CHEMISTRY... NOW WHAT?

Quick Facts: Chemists and Materials Scientists

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<table>
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<tbody>
<tr>
<td>2020 Median Pay</td>
<td>$80,680 per year</td>
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<tr>
<td>Entry-Level Education</td>
<td>Bachelor’s degree</td>
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<tr>
<td>Work Experience in a Related Occupation</td>
<td>None</td>
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<tr>
<td>On-the-job Training</td>
<td>None</td>
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<tr>
<td>Number of Jobs, 2019</td>
<td>93,700</td>
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<tr>
<td>Job Outlook, 2019-29</td>
<td>5% (Faster than average)</td>
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<td>Employment Change, 2019-29</td>
<td>4,300</td>
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What Chemists and Materials Scientists Do

Chemists and materials scientists study substances at the atomic and molecular levels and analyze the ways in which the substances interact with one another. Chemists and materials scientists work in laboratories and offices. They typically work full time and keep regular hours. Chemists and materials scientists need at least a bachelor’s degree in chemistry or a related field. However, a master’s degree or Ph.D. is needed for many research jobs.

What is Chemistry?

Chemistry is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. Chemists improve many products, from the food we eat and the clothing we wear to the materials with which we build our homes. Chemistry helps to protect our environment and searches for new sources of energy. There are five main branches of chemistry, each of which has many areas of study.

Analytical chemistry uses qualitative and quantitative observation to identify and measure the physical and chemical properties of substances. In a sense, all chemistry is analytical.

Physical chemistry combines chemistry with physics. Physical chemists study how matter and energy interact. Thermodynamics and quantum mechanics are two of the important branches of physical chemistry.

Organic chemistry specifically studies compounds that contain the element carbon. Carbon has many unique properties that allow it to form complex chemical bonds and very large molecules. Organic chemistry is known as the “Chemistry of Life” because all of the molecules that make up living tissue have carbon as part of their makeup.
Inorganic chemistry studies materials such as metals and gases that do not have carbon as part of their makeup.

Biochemistry is the study of chemical processes that occur within living organisms.

What do chemists do in chemistry and related fields?

Biochemists and biophysicists study the chemical and physical principles of living things and of biological processes.

Chemical technicians use special instruments and techniques to assist chemists and chemical engineers.

Food chemists improve the quality, safety, storage and taste of our food. Food chemists may work for private industry to develop new products or improve processing. They may also work for government agencies such as the Food and Drug Administration to inspect food products and handlers to protect us from contamination or harmful practices. Food chemists test products to supply information used for the nutrition labels or to determine how packaging and storage affects the safety and quality of the food. Flavorists work with chemicals to change the taste of food. Chemists may also work on other ways to improve sensory appeal, such as enhancing color, odor or texture.

Environmental chemistry is an interdisciplinary study that involves both analytical chemistry and an understanding of environmental science. Environmental chemists must first understand the chemicals and chemical reactions present in natural processes in the soil, water and air. Sampling and analysis can then determine if human activities have contaminated the environment or caused harmful reactions to affect it. Water quality is an important area of environmental chemistry.

Forensic science technicians aid criminal investigations by collecting and analyzing evidence.

Agricultural chemists develop fertilizers, insecticides and herbicides necessary for large-scale crop production. They must also monitor how these products are used and their impacts on the environment. Nutritional supplements are developed to increase the productivity of meat and dairy herds. Agricultural chemists may work with the Department of Agriculture, the Environmental Protection Agency, the Food and Drug Administration or for private industry. Agricultural biotechnology is a fast-growing focus for many agricultural chemists. Genetically manipulating crops to be resistant to the herbicides used to control weeds in the fields requires detailed understanding of both the plants and the chemicals at the molecular level. Biochemists must understand genetics, chemistry and business needs to develop crops that are easier to transport or that have a longer shelf life.

Chemical engineering combines a background in chemistry with engineering and economics concepts to solve technological problems. Chemical engineers apply the principles of chemistry, biology, physics, and math to solve problems that involve the use of fuel, drugs, food, and many other products. They are involved in designing and operating processing plants, develop safety procedures for handling
dangerous materials, and supervise the manufacture of nearly every product we use. Industries require chemical engineers to devise new ways to make the manufacturing of their products easier and more cost effective. Chemical engineers work to develop new products and processes in every field from pharmaceuticals to fuels and computer components.

