POWER PLANTS: HOW ARKANSAS LEADS RESEARCH OF PLANT-BASED CANCER TREATMENTS

Dr. Fabricio Medina-Bolivar, Arkansas State University

Treatments for cancer and the search for cures are a multibillion-dollar industry, directed by the nation's leading researchers and funded both federally and privately. The mission is critical. In 2022, an estimated 609,360 people will die of cancer in the United States. Breast cancer is an especially destructive disease – the second leading cause of death among women. According to the Arkansas Department of Health, 1 in 8 women will develop breast cancer. Whether you know a family member or friend with the disease, or you've battled it yourself, chances are that you have personally been affected by breast cancer.

Research is taking a variety of approaches to cancer prevention, treatment and cures. At the Arkansas Biosciences Institute (ABI) at A-State, one ARA Academy researcher, Dr. Fabricio Medina-Bolivar, and his team have found very promising results in novel organic compounds that have a particularly positive effect on cancer treatments.

"My research focuses on producing and discovering compounds from plants with applications in human health," explained Dr. Medina-Bolivar, professor of plant metabolic engineering at A-State. Medina-Bolivar uses a system called "hairy roots" in which the plant roots have been "immortalized" to grow as roots forever. These roots are the factories to make diverse classes of compounds called stilbenoids that certain plants produce in nature.

How do these stilbenoid compounds relate to the treatment of cancer? Chemotherapy drugs cause a variety of unpleasant side effects, and Medina-Bolivar is researching the use of prenylated stilbenoids as adjuvants (substances that enhance efficacy) for FDA-approved chemotherapies. The goal is to reduce the drug dose without compromising its activity in inducing cancer cell death. Ultimately, this will translate into reduced side effects from chemotherapy treatments. "We've found that certain prenylated stilbenoids from peanuts are showing this adjuvant effect, particularly in triple-negative breast cancer cells. We are currently evaluating the signaling pathways activated by prenylated stilbenoids that induce cell death in cancer cells," said Medina-Bolivar.

Producing stilbenoids in significant quantity is a challenge. Plants only produce these compounds as a mechanism for defense (such as when the plant is attacked by a fungus). Through his research, Medina-Bolivar has increased the production of prenylated stilbenoids by more than 50,000 times. This has resulted in several patents around bioproduction technologies. The process is scalable, and he hopes to implement the hairy-root-based bioproduction technology at the industrial level.

Medina-Bolivar credits much of the success of his research to ABI, where he was among the first group of scientists to establish a lab when the facility opened in 2004. "Over the years, ABI has been instrumental in the growth of my research by providing seed-type grant funding, core facilities and facilitating collaborations with other institutions," said Medina-Bolivar, whose work will someday unearth preventive therapies for cancer, cardiovascular disorders and other aging-associated diseases.