

RESEARCH SPOTLIGHT

TRANSLATING SCIENCE TO PRACTICE

Discovery Beyond Dentistry



DR. GEORGE HAJISHENGALLIS

Dr. George Hajishengallis links relief from periodontal disease to an array of inflammatory conditions

By pinpointing the underlying cause of one of the most common dental ailments—periodontal disease— Dr. George Hajishengallis forged a path to relief for patients beyond the dentist’s chair.

Dr. Hajishengallis, Thomas W. Evans Centennial Professor in Penn Dental Medicine’s Department of Microbiology, has spent most of his career studying periodontitis, an oral disease marked by microbe-driven inflammation of the tissues and bone that support the teeth. While nearly half of all adults in the United States suffer from some form of periodontal disease, treatment options are limited to scaling and planing, a procedure that treats, but does not cure, the condition.

STOPPING GUM DISEASE IN ITS TRACKS

In his lab, Dr. Hajishengallis identified a key protein, Del-1, which he discovered can inhibit the chronic inflammation and bone loss associated with periodontitis. By introducing Del-1 to the gums, he found in preclinical models that not only can this protein block the progression of periodontal disease, but it can reverse the condition.

“For the first time, we have found pathways to roll back the damage caused by periodontal disease,” says Dr. Hajishengallis. “Even after one treatment, you could see a big difference in inflammation.”

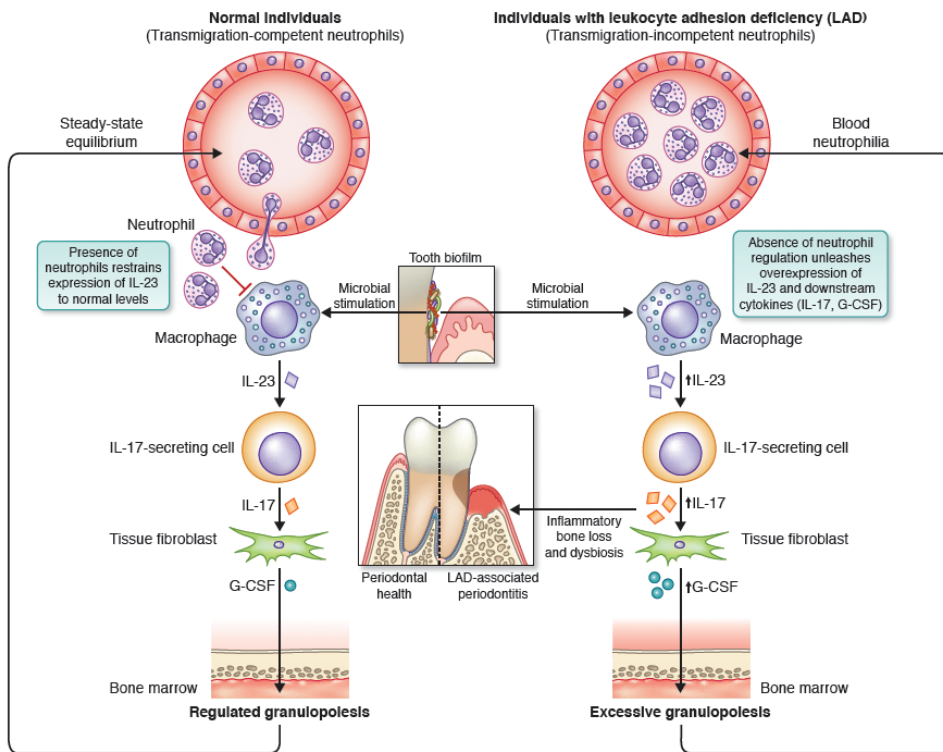
Millions of dental patients could benefit from Dr. Hajishengallis’ novel application of Del-1. What’s more, his work has the capacity to impact patients suffering from other diseases beyond periodontitis—or even dentistry.

“As we were marveling at the significance of Del-1 in periodontal disease, new questions kept bubbling up,” Dr. Hajishengallis says. “What could this protein do for other diseases? What if it is expressed not only in the gums, but in other tissues?”

CONNECTING THE DOTS TO MS

Further research from his lab connected Del-1 protein deficiencies to multiple sclerosis (MS), which is characterized by inflammation in the nervous system. With a greater understanding of how Del-1 acts in the context of MS, the researchers explored whether the protein might act as a therapy for the disease. After administering Del-1 to mice suffering from an MS flare-up, they were pleased to find that the mice did not experience further episodes of the disease.

“It’s amazing that our work in periodontitis has found application in a central nervous system disease. This shows that periodontitis can be a paradigm for other medically important inflammatory diseases,” Dr. Hajishengallis says. “It’s these types of breakthroughs that make my work deeply gratifying.”



REAL-LIFE IMPACT

In addition to multiple sclerosis, Dr. Hajishengallis' research on periodontal disease holds implications for leukocyte adhesion deficiency (LAD), a rare genetic disorder that causes recurrent bacterial infections. Individuals with LAD often suffer from aggressive gum disease that does not respond to professional dental care or antibiotics, leading them to lose teeth early in life.

After detecting LAD in a strain of mice while studying the mouse model of periodontitis, Dr. Hajishengallis found that the disease could be treated by using an antibody to block a molecule that causes damaging inflammation. Based on this, Dr. Hajishengallis and his collaborators used a previously FDA-approved drug that blocks the activity of this molecule to treat a 19-year-old LAD patient with severe periodontitis and a chronic, non-healing skin wound. The patient saw dramatic improvement in both his oral health and wound, and the successful results were described in a 2017 report in the *New England Journal of Medicine*.

"I am very excited to see that what began as advancements in dental medicine can be significant for patients with different types of inflammatory diseases," Dr. Hajishengallis says.

LIMITLESS CURIOSITY, LIMITLESS SUCCESS

His abiding scientific curiosity propelled Dr. Hajishengallis from dental school in Athens, Greece, to an internationally renowned basic and translational research lab at Penn Dental Medicine.

"In my final year of dental school, I started to think about how much potential there was for my field to evolve in infinite, groundbreaking ways," he says. "After that realization, I was certain that I wanted to be a part of that progress through a career in research."

Dr. Hajishengallis has been widely recognized for his contributions to the advancement of dental medicine. In 2016, he received a MERIT (Method to Extend Research in Time) Award from the National Institutes of Health to continue his research on the role of Del-1 and other molecules in curing inflammatory diseases. This highly selective grant is awarded to less than five percent of NIH-funded researchers across all disciplines.

As for future applications of his research, Dr. Hajishengallis is highly optimistic: "Because of the relevance of the Del-1 molecule in a broad spectrum of inflammatory conditions, there is no limit to the number of patients we can impact by bringing our innovations from bench to bedside."

MORE INFORMATION

For more information on how to support the research of Dr. Hajishengallis, contact Elizabeth Ketterlinus, Senior Associate Dean for Development & Alumni Relations, ekett@upenn.edu, 215-898-3328.