

# Natural Bioactive Compounds

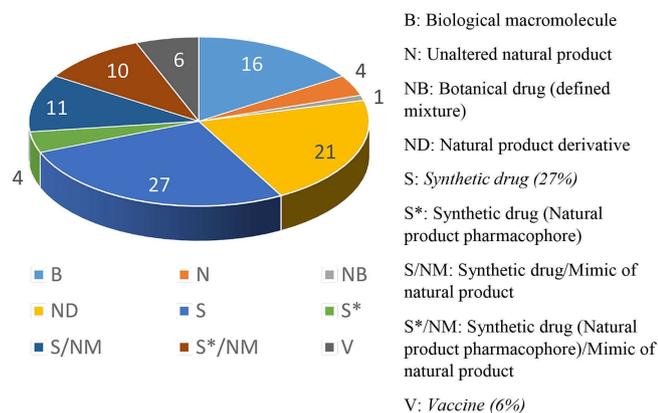
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Nature has long provided us with molecules for therapeutic applications limited only by the imagination and creativity of mankind. Ancient civilizations such as those that once existed in China, Greece, India and Egypt left numerous examples and legends of the discoveries and uses of plant-based medications.<sup>[1]</sup> In Chinese mythology, Shennong, who lived around 2700 BC and considered the founder of Chinese medicine, experimented with medicinal plants on himself and taught others the benefits of using these plants.<sup>[2]</sup> In Greece, *Historia Plantarum* written by Theophrastus between 350 BC and 287 BC described plant structure, growth, and medicinal uses.<sup>[3]</sup> Although quinine was first isolated in 1820 from the bark of a cinchona tree, the bark extract was used long before by indigenous South Americans as a muscle relaxant, and its use as a malaria therapeutic dates back to at least the 17<sup>th</sup> century.<sup>[4]</sup> At the dawn of the modern science era, aspirin derived from salicylic acid extracted from willow tree bark was famously debated as an anti-inflammatory panacea. The discovery of penicillin and streptomycin showed that microorganisms like fungi and bacteria can also be the sources of bioactive wonder drugs. Beginning in the 1950s, researchers started to isolate bioactive molecules from marine sponges.<sup>[5]</sup> Soon after, investigations and medicinal uses of these marine molecules grew rapidly. Recent findings show that natural

bioactive compounds can be as small and simple as molecular oxygen, nitric oxide and carbon monoxide.<sup>[6]</sup>

The past successes of mining bioactive compounds from Nature profoundly impacted drug development. Ironically, the triumphs turned into the demise of antibiotic development when it was infamously stated in 1967 by the then US Surgeon-General: “The time has come to close the chapter on infectious diseases.” Nowadays, we know better. New anti-infectives as well as other classes of medicinal compounds are in great demand. Inspired by the discoveries of penicillin, vancomycin, resveratrol, lovastatin, paclitaxel and many other natural products, researchers worldwide continuously devote efforts to find natural bioactive compounds through bioprospecting, microbe engineering and enzymatic diversification. As reported in a review article that among the drugs approved from 1981 to 2014, sixty seven percent of them were developed with influence from natural products (Figure 1).<sup>[7]</sup>

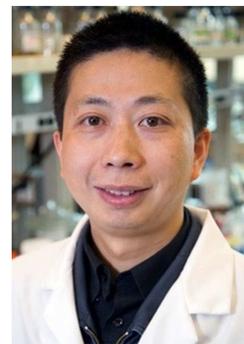
This special issue of natural bioactive compounds highlights several significant and representative reviews with the intention of encompassing recent progress in focused areas in addition to topics of growing interest to the chemistry community. From molecules as small as carbon monoxide and nitric oxide to larger peptides and proteins, from organisms as tiny as fungi to coral, and from plants to animals, it is a collection of reviews on natural bioactive compounds and a testimony to the wide-ranging and marvelous chemical treasures that Nature offers. We hope that this special issue can also corroborate the call for better protection of the environment, natural resources and Mother Earth.



**Figure 1.** All new approved drugs 1981 – 2014; n = 1562. Figure used with permission from <https://pubs.acs.org/doi/10.1021/acs.jnatprod.5b01055>; further permissions related to the material excerpted should be directed to the ACS.

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## References

- [1] J. D. Phillipson, *Phytochemistry* **2001**, *56*, 237–243.
- [2] *Chinese Mythology*, A. Christie, 1975, London: Hamlyn.
- [3] *Theophrastus: Enquiry into Plants* A. Hort, ed. 1916, William Heinemann and G. P. Putnam's Sons.
- [4] *Treatment and Prevention of Malaria: Antimalarial Drug Chemistry, Action and Use*, H. M. Staines, S. Krishna ed., 2011, Springer Verlag.
- [5] M. F. Mehbub, J. Lei, C. Franco, W. Zhang, *Mar. Drugs* **2014**, *12*, 4539–4577.
- [6] T. Shimizu, D. Huang, F. Yan, M. Stranova, M. Bartosova, V. Fojtiková, M. Martinková, *Chem. Rev.* **2015**, *115*, 6491–6533.
- [7] D. J. Newman, G. M. Cragg, *J. Nat. Prod.* **2016**, *79*, 629–661.

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