WALKER BYRNES

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CURRENT AFFILIATIONS

Georgia Tech Research Institute – Aerospace, Transportation, and Advanced Systems Lab
Research Engineer 2, Intelligent Sustainable Technologies Division   *June 2020 - Present, Atlanta, GA*

Georgia Tech – People, AI, and Robots Lab
PhD Student   *August 2024 - Present, Atlanta, GA*

NSF Engineering Research Center for Cell Manufacturing Technologies (CMaT)
Member, Trainee   *June 2020 - Present, Atlanta, GA*

Georgia Tech – Institute for Robotics and Intelligent Machines (IRIM)
Research Faculty Member   *January 2023 - Present, Atlanta, GA*

Georgia Tech – Institute for Bioengineering and Biotechnology (IBB)
Research Faculty Member   *May 2023 - Present, Atlanta, GA*

EDUCATION

Georgia Institute of Technology   Atlanta, GA
Ph.D. Computer Science – School of Interactive Computing   August 2024 – May 2029 (Projected)

Georgia Institute of Technology   Atlanta, GA
M.S. Computer Science – Robotics and Perception   August 2020 – December 2022

Georgia Institute of Technology   Atlanta, GA
B.S. Mechanical Engineering / Computing & Intelligence Minor   August 2015 – May 2020

RESEARCH INTERESTS

Generalizable Robot Autonomy. I am interested in the techniques and methods by which we can make robots generally applicable, agile, and useful outside of specific use cases and domains. I aim to utilize techniques from *AI Planning*, *Reinforcement Learning*, *Multimodal Perception*, and *Knowledge Representations* to make useful robots able to operate in a complex and unstructured world.

Multi-Robot System Planning. Additional complexities arise in systems involving multi-task multi-robot coordination and collaboration. Traditional techniques for optimizing robot behavior do not scale when applied to these larger collaborative systems as they fail to account for actions carried out by other robots and are unable to collaborate to improve individually slow or complex tasks. I plan to study the complexities of multi-task multi-robot systems and develop algorithms that can more efficiently enable robots to assemble teams and work together on tasks.

Automation and Robotics in Biomanufacturing. Cell therapy and biomanufacturing is a field in which robots and intelligent machines are not present to the same extent as more traditional domains. The complex biochemical processes occurring in cell manufacturing, the heterogeneous and often undetermined nature of living cells as a treatment, and the small scales such operations take place in all pose significant barriers to the development and implementation of automated technologies. I have invented process analytical technologies to aid the cell manufacturing process and integrated unit devices into interconnected biomanufacturing systems.

PREVIOUS EXPERIENCE

Andson Biotech	Atlanta, GA
Mechanical Engineering Consultant	June 2022 – December 2022
Georgia Tech Research Institute – ATAS Food Processing Technologies Division	Atlanta, GA
Software Development Co-op	June 2018 – December 2019
The Dow Chemical Company	Carrollton, KY
Mechanical Engineering Intern – Reliability Engineering	September 2017 – December 2017

SERVICE AND OUTREACH

- **Rural Georgia High School Curriculum Module – Sensors in Agriculture** *Fall 2023 - Spring 2024*
    - Curriculum to introduce rural GA high school students to STEM concepts.
    - Multimodal sensor data analysis and inference applied to agricultural production.
- **STEM@GTRI High School Internship Program - Project Lead** *Summer 2021-2023*
    - Robotic Ag-Tech Curriculum Demonstration (6 students) *Summer 2024*
    - Automated Robotic Arm Pipetting Techniques and Behaviors (6 students) *Summer 2023*
    - Robot Well Plate End Effector and Manipulation Techniques (6 students) *Summer 2022*
    - Braccio Robot Arm Computer Vision Capabilities (10 students, remote) *Summer 2021*

MENTORING

Direct Reports – BSc: 5, HS: 22
- Undergraduate Student Assistant (BSc)
    - 2 STEM@GTRI Project Mentor – Robot Control *Summer 2022, 2023*
    - 3 Software Engineering – Data Analysis *Fall 2021, Spring 2022, Fall 2022*
- High School Intern (HS)
    - 22 STEM@GTRI Program – Robotics *Summer 2021, 2022, 2023*

