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Importance of Natural Products in the Modern History

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Commentary Article

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INTRODUCTION

A natural product is a chemical organic substance which is produced by the living organisms found in the nature that are produced by the pathways of primary and secondary metabolism [1,2].It can be synthesized by the chemical synthesis by semi synthesis and total synthesis and responsible for the development in the field of organic chemistry by providing challenging synthetic targets. Natural products have pharmacological activity that can be useful in treating various kinds of diseases. These may act as active components not only for traditional medicine but also for modern medicines [3,4].These natural products often used as starting points for drug discovery in the chemical synthesis from which synthetic analogs can be prepared with improved efficacy, potency, safety and purity[5,6].

It can be divided into two major classes' primary and secondary metabolites. Primary metabolites is essential to the survival of the organism mainly involves in the energy production includes respiratory and photosynthetic enzymes and secondary metabolites that mainly effects the other organisms but helps to increase the competitiveness of the living organism in its environment [7-10].

CLASSIFICATION OF THE NATURAL PRODUCTS

1) Based on the molecular skeletal structure - open chain aliphatic, alicyclic and cycloparaffinic, aromatic, benzoid and heterocyclic
2) Based on physiological activity - plant or animal origin
3) Based on chemotaxonomy - review the plant constituents
4) Based on biogenesis - biosynthetic pathways of plants and animal metabolites

BIOSYNTHETIC PATHWAYS

Major classes of natural products are described below:

- Photosynthesis or gluconeogenesis → monosaccharides → polysaccharides (cellulose, chitin, glycogen etc.)
- Acetate pathway → fatty acids and polyketides
- Shikimate pathway → aromatic amino acids and phenylpropanoids
- Mevalonate pathway and methyletrythritol phosphate pathway → terpenoids and steroids
- Amino acids → alkaloids

i) **Carbohydrates**

These are the essential nutrients in energy production for most of the living organisms.These are the products of plant photosynthesis and animal gluconeogenesis.Polysaccharides formed from simpler carbohydrates which are the structural components for plants and microorganisms includes the cell wall of bacteria [11-14].

ii) **Fatty acids and polyketides**

These classes of natural products have diverse structures and functions which includes prostaglandins and macrolide anti-biotics [15-18].

SOURCES OF NATURAL PRODUCTS:

The extraction from natural products from the tissues, cells, secretions of microorganisms, animals and plants. An unfractioned product which is a crude form extracted from any of these sources contain new chemical compound. Researchers travel all over the world obtaining samples to analyse and evaluate in drug discovery by various screening methods by bioassays [19-22].

The lead of natural products may be obtained by the following methods;

1) By total synthesis

2) A precursor for a semisynthetic compound

3) A frame work which serves as a basis for a structurally different compound by total or semi-synthetic process.

MEDICINAL USES

Ancient civilization conducted various experiments with various plants and animal parts in order to know what biological activity might be present. Through the trial and error experiments they had been found that these crude drugs have healing power in reducing the diseases and they have pass down the knowledge through the various generations in traditional Chinese medicine and Ayurveda. These extracts of crude drugs may lead to the discovery of other active ingredients and eventually lead to the development of chemically pure drugs which have real beneficial effects [23-25].

Now days, current prescribed drugs directly derived from natural products. Some of the examples include oldest natural product based drugs are analgesics where the bark of the Willow tree had the effect of pain relieving properties, this is due to the salicin natural product hydrolyzed into salicylic acid. Acetylsalicylic acid which is better known as the aspirin, a synthetic derivative used as a pain reliever [26,27].

The first anti-biotic penicillin acts as a anti-infective which is a natural product obtained from the mold of Penicillium Notatum.

ISOLATION AND PURIFICATION

All the natural products begin as mixtures with other compounds from the natural sources from which the product must be isolated and purified. The isolated product obtained generally from milligrams to grams in a pure form by doing extraction methods by precipitation, adsorption, chromatography and crystallization methods. After extraction, needs to study the physical and chemical properties of the product ,chemical structure elucidation and structural activity relationship of the product and performing various chemical synthesis by using various solvents to get various derivatives or analogs and after structure elucidation, the biological activity of the product is determined [28,29].

SYNTHESIS

The structure of the natural products is very complex. The obtained natural product is a qualitative consists of molecular weight of the compound and the arrangements of the functional groups, rings with respect to one another, the number of carbon atoms along with the various other atoms and its stereo chemical elements, its density, stability, physical and chemical properties of the molecule and its intermediates are studied for the novelty of the structure and also the compound. Those having less complex structure are easily prepared with readily available cost effective process. In order to avoid the expensive chemical process, a semi -synthetic method can also be used by using various intermediates.

CHEMISTRY

Natural products chemistry is a distinct area of chemical research plays an important role in the chemistry in the pre-clinical and clinical studies for drug discovery research. It is associated with the isolation and purification of the chemical products and developed by using various methods in determination of chemical structure by NMR studies and identification of the pharmacological areas of the chemical product. Synthetic strategies and tactics are used in the field of organic chemistry by providing challenging targets in order to reach the biological activity of the product to the targeted site. Natural products motivates and helps in the development of new variants by using old and new chemical reactions e.g.: the Evans aldol reaction, Sharp less epoxidation, Woodward cis-hydroxylation etc. Research has been carried out to understand the biochemical pathways in the natural products synthesis [30].

The growing trend of the natural products has been enhanced by re-engineering the biosynthetic pathways to understand the secondary metabolism and provide new products with different biological activities.Poly pharmacy and polypharmacology providing opportunities in studies of natural products in the discovery of new therapeutics for the alternate medicine.[31]The synthetic studies of natural products will be as a biomarker by which various synthetic strategies, methods and tactics are used and developed practically by conducting experiments. These synthetic analogues are designed to maximize the target optimization and identification of the target to show increase pharmacological effect by studying the SAR studies [32].

For curing wide variety of the diseases, a wide range of natural products have been using since ancient civilisation.They used to treat various diseases such as malaria,cancer,cardiovascular, GI disturbances, etc. The drugs have been discovered and developed after knowing the medicinal use and biological effect of that particular plant or from its parts of the plant includes roots, barks, fruits, seeds or the whole plant and then isolates the bioactive compound which is used in the treatment of human illness. All this facts shows that these medicinal plants have immense potential source for modern drugs [33,34].

Now days, traditional Chinese medicines are immensely increased to prevent the chronic diseases. These products may increase the therapeutic effects on the conventional medicine and incorporated in the prescription drug therapies. In ancient civilization the usage of endogenous natural products having different therapeutic properties are used as a main source of drugs. The natural products have been selected based on the screening of many compounds by utilizing electrophysiological studies.Sesquiterpene compounds have more pharmacological and biological effects [35-37].

Most of the population in the western world is on rise to use the herbal medicine an an complementary therapy. The people often take with different herbs alng with prescribed medication simultaneously which shows potential for both pharmacodynamics and pharmacokinetic interactions but sometimes adverse effects can also be observed.Thus,there is need to study the interaction between the drugs to avoid the adverse effects.

The scope and impact of natural products will be greatly increased by conducting research on different areas and continue to expand by providing opportunities for new discoveries for dissemination of high quality work in this field. Medicinal plants used as herbs as a traditional medicine for various types of diseases. These are used as for the preparation of modern drugs or used as a source for raw material. It lies in the bioactive phytochemical constituents are alkaloids, saponins,flavanoids,tannins,terpenoids, phenolic compounds, steroids and glycosides. These form the backbone of the drugs [38-40].

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