Recent Advances in Drug Discovery and Treatment of Neglected Diseases

Neglected tropical diseases occur predominantly in tropical and subtropical countries, affecting vulnerable people living in poverty and in contact with infectious organisms, such as viruses, bacteria, parasites, as well as different types of vectors. Despite a large number of affected people, there are few therapeutic options to treat neglected diseases. Furthermore, such drugs have severe side effects on patients, and the emergence of resistance to infectious organisms has been reported. Taking into account all these concerns, it is urgent to develop new drugs and therapeutic approaches to overcome the current situation of neglected diseases, providing a better quality of life to affected people.

In this regard, different approaches and strategies have been developed to characterize new drugs for the treatment of such diseases. One of the most useful and elegant methods to find prototype drugs is based on traditional medicine, involving the use of plants and animals to treat different classes of diseases [1]. Furthermore, based on observation of medicinal plant activity in the field, researchers have been able to develop commercial drugs used to treat different human conditions, such as severe pain [2], metabolic [3], and infectious diseases [4], among others. In addition, further studies with these plants have led to the purification and identification of different classes of molecules that today can be explored for different purposes and medical applications.

In fact, a single species of plant can produce and accumulate a huge diversity of majority and minority molecules. The use of different dereplication techniques, especially those that associate chromatographic and spectrometric/spectroscopic methods, such as UPLC/MS, has allowed the identification of hundreds of compounds in a plant extract, including metabolites produced at a small concentration [5]. This approach avoids, after laborious chromatographic procedures, the isolation of known compounds; however, the purification of new natural products, especially bioactive ones, still remains a necessary challenge since the complete structural elucidation and conduction of bioassays are essential parts of the detection of prototypes for drug discovery [6, 7]. Although different molecules can be found in a single plant, the main drawback that limits the studies is related to the yield of bioactive molecules. In this case, the majority of published studies characterize extract activity, purify some classes of majoritarian molecules, and test them in in vitro protocols, because a relatively small amount is required to produce confident sets of data [8]. In recent years, interesting review articles have been published on this matter, and they show that thousands of articles deal with the microbicidal activity of plant extracts and molecules, but only a few numbers of articles have been published with respect to the in vivo activity of plants and their purified molecules in experimental models of infectious diseases. Although both in vitro and in vivo models are complementary and important to confirm the efficacy of a given extract or molecule, it is important to note that in vivo experiments would offer the most reliable data on the therapeutic activity of molecules, but at the same time, they are expensive and not all research institutes have adequate facilities to conduct such experiments. Therefore, despite the existence of interesting classes of bioactive molecules, it becomes possible to note that tropical diseases still are neglected at different levels.

However, elegant works exemplify the opportunities that medicinal chemistry and pharmaceutical technology have contributed to the field of neglected tropical diseases. In experimental models of infectious disease, medicinal chemistry has optimized classes of molecules whose bioactivities are more potent than natural products; according to the structure-activity relationship, rational molecules have been designed [9]. Similarly, pharmaceutical technology has shown that classical molecules, such as terpenes, flavonoids, as well as complex molecules, such as amphotericin B, a drug used to treat mycosis and leishmaniasis, have been successfully trapped in lipid carriers, and in experimental models (in vitro and in vivo), such formulations have low or absent toxicity together with potent therapeutic activities [10–12].

Therefore, it is possible to observe that numerous approaches exist to characterize new and efficient therapies; however, rare studies follow clinical tests in humans. This can be related to the yield of the bioactive molecule purified from natural resources, but it can also be related to a failure in communication between the academy and pharmaceutical industries, or even a lack of a governing policy on this matter that should be encouraged [13].

REFERENCES


**Prof. Dr. João H. G. Lago**  
*Guest Editor*  
ABC Federal University, São Paulo  
Brazil  
Tel: 55-11-3356-7000  
E-mail: joaohglago@gmail.com

**Prof. Dr. Luiz Felipe Domingues Passero**  
*Guest Editor*  
São Paulo State University, São Paulo  
Brazil  
Tel: 55-13-3569-7185  
E-mail: felipepassero@yahoo.com.br

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