

Careers in Chemistry and Biochemistry – a Brief Overview

The following describes typical career areas for practicing chemists and biochemists. However, students often study chemistry or biochemistry in preparation for **health professions**, in medicine, pharmacy, dentistry, optometry, veterinary medicine, naturopathy and others. Some develop rare and valuable combinations of skills by later going into **other professions** like law, business administration or library science. Others get into occupational health and safety, compliance verification, regulatory affairs, technical writing or database management, as well as sales and marketing. Many **teach** their favorite subjects in elementary or secondary schools. Some pursue graduate studies and build careers in **research** and a few become college or university professors.

ANALYTICAL CHEMISTS use chemical tests and instrumentation to detect particular substances and quantify their amounts and develop techniques and instrumentation for new substances or for increased reliability, increased precision, lower cost and ever-decreasing detection limits. Analytical chemistry is at the basis of many areas of employment: environmental chemistry, atmospheric chemistry, waste management, water treatment and purification, soil remediation, forensics, flavour and fragrance chemistry, food chemistry, mining and geochemistry, oil refinement, pulp and paper chemistry, to name some.

Analytical chemists are employed in every part of the chemical, pharmaceutical and biopharmaceutical world, in the food industry, in waste management industries as well as in government and private consulting labs and with manufacturers and vendors of analytical and other instrumentation.

BIOCHEMISTS specialize in the study of molecules, big and small, natural and synthetic, that interact with or are a part of living systems, be they microbial or gigantic, animal or vegetable, marine or terrestrial, healthy or diseased. Biochemistry includes the sciences of molecular biology, immunochemistry, neurochemistry as well as bioinorganic, bioorganic, bioanalytical and biophysical chemistry. They work most often with other scientists in a diverse array of application areas from medicine, dentistry, veterinary science, crop science, forestry, pharmacology, physiology, microbiology, biotechnology and clinical chemistry.

Government departments and agencies that deal with agriculture, fisheries, forests, health, food, drugs and the environment all employ biochemists analyzing food, drugs, air, water, waste, or animal tissue. Industries that produce agricultural chemicals, pharmaceuticals, foods, feeds and consumer products also employ biochemists in research as well as in marketing, management, science information, technical writing and editing. Drug companies employ biochemists to research the causes of disease and to develop drugs to combat them. Biotechnology companies employ biochemists in quality control, clinical research, manufacturing and information systems with various applications to the environment, energy, human health care, agriculture and animal health. Some biochemists work in clinical and laboratory settings in hospitals.

INORGANIC CHEMISTS are versatile and deal with most of the periodic table, especially metals and metals are almost everywhere, from small molecules to large biological molecules to polymeric and network solids and bulk materials. Inorganic chemistry is at the basis of many areas of employment: catalysis in almost every chemical industry, materials of all kinds (clays, ceramics, minerals, cements, etc.), pigments (paints, inks), coatings, water treatment and purification, geology, mining and extraction technology, agricultural chemicals, micro-electronics and semiconductors, even biochemistry and medicine.

Inorganic chemists are employed by industries whose business is

based on inorganic materials, such as mining companies, microchip or computer manufacturers and ceramics makers, to name a few, but also in nearly all other chemistry sectors. They are also employed by government ministries and agencies, overseeing agriculture, natural resources, energy, the environment, water. Their versatility and broad-based knowledge also makes them ideal teachers at all levels in the education sector.

ORGANIC CHEMISTS deal with the preparation, structure, properties and reactions of carbon-containing compounds and carbon-containing compounds are everywhere: rubber, plastics, fuels, pharmaceuticals, cosmetics, detergents, coatings, adhesives, dyestuffs, textiles, food, paper, agrichemicals. Most all of the modern, high tech materials are composed, at least in part, of organic compounds and all biological molecules (DNA, RNA, proteins, polysaccharides, lipids) are organic molecules. In many areas of application, organic chemists will work together with biochemists or with inorganic, physical and/or analytical chemists in a team environment.

Organic chemists at all levels are employed by pharmaceutical, biotech, chemical, consumer product, petroleum and other industries ranging in size from the very small to very largest. Government and hospital labs also employ organic chemists.

PHYSICAL CHEMISTS are interested in how atoms, molecules, molecular assemblies and networks do what they do, whether this means how proteins fold, how coatings adhere, how flames propagate, how crystallization works or how catalysts catalyze. Physical chemists work with solids, liquids, gases and things in between like liquid crystals, glasses, super-cooled and supercritical fluids. Physical chemists are well grounded in chemical theory, in mathematics and physics and may also be highly knowledgeable in optics, magnetics, microfluidics, photophysics or electronics, but can work in every science. Physical chemists are most useful in interdisciplinary areas, able to understand the language of engineers and other scientists.

Physical chemists find employment in a wide range of settings, including almost every type of industry, as well as government agencies, research institutes and educational institutions. Industries employing physical chemists are as diverse as plastics, ceramics, catalysis and pharmaceuticals and are essential in those that produce surfactants, colloids, aerosols, coatings, personal care products and electronics. They Physical chemists also work in such areas as environmental and analytical chemistry, high-temperature science, cryogenics, surface science, corrosion science, explosives, atmospheric science, propulsion technology and electrochemical processes. High-tech materials science, nanoscience and chemical biology are growing fields for physical chemists, as is the increasingly important field of molecular modeling and computation, for which physical and theoretical chemists are well suited.