The HAM Exo-Musculature is a novel hydraulic actuator for medical and robotic applications. A hydro-artificial muscle (HAM) system is the main mechanism behind the device. This actuator system incorporates an inner member (tube, in this case) and an outer member (sleeve). These two members work in concert to receive incompressible actuating fluid from a reservoir. When fluid is pumped from the reservoir into the tube, pressure is increased and the actuator expands to provide a push force. This pressure can be maintained until the used releases it, creating a pull force. The outer sleeve prevents the inner tube from expanding radially and provides an unbroken barrier so the tube cannot protrude outwardly. This ensures maximum efficiency. The HAM Exo-Musculature can include multiple actuators to provide many degrees of freedom as well as position sensors that can detect the angle of the device to ensure accuracy. Most importantly, the versatile design of the HAM Exo-Musculature makes it useful for several applications including increasing mobility in elderly patients and those with muscular degenerative disorders, artificial muscle for rigid robots and robotic prosthetics, and providing augmented strength for humans (soldiers, in particular).

**Features:**
- Simple two-member actuator design - elastic tube inside of an inelastic sleeve
- Incompressible actuation fluid stored within fluid reservoir
- Multiple actuators can be used to allow for many degrees of freedom
- Can include position sensors
- Can be integrated with a desired artificial skeleton or can be utilized as a stand alone robotic system

**Benefits:**
- Inexpensive to produce
- Similar in size, mass, and performance to biological muscles
- Promotes muscle rehabilitation
- Works with the body’s natural movement
- Can be made from a variety of medical grade materials

**Inventors:**
Marko Popovic, Cagdas Onal, Gregory McCarthy, Nicholas Corso, Daniil Effraimidis, Brian Jennings

**Contact:**
Todd Keiller, Director
Office of Intellectual Property & Innovation
Worcester Polytechnic Institute
tkeiller@wpi.edu
+1 508 831 4907