Chapter 1
Medicinal Plants: A Renewable Resource for Novel Leads and Drugs

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Abstract Present-day drug development is strongly focused on finding active compounds on well-defined targets using high throughput screening approaches. Unfortunately it seems that this approach is becoming less and less successful, as in most cases already good compounds are on the market, and the rapidly rising costs of drug development will make it increasingly difficult to make an economically competitive novel drug for any major disease. In other words, the reductionist approach presently used is becoming less successful. The time has come to rethink drug development. Many Western medicines are based on traditional knowledge from Europe and the Mediterranean region. This is why interest is rapidly increasing in Indian and Chinese medicine, both of which represent a very long tradition of apparently safe use. However, these healthcare systems are different from Western medicine, so novel methods are required to verify the efficacy and safety of the therapies. As it often concerns personalized medication with complex mixtures, a reductionist approach of screening for a single active compound on a known target will in many cases not be successful, as more than one target may be involved; in addition, and complicating the situation even more, synergism and prodrugs may be involved. Systems biology as a novel holistic way of dealing with biological problems seems here an interesting option. Systems biology means proceeding without a hypothesis, just observing, measuring as many parameters as possible in a biological system and afterwards using chemometrics to reveal any meaning in the data. This approach has already proven successful in studying medicinal plants and, in combination with the classical natural-product-based drug lead finding, is expected to be a major issue in the coming years. As present-day patent laws require innovative and unexpected findings, the development of old knowledge does not fit this requirement. Therefore, to support the development of evidence-based traditional medicines, it would be of great interest if some sort of protection could be obtained for companies developing such medicines so that they could earn back their huge R&D investments.

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1.1 Introduction

Since ancient times humans have explored their environment for plants that could be used to cover all their basic needs: food, shelter, fuel and health. This has resulted in the use of a large number of plants; in particular, food plants’ extensive breeding has resulted in high-yield crops. In the case of medicinal plants, such breeding has largely not yet taken place as nature could provide a sufficient supply. The number of medicinal plants has been estimated to be on the order of 40,000 to 70,000 [1], which means that almost 25% of all plant species have some sort of medicinal use somewhere in the world. This heritage from our ancestors has continued to develop in Western medicine and has resulted in the isolation and production of pure active compounds (e.g. morphine, atropine and digoxin) and later in the development of novel synthetic compounds based on this knowledge (e.g. local anaesthetics based on cocaine, analgesics based on morphine). Some of these synthetics based on natural products have been very successful, e.g. acetylsalicylate, which development was based on the use of Salix bark as analgesic. In other cases the result has not been so successful, e.g. the acetyl derivative of morphine (heroin). This illustrates that many medicines in the West have originated in phytotherapy, as occurred in European/Mediterranean region.

In addition, the statistics on novel drugs developed in recent decades show that natural products are a major source of inspiration for drug development [2], with only 30% of all novel molecules (of the 1184 so-called novel chemical entities or NCEs) introduced into the market in the period 1981–2006 being pure synthetic and all others being natural products or natural product related. These statistics also show that the number of novel chemical compounds reaching the market is decreasing every year. The high costs (approx. 1000 million euros) and long duration (more than 10 years), as well as the fact that for most major ailments good medicines that are already available hampers the development of novel drugs by the pharmaceutical industry. Recently problems with serious side effects caused that several novel medicines had to be taken of the market shortly after their introduction. This does not also help to increase efforts at novel drug development.

At the same time the strong emerging economies of countries like India and China have led to greater interest in local healthcare systems, which are even considered an important (cheap) alternative to expensive treatments using Western drugs (see Chapters written by Pandey et al., Melzer and Saller, and McGregor (this volume)). Moreover, after thousands of years of extensive and widespread use of traditional medicines, the question arises as to why we should not consider these medicines again using all the tools of modern science [3, 4]. Further studies may lead to the discovery of novel modes of action, novel biologically active compounds, confirmation of traditional use, or, in the worst case, the fact that no activity is present and even that a given medicine’s use can carry risks of toxicity (see Chap-