Current Topics

Recent Research in Bioactive Natural Products from Traditional Medicinal Plants

Foreword

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According to the WHO Traditional Medicine Strategy 2014–2023,1) traditional medicine is an important but often underestimated part of health services. In some countries, traditional medicine or nonconventional medicine may be termed “complementary medicine.” Traditional medicine has a long history of use in health maintenance and in disease prevention and treatment, particularly for chronic diseases. Natural products, especially those derived from higher plants, used for traditional and complementary medicines have attracted scientists from ancient times because of their potential therapeutic values. This Current Topics section contains six reviews of natural product chemistry involving attractive, comprehensive research on new candidates for the prevention and treatment of early-stage lifestyle-related diseases and intractable inflammatory diseases.

In the first review, entitled “Effects of Benzophenones from Mango Leaves on Lipid Metabolism,” was written by Professor Wang et al. (Tianjin University of Traditional Chinese Medicine, P. R. China). Mango (Mangifera indica L.) leaves are considered useful in treating diabetes and respiratory infections in traditional Chinese medicine. Professor Wang and his colleagues summarize phytochemical information on mango leaves and biological evaluations of their effects on lipid metabolism. In particular, the effects of the benzophenone constituents including mangiferin on triglyceride metabolism in 3T3-L1 cells as well as their structure–activity relationships (SAR) and mechanisms of actions are clarified. An active metabolite after the oral administration of mangiferin, norathryiol, was found to contribute to the activation of sirtuin-1 and liver kinase B1 and increase the intracellular AMP level and AMP/ATP ratio, followed by AMP-activated protein kinase (AMPK) phosphorylation, leading to increased phosphorylation of the sterol regulatory element-binding protein-1c.

In the second review, Dr. Ning Li and her colleagues (Shenyang Pharmaceutical University, P. R. China) summarize their investigations of naturally occurring inhibitors, including flavonoids, lignans, sesquiterpene-coumarins, and stilbenoids, of the overactivation of microglial cells, under the title, “Natural Inhibitors on Over-Activation of Microglia from Herbals.” Neuroinflammation resulting from the overactivation of microglial cells plays an essential role in neurodegenerative diseases. Therefore, inhibiting that overactivation and the production of cytotoxic intermediates such as tumor necrosis factor-α (TNF-α) and nitric oxide (NO) may become an effective therapeutic approach for the treatment of neuroinflammation. Dr. Ning Li and her colleagues not only give an overview of SAR studies of naturally occurring inhibitors but also indicate possible target molecules and propose that those active natural products may be promising resources for the development of new antineuroinflammatory drugs.

The review entitled “Progress in Development of Interventions to Prevent Birth Defects in Diabetic Pregnancies” is by Dr. Xuezeng Li and his colleagues (Yanbian University, P. R. China). Diabetic embryopathy is a complication of diabetes in which maternal hyperglycemia in early pregnancy causes birth defects in newborn infants. The physiopathologic mechanism of maternal diabetes-induced birth defects is complicated and not entirely understood, but several research groups including Dr. Li’s have demonstrated that it is associated with decreased cell proliferation and increased programmed cell death. This review is based on their previous research focused on naturally occurring inhibitors such as flavonoids, curcuminoids, and stilbenoids and their preventive effects against maternal diabetes-induced birth defects as well as their related mechanisms of action.

The fourth review, “Relationship between Structural Characteristics and Plant Sources along with Pharmacology Research of Quassinoids,” by Dr. Yi Zhang and his colleagues (Tianjin University of Traditional Chinese Medicine, P. R. China), describes recent pharmacological research. Quassinoids, which are classified as nor-triterpenoids having C19, C20, C22, and C25 skeletons, are widely distributed in the family Simaroubaceae with multiple bioactivities such as anticancer, antimalarial, antioxidative, antiadibiotic, antiviral, and antiinflammatory effects. Dr. Zhang’s group review studies on the chemical structural characteristics and plant sources, including 41 species belonging to 21 genera, of two families containing 190 quassinoids published during 2004–2018, as well SAR studies of quassinoids to determine their biological activities such as anticancer, antiparasitic, antiviral, and anti-inflammatory effects.

The fifth review by Professor Matsuda et al. (Kyoto Pharmaceutical University, Japan) addresses “Biofunctional Effects of Thiohemiaminal-Type Dimeric Sesquiterpene Alkaloids from Nuphar Plants.” Dimeric sesquiterpene thioalkaloids such as 6-hydroxythiobinupharidine, 6,6’dihydroxythiobinupharidine, etc., which have a unique thiaspirane ring in their thiohemiaminal structure, were isolated from the rhizomes of Nuphar japonicum D.C. (Nymphaceae). Professor Matsuda et al. describe their recent studies on the anticancer activities of the dimeric sesquiterpene thioalkaloids such as immunosuppressive effects using the sheep erythrocyte cell plaque-forming cell (PFC) assay and antimitastic and apoptosis-inducing effects in tumor cell lines.

The final of the six reviews is by our group and entitled “A
Review of Biologically Active Natural Products from a Desert Plant *Cistanche tubulosa.*” We began research on the stems of *C. tubulosa* (Orobanchaceae, *kanka-nikujuyou* in Japanese) from early 2005. This review summarizes our recent findings on the chemical constituents from the stems of *C. tubulosa* as well as their bioactivities such as vasorelaxtant, hepatoprotective, and glucose tolerance-improving activities. A total of 69 chemical constituents including 20 iridoids, seven aliphatic monoterpenoids, and 28 phenylethanoid glycosides were isolated from methanol extracts of the *C. tubulosa* stems. Among the bioactive principles, the phenylethanoid glycosides echinacoside and acteoside, which were obtained as the principal isolates among them, were found to show those activities and therefore may be useful for the treatment of various lifestyle diseases such as hypertension, diabetes, hepatitis, etc.

Natural products remain important repositories of promising therapeutic candidates due to their rich chemical and biological diversity. In particular, they are expected to yield new therapeutic candidates for prevention and treatment in the early stages of lifestyle-related diseases and intractable inflammatory diseases, as featured in this Current Topics section. Natural products could contribute greatly to the development of agents to treat these diseases in the future.

I sincerely appreciate the work of all these authors and their significant contributions.

Reference