Technical Mentor – MSc: 1 (current), BSc: 2+3(current)
- Graduate Student Researcher (MSc)
    - 1 Mechanical Engineering – Biomanufacturing *Fall 2022 – Present*
- Undergraduate Student Researcher (BSc)
    - 1 Mechanical Engineering – Biomanufacturing *Fall 2022 - Present*
    - 1 Mechanical Engineering – Sensors *Fall 2021 – Present*
    - 2 Software Engineering – Robotics *Fall 2022 – Present, Summer 2023*
    - 1 Software Engineering – Sensors / Embedded Systems *Summer 2022*

SELECTED INVITED TALKS AND DEMOS

- **CPP Sensing, Automation, and Feedback Control in a Vertical Wheel Immune Cell Bioreactor**
  Invited Speaker and Poster at CMaT Annual Retreat, San Juan, PR – ***Best Poster Award 1st Place*** *Nov 2023*

- **Inventory Autonomy Architecture – USMC LOGCOM Robotics**
  GTRI Georgia State Impacts Symposium Posters x2, Atlanta, GA *Sep 2023*

- **UGV-Mounted Chem/Bio Interferometric Sensor with Spatial Concentration Mapping**
  Invited Demo at US INDOPACOM Crimson Viper exercise, Pattaya, Thailand *Aug 2023*

- **Automated Peracetic Acid Sensor in Poultry Processing**
  Demo at International Processing and Production Expo, Atlanta, GA   *Jan 2023*

- **UGV-Mounted Chem/Bio Interferometric Sensor**
  Invited Demo at Chemical Biological Operational Assessment, Camp Dawson, WV   *May 2023*

PUBLICATIONS / TALKS

- **Byrnes, W.**, Bogdanovic, M., Balakirsky, A., Balakirsky, S., Garg, A., 2024. CLIMB: Language-guided Continual Learning for Robot Task Planning., (*Currently under review for ICRA 2025*).

- **Byrnes, W.**, Kanwar, B., Damen, N., Wang, B., Bowles-Welch, A., Roy, K., Balakirsky, S., 2023. Process Development and Manufacturing: A NEEDLE-BASED AUTOSAMPLER FOR BIOREACTOR CELL MEDIA COLLECTION. Cytotherapy 25, S172.

- Wang, B., Kanwar, B., **Byrnes, W.**, Costa, P.C., Filan, C., Bowles-Welch, A., Robles, F., Balakirsky, S., Roy, K., 2023. Process Development and Manufacturing: DIGITAL TWIN-ENABLED FEEDBACK-CONTROLLED AUTOMATION WITH INTEGRATED PROCESS ANALYTICS FOR BIOMANUFACTURING OF CELL THERAPIES. Cytotherapy 25, S206–S207.

- Wang, B., Bowles-Welch, A., Kanwar, B., **Byrnes, W.**, Liu, Z., Zhang, C., Balakirsky, S., Yeago, C., Roy, K., 2022. Advanced manufacturing process design for Mesenchymal Stromal Cell therapies.

- **Byrnes, W.**, Ahlin, K., Rains, G., McMurray, G., 2019. Methodology for Stress Identification in Crop Fields Using 4D Height Data. IFAC-PapersOnLine 52, 336–341.

PATENTS

- Peracetic Acid Sensing Layer Composition and Related Systems. J. Xu, **W. Byrnes**. *PCT Application No. PCT/US23/36261 – US Patent Application No. 18/385,106.*   *Filed October 2023*

- Feedback-Controlled Medium Scale Hollow Fiber Bioreactor System with Inline Sensing and Automated Sampling. A. Bowles-Welch, B. Wang, B. Kanwar, **W. Byrnes**, Z. Liu, C. Yeago, S. Balakirsky, K. Roy. *PCT Application No. PCT/US23/12492.*   *Filed February 2023*

- Automated Needle Based Sample Collector for Bioreactors. **W. Byrnes**, S. Balakirsky, B. Kanwar, A. Bowles-Welch, B. Wang, C. Yeago, K. Roy. *PCT Application No. PCT/US23/12491.*   *Filed February 2023*

REFERENCES

Please reach out for timely provision of letters of support and contact information from references.