CAREER: Physical Principles and Applications of Plant-Inspired Tip Growth for Robotics

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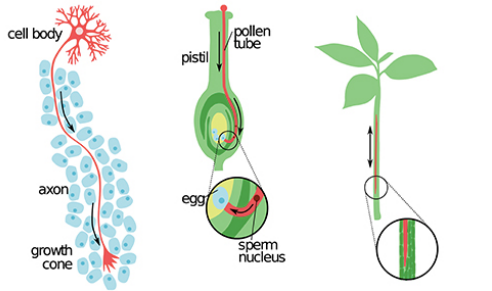
UC SANTA BARBARA engineering

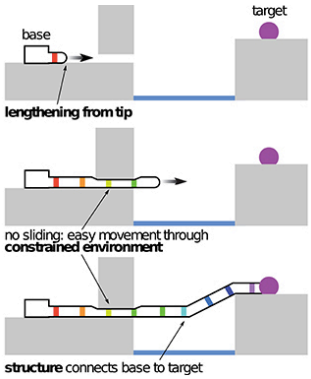
Concept

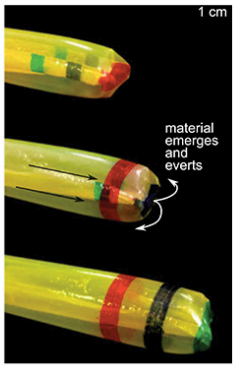
Can we leverage the concept of tip growth, found across diverse organisms in nature?



neuron: **connection for signals** | pollen tube: **conduit for delivery** | sclerenchyma cell: **support for vertical growth**

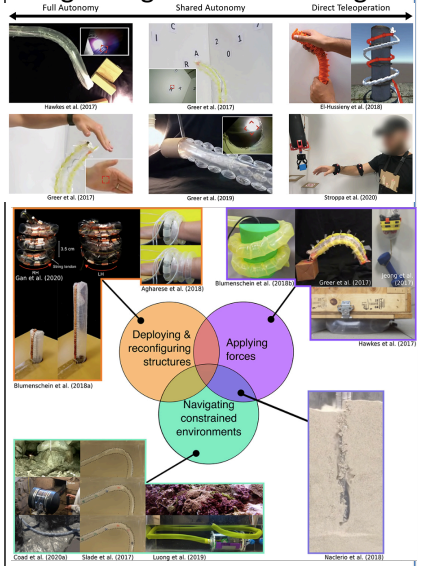
The research objective of this project is to use analytical modeling and hypothesis-driven experimentation to elucidate the physical principles governing the behavior of tip-growing "vine" robots.





Scientific Impact

1) Design, Modeling, Control: Organizing Current Knowledge

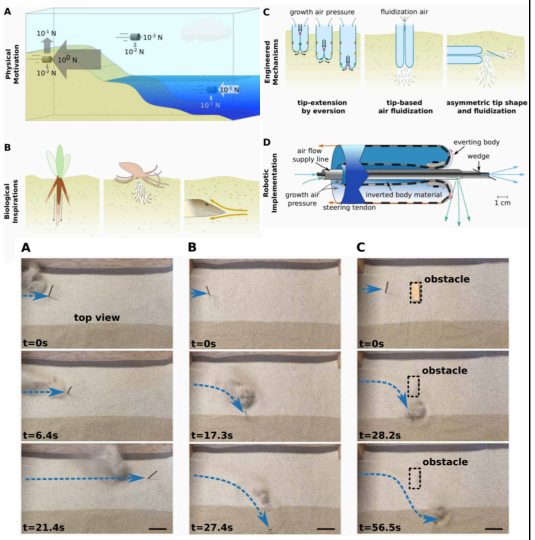


Blumenschein, Laura H. and Coad, Margaret M. and Haggerty, David A. and Okamura, Allison M. and Hawkes, Elliot W.. (2020). Design, Modeling, Control, and Application of Everting Vine Robots. Frontiers in Robotics and AI. 7 .

2) New Methods for Steering and Retraction

Haggerty, David Arthur and Naclerio, Nicholas and Hawkes, Elliot Wright. (2021). Hybrid vine robot with internal Steering-Reeling Mechanism enhances system-level capabilities. *IEEE Robotics and Automation Letters.*

3) New Understanding and Applications: Burrowing in Granular Media



Naclerio, Nicholas D. and Karsai, Andras and Murray-Cooper, Mason and Ozkan-Aydin, Yasemin and Aydin, Enes and Goldman, Daniel I. and Hawkes, Elliot W.. (2021). Controlling subterranean forces enables a fast, steerable, burrowing soft robot. Science Robotics. 6 (55) Article No. eabe2922.

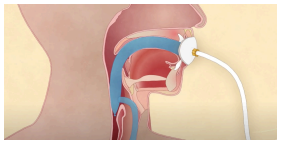
Broader Impact

Developing Remote Soft Robotics Course

We have created fully remote courses with six lab modules for instructing soft robotics at the undergraduate and graduate levels. We have shared the content with an initial group of colleagues for feedback.

Medical Applications

We are developing the understanding and expertise to move easily through the body. The first application area is emergency intubation.



Extreme subterranean mobility

We are developing the understanding and expertise to move below ground. Applications include search and rescue in mudslides as well as deployment of sensors for farming.

Outreach

We created a science outreach video in collaboration with the YouTube Science Channel Veritasium, and has been viewed more than 20 million times!

2022 NRI & FRR Principal Investigators' Meeting
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Award ID#: 1944816