MELISSA RUSZCZYK, PH.D.

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EDUCATION AND TRAINING

Postdoctoral Researcher
University of Miami — *September 2022-Present*
Department of Physics
Advisor: Dr. Vivek N. Prakash

Georgia Institute of Technology — *May 2022-August 2022*
Civil and Environmental Engineering
Advisor: Dr. Donald R. Webster

Ph.D. Georgia Institute of Technology — *August 2017-May 2022*
Ocean Science and Engineering
Minor in Applied Mathematics
Advisors: Dr. Jeannette Yen & Dr. Donald R. Webster

B.S. Allegheny College — *September 2013-June 2017*
Biology and Music
Dr. Milton Ostrofsky & Dr. Lowell Hepler

RESEARCH INTERESTS

Small-scale biomechanics, marine invertebrates, invertebrate morphology, bio-fluid interactions, marine ecology, life in low and intermediate Reynolds number environments

PUBLICATIONS

1. **Ruszczyk, M.**, Webster, D. R., Yen, J. (in press). The response of a freshwater copepod to small-scale, dissipative eddies in turbulence. *Limnology and Oceanography*. Early view: https://aslopubs.onlinelibrary.wiley.com/doi/full/10.1002/lno.12402
2. Gooshvar, S., Madhu, G., **Ruszczyk, M.**, Prakash, V. N. (2023). Non-bilaterians as model systems for tissue mechanics. *Integrative and Comparative Biology*. 63(6), 1442-1454. https://doi.org/10.1093/icb/icad074
3. **Ruszczyk, M.**, Webster, D. R., Yen, J. (2022). Trends in stroke kinematics, Reynolds number, and swimming mode in shrimp-like organisms. *Integrative and Comparative Biology*, 62(3), 791-804. https://doi.org/10.1093/icb/icac067
4. **Ruszczyk, M.**, Webster, D. R., Yen, J. (2021). Dual phase-shifted ipsilateral metachrony in *Americamysis bahia*. *Integrative and Comparative Biology*. 61(5), 1644-1657. https://doi.org/10.1093/icb/icab119
5. Byron, M. L., Murphy, D. W., Katija, K., Hoover, A. P., Daniels, J., Garayev, K., Takagi, D., Kanso, E., Gemmell, B. J., **Ruszczyk, M.**, Santhanakrishnan, A. (2021). Metachronal motion across scales: Current challenges and future directions. *Integrative and Comparative Biology*,

61(5), 1674-1688. https://doi.org/10.1093/icb/icab105

CONFERENCE PRESENTATIONS

Ruszczyk, M., Chandragiri, S., Alimi, W., Brown, O., Kiel, P. M., Xia, J., Haughey-Gramazio, C., Baker, A., Stickley, M., Miller, M. W., Langdon, C., Suraneni, P., Prakash, V. N. Physiochemical dynamics of substrates for enhanced coral growth in laminar flow conditions [eLightning]. In: Ocean Sciences Meeting; February 18-23, 2024; New Orleans, Louisiana.

Ruszczyk, M., Webster, D. R., Yen, J. Copepod from alpine ponds responds different than marine copepods to dissipation-scale turbulent flow structure [poster]. In: ASLO 2023 Aquatic Sciences Meeting; June 4-9, 2023; Palma de Mallorca, Spain. Poster ID: 749.

Ruszczyk, M., Webster, D. R., Yen, J. A freshwater copepod's response to dissipation-scale turbulent flow structure [abstract]. In: The Society for Integrative and Comparative Biology Annual Meeting 2023; January 3-7, 2023; Austin, Texas.

Ruszczyk, M., Cardelino, M., Perretta, G., Elmi, D., Webster, D. R. Phytoplankton morphology affects susceptibility to aggregation via microscale turbulence [abstract]. In: 75th Meeting of the APS Division of Fluid Dynamics; November 20-22, 2022; Indianapolis, Indiana. Abstract ID: J05.00007.

Ruszczyk, M., Webster, D. R., Yen, J. Metachrony across swimming modes and Reynolds number in free-swimming crustaceans [abstract]. In: Ocean Sciences Meeting; February 27-March 4, 2022; Honolulu, Hawaii.

