Foreword

It is commonplace that our lives have become “globalized”. And there are global opportunities for individuals and companies which, on the other hand, often impact negatively on local communities (Posey 2002). Our food use has changed thanks to the integration of “novel foods” derived from traditions which until recently were out of reach and which were just unknown and exotic (Heinrich et al. 2005, Heinrich and Prieto-Garcia 2008, Heinrich et al. 2011). Simultaneously, we face global ecological, socio-cultural, economic and health problems and threats.

Generally, claims for global solutions for such problems abound. The sciences, be it a socio-cultural, a natural or a health science, is one of the most important and promising global approaches to solving today’s problems. However, limited evidence exists for claims that these problems generally have a “global solution” or a “fit for all” silver bullet. Instead, key counter-arguments have centred on local solutions to such global problems. Therefore, a complex network of local responses is needed which is in constant exchange and dialogue with the global networks of knowledge and power. Overall, it is essential to be conscious of the global developments and to understand such problems in a global context, but the solutions should vary depending on local or regional needs. While this is in no way a defence of “provincialism”, it highlights the need for understanding what are locally best suited solutions and about developing strategies for solving local needs in the context of delivering optimized healthcare.

The local and global interface can in fact be split up into a wide range of more specific dichotomies like:

- Self reliance (agriculture and gathering)—commercial sourcing/consumer driven
- Labour intensive—mechanized
- Low technological input production—high input production
- Preparing herbal medicines—the Herbal Medical Products
- Observational—Science based
- Herbal medicines defined by ethnicity and/or class—multicultural
- Whole system based—molecular
- Low tech—Biotechnology
And as an outcome of the specific role such products play in many societies:

- Alternative—mainstream

This book, *Medicinal Plants: Diversity and Drugs* covers a wide range of mostly basic-science centred aspects of research into medicinal plants—the global nature of its coverage is evident both by the geographical spread of its editors and chapter authors, but also by the global importance of the topics they address. It provides reviews and diverse points of view in a fast-developing area. Medicinal plant research is flourishing especially in Asian countries where it is seen as a key element of national development and a core area of biotechnology. And yes, it is a global topic and a global need. At the same time it does highlight that all authors seek solutions for specific local needs. All this is very much exemplified in the diverse chapters that make up this book.

As Geoff Cordell poignantly spells out in his chapter, *herbal medicines have to be effective: when you take a product for a medical effect it has to “work”.* It is not sufficient that it has been used for thousands of years or is regarded as “safe” (Cordell, this volume; Modarai et al. 2007). There are set standards which can serve as a general framework for defining a research strategy. And new technologies like network pharmacology, systems biology and metabolomics offer a range of exciting opportunities (Verpoorte et al. 2005, Gertsch 2011). The quest for effectiveness is a global aspect of research in medicinal plants, how we achieve this and what evidence we can draw upon will depend on the scientific approaches used in a specific setting and the resources available in that country.

Again from a global perspective, medicinal plant research is a prime area where integrating of concepts and methods from different research traditions, most importantly in agriculture and health is needed (www.lidc.org.uk/pages.php?page=57). Research has long gone passed the historical focus of discovering new drug leads from nature (Heinrich and Teoh 2004, Kinghorn et al. 2011) but is still often conducted within silos defined by specific disciplines like chemistry, pharmacology, plant biology or clinical sciences. However, today this field of research needs to be multidisciplinary and more and more research groups endeavour to achieve such a broader approach.

This book looks at all these complex relationships, highlights achievements and thus provides the reader with a wide knowledge-base essential for understanding how we can advance the sciences relevant to understanding medicinal plants—plant biology/pharmacognosy, ethnopharmacology, phytochemistry, toxicology, clinical studies, pharmacokinetics, but as importantly public health and agricultural sciences.
As a closing comment, let me highlight one gap in our knowledge and encourage researchers in the field of medicinal plants to engage with this topic. Medicinal plants are produced agriculturally or gathered/wild-crafted. While we know a lot about many of these plants and about the finished products, their chemistry, pharmacology and in some cases their clinical effectiveness, our scientific understanding of this production or value chain and how it impacts on the products we use and their quality. From “seed to product” or from “farm/wild-crafting to retailer”—these different value chains raise a wide range of questions, relevant both from the perspective of socio-cultural and natural sciences:

- How complex are these chains for individual botanical drugs and products derived from them?
- Who controls these value chains? While in some cases, they seem to be largely in the hands of individual larger companies, in other cases there is a complex chain of producers, several middlemen and traders, producers and retailers?
- How does this impact on the products’ composition and quality?
- Who benefits most from this chain and who is disadvantaged?

This will enable us to understand important aspects of poverty and its consequences but also health impacts of herbal medicines. For something that is so essential for many patients and consumers, it is surprising that we know so little about the structure and complexity of these value chains.

Considerable effort has gone into understanding these chains for many high value products like tea, coffee, chocolate and some spices especially the ones in the fair-trade sector and we as scientists in the area of medicinal plant research will have to incorporate this core topic into our future research. Not only is this relevant from a bio-behavioural and anthropological perspective (Etkin 1988), but understanding this will also be a basis for ascertaining the supply with high-value herbal medical products (“botanical medicines”). The Convention on Biological Diversity (or Rio Convention) and the subsequent treaties and conventions have laid a basis for new collaborative relationships between provider and user countries of biodiversity (see Cordell, this volume; Cordell and Colvard 2005), but this framework is limited to “new” discoveries and we will need a much more detailed understanding of existing products, their historical and emerging role, and of the opportunities and risks associated with their global uses.