*Geochemists* combine chemistry and geology to study the makeup and interaction between substances found in the Earth. Geochemists may spend more time in field studies than other types of chemists. Many work for the U.S. Geological Survey or the Environmental Protection Agency in determining how mining operations and waste can affect water quality and the environment. They may travel to remote abandoned mines to collect samples and perform rough field evaluations, and then follow a stream through its watershed to evaluate how contaminants are moving through the system. Petroleum geochemists are employed by oil and gas companies to help find new energy reserves. They may also work on pipelines and oil rigs to prevent chemical reactions that could cause explosions or spills.

**Who Could I Work For?**

- Educational Institutions
- Science Museums
- Quality Control Laboratories
- Pharmaceutical / Biotech
- Mineral and Metal Industries
- Hospital Research Laboratories
- Industrial Laboratories
- Food / Beverage Companies
- Health Protection Branches
- Waterworks Departments
- Hazardous Waste Management
- Chemical Testing Companies
- Research Centers / Institutes
- Cosmetic Companies
- Utility Companies
- Chemical Distributors
- Hospitals
- Newspapers / Magazines
- Oil Companies
- Chemistry Consulting Firms
- Environmental Consulting
- Pulp And Paper Industries
- Chemical Laboratories
- Agricultural Companies
- Professional Chemical Societies
- Textile Manufacturers
- Police Laboratories
- Chemical Manufacturing
- Petroleum Refineries
- Government
- Aerospace Companies
- Technical Librarian

**Where Might I Do An Internship?**

*UMass Amherst Chemistry majors have done field experience internships at the following sites:*

- Abbott Laboratories
- Amherst (Town of)
- ARIAD Pharmaceuticals, Inc
- ArQule
- Associates of Cape Cod
- Campbell’s Foods
- EMD Millipore
- EnerSys Energy
- Infinity Pharmaceuticals
- MassPIRG
- Millennium Pharmaceuticals
- NuOrtho Surgical, Inc.
- Sanofi Group (Pasteur & Genzyme)
- UMass Amherst Emergency Medical Services
- UMass Amherst Environmental Health & Safety
- Walt Disney World
- Yankee Candle
What Can I Do With An Undergraduate Degree In Chemistry?

Chemist  Forensic Lab Analyst  Chemical Technologist  Assayer  Product Tester  Production Chemist  Lab Coordinator  Chemical Analyst
Quality Control Chemist  Pulp and Paper Chemist  Occupational Health and Technical Writer  Analytic Chemist  Color Development Specialist
Laboratory Technician  Paint Formulation Chemist  Medical Laboratory  Environmental Engineer
Technical Sales  Paper Product Developer  Research Assistant  Geochemist
Representative  Chemical Information  Associate Chemist  Environmental Engineer
Chemical and Drug Sales  Specialist  Process Development  Geochemist
Representative  Occupational Health and Industrial Hygienist  Teacher
Consumer Protection  Safety Officer  Associate Chemist  Crime Lab Analyst
Specialist  Medical Laboratory  Food and Drug Analyst  Dentist
Water Quality Analyst /  Technician  Chemical Safety Officer  Medical Technologist
Technician  Analytic Chemist  Clinical Technician  Teacher
Technical Writer  Associate Chemist  Food and Drug Analyst  Crime Lab Analyst
Aerosol Development  Research Assistant  Pollution Controller  Dentist
Manager  Chemical Safety Officer  Information Analyst  Medical Technologist
Quality Assurance Chemist  Clinical Technician  Soil Tester  Medical Technologist
Methods Development  Food and Drug Analyst  Pollution Controller  Medical Technologist
Chemist  Pollution Controller  Information Analyst  Medical Technologist
Process Development  Information Analyst  Soil Tester  Medical Technologist
Chemist  Soil Tester  Laboratory Analyst  Medical Technologist
Organic Mass Spectrometrist  Laboratory Analyst  Laboratory Analyst

Chemistry majors learn to think creatively, troubleshoot complex problems, perform detailed analyses, and make decisions based on research. These skills are highly valuable in any workplace, and have applications in virtually every field. Not all graduates from chemistry programs go on to work as chemists, though. While many do work in a field closely related to chemistry, others choose to take a completely different path. Sales and teaching positions are among the most common career choices for those who pursue a career in an unrelated field.

It’s very common for chemistry majors to attend graduate school after they complete their undergraduate studies. These graduates make great candidates for medical school, optometry school, dental school, pharmacy school, and veterinary school. Since chemistry majors develop strong research skills, they are also successful in law school, and many go on to work as patent lawyers.

