Treat acne with coconut oil and nano-bombs

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Ph.D. student Dissaya "Nu" Pornpattananangkul is developing a smart system of drug delivery for a natural product found in both coconut oil and human breast milk -- lauric acid. Lauric acid shines as a possible new acne treatment thanks to a bioengineering graduate student from the UC San Diego Jacobs School of Engineering. The student developed a "smart delivery system" - published in the journal *ACS Nano* in March 2010 -- capable of delivering lauric-acid-filled nano-scale bombs directly to skin-dwelling bacteria (*Propionibacterium acnes*) that cause common acne. On Thursday April 15, 2010 bioengineering graduate student Dissaya "Nu" Pornpattananangkul will present her most recent work on this experimental acne-drug-delivery system at Research Expo, the annual research conference of the UC San Diego Jacobs School of Engineering. Credit: UC San Diego / Daniel Kane

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lauric acid -- shines as a possible new acne treatment thanks to a bioengineering graduate student from the UC San Diego Jacobs School of Engineering. The student developed a "smart delivery system" - published in the journal *ACS Nano* in March - capable of delivering lauric-acid-filled nano-scale bombs directly to skin-dwelling bacteria (*Propionibacterium acnes*) that cause common acne.

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Common acne, also known as "acne vulgaris," afflicts more than 85 percent of teenagers and over 40 million people in the United States; and current treatments have undesirable side effects including redness and burning. Lauric-acid-based treatments could avoid these side effects, the UC San Diego researchers say.

"It's a good feeling to know that I have a chance to develop a drug that could help people with acne," said Pornpattananangkul, who performs this research in the Nanomaterials and Nanomedicine Laboratory of UC San Diego NanoEngineering professor Liangfang Zhang from the Jacobs School of Engineering.

The new smart delivery system includes gold nanoparticles attached to surfaces of lauric-acid-filled nano-bombs. The gold nanoparticles keep the nano-bombs (liposomes) from fusing together. The gold nanoparticles also help the liposomes locate acne-causing bacteria based on the skin microenvironment, including pH.

Once the nano-bombs reach the bacterial membranes, the acidic microenvironment causes the gold nanoparticles to drop off. This frees the liposomes carrying lauric acid payloads to fuse with bacterial

membranes and kill the *Propionibacterium acnes* bacteria.

"Precisely controlled nano-scale delivery of drugs that are applied topically to the skin could significantly improve the treatment of skin bacterial infections. By delivering drugs directly to the bacteria of interest, we hope to boost antimicrobial efficacy and minimize off-target adverse effects," said Zhang. "All building blocks of the nano-bombs are either natural products or have been approved for clinical use, which means these nano-bombs are likely to be tested on humans in the near future."

Zhang noted that nano-scale topical drug delivery systems face a different set of challenges than systems that use nanotechnology to deliver drugs systematically to people.

Pornpattananangkul and UC San Diego chemical engineering undergraduate Darren Yang confirmed, in 2009 in the journal Biomaterials, the antimicrobial activity of nano-scale packets of lauric acid against *Propionibacterium acnes*.

Pornpattananangkul, who is originally from Thailand, said that it's just a coincidence that her research involves a natural product produced by coconuts - a staple of Thai cuisine.

Provided by University of California - San Diego

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