"Missing Link" Offers Treatment Alternatives

A tiny primitive fish that makes up 70 percent of the biomass in Tampa Bay is the "missing link" marking the point in evolution that led to the development of the modern-day human immune system.

The inch-long spineless fish, called a lancelet, produces a key immune system protein that is similar to but much hardier than the version found in people. The bay waters are a microbial soup teeming with microorganisms, yet the worm-like bottom-feeder is remarkably adept at standing up to the bacterial, viral and chemical threats in its environment. Understanding how it does so could lead to improved biodefense and better immune-boosting drugs to fight cancer and disorders such as rheumatoid arthritis, say scientists at UF and the University of South Florida, who reported their findings recently in *Nature Immunology*.

"At a basic level, this sea worm tells us about the evolution of the immune response; specifically, it tells us that primitive organisms have more sophisticated immune systems than we previously thought," said X-ray crystallographer David Ostrov, an assistant professor of pathology, immunology and laboratory medicine at UF's College of Medicine who is affiliated with the UF Shands Cancer Center. "This is the first organism below the level of jawed vertebrates that expresses the type of proteins we use in our own complex adaptive immune system."

The human immune system is constantly at work, on guard to tackle new ills while remembering past offenders. Compared with its predecessors on the evolutionary tree, the lancelet shares genes and proteins remarkably similar to ours that enable it to also skillfully elude attack.

"This influences our therapeutic strategy because we must consider that an organism we are trying to target may have an elaborate defensive system of its own, with features that neutralize what we're trying to do to it," Ostrov said. "For example, if we're trying to create a vaccine against a specific pathogen such as anthrax, smallpox or bird flu, we have to take into account the defensive measures those and other organisms might have."

The researchers bombarded a highly concentrated, crystallized form of an immune system protein isolated from the fish with X-rays, yielding incredibly high-resolution images of its structure.

Scientists can actually see where individual hydrogen atoms are positioned in the protein's core, providing clues as to which atoms are participating in key stabilizing interactions. The lancelet's immune response proteins, however, are resilient. Understanding their essential architecture with such precision could lead to new, improved types of antibody-based therapies that are better able to persist in the body, Ostrov said.

The study was funded by the National Institute of General Medical Sciences, the National Institute of Allergy, Immunology and Infectious Diseases, the Cure Autism Now Foundation and the U.S. Department of Energy.

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Fertilizer Amounts Focus of Study

Florida's 5 million acres of home and commercial lawns may need fertilizer, but its water resources don't — so University of Florida researchers have embarked on a landmark study to verify the effectiveness of current state lawn-care recommendations.

Funded by the state Department of Environmental Protection, the five-year, $3.5 million study is UF's largest turfgrass research project ever, said Laurie Trenholm, an associate professor with UF's Institute of Food and Agricultural Sciences and one of the study's principal investigators. The research focuses on nitrogen and phosphorus, essential plant nutrients that pose significant threats to Florida's water quality.

"We've known for years how to produce beautiful turf, but now we're determining how to do it with the smallest amount of fertilizer," said Trenholm, who is also head of the Florida Urban Turfgrass Program. "When we're done, we'll have proven recommendations that are right for almost any landscape situation."

The study is based at three UF research facilities — in Gainesville, Fort Lauderdale and near Pensacola — and addresses a variety of grass species, soil types and growing conditions, she said.

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Associate Professor John Cisar, left, and postdoctoral researcher Dara Park take a sample of water collected beneath a turfgrass plot at UF's Fort Lauderdale Research and Education Center.