Career Planning Resources & Websites
UMass Amherst CNS Career Center  cns.umass.edu/careers
UMass Amherst CNS Career Center  www.cns.umass.edu/careers
FOCUS2 Career and Education Planning  www.umass.edu/careers/planning for sign-in button
What Can I Do With This Major?  https://www.umass.edu/careers/planning

(Click on "What Can I do with this Major" icon on the right-hand column.)
O-Net: “Chemistry”  
Massachusetts Career Information System  
(Click Mass Resident to login with “Amherst/01003” Then click “Occupations” or “Assessments”)
* Amer Chem Society “Chemistry Careers”  
Organic Chemistry Resources Worldwide  
Science.gov Gateway to US Federal Science

**Chemistry Internships & Job Search Resources**
* UMass Handshake Database of Internships & Jobs  
  BioPharmGuy
  Internships and Research Opportunities
* Chem Dept Research Experiences for Undergrads  
* Chem Dept Internships Resources  
* Finding Independent Lab Research On Campus  
* UMass Amherst Chemistry Undergraduate Research  
* Doing Your Own Independent Research at UMass  
* Office of Undergraduate Research and Studies (OURS)
AAMC Summer Undergrad Medical Research Programs  
ACS Summer Undergrad Research Fellowships (SURF)
* Bio-Med Research Opps for Pre-Meds (BIG List)
Federal Government Undergrad STEM Internships  
Funded Summer STEM Research Opportunities
* Mass Life Sciences Center Internships  
National Institute of Health (NIH) Fellowships  
NIH Pathways Internship Program

**Chemistry Job Boards**
Academic Jobs Online  
American Chemistry Council Jobs Board  
American Chemistry Society Jobs Board  
BioSpace  
Chemical Jobs Recruiters  
Chemistry Jobs  
Chemistry Research Jobs
* Computational Chemistry List (CCL)  
Freelance Chemistry Opportunities  
Health & Human Services (HHS) Jobs  
I Hire Chemists
* Life Sciences Recruiters for multiple companies  
LinkedIn Chemistry Jobs
National Institute of Health (NIH) Jobs https://hr.nih.gov/jobs/scientific
Nature Careers in Chemistry https://www.nature.com/naturecareers/jobs
New Scientist Chemistry Jobs https://jobs.newscientist.com/searchjobs
Organic Chemistry Portal www.organic-chemistry.org/jobs
UMass Amherst Chemistry In-Dept Job Opportunities https://www.umass.edu/chemistry/faculty

Chemistry Professional Organizations
American Association for the Advancement of Science www.aaas.org
American Chemical Society www.acs.org
American Physiological Society www.the-aps.org
American Society for Biochem and Molecular Bio www.asbmb.org
Association of American Medical Colleges www.aamc.org
Biochemistry Society www.biochemistry.org
Chem Industry Directories By Specialty www.chemindustry.com/index
International Society of Pharmaceutical Engineers www.ispeboston.org
Massachusetts Biotechnology Council www.massbio.org
UC Santa Barbara Library of Chem Societies (huge list) http://guides.library.ucsb.edu/content

Additional Resources
Best of the Web List of Science Job Sites http://botw.org/top/Science/Employment
Current Biotech & Life Sci Jobs http://biopharmguy.com

General Job Search Engines
Glass Door www.glassdoor.com/index.htm
Indeed www.indeed.com
One-Stop Career Centers (search by zip code) http://careeronestop.org/jobsearch/findjobs
SimplyHired www.simplyhired.com
Important Transferable Qualities to Include On Your Resume

Analytical skills. Chemists must be able to conduct scientific experiments and analyses with accuracy and precision.

Critical-thinking skills. Chemists draw conclusions from experimental results through sound reasoning and judgment.

Interpersonal skills. Chemists typically work on research teams and need to be able to work well with others toward a common goal. Many also serve as team leaders and must be able to motivate and direct other team members.

Math skills. Chemists regularly use complex equations and formulas in their work, and they need a broad understanding of mathematics, including calculus and statistics.

Perseverance. Scientific research involves substantial trial and error, and chemists must not become discouraged in their work.

Problem-solving skills. Chemists use scientific experiments and analysis to find solutions to complex scientific problems.

Speaking skills. Chemists frequently give presentations and must be able to explain their research to others.

Writing skills. Chemists write memos, reports, and research papers that explain their findings.

What Do Employers Look For? (NACE 2020 Job Outlook for Students)