Thus, there are numerous opportunities and challenges to build upon the diverse perspectives presented in this interesting and stimulating volume.

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Preface

Medicinal plants have been the cornerstone of health care since recorded time. Their myriad uses have been documented and passed down through the generations for over 4,000 years. Numerous drugs, both prescription and over-the-counter, have been made available for many important global diseases since scientific investigations began in the early part of the 19th century. Now, in the early part of the 21st century, an urgency to explore these traditional remedies to meet patient needs the world over has emerged. The sciences and the technologies which can be applied to elucidating the safety and efficacy of traditional medicines have evolved. At the same time, much knowledge of the use of plants in various health practices remains to be recorded. This volume will present an illustrative overview of some selected areas of traditional medicine and the historical and contemporary use of medicinal plants. It will also indicate some of the critical areas of ongoing research which are transforming the study of medicinal plants with a view to enhance the quality of health care for the majority of the people on Earth.

The first chapter (Cordell) offers a brief, but broad, overview of various aspects of traditional medicine, and explores some of the new strategies in regulations, information systems, botany, chemistry, biology and clinical trials which are available to improve the practices of traditional medicine globally. Chapter 2 (Furtado Macedo and Furtado Macedo) examines the important aspect of enhancing the production of biologically important secondary metabolites in traditional medicines, while at the same time improving standardization. In Chapter 3, Hardas and Rai discuss aspects of the importance of collecting, storing and analyzing information on the traditional uses of plants, and developing that information for the purposes of drug discovery. Benko-Iseppon, in Chapter 4, focuses on the many uses of Croton species in northeastern Brazil, and on the need to make studies on distribution and genetic diversity an important aspect of the development of medicinal plants. In a following chapter, the same author describes her research over the past years to examine issues related to the propagation of locally used medicinal plants and the development of a data bank on 160 plant species from nine different ecosystems.

Another ethnomedical study based in Brazil is described by Leitão and co-workers in Chapter 6. Here, remote indigenous communities in
Oriximiná were studied for their use of the mega biodiversity in the region, and amazingly uncovered 227 species in 211 genera being used for over 2500 indications. An ethnopharmacological study in eastern Andalusia in Spain is described in Chapter 7 by Benítez et al. in which the literature relating to the known medicinal taxa are analyzed for their chemical and biological effects in comparison with use. As a result, in the studied area of Western Granada province, the use of about 30% of the plants could not be justified.

Propolis is a popular product in several parts of the world with many wide ranging proposed uses. In Chapter 8, Rastrelli and co-workers discuss aspects of the chemistry and biology of propolis derived from various tropical and temperate regions. One of the most devastating diseases in the tropical world is malaria. In Chapter 9, Rahamatullah describes ethnomedical studies in Bangladesh on over 100 plants which are being used in that country for malaria by folk medicine practitioners. Marinoff and Martinez in Chapter 10 describe the uses of *Usnea sulcata* in the Chaco province in Argentina as an antifungal and hemostatic agent. Another one of the burgeoning global diseases is diabetes, and many plants are used throughout the world. Newmaster and colleagues in Chapter 11 present some of the ethnomedical and scientific background to the widespread use of *Gymnema sylvestre* as an antidiabetic plant.

A frequently unappreciated area of medicinal plant use is that for animal husbandry. Severino and Ambrosio remind us in Chapter 12 that many cultures in the world treat various ailments in both companion and farm animals with natural materials either out of choice or necessity. An area that is developing rapidly in awareness is that of endophytes in plants and the role that they can play in finding new natural products with biological activity for drug discovery. Zaferanloo and co-workers in Chapter 13 discuss the strategies which can be applied to traditional medicines for this purpose.

Perhaps the most studied aspect of traditional medicines for drug discovery is in the realm of cancer chemoprevention and therapy, which has resulted in several clinically useful agents. Accame and co-workers in Chapter 14 discuss some of the latest developments in this area. Domínguez and co-workers in Chapter 15 present some of the recent studies related to traditional medicines and the inhibition of reactive oxygen species as a way to prevent neurodegenerative diseases. Inflammatory diseases and the role of herbal preparations in their treatment are the focus of Chapter 16 by Talhouk and co-workers. Experimental aspects of the development of traditional medicines as anti-diabetic agents using *in vitro* bioassays are discussed by Mahomoodally in Chapter 17.

A different perspective on propolis is offered by Robles-Zepeda and co-workers in Chapter 18, where the focus is placed on aspects of
the chemistry arising from the different floral origins of bee glue. Zari in Chapter 19 discusses some of the medicinal aspects of various essential oils now widely used as remedies for skin ailments to cancer. The uses of essential oils as antibacterial and antiviral agents are discussed by Reichling in Chapter 20, and the techniques for solvent selection for the effective isolation of natural products through countercurrent chromatography is described by Leitão in Chapter 21.

It is hoped that this sprinkling of chapters will demonstrate the diverse implications for traditional medicine in health care, and the tremendous opportunities that exist to take traditional medicine to the next level of scientific development for the prevention and treatment of a wide range of disease states. Strategic investment in potentiating these opportunities is critical for the future of humankind.

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