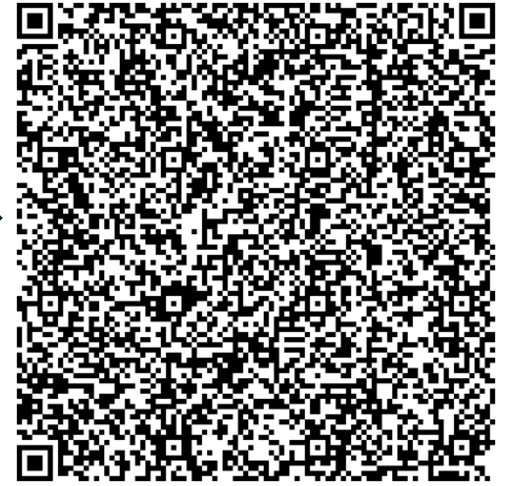




Mark your
attendance!



Research 101

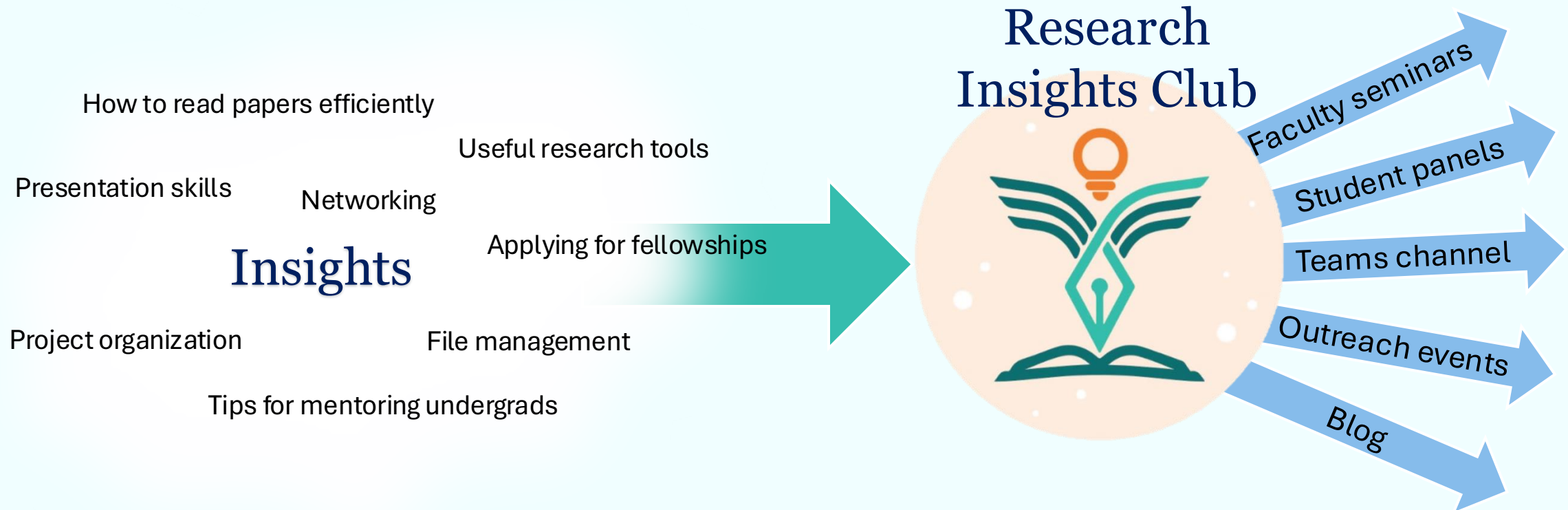
Information for the Research Curious

Our Purpose

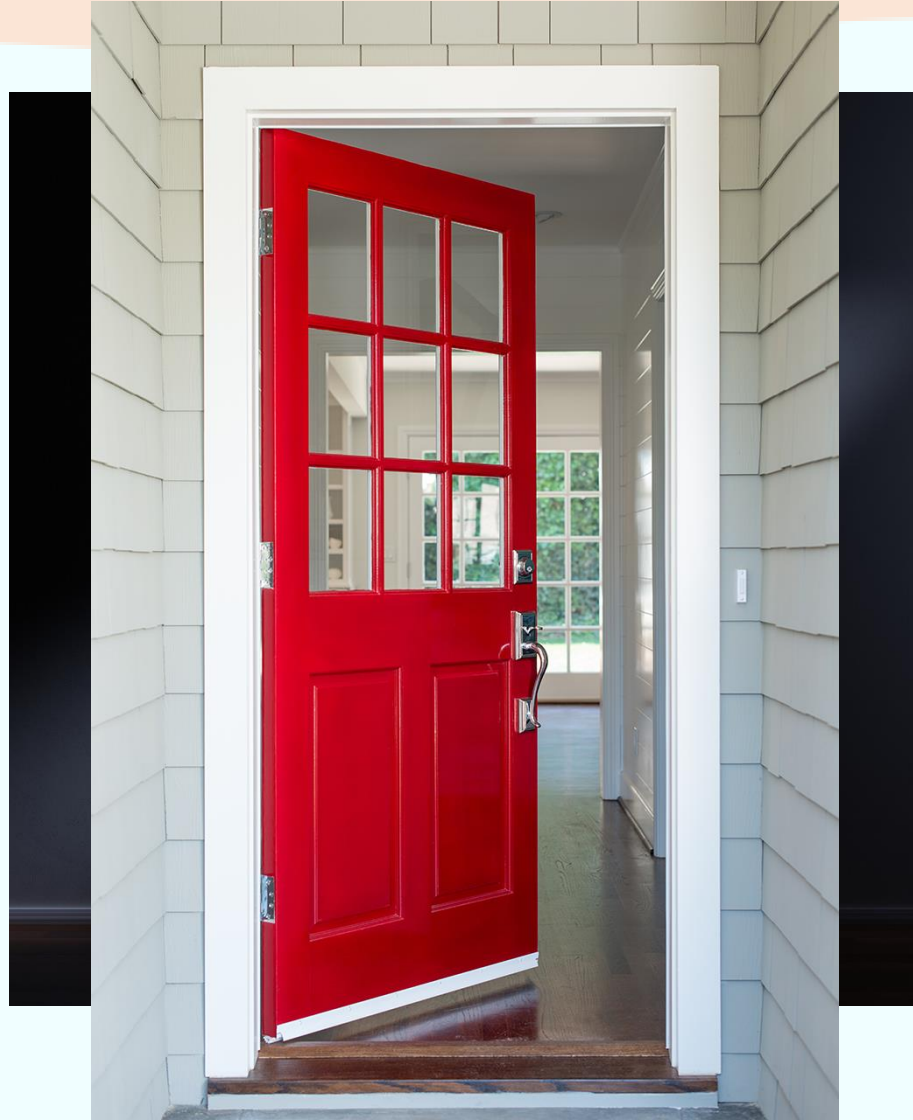
- (1) To disseminate detailed and hard-to-obtain knowledge to Georgia Tech students to help them navigate and thrive in the complex field of academic research.*
- (2) To facilitate knowledge transfer and networking between student researchers outside their usual fields.*



Implementation Strategy



Today's goal: demystify research





What brings you here?

The benefits of research

- Work on interesting projects
 - Explore your interests
- Mentorship from professors
- Companionship from lab
- Build up resume for future research roles (Ph.D., industry)
- Writing & presentation skills will get a huge upgrade

Topics

- What is research
- Who does research
 - Academic labs
- What do researchers do
 - How is research funded
- Where do researchers communicate their research?
 - Journals
 - Author order meaning
- How is the research impact of a person measured?
- Next steps: how to get involved in research

What is Research?

