

Similarities Between Pharmaceuticals and Herbicides

Stephen O. Duke

*Natural Products Utilization Research Unit, Agricultural Research Service, United States
Department of Agriculture, University, MS, USA, sduke@olemiss.edu*

For many years, virtually all pharmaceutical companies had an agrochemical division. This was partly to maximize the benefits of expensive chemical synthesis efforts by searching for many types of useful biological activity. Leads for pharmaceuticals and pesticides often overlap, in some cases leading to both pharmaceuticals and herbicides. This review will focus on herbicides and herbicide classes that have been found to have potential pharmaceutical properties, both as therapeutics that act through human molecular target sites and those that act on infectious agents. An example of the first case are compounds that target acetyl CoA carboxylase in plants to inhibit fatty acid synthesis and in humans as an anti-inflammatory agent. Another such example are triketones that can act as both herbicides and as treatments for the genetic disease tyrosinaemia. Examples of the second case are the relatively large number of herbicides that have anti-*Plasmodium* spp. (the malaria microbe) activity. It turns out that *Plasmodium* spp. have an organelle that is apparently a vestigial chloroplast, the apicoplast. Although, our lab has found that apicoplast-associated target sites are not necessarily likely to be good targets for herbicides with chloroplast-localized targets. Other herbicides, such as dinitroanilines, are active against several protozoan parasites by the same mechanism by which they kill plants, interaction with tubulin to halt cell division. These and other multiple activities of various herbicides and herbicide classes provide perspective on the broad biological activity of herbicides.

Suggested reading:

Delaney, J., E. Clarke, D. Hughes, and M. Rice. 2006. Modern agrochemical research: A missed opportunity for drug discovery. *Drug Discovery Today* 11:839-845.

Duke, S.O. 2010. Herbicide and pharmaceutical relationships, *Weed Sci.* 58: In press.