

# Drug Development from Natural Resources

## Scope and Challenges

Drug Development from Natural Resources

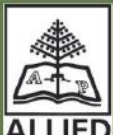
Scope and Challenges



*Edited by*

**SubbaRao V. Madhunapantula**

Centre for Science and Technology of the Non-Aligned and  
Other Developing Countries (NAM S&T Centre)



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# Drug Development from Natural Resources: Scope and Challenges

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# Endosymbionts of Plants and Marine Organisms: A Search for Lung Cancer Drug

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*ABSTRACT: Lung cancer is one of the lethal forms of cancer world-wide, contributing 28% of the total cancer related deaths. In India, it is the most commonly occurring cancer form in males. Proactive research strategies for its treatment and management have led to major advancement in surgery, chemotherapy and radiotherapy. Chemotherapy, among these, is the most prevalent treatment. However, treatment complexities such as genetic and environmental factors, tumour heterogeneity, resistant tumour and secondary health problems are biggest hurdles in effective chemotherapy. Owing to these challenges, the need for novel, effective and safer therapeutic agents has led to evaluation of natural compounds from traditional medicinal plants especially bioactive compounds. However, production of bioactive compounds from host organism depends on specific stage, nutritional, stress and environmental conditions. Due to these limitations, exploring endosymbiotic microorganisms from the host having medicinal properties provides a prospect of, inexhaustible and cost-effective source for bioactive compounds. Endophytes (plant's endosymbionts) produce similar metabolites as the host, as a result of their adaptation strategy. Compounds such as vinblastine, taxol, camptothecin, podophyllotoxin, topotecan and vincristine, are some of the examples of metabolites from endophyte origin used as anticancer agents. Another rich source of bioactive secondary metabolites is animals and plants of marine origin. Endosymbiotic microbes present in marine animals such as sponges, corals, starfish, bryozoans, sea urchins, fishes and prawns have recently emerged as rich sources of anti-cancer bioactive compounds. Since, marine biodiversity, are hardly explored, these sources may provide metabolites that may be used for therapeutic drugs against ailments, with minimum side effects. This review provides an insight to the symbiotic microbes with bioactive compounds with a potential in lung cancer therapy.*

**Keywords:** Bioactive Compounds, Marine Endosymbionts, Chemotherapeutic Agents, Secondary Metabolites, Taxol, Host-Microbe Interactions.

## 1. INTRODUCTION

Cancer remains the second leading cause of deaths globally. Owing to its increased morbidity, cancer cases have been predicted to reach about 24 million in less than two decades (Are *et al.*, 2018). During recent decades, lung cancer has become one of the most lethal forms of cancers, contributing to about 28% of the total cancer mortality (Rawat *et al.* 2009; Iqbal *et al.*, 2017). Its common treatment therapies include surgical procedure, radiotherapy and chemotherapy. However, the treatment complexities can be further aggravated due to diverse nature of patients' genetic and environmental conditions, delay in diagnosis, patient age, drug side effects, tumour heterogeneity, concomitant diseases and resistant tumours (Wingo *et al.*, 1999; Behera and Balamugesh, 2004). Chemotherapeutic agents also cause secondary health problems such as hair loss, fatigue, diarrhoea, weakened eyesight, cardiomyopathy, ischemia, and dysrhythmias (Siegel *et al.*, 2012; Goyal *et al.*, 2017). Moreover, a major limitation in chemotherapy in India is the high dropout rates, leading to resistant cancers (Goyal *et al.*, 2017). Owing to these challenges, the need for novel, effective and safer therapeutic agents has led to evaluation of natural compounds from traditional medicinal plants.

Natural bioactive compounds are extra-nutritional or secondary metabolites produced by plants and animals (mostly lower vertebrates), that are increasingly being used for their antibacterial, antifungal, anti-cancerous and therapeutic properties (Cragg and Newman, 2004). Bioactive compounds from natural sources alone contribute to about 80% of the drugs available commercially for various therapeutic purposes (Singh and Dubey, 2015). With four of the thirty-five biodiversity hotspots in the world, India is rich in plants with therapeutic benefits and has about 2500 indigenous plant species being used in medicines (Samant *et al.*, 1998; Singh *et al.*, 2009; Singh *et al.*, 2019). However, production of bioactive compounds from these plants is dependent on various factors such as specific developmental stage of the plants, their nutritional availability, exposure to stress and environmental conditions (Chandra *et al.*, 2012; Dudeja and Giri,