMING FOR NATURAL SCIENTISTS
FISH 554: BEAUTIFUL GRAPHICS IN R
FISH 560: APPLIED MULTIVARIATE STATISTICS FOR ECOLOGISTS
MECHEM 541: BIOLOGICAL MASS SPECTROMETRY
OCEAN 518: SCIENTIFIC WRITING
CENV 590: APPLIED IMPROVISATION FOR SCIENCE COMMUNICATIONS
MICROM 431: PROKARYOTIC RECOMBINANT DNA TECHNIQUES

Chemical Oceanography students are also encouraged to have a mathematical background through partial differential equations (equivalent to Applied Math 351/353 or 401/402) and a strong background in physical, inorganic or organic chemistry.

SEMINARS

There is a weekly seminar in Chemical Oceanography. Students are required to attend and encouraged to present the results of their research after their first two years. In addition, courses on special topics of interest are offered as OCEAN 529, Seminar in Chemical Oceanography.
Every graduate student is required to take a minimum of one 3-credit, numerically-graded, 500-level course from each option outside their own for a total of three courses and 9 credits. Each option will provide a list of courses that can be taken to fulfill this requirement (see http://www.ocean.washington.edu/academics/grad-req.html). The student is expected to complete this breadth requirement prior to receiving an MS degree. Normally, physical oceanography students should plan to take OCEAN 510 Physics of Ocean Circulation, OCEAN 535 Biological Oceanography, and OCEAN 540 Marine Geology and Geophysics. A Graduate Student Affairs committee, chaired by the Graduate Program Coordinator, will address any requests for waivers.