Natural Sources for Modern Pharmaceuticals

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Approximately 63% of all approved small molecule drugs are derived from natural products, or are nature-inspired semisynthetic derivatives of natural products.

Chemical compounds or substances produced from living organisms – natural products – often have a biological activity which may be useful in pharmaceuticals. These natural chemical compounds may be extracted from tissues of terrestrial plants, marine organisms or microorganism fermentation broths. A crude extract from any one of these sources typically contains novel, structurally-diverse chemical compounds.

Most biologically-active natural product compounds are secondary metabolites which are not directly involved in the normal growth, development or reproduction of organisms. The function or importance of secondary metabolites to the organism is usually of an ecological nature as they are used as defenses against predators, parasites and diseases. Plants have always been a rich source of useful drugs (e.g. morphine and quinine).

Clinically useful drugs which have recently been isolated from plants include the antimalarial agent artemisinin from *Artemisia annua*, and the anticancer agent paclitaxel (Taxol) from the yew tree.

Microorganisms produce a large variety of antimicrobial agents which have evolved to give their hosts an advantage over their competitors in the microbiological world. Some examples of antibacterial drugs isolated from microorganisms are cephalosporins, tetracyclines, aminoglycosides, rifamycins, and chloramphenicol.

Marine sources such as coral, sponges, fish, and marine microorganisms have chemicals with interesting biological activities. For example, curacin A is obtained from a marine cyanobacterium and shows potent antitumor activity.

Animals can sometimes be a source of new drugs. For example, a series of antibiotic peptides were extracted from the skin of the African clawed frog. Venoms and toxins from animals, plants, and microorganisms are extremely potent because they have specific interactions with a macromolecular target in the body and have been used as lead compounds in the development of novel drugs. For example, teprotide, a peptide isolated from the venom of the Brazilian viper, was the lead compound for the development of the anti-hypertensive agents cilazapril and captopril.

If the active principle is present in a mixture of other compounds from a natural source, it has to be isolated and purified. The ease with which the active principle can be isolated and purified depends on the structure, stability, and quantity of the compound. The development of experimental procedures such as freeze-drying and modern chromatography and spectroscopy has made feasible the isolation and purification of natural products.

The Food Technology Centre has modern facilities to extract, isolate and purify natural bioactive compounds. Please contact Dr. Muhammad Yousaf, Organic/Purification Chemist, to learn more about our extraction, isolation and purification services: tel: (902) 368-5795; email myousaf@gov.pe.ca.