Biocatalysis of Bioactive Taxanes

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Technology description

Executive Summary

A shortage of the chemotherapeutic paclitaxel (Taxol®) due to an unreliable pharmaceutical supply chain lead researchers at Michigan State University (MSU) to discover and propose a novel, faster way of producing paclitaxel and related anti-cancer drugs: Using a biocatalytic process, Taxol can now be produced in a more streamlined and faster in vitro synthesis process to quickly ramp up the production during shortages, ensuring the pharmaceutical supply for many breast cancer patients as well as patients with ovarian, lung, bladder, and colon cancers.

This biocatalysis method also provides a streamlined in vitro enzymatic process for the production of taxane drugs such as cabazitaxel (Jevtana®) and docetaxel (Taxotere®), reducing the use of petroleum-based solvents such as hexanes and tetrahydrofuran and eliminating the use of pyrophoric reagents such as n-butyllithium.

Description of Technology

Researchers at MSU discovered a key enzyme, Tyrocidine Synthetase A (TycA: PheAT), which catalyzes the production of phenylisoserinyl CoA thioester, a key precursor to anti-cancer taxane drugs. A second enzyme, phenylpropanoyltransferase (BAPT), is used with PheAT in an enzyme cascade reaction to produce further taxane intermediates. This biocatalysis method provides a simple, streamlined in vitro enzymatic process for the production of taxane drugs such as cabazitaxel (Jevtana®), docetaxel (Taxotere®), as well as paclitaxel (Taxol®). Water-based buffer steps reduce use of petroleum-based solvents such as hexanes and tetrahydrofuran. The proposed method also eliminates the use of pyrophoric reagents such as n-butyllithium in the production of cabazitaxel. Lab scale production yields have shown far greater results than the calculated theoretical yields.

Application area

Global cancer drug market

Commercial potential for experimental precursors in research market

Advantages

More efficient, faster, and more flexible synthesis of paclitaxel and related anti-cancer drugs

More streamlined production process

Controlled environment, in vitro synthesis possible

No harsh organic solvents used, greener production

Institution

Michigan State University

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