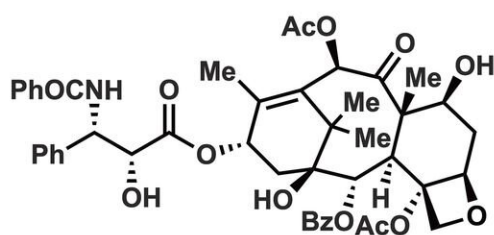


Synthetic canataxpropellane at last: Reproducing one of nature's most complex products

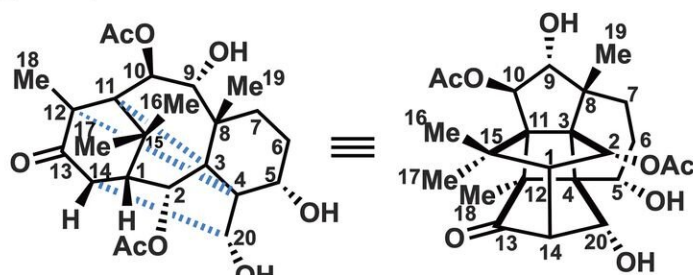
February 11 2020, by Bob Yirka

A Classic taxane core



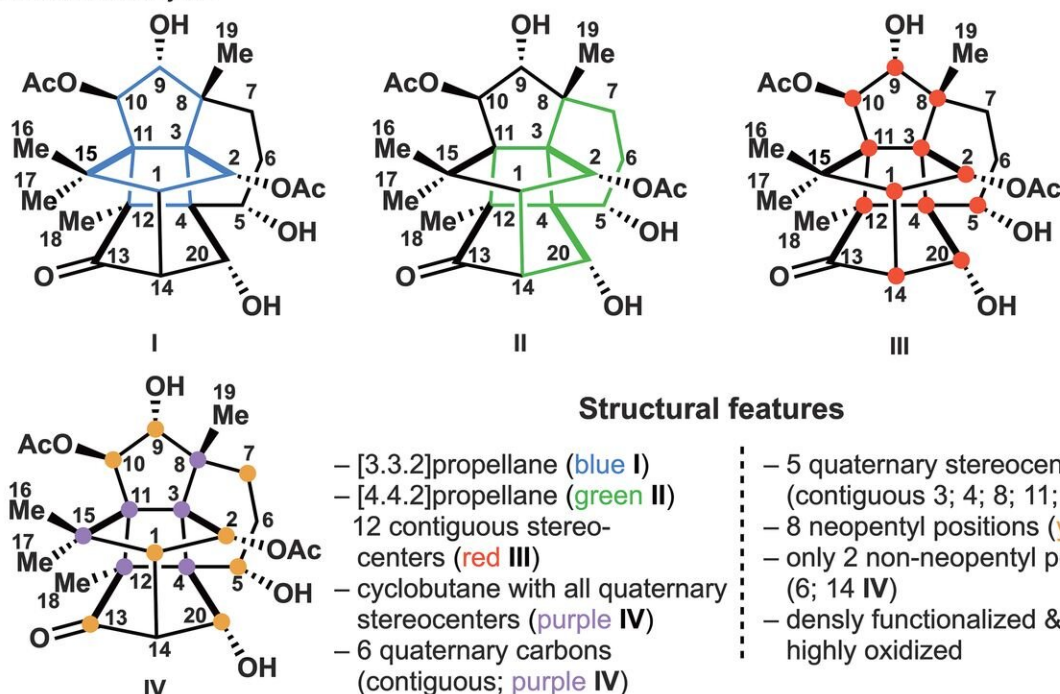
Taxol (1)

B Complex taxane core



canataxpropellane (2)

C Structure analysis



Comparison of the Taxol core with the complex taxane core and key features of (–)-canataxpropellane (2). Credit: *Science* (2020). DOI: 10.1126/science.aay9173

A team of chemists at the University of Konstanz in Germany has succeeded in synthesizing canataxpropellane—one of the most complex natural products ever produced. In their paper published in the journal *Science*, the group describes the long and arduous process they used and relate that they almost gave up several times along the way.

Canataxpropellane is a unique taxane with a polycyclic carbon skeleton unlike any other. Taxanes are a type of anticancer drug made from substances in yew trees. For such substances to be useful, chemists must find a way to synthesize them so that they can be mass produced. One such product is the anticancer drug Taxol. Several attempts have been made to synthesize canataxpropellane, but have failed due to its complex nature. It has a seven-ringed cage-like structure with six contiguous all-carbon quaternary centers and 12 contiguous stereocenters. In this new effort, the researchers overcame multiple obstacles in developing a way to synthesize the taxane in 26 steps.

The team overcame a challenge early in the process—assembling a cyclobutane ring along with a quaternary chiral center through use of an alkene-arene-ortho photocycloaddition. But then it took them more than a year and a half to overcome the second challenge—in all, it took the team five years to develop the process, an effort that nearly failed multiple times and tested the team's patience and ingenuity. The yield is 0.5 percent.

Once the team had developed a way to synthesize canataxpropellane, they took it a step further. Over the course of the following two months, they developed a way to prepare enantiomerically pure

canataxpropellane. That effort led the researchers to the discovery of a new chiral directing group for one of the reactions important to the overall process.

It is not known if canataxpropellane can be used as a [cancer treatment](#), but it is believed by many chemists that its syntheses will lead to more efficient ways to synthesize other taxanes currently in use for cancer treatment, bringing down prices. It is also expected that it will lead to testing canataxpropellane in new ways now that it is possible to produce it upon demand in a lab.

More information: Fabian Schneider et al. Total synthesis of the complex taxane diterpene canataxpropellane, *Science* (2020). [DOI: 10.1126/science.aay9173](https://doi.org/10.1126/science.aay9173)

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