

Phytochemical Debate/Essay Activity

Green Chemistry Institute, gci@acs.org
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Introduction

Earth Day is a time to reflect on the interdependent roles of humans and the environment. The theme of ChemisTREE focuses on the connections between humans, chemistry and plants. This activity offers an opportunity to use writing or debate skills to investigate chemicals produced by plants, or phytochemicals. Information and references for taxol, camptothecin and azadirachtin are provided. These phytochemicals are used in medicine and agriculture, providing intriguing examples of the chemistry that goes on inside of trees.

Green Chemistry Principles (See [12 Principles](#) for a complete list.)

- Renewable Feedstocks
- Designing Safer Chemicals

Procedure

Compare and contrast the three examples of phytochemicals provided below. Your discussion should include answers to the following questions:

- How was the drug discovered (who, what, where, when, why)?
- What is the primary chemical action of the drug?
- What is the medicinal or agricultural value of the drug?
- How will industrial production of the chemical be different than the natural production in the tree? Will that change your perception of the chemical's green chemistry status?
- Is using renewable feedstocks the same as designing safer chemicals? In other words, are plant-derived chemicals always safer than laboratory synthesized chemicals?

1. Taxol[®] (paclitaxel), an anti-tumor drug derived from the Pacific yew tree, *Taxus brevifolia*

For more information see these websites and articles:

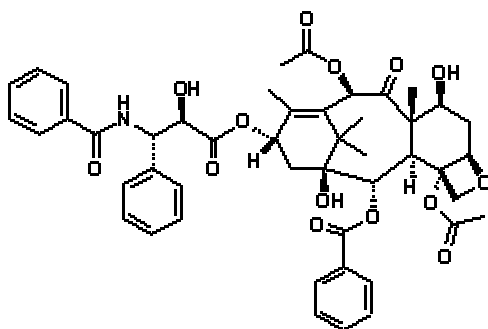
<http://www.bris.ac.uk/Depts/Chemistry/MOTM/taxol/taxol.htm>

<http://www.rti.org/page.cfm?objectid=0098D2DD-3FBE-4FD5-BAB462E2C7EE789C>

Chemical & Engineering News, August 27, **2001**, 79, 64-65.

<http://pubs.acs.org/subscribe/journals/cen/79/i35/html/7935books.html>

Taxol Chemical Structure



Source: The American Society of Pharmacognosy
<http://www.phcog.org/obits/Wall.html>

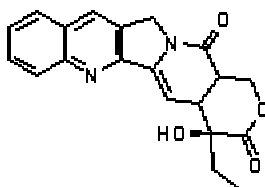
2. Camptothecin[™] (CPT), an anti-tumor drug derived from the Chinese tree, *Camptotheca acuminata*

For more information see these websites and articles:

<http://www.rti.org/page.cfm?objectid=0098D2DD-3FBE-4FD5-BAB462E2C7EE789C>

Comins, D.L.; Nolan, J.M. *Organic Letters*, 2001, 3, 4255-4257.

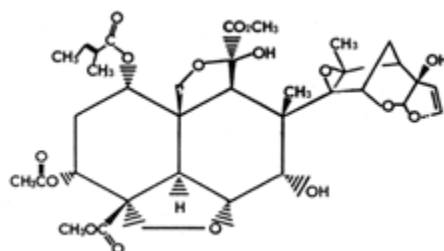
Camptothecin Chemical Structure



Source: The American Society of Pharmacognosy
<http://www.phcog.org/obits/Wall.html>

3. **Azadirachtin**, an insecticide derived from the Neem tree of South Asia, *Azadirachta indica*
For more information see these websites:
http://www.colostate.edu/Depts/Entomology/courses/en570/papers_1994/howatt.html
http://www.mhhe.com/biosci/pae/botany/botany_map/articles/article_33.html

Azadirachtin Chemical Structure



Source: Archer Landscape and Botanicals
<http://user.gru.net/parker1/>

Additional References

- Goodman, J.; Walsh, V. *The Story of Taxol*, Cambridge University Press: Cambridge, UK, 2001.
- Jew, S.; Kim, M.G.; Kim, H.-J.; Roh, E.-J.; Park, H. *Korean Journal of Medicinal Chemistry*, **1996**, *6*, 263-282.
- National Research Council (US). *Neem - a tree for solving global problems*. National Academy Press: Washington, DC, 1992.
- Schmutterer, H., Ed. *The Neem Tree*, VCH Weinheim, 1995.