

VC2: Careers: Medicinal Chemistry

Medicinal Chemistry



Has a history

Medicinal chemistry is the application of chemical research techniques to the synthesis of pharmaceuticals. During the early stages of medicinal chemistry development, scientists were primarily concerned with the isolation of medicinal agents found in plants. Today, scientists in this field are also equally concerned with the creation of new synthetic drug compounds. Medicinal chemistry is almost always geared toward drug discovery and development.

Is carrying out basic research

Medicinal chemistry research is an important area of research that is performed in many university labs. As an assistant professor at the University of Maryland School of Pharmacy, Alex Mackerell, Jr. has done research on cocaine and cocaine analogs to develop drugs for the treatment of cocaine addiction. His research, however, was not solely focused on just getting a product, but also on understanding basic chemical reactions and their properties. "We were interested in the physical properties and in the underlying mechanisms of cocaine," he says. The purpose of the research was to develop a cocaine antagonist that would cause ill effects when cocaine is ingested. This type of research characterizes the research being conducted in academic environments.

Can lead to treatment of diseases

Grace Lee is using her bachelor's degree in pharmaceutical chemistry for a different kind of drug development. She is a part of a team of analytical chemists at the National Institute of Health (NIH) who formulate drugs that could be used to treat patients with very rare diseases. These formulations are called orphan drugs because they are used to treat diseases found in only small portions of the population. "We try to develop a treatment either from scratch or from research that has already been done in other countries," she says. "My job is challenging because it requires working with several different compounds at one time." Everyday she relies on her knowledge from her undergraduate courses in analytical and organic chemistry. She uses this basic chemistry training when testing and retesting compounds for safety and efficacy, which is the measure of how well a drug product works in the human body.

Is developing guidelines

Chemists at the U.S. Food and Drug Administration (FDA) review new drug applications from pharmaceutical companies and are also responsible for

reviewing the processes by which the substances are made. These chemists do not work in a laboratory, but their role in medicinal chemistry is important. Charles Kumkumian is the assistant director of the Office of Drug Evaluation for the FDA that, he says, is the largest regulatory group in the world, employing more than 9,000 people. He says that there are about 900 chemists employed in various functions throughout FDA. Ten percent of these are chemists who review new drug applications for entirely new therapeutic entities. An equal number of chemists review additional new drug applications that are generic formulas or over-the-counter dosages.

Links many scientific disciplines

The focus on development of new synthetic drug compounds has resulted in the incorporation of many other disciplines, such as biochemistry and molecular biology, into medicinal chemistry. "Medicinal chemistry involves working in teams with scientists from a variety of other disciplines," says James Kaminski, a senior principal scientist at Schering Plough. "There is a lot of collaboration between chemists and biologists while searching for a lead on a new drug or doing research on a preclinical drug candidate. Then, when you look into the drug safety profile, you work with toxicologists and pharmacologists."

Joel Barrish, group/project leader in pharmaceutical and drug discovery research at Bristol-Myers Squibb, says that most of his time is spent coordinating the synthetic chemistry efforts of chemists in his group with other members of the project working group outside of chemistry. These areas include biology, computer-aided design, x-ray crystallography, metabolism and pharmacokinetics, legal and regulatory affairs, clinical, franchise management, pharmaceuticals, and process research chemistry. Barrish says, "Working in teams is essential to discovering drugs because many different aspects of a molecule must be defined to identify a candidate for clinical studies." He adds, "Medicinal chemistry is the drug discovery engine that provides the tools for the rest of the organization so they can determine the importance of particular biological targets. Kaminski also believes that understanding and interacting with other scientists is key to being successful in this area. Most medicinal chemists find that the opportunity to do research with other scientists while helping to new drugs is an exciting part of their work. Barrish says, "Drug discovery research is a highly creative and stimulating work environment where people are driven to succeed by personal and scientific objectives, and the desire to contribute to society's well-being."

FACT FILE: Medicinal Chemistry

WORK DESCRIPTION

Medicinal chemists apply their chemistry training to the process of synthesizing new pharmaceuticals. They also work on improving the process by which other pharmaceuticals are made. Most chemists work with a team of scientists from different disciplines, including biologists, toxicologists, pharmacologists, theoretical chemists, microbiologists, and biopharmacists. Together this team uses sophisticated analytical techniques to synthesize and test new drug products and to develop the most cost-effective and environmentally friendly means of production.

WORK CONDITIONS

Medicinal chemistry offers a variety of lab opportunities. Most chemists use their research skills to formulate, produce, and analyze new compounds. However, each lab environment is unique daily activities and career opportunities differ with each one. In academia, chemists explore a

compound's different mechanisms in basic research as well as teach at least one full course. In government, laboratory work is not always required, especially at the FDA where they review drug applications. Industry, on other hand, offers chemists a choice of moving into management or staying in the lab.

PLACES OF EMPLOYMENT

Though a wide array of positions exist for chemists in medicinal chemistry, the availability of these jobs is dependent upon the economy, shifting government regulations, and research grants. Employment prospects include the academic environment, pharmaceutical companies, and government. Biotechnology organizations also employ chemists in this area. Industry provides the opportunity to choose between a traditional laboratory career or a non laboratory chemistry career in management. Government also offers a choice between a laboratory position and a nonlaboratory chemistry position, such as drug application review.

PERSONAL CHARACTERISTICS

Medicinal chemists must enjoy varied activities and must be receptive to exploring the unknown. A good imagination and persistence are also two important qualities to have when considering a career in medicinal chemistry. Being a team player with good writing and verbal communication skills are invaluable assets when interacting with scientists from other disciplines.

EDUCATION AND TRAINING

Generally, pharmaceutical companies hire only people with research experience, advanced degrees especially in organic chemistry, and at least two years of post-doctoral experience. Most chemists in traditional research careers are Ph.D. chemists while chemists with B.S. degrees generally serve as research technicians. You can place yourself in a competitive position by getting as much experience as possible with a strong background in organic chemistry and biochemistry. A number of universities have formed medicinal chemistry programs in the past 20 years.

SALARY RANGE

The starting salary for a B.S. chemist ranges from the high \$20,000 to the low \$30,000-per-year range. Master's degree holders earn salaries in the high \$30,000 to low \$40,000-per-year range. Salary range for Ph.D. chemists falls in the mid to high \$40,000 to mid \$50,000-per-year range.

JOB OUTLOOK

Because of the ever-changing economy and government health care reform regulations, the job outlook for medicinal chemists in today's market is mixed. Many changes are taking place within the pharmaceutical industry. Companies have been decreasing the size of their research labs or merging with other companies. Therefore, the job outlook is somewhat uncertain for medicinal chemists. While industry is downsizing, some government agencies are looking for chemists to fill nonlaboratory chemistry positions. An excess of jobs is not available in academia either. Some chemists are optimistic that this downturn is only cyclical as much research remains to be done.

FOR MORE INFORMATION

American Association of Pharmaceutical Scientists
1650 King Street, 2nd Floor
Alexandria, VA 22314-3105
703.548.3000

WHAT YOU CAN DO NOW

Undergraduate students should maintain a high degree of scholarship and get as much experience as possible. Internships provide valuable experience and are the best way to see if a career in medicinal chemistry in a pharmaceutical lab appeals to you. Undergraduate research in university laboratories is another way to gain experience and as well as become familiar with the day-to-day activities in academia. Chemists advise undergraduate students to get a strong background in the basic chemistry courses and, if a research position in this areas is desired, continue on to get an advanced degree.

Copyright 1994, 1998 American Chemical Society

Careers | [VC 2](#)

Copyright (c) 2004 American Chemical Society.
All Rights Reserved.