Since its discovery, chiral chemistry has played a pivotal role in how scientists examine novel compounds.

This unique characteristic describing a molecule’s geometry in three-dimensional space revolutionized several industries. From agricultural innovations to pharmaceutical discoveries, and everywhere in between, chirality has forever transformed the field of chemical research.

The Emergence of Chiral Therapeutics

In 1848, French scientist Louis Pasteur first observed that a solution of naturally occurring sodium ammonium tartrate rotated a plane of polarized light. When he used those same conditions to examine the tartrate obtained from a chemical synthesis, he realized there was no rotation. After further analysis of the sample, he noticed that the crystals actually possessed small distinguishable sides. Furthermore, he discovered that in the synthetic sample, half of the crystals were, from his perspective, right-handed and half were left-handed. Contrastingly, the crystals from the naturally occurring sample were all oriented in the same direction. After further testing, Pasteur concluded that the optical activity of a compound was related to the asymmetric internal arrangement of its molecules. This critical event in scientific history gave us the first observable evidence of the phenomenon known today as chirality.
Pasteur’s discovery paved the way for innovative research not only in chemistry, but in medicine as well. To this day, more than half of all medications on the market consist of chiral compounds, including common household names such as Advil™ and Prilosec™. Advil, which many of us reach for when experiencing aches and pains, is actually sold as a racemic mixture - meaning the medication is composed of equal parts right-handed and left-handed molecules. Methamphetamine is another chiral compound. However, while many of us know the right-handed form as the destructively addictive drug, left-handed methamphetamine is actually a commonly used nasal decongestant. Because of these critical distinctions, it was important to have reliable and effective methods of analysis.

**The Role of Chiral Chromatography**

As new pharmaceutical drugs emerged from laboratories at extraordinary rates, it was necessary for analytical methods to develop just as quickly. Additionally, with the realization that this seemingly subtle difference in structure could have drastically different
physiologically effects – as in the case of methamphetamine – there was a sudden need for applications that could distinguish between the two rotational forms, or enantiomers, of chiral therapeutics. And although many methods of chemical analysis existed, high performance liquid chromatography (HPLC) excelled at this task due to its simplicity and effectiveness. Thus, liquid chromatography understandably became the prevailing method of analysis for novel chiral pharmaceutical compounds.

Today, technological advancements have allowed scientists to detect individual isomers at incredibly low concentrations, and quantify the amount of each form present in a sample. Naturally, the next logical step was to implement chiral separations for processing and manufacturing purposes. Pharmaceutical companies now utilize chiral purifications for large scale production of these enantiomeric drugs.

Through innovations of the Chiral Stationary Phase (CSP), chromatographic methods have become faster and more effective at identifying enantiomers. This evolution in processing has been vital to the pharmaceutical industry, as federal regulation now requires all new stereoisomeric drugs be studied as pure isomers. In fact, the majority of samples tested today at PhenoLogix through our Free Chiral Screening service are potential chiral therapeutics. Now, more than ever, it is critical to achieve efficient separation and analysis of racemic drugs in order to eliminate unwanted effects from potentially toxic isomers.
Chiral Chromatography and the Pharmaceutical Industry

Summary

Chiral chemistry has played a pivotal role in how scientists examine novel compounds. This
unique characteristic describing a molecule’s geometry in three-dimensional space revolutionized several industries. From agricultural innovations to pharmaceutical discoveries, and everywhere in between, chirality has forever transformed the field of chemical research.