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Research in Chemistry – Some Perspectives.

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The aim of the International Year of Chemistry (IYC) 2011 is to increase public appreciation of the achievements of chemistry and its contributions to human life and welfare. The year 2011 also coincides with the 100th anniversary of the Nobel Prize awarded to Madame Marie Curie and gives us an opportunity to also celebrate the contributions of women to science.

Chemistry has played a critical role in solving global problems that have been associated with increases in the world's population. These include providing increased and sustainable sources food and clean water, new sources of energy, improvement in health and control of diseases, protection of the environment and transportation.

Cultivating new land is not the only solution for increasing food supply. Improvements are needed in food production, food preservation, and conservation of soil nutrients, water, fuel, and better use of solar energy. Chemical research is necessary to help future generations deal with the problems associated with the need for an adequate food supply. Sustainable food supplies need an understanding of the biological role of plant hormones and growth regulators as well as advances in pest control. New sources of environmentally friendly pesticides, insecticides, herbicides and fungicides are required for crop protection. Chemistry has played a central role in determining the structure and shapes of these molecules, and synthetic analogues of these compounds are now available.

To ensure the provision of more food supplies requires understanding the basic principles and the nature of issues involved in pest control. These require knowledge and understanding of biology, chemistry, biochemistry, physics, physiology, and medicine. Borders between various disciplines have become less distinct. There is a central role for chemists in determination of structures and shapes of molecules, their reactivity and synthesis of biologically important molecules. Often only minute quantities of complex molecular compounds are available for isolation and identification.

Purification of compounds is necessary to explain bioactivity on the basis of molecular structure. Advances and improvements in separation and isolation techniques have made genetic engineering possible. Modern spectroscopic techniques used routinely to analyse and determine complex molecular structures are essential tools for the research chemist. Of these techniques NMR spectroscopy has had the widest impact while mass spectrometry has helped to identify larger and larger molecules. FT-IR and diffraction methods are used to clarify structures of biologically important molecules. Therefore chemists are essential in multidisciplinary collaborations and there are many opportunities in chemistry for advances through both basic and applied research.

Purification is a necessary first step to explain biological activity on the basis of molecular structure. Chromatography is one of the oldest techniques used in isolation and purification.

It involves separating molecules or ions by dividing species between a moving phase and a stationary phase. Many chromatographic techniques are used routinely in chemistry laboratories.

Counter-current chromatography (CCC) is a technique that has been used effectively for the separation of many different classes of natural products. A solid stationary phase is used in all chromatographic techniques. CCC uses a support-free liquid stationary phase in which irreversible binding to the column material is prevented. In CCC a crude extract maybe introduced directly into the machine and sample preparation is made easy. CCC has made possible separation of natural products that were difficult /impossible to separate by other methods. High-speed counter-current chromatography (HSCCC) was used during a research project carried out at the University of Peradeniya to separate proanthocyanidins, a highly reactive and unstable group of flavan-3-ols, from an extract of tea shoots.

It is essential that scientific research is part of the mission of any university because it represents the complementary element required by the learning process, which should also impart the expertise required for acquiring knowledge. The development of scientific research as a fundamental competence is essential for survival in a competitive environment, for encouraging creativity and the birth of new ideas. Major developments in science and technological innovations generally derive from curiosity driven research carried out in universities throughout the world and these developments have had great impact on national interests. Fundamental research generates new technologies, the returns from which are gains in culture, comfort, convenience, security, recreation, health and the extension of life. Many countries have been enriched with new industries and technologies that have contributed to improvements in health, welfare, comfort and security of society as a result of basic research carried out in universities.