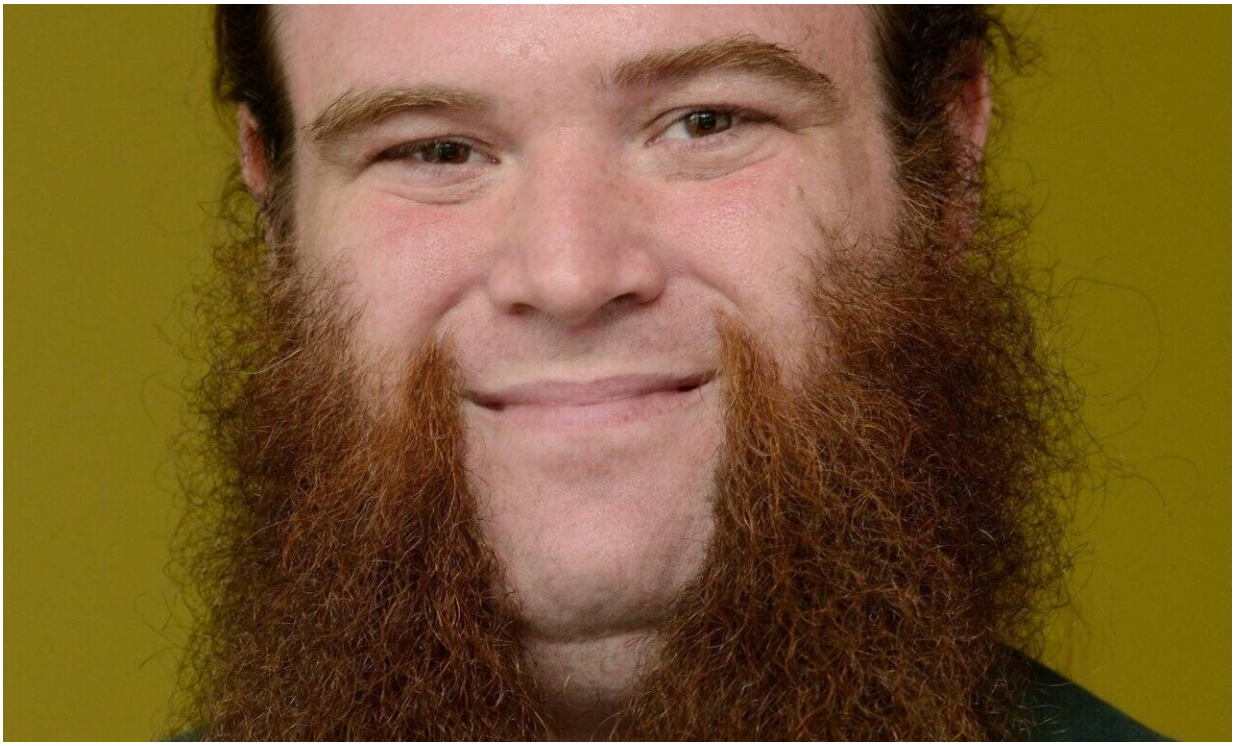
Researchers to study physics of underwater walking

August 8 2019



Astley is an assistant professor of biology and polymer science whose lab focuses on the biomechanics of animal movement across unstructured terrain. As a faculty member of UA's renowned Biomimicry Research and Innovation Center (BRIC), Astley studies animals for the purpose of solving human problems. Credit: University of Akron

Around 360 million years ago, creatures trekked out of the water and

onto dry land, becoming the first terrestrial animals. The colonization of land by animals may be one of the greatest evolutionary events in the history of life, but our understanding of the physics of this event is limited. Professor Henry Astley, Ph.D., from The University of Akron (UA) seeks to find answers.

Determining which forces dictate underwater walking will answer evolutionary questions, provide insight into the animals of today, and equip engineers with valuable information that will lead to more efficient and elegant underwater walking robots. These robots could have endless applications, aiding in anything from underwater drilling to emergency rescue to exploration.

Animals were walking underwater long before they stepped foot onto dry land. Astley wants a deeper understanding of this behavioral predecessor, which is why he is embarking on a new project to study this scientific mystery. Astley has been awarded a $297,267 two-year EAGER (Early Concept Grants for Exploratory Research) grant from the National Science Foundation (NSF) to assist in his journey through these uncharted waters. His project, "First Steps: Dynamics and Control of Underwater Walking," qualified for EAGER funding, which is used by the NSF to support exploratory work in its early stages on untested, but potentially transformative, research ideas or approaches.

Astley is an assistant professor of biology and polymer science whose lab focuses on the biomechanics of animal movement across unstructured terrain. As a faculty member of UA's renowned Biomimicry Research and Innovation Center (BRIC), Astley studies animals for the purpose of solving human problems.

"No one's ever really delved into the physics of underwater walking," says Astley. Underwater walking can be explained as a combination of terrestrial walking and swimming. This unique fusion of movements

creates challenges for researchers.

In water, animals swim in an environment where their body weight is supported through buoyancy and by propulsion via hydrodynamic interactions—through pushing off surrounding water. On land, animals face greater limitations from gravity. They must be supported by limbs or drag across the land's surface though propulsion by substrate interactions—pushing or pulling across land. Because underwater walking is a combination of both locomotive techniques, a "weird mix of physics," according to Astley, it is unclear how the primary forces these animals face interact.

In order to understand the baseline physical properties of underwater walking, Astley and his team, led by Integrated Bioscience doctoral student Kaelyn Gamel, will be studying the underwater walking of Spanish ribbed newts. In order to collect data regarding the forces in effect, the newts will walk across a submerged force sensor system placed at the bottom of a standard fish tank.

"Robots are moving out of assembly lines and into the natural world," says Astley. His research is an important first step in optimizing this transition.

Provided by University of Akron