Research is...

n. "the **systematic** investigation into and study of materials and sources in order to establish facts and reach new conclusions"

v. "to investigate **systematically**"



The scientific method

Using evidence to test hypotheses and come to new conclusions

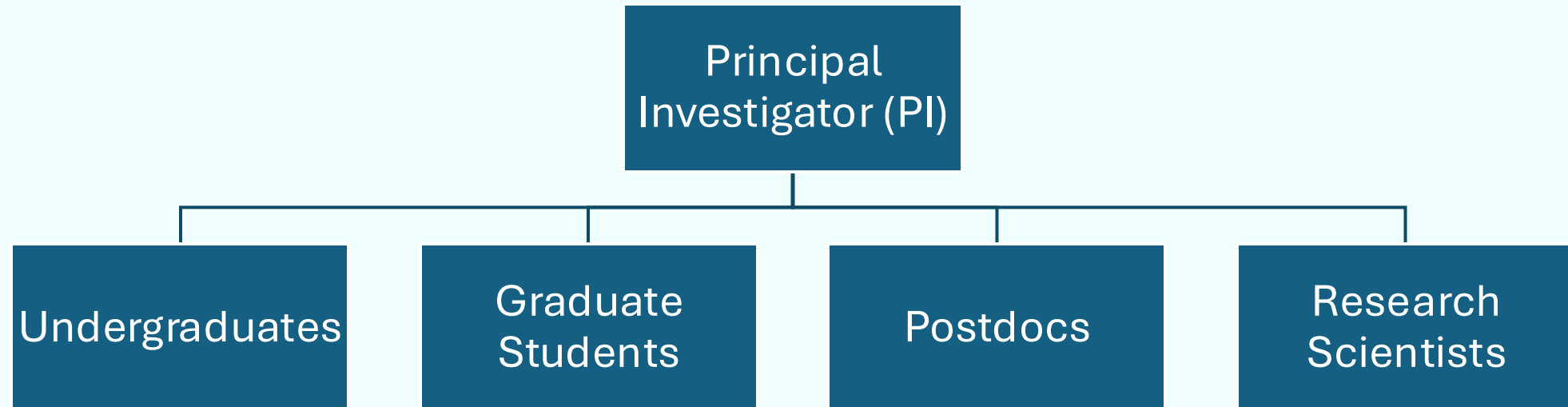
Who does research?

- Industry
 - R&D
- Government
 - CDC
 - DoD
 - NASA
- Academics
 - Research Faculty
 - Graduate students
 - Masters, Ph.D.
 - Postdocs, research scientists
 - Undergraduates

