ORGANIC CHEMISTRY

Why is organic chemistry important? The answer lies in the fact that every aspect of life, mammalian and non-mammalian as well as plant and microscopic life, involves organic chemistry. In addition, many of the products we use every day (pharmaceuticals; plastics; clothing; etc.) involve organic molecules. Organic chemistry holds a central place in chemical studies because its fundamental principles and its applications touch virtually all other disciplines. Several years ago, a T-shirt at an American Chemical Society meeting (in Dallas) sported the logo "Chemistry: The Science of Everything."

Humans have been using practical applications of chemistry for thousands of years. Plants have been "milked", cut, boiled, and eaten for thousands of years as folk medicine remedies, particularly in Africa, China, India, and South America. Modern science has determined that many of these plants contain organic chemicals with effective medical uses, and indeed many of our modern medicines are simply purified components of these plants.

For most of human history, humans were able to use chemicals without actually understanding the science behind them. Organic chemistry became a defined science (the chemistry of carbon compounds) in the 19th century, but organic compounds have been known and used derivatives of them made by chemists. In one example, the bark of Cinchona trees was chewed for years to treat symptoms of malaria, and it was later discovered that this bark contains quinine, which is a modern medicine. Ancient Egyptians ate roasted ox liver in the belief that it improved night vision. Later it was discovered that ox liver is rich in Vitamin A, a chemical important for maintaining healthy eyesight. Eventually, we learned how to make new organic molecules rather than simply isolating and using those that were found in nature. In the mid-19th century a new compound was synthesized (chemically prepared from other chemicals) called acetylsalicylic acid, better known as aspirin, and it was found to be well tolerated by patients as an effective analgesic (this means that it reduces some types of pain). These few examples are meant to represent the thousands of folk medicine remedies that have led to important medical discoveries. All of these involve organic compounds.

Plants provided ancient humans with many organic chemicals or mixtures of chemicals that were useful for purposes other than medicine. Ethyl alcohol has been produced by fermentation of grains and fruits, and consumed for thousands of years in various forms. In ancient Bengal (part of India), in Java, and in Guatemala, plants provided a deep blue substance used to colour clothing. In recent times, the main constituent was found to be indigo. The ancient Phoenicians used an extract from a snail found off the coast of Tyre (now called Lebanon) to color cloth. It was beautiful and very expensive and the dye was called Tyrian

purple. It was so prized that Roman Emperors used it to colour their clothing, and for many years no one else was permitted to wear this colour (hence the term "born to the purple").

These few examples show that organic chemicals have been important to humans for a very long time. For most of this time, however, humans did not know the actual chemical structures of these compounds, or even that they were dealing with discreet molecules. What they did know, however, was that a multitude of materials could be obtained from natural sources, primarily from living organisms.

It was not until the 18th century that people began to look for specific chemicals in these natural materials. One of the first to look for chemicals was Carl Wilhelm Scheele (Sweden; 1742-1786), who isolated acidic components from grapes and lemons by forming precipitates with calcium or lead salts, and then adding mineral acids to obtain the actual compounds. The compound from grapes is now known to be tartaric acid and that from lemon is now known to be citric acid. This practice of isolating specific compounds (now known to be organic compounds) from natural sources was continued for many years (it continues today). Such compounds are called "natural products."