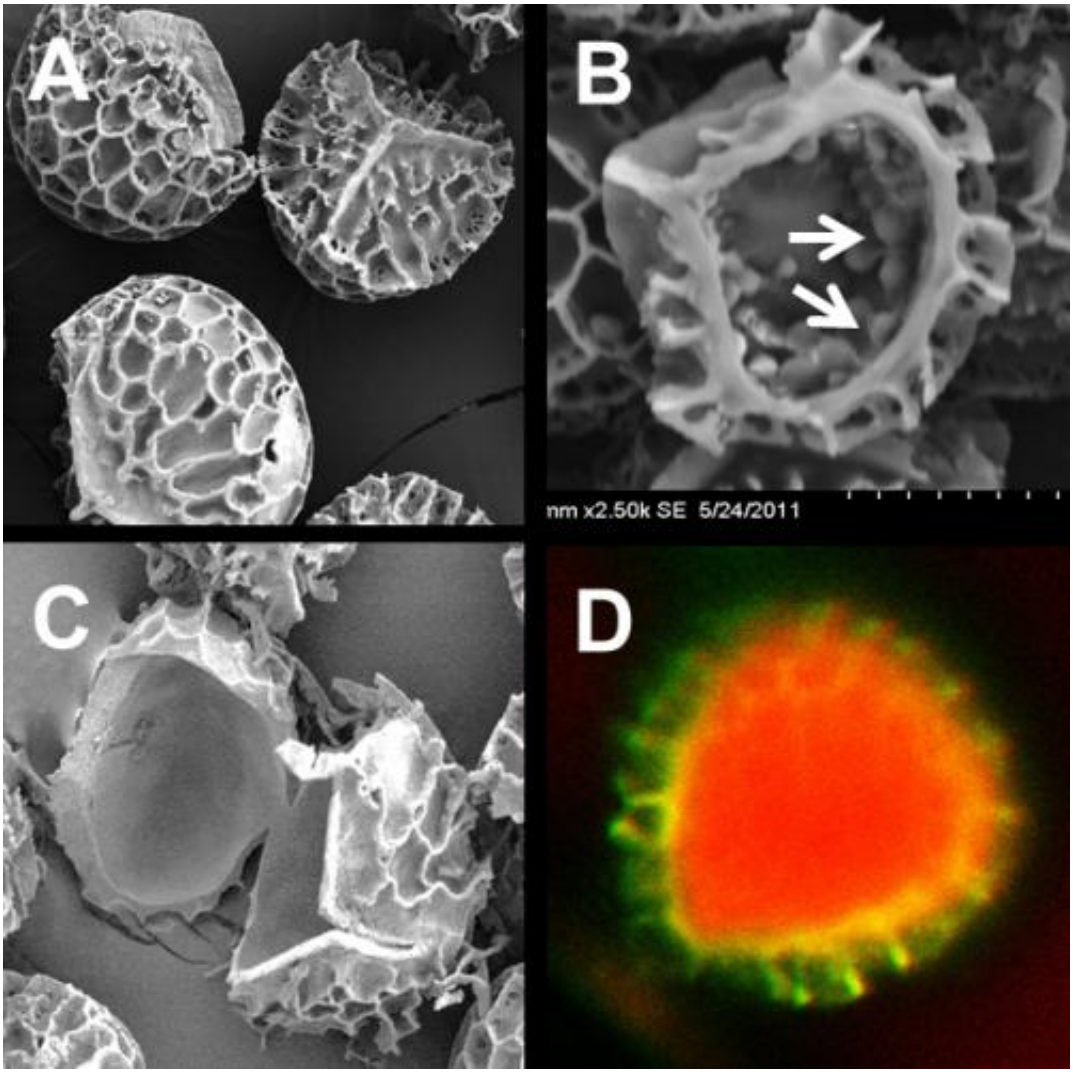
Pollen: Can humans' seasonal bane become a tool in the fight against disease?

November 28 2012



Club moss pollen/spores for oral vaccination. Scanning electron micrographs of (A) intact pollens, (B) interior of manually crushed pollen showing native plant matter, and (C) interior of manually crushed pollen after pollen-cleaning procedure to remove plant biomolecules. (D) Confocal micrograph showing a

model test vaccine filled into clean pollen.

As a globally deployed force tasked with defending U.S. interests and delivering humanitarian assistance to international populations, the Department of Defense must be able to provide health care anywhere in the world at any time to protect against natural and man-made health threats. Having trained and equipped medical personnel on hand is not feasible for every mission, however, which is one reason why DoD invests in medical treatments that can be easily administered by one's self or by fellow servicemembers. Among the 2012 class of academic researchers receiving mentorship and funding through DARPA's Young Faculty Awards (YFA) program, one individual is studying novel methods for packaging and delivery of orally consumed vaccines. His tool of choice: pollen.

Harvinder Gill, an assistant professor of chemical engineering at Texas Tech University, seeks to understand, engineer and test a pollen-based oral vaccination platform to protect against a range of infectious diseases. If successful, his research could lead to more effective, more easily administered and more easily transported vaccines for deployed troops.

What attributes does pollen have that make DoD consider it anything more than a seasonal menace to humans' sinuses? To start with, the exterior of a pollen grain is a shell made of a naturally durable, non-allergenic polymer. The contents of the shell that actually contain the allergy-inducing plant proteins and fats can be cleaned out, rendering the shell itself neutral. The leftover space inside the shell could be filled with vaccines and delivered into the body through oral ingestion. The pollen shell's natural toughness would help the vaccine survive conditions inside the body. The pollen could then pass through the intestinal lining to deliver vaccine.

The value of an orally consumed vaccine is that it is efficient, painless, can be self-administered and can induce both systemic and mucosal immune responses, thus enhancing protection. But why is pollen any better for this than a traditional pill? The body's own processes often limit the effectiveness of pills. When patients ingest vaccines and other medications, stomach acids and digestive processes can degrade the medication. Because pollen shells are durable, however, they can potentially survive inside the body and safeguard a vaccine until it can be delivered. All this means that along with the traditional image of pollen as airborne particles that cause headaches and sneezing, pollen could also eventually be known as an edible vaccine delivery vehicle.

"DARPA already has a large portfolio of biology programs aimed at protecting the health of U.S. warfighters from threats known and unknown," said Jay Schnitzer, director of DARPA's Defense Sciences Office, which currently oversees the YFA program. "We actively support innovative basic research like that conducted by YFA recipients because it helps open new areas for exploration and fosters valuable, lasting relationships between DoD and the research community."

More information about Dr. Gill's research may be found at www.gill-lab.che.ttu.edu. His laboratory is currently investigating pollen grains, micro-needles, gold nanoparticles and polymeric micro-nano particles for mucosal vaccination and cancer drug delivery.

DARPA anticipates releasing the next YFA solicitation in late 2012. Interested candidates should please watch www.grants.gov and www.darpa.mil for updates.

Provided by DARPA

November 28) retrieved 25 April 2024 from https://phys.org/news/2012-11-pollen-humans-seasonal-bane-tool.html