Research Groups



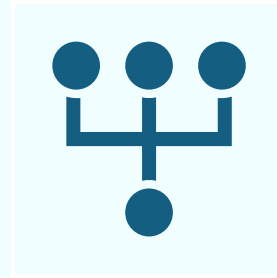
The academic lab



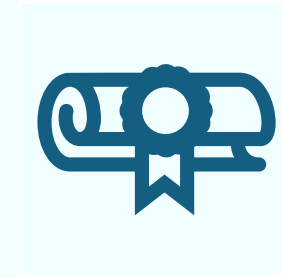
The PI



Professor/Research
Faculty



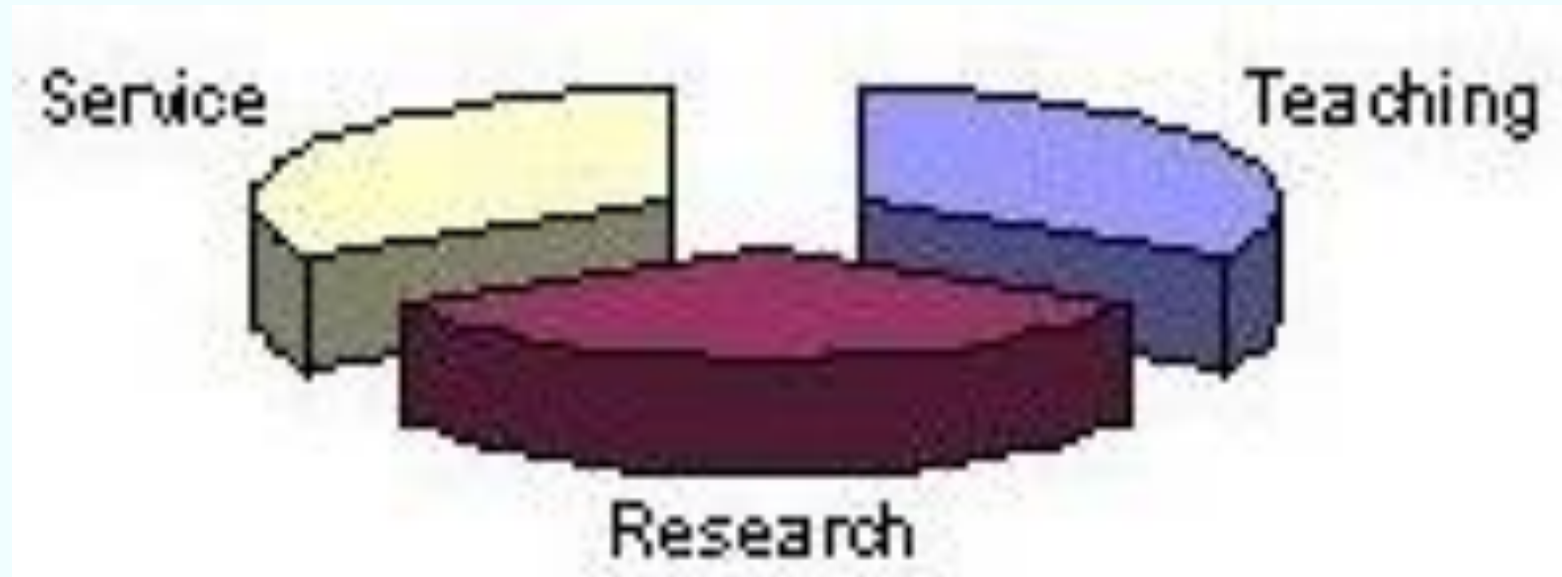
“Manager” of the lab



Apply for grants, publish
papers, go to conferences

- “Faculty” are the academics including professors, teaching faculty & research faculty
- “Staff” have admin or other support roles

