



Organic Chemists

... Help to improve the standard of life

Organic chemistry is that branch of chemistry that deals with the structure, properties, and reactions of compounds that contain carbon. It is a highly creative science. Chemists in general, and organic chemists in particular, can create new molecules never before proposed, which, if carefully designed, may have important properties for the betterment of the human experience. Organic chemistry is the largest chemistry discipline in both total numbers and annual Ph.D. graduates.

Beyond our bodies' DNA, peptides, proteins, and enzymes, organic compounds are all around us. They are central to the economic growth of the U.S. economy in areas such as the rubber, plastics, fuel, pharmaceuticals, cosmetics, detergents, coatings, dyestuffs, and agrochemical industries. The very foundations of biochemistry, biotechnology, and medicine are built on organic compounds and their role in life processes. Almost all of the modern, high-tech materials are composed, at least in part, of organic compounds. Clearly, organic chemistry is critically important to our high standard of living.

Organic chemists at all degree levels are found in all those industries that depend on research and development (R&D), working on projects from fundamental discovery to highly applied product development. The foundation of the pharmaceutical industry is its large pool of highly skilled organic chemists. For example, nature may provide a molecule such as a complex antibiotic, an antitumor agent, or a replacement for a hormone such as insulin; organic chemists determine the

structure of this newly discovered molecule and then modify it to enhance the desired activity and specificity of action, while decreasing undesired side effects. Indeed, organic chemists have produced a wonderful myriad of highly successful products to fight human diseases. Nearly all modern pharmaceutical agents are first designed, synthesized, and optimized by organic chemists working in collaboration with biologists.

There is tremendous excitement and challenge in synthesizing a molecule never before made synthetically or found in nature. Tailoring the properties of that molecule via chemical synthesis to produce beneficial effects to meet the needs of present and future human existence is both challenging and rewarding.

... Work inside and outside the lab

Organic chemists spend time in the lab but also work outside the lab studying scientific literature, doing library research, collaborating with colleagues, writing reports, preparing publications, and peer-reviewing research manuscripts. Computers are playing an ever-increasing role in simplifying these tasks. Depending on education, skills, employer, specific projects, and career track, organic chemists may be involved in a variety of tasks, including carrying out procedures at the bench, designing and directing the research efforts of a group of scientists, and managing research facilities. Whether working inside or outside the laboratory, organic chemists compare their work in the field to solving puzzles or doing detective work.

FACT FILE: Organic Chemists

WORK DESCRIPTION ► Organic chemistry is the science of designing, synthesizing, characterizing, and developing applications for molecules that contain carbon. Organic chemists create and study organic compounds, the reactions that produce them, and their chemical and physical properties. They create and explore new uses for new or existing organic materials. They carry out synthesis reactions and isolations in a laboratory environment using sophisticated instrumental methods such as nuclear magnetic resonance spectroscopy; gas and liquid chromatography; and infrared, ultraviolet, and visible spectroscopy. Most of the instruments are computer-driven and controlled, so computer literacy is required. Complex molecules that require synthetic modification may call for three-dimensional computer modeling capability to aid in visualizing their domains.



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WORKING CONDITIONS ► Most organic chemists will find themselves working in modern, clean, well-lit, and safe research/development facilities equipped with up-to-date equipment and instrumentation designed to facilitate efficient project goal achievement. Individuals work on a team, and interactions with its members provide a valuable learning opportunity. Although a Ph.D. chemist will usually have overall responsibility for a project, everyone's ideas and input will be valued and used. Bachelor's degree chemists will spend most of their time working at the bench; however, time will also be spent with data recording, report writing, and interactions with people and disciplines outside the team. Computers greatly aid the collection, recording, managing, and analyzing of data, and even report writing. More and more, computers bring the outside world's technical literature right into the laboratory, and they are also invaluable in providing computer-aided design techniques for constructing new molecules and modifying existing ones.

PLACES OF EMPLOYMENT ► Organic chemists at all levels are employed by pharmaceutical, biotech, chemical, consumer product, petroleum, and other industries from the small to the very large. R&D is the primary opportunity in industry. Research universities that grant Ph.D.s have excellent teaching and research opportunities for Ph.D. chemists, many of whom will have postdoctoral training. Liberal arts colleges and universities, where excellent teaching and research are encouraged and rewarded, also employ mostly Ph.D. chemists. Government labs also employ organic chemists.

PERSONAL CHARACTERISTICS ► Like any other discipline, organic chemistry requires that the practitioner possess and cultivate a set of desired personal characteristics often called "What Counts" factors. These include creativity and innovation, technical mastery, problem-solving ability, initiative and follow-through, leadership, ability to work with others (teamwork), and good oral and written communication skills. Developing and constantly strengthening these abilities will help you get a job and keep a job, and will lead to a successful and satisfying career anywhere you are employed.

EDUCATION AND TRAINING ► In R&D, most bachelor-level organic chemists work "at the bench" in a laboratory setting, often working as part of a team with master's and doctoral scientists or engineers. The higher the degree, the greater the responsibility, so the Ph.D. scientist will usually have overall responsibility for the project's content and direction. But many bachelor's chemists work independently, and all can advance in responsibility and pay commensurate with acquired experience.

A benefit provided by most companies is paid tuition for the bachelor's or master's chemist who wishes to obtain a higher degree while working full-time. What is learned while pursuing that higher degree, coupled with the practical job experience, can be the key to more rapid advancement in responsibility and pay.

JOB OUTLOOK ► Most companies develop products that solve consumer or customer problems, and many of the solutions are based on organic molecules. This is especially true in pharmaceutical and consumer products, but also in all the other industrial areas mentioned earlier. Because new sets of problems and opportunities constantly arise, organic chemists are in demand to synthesize and produce the molecules that solve those problems. Consequently, the job market for organic chemists is usually strong, again reflecting the fact that organic compounds and chemists are a vital force driving so many varied industries.

Teaching opportunities for Ph.D. chemists are available each year, but the competition is quite stiff. Most research universities and liberal arts colleges require the Ph.D. degree. However, some four- and two-year colleges hire master's-level chemists for teaching and limited research opportunities.

More than 1300 biotechnology firms and large companies in the United States hire all degree levels of organic chemists. Government laboratories also present opportunities for all levels of organic chemists.

SALARY RANGE ► In 2002, the median starting salary for master's degree chemists specializing in organic chemistry was in the mid- \$40,000-per-year range, whereas new Ph.D. chemists started at around \$64,000 per year. A chemist with 10 years of experience in organic chemistry working in industry and holding a bachelor's degree earned a median annual salary of \$58,000. A Ph.D. working as an organic chemist and with the same years of experience earned an annual median salary of \$85,000. In academe, a tenured organic chemistry professor with 10–12 years experience can earn \$80,000–90,000 annually.

FOR MORE INFORMATION

ACS Division of Organic Chemistry
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chemistry.org
www.chem.wayne.edu/acs-organic-division/

Organic Chemistry Resources Worldwide
www.organicworldwide.net

WHAT YOU CAN DO NOW ► It is important that you compile a solid record of achievement in undergraduate school, focusing on activities that both build and demonstrate your possession of the "What Counts" factors covered under PERSONAL CHARACTERISTICS (above). Participate in an undergraduate research project to begin the process of developing meaningful laboratory skills. And, very importantly, secure a co-op or summer internship. In one summer you can decide whether you like industrial R&D or not, and the company can decide whether they see a future for you as a permanent employee. More and more, internships are becoming the preferred route into the company of your choice. The internship puts you ahead of those without one because you have started the process of coming "on board" that is the first step in beginning a career with a company.