Ruszczyk, M., Webster, D. R., Yen, J. Trends in Reynolds number, swimming behavior, and metachronal stroke kinematics in free-swimming crustaceans [abstract]. In: The Society for Integrative and Comparative Biology Annual Meeting 2022; January 3-7, 2022; Phoenix, Arizona.

Ruszczyk, M., Webster, D. R., Yen, J. Benefits of concurrent metachronal cycles as observed in *Americamysis bahia* [abstract]. In: 74th Meeting of the APS Division of Fluid Dynamics; November 21-23, 2021; Phoenix, Arizona.

Ruszczyk, M., Webster, D. R., Yen, J. Metachronal Stroke Kinematics in *Euphausia pacifica* [abstract]. In: Southeast Regional Society for Integrative and Comparative Biology; November 6, 2021; Atlanta, Georgia.

Ruszczyk, M., Webster, D. R., Yen, J. Dual phase-shifted ipsilateral metachrony in *Americamysis bahia* [invited speaker]. In: The Society for Integrative and Comparative Biology Annual Meeting 2021; January 3-February 28, 2021; Washington D. C.

Ruszczyk, M.., Webster, D. R., Yen, J. Metachronal Swimming in Pacific Krill, *Euphausia pacifica* [poster]. In: Ocean Sciences Meeting; February 16-21, 2020; San Diego, California. Poster ID: PI44A-2527.

Ruszczyk, M., Webster, D. R., Yen, J. Freshwater Copepod Behavior in Turbulent Eddies [abstract]. In: 72nd Meeting of the APS Division of Fluid Dynamics; November 23-26, 2019; Seattle, Washington. Abstract ID: P32.008.

Ruszczyk, M., Webster, D. R., Yen, J. Underwater propulsion at intermediate *Re*: Multi-oar biomechanics of mysids [abstract]. In: 71st Meeting of the APS Division of Fluid Dynamics; November 18-20, 2018; Atlanta, Georgia. Abstract ID: BAPS.2018.DFD.G22.2.

INVITED SEMINARS

University of Miami: Modern Physics Honors Seminar *2022*
Trends in stroke kinematics, Reynolds number, and swimming mode in shrimp-like organisms

University of Miami: Invertebrate Neuroscience Meeting *2022*
Trends in stroke kinematics, Reynolds number, and swimming mode in shrimp-like organisms

Georgia Institute of Technology: Ocean Science and Engineering Seminar *2022*
Dual phase-shifted ipsilateral metachrony in *Americamysis bahia*

FUNDING

Identifying coral larvae's searching strategies for settlement location
National Science Foundation: Postdoctoral Fellowship: OCE-PRF [pending]
$167,800 (July 1, 2024 – June 30, 2026)
PI: M. Ruszczyk

TEACHING EXPERIENCE

Georgia Institute of Technology
- Ecology Lab (BIOL 2336) *2017, 2021*
- Experimental Design and Statistical Methods (BIOL 4401) *2018*
- Organismal Biology Lab (BIOL 1521) *2018*

Allegheny College
- Chemical Concepts II *2015*
- Chemical Concepts I *2014*

RESEARCH MENTOR EXPERIENCE

Undergraduate Students
- Owen Brown: Flow field analysis of coral larvae (Spring 2023), Concrete effects on local alkalinity (Summer 2023), Coral gamete rising rates (Fall 2023)
- Johnnie Xia: Coral gamete rising rates (Spring 2023, Summer 2023)
- Maria Cardelino: Kinematic analysis of phytoplankton in a Burgers vortex (Summer 2022)
- Gianna Perretta: Kinematic analysis of phytoplankton in a Burgers vortex (Summer 2022)
- Anikait Dhond: Digitization of copepod motion in a Burgers vortex (Summer 2021, Spring 2022)
- Ashley Jhun: Digitization of copepod motion in a Burgers vortex (Summer 2021)
- Ngoc Thuy An (Keira) Tran: Digitization of copepod motion in a Burgers vortex (Summer 2021)
- Juliette Goff: Digitization of copepod motion in a Burgers vortex (Spring 2021)
- Agam Singh: Digitization of copepod motion in a Burgers vortex (Spring 2019), Digitization of krill biomechanics (Fall 2019, Spring 2020, Summer 2020, Fall 2020)
- Anugraha Babuji: Digitization of krill biomechanics (Summer 2020)
- Emma Slater: Digitization of krill biomechanics (Summer 2020)
- Enye Lee: Digitization of krill biomechanics (Fall 2019)
- Kevin Joseph: Digitization of krill biomechanics (Fall 2019)
- Uma Patel: Digitization of krill biomechanics (Summer 2019)
- Tianyi Zuo: Digitization of copepod motion in a Burgers vortex (Fall 2018)

RESEARCH EXPERIENCE

Alkalinity Effects on Coral Growth in Flow *2022-present*
University of Miami
Advisor: V. N. Prakash

- Does increasing local alkalinity for settled coral larvae using different cement compounds increase coral growth under flow conditions in a laboratory setting?

Rising Rates of Coral Gamete Bundles *2022-present*
University of Miami
Advisor: V. N. Prakash

- Estimate density of coral gamete bundles from the rising rates during spawning

Kinematic Analysis of Phytoplankton Trajectories in Burgers Vortex *2022*
Georgia Institute of Technology
Advisor: D. R. Webster

- How does phytoplankton morphology affect interactions with microscale turbulence?

Crustacean Behavior and Morphology in Low and Intermediate Reynolds Number Environments *2017-2022*
Georgia Institute of Technology
Doctoral Thesis
Advisors: D. R. Webster, J. Yen

- How does the physics of living in a fluidic environment impact the ecology and morphology of plankton?
- Quantify and characterize swim modes and gait parameters of *Euphausia pacifica* and *Americamysis bahia*
- Quantify the freshwater *Hesperodiaptomus shoshone*'s behavioral response to vortices of various orientations and intensities and compare to marine species

Serial Sonification of *Chaoborus* Behavior in Response to *Daphnia* Size: Intricacies of the Predator-Prey Relationship *2016-2017*
Allegheny College
Undergraduate Thesis
Advisors: M. Ostrofsky, L. Hepler, S. Wissinger

- Can *Chaoborus* detect differences in the size of their prey, resulting in a preference before physical contact?
- Relate data across disciplines and compose a piece of music based on results

Mate Tracking Behavior of *Hesperodiaptomus shoshone* *2016*
Georgia Institute of Technology
REU Position
Advisor: J. Yen

- Where do copepods determine the sex of the copepod they are tracking; before or upon physical contact?

Ultraviolet Light is not the Sole Trigger of Diel Vertical Migration in *Daphnia* *2015*
Allegheny College
Advisor: M. Ostrofsky

- How does a 12:12 UV-only photoperiod affect the migration habits of *Daphnia*

The Impact of Environmental Stress on the Immune System of *Plethodon cinereus* *2014*
Allegheny College
Advisor: M. Venesky

- Does susceptibility to fungal pathogens increase in red-backed salamanders under increased corticosterone levels?

Photoreactivation Efficiency in *Serratia marcescens* at Various Wavelengths *2014*
Allegheny College
Advisor: T. Humphreys

- Does photolyase in *Serratia* have an ideal wavelength at which it functions to correct mutations from ultraviolet light?

HONORS AND AWARDS

Excellence in Teaching: Student Choice Award *2018*
Received for teaching Ecology (2017) at Georgia Institute of Technology

Interdisciplinary Studies Faculty Prize *2017*
Received for undergraduate research thesis, "Serial Sonification of *Chaoborus* Behavior in Response to *Daphnia* Size: The Intricacies of the Predator-Prey Relationship"

SCIENTIFIC OUTREACH

Ocean Visions Planning Committee *2019*
Building Manager and Tech Supervisor

PROFESSIONAL AFFILIATIONS

The Society for Integrative and Comparative Biology *2020-Present*
American Physics Society, Division of Fluid Dynamics *2019-Present*
Association for the Sciences of Limnology and Oceanography *2019-Present*

Last Updated: January 12, 2024