Professors have many duties



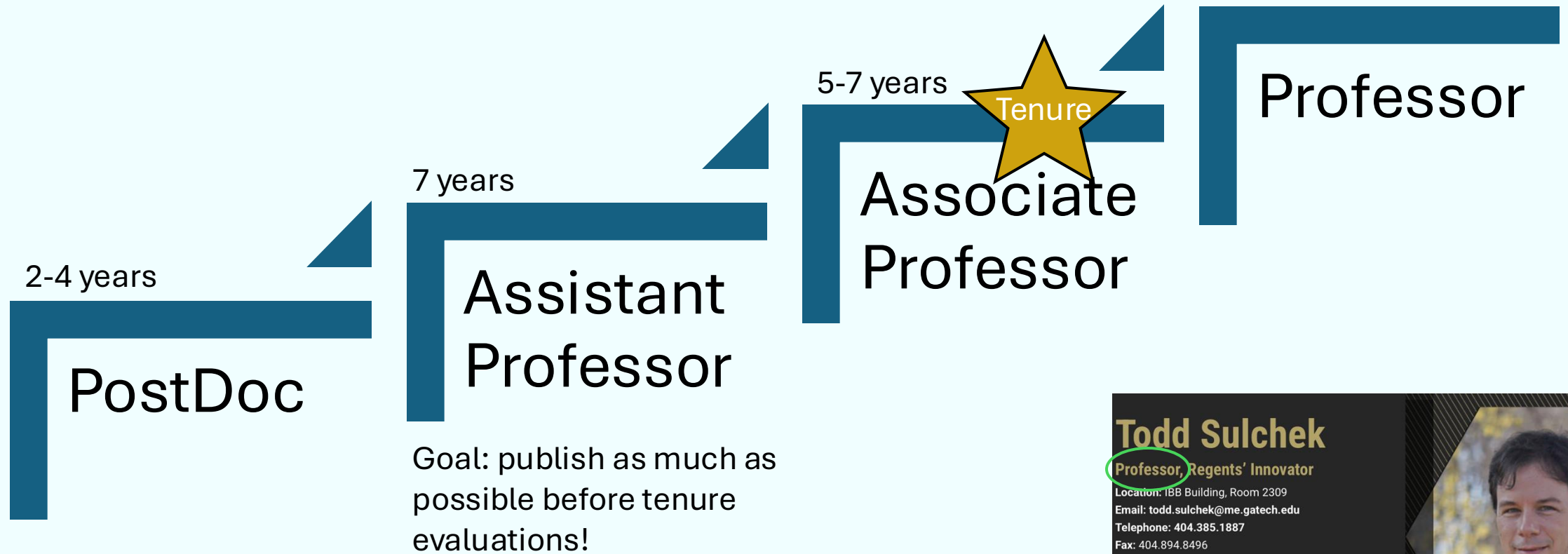
The PI leads the lab

- Hire students & postdocs
- Mentor students & postdocs
- Decide what projects to pursue
- Make sure papers get written
- **Apply for funding**
 - Write grant proposals

PIs rarely (if ever) work in the lab!



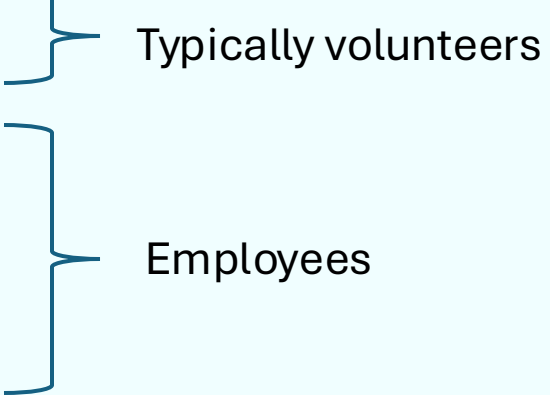
The road to tenure is long



What do Researchers Do?



Academic Researchers

- Undergraduates
 - Graduate Students
 - Postdocs
 - Research Scientists
- 
- Typically volunteers
- Employees

What do researchers do

- They **do** the research

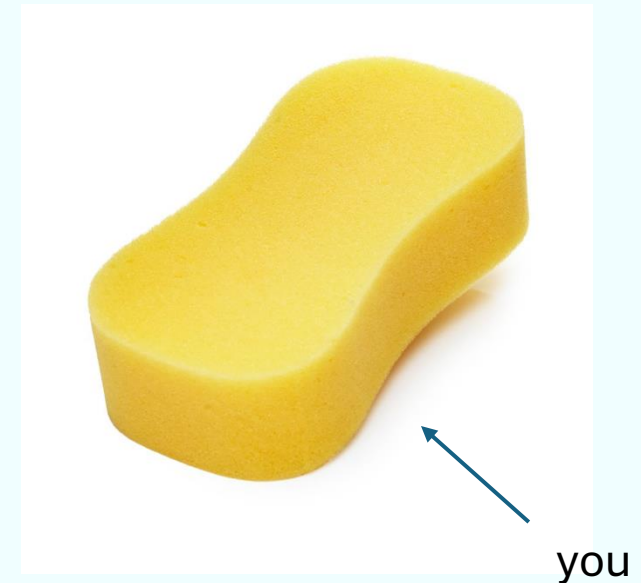
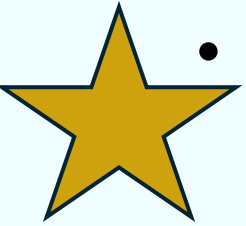


Not a professor in sight

Research can be experimental or computational/theoretical

What to expect from research as an undergraduate

- Assist a graduate student or postdoc
 - Training, shadowing
 - Reading papers, learning about the field
 - Perform your own task
 - Experiment
 - Create a tool
- Gain independence over time
- If you do enough, you can become a co-author or present at a conference



Publishing & Conferences

Journal articles: the currency of research

- aka “research paper”
- Article in a scientific journal
- Two types
 - Primary research
 - Reviews
- Found on research databases
 - Google Scholar
 - PubMed
 - Elsevier
- Peer-reviewed
 - 2+ experts thoroughly read and “signed-off” on your paper

Examples of Journals



The structure of a research paper

- Abstract
- **Introduction**
- **Methods**
- **Results**
- **Discussion**
- Conclusion
- References
- Supplemental Information

Paper example

Home > [Microfluidics and Nanofluidics](#) > Article

Obstacle-free planar hybrid micromixer with low pressure drop

Research Paper | Published: 15 July 2020
Volume 24, article number 61, (2020) [Cite this article](#)

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[Microfluidics and Nanofluidics](#)
[Aims and scope](#) →
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[1157](#) Accesses [27](#) Citations [4](#) Altmetric [Explore all metrics](#) →

[Sajad Razavi Bazaz](#) [Hoseyn A. Amiri](#), [Steven Vasilescu](#), [Ali Abouei Mehrizi](#) , [Dayong Jin](#), [Morteza Miansari](#)  & [Majid Ebrahimi Warkiani](#)  **Last author – the PI***

1st author – did the most work*

Last author – the PI*

*This can vary depending on the field

Question: what is the name of the journal?

Research impact: citations (for better or worse)

- Citations are references to your work
- Impact metrics:
 - Individuals – h-index
 - The highest number of a person's papers with at least that number of citations
 - Journals – Impact Factor

$$IF_y = \frac{\text{Citations}_y}{\text{Publications}_{y-1} + \text{Publications}_{y-2}}$$

Example: Nature

$$IF_{2017} = \frac{\text{Citations}_{2017}}{\text{Publications}_{2016} + \text{Publications}_{2015}} = \frac{74090}{880 + 902} = 41.577$$

microfluidic cell sorting

About 96,500 results (0.07 sec)

Microfluidic cell sorting: a review of the advances in the separation of cells from debulking to rare cell isolation
[CW Shields Jr](#), [CD Reyes](#), [GP López](#) - Lab on a Chip, 2015 - pubs.rsc.org
... of **microfluidic cell sorting** technologies, while ... **sorting** technologies by the type of **cell** preparation required (ie, fluorescent label-based **sorting**, bead-based **sorting**, and label-free **sorting**...
☆ Save Cite Cited by 1199 Related articles All 8 versions Web of Science: 789

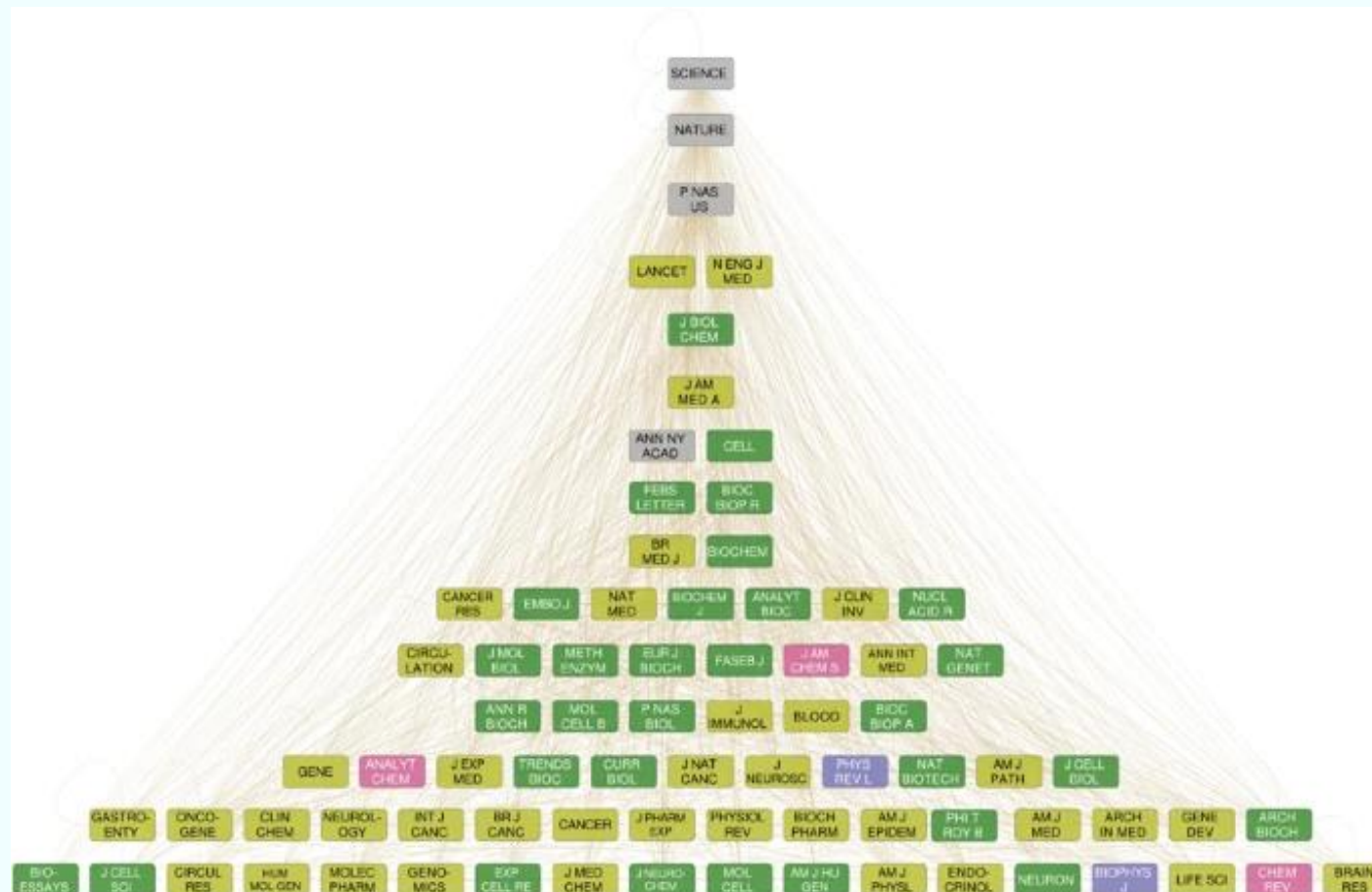
[HTML] **Recent advances in microfluidic cell sorting systems**
[Y Shen](#), [Y Yalikun](#), [Y Tanaka](#) - Sensors and Actuators B: Chemical, 2019 - Elsevier
... on the **sorting** ability. Therefore, we classify most recent methods of **microfluidic cell sorting** as precise or large amount **sorting** methods based on the ability for **sorting** the number of **cells**...
☆ Save Cite Cited by 171 Related articles All 3 versions Web of Science: 129

[HTML] **Microfluidic: an innovative tool for efficient cell sorting**
[J Autebert](#), [B Coudert](#), [FC Bidard](#), [JY Pierga](#)... - Methods, 2012 - Elsevier
... an overview of **cells sorting** in **microfluidics**, with an emphasis on circulating tumor **cells**. ... Many **microfluidics cells sorting** methods, especially the ones with clinical applications are thus ...
☆ Save Cite Cited by 212 Related articles All 11 versions Web of Science: 122

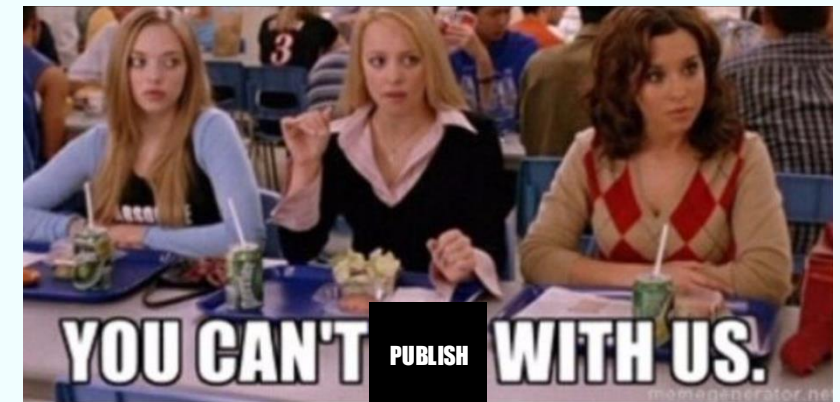
Recent advances in microfluidic cell sorting techniques based on both physical and biochemical principles
[W Tang](#), [D Jiang](#), [Z Li](#), [L Zhu](#), [J Shi](#), [J Yang](#)... - ..., 2019 - Wiley Online Library
... **sorting** methods together. In this review, we focus on the recent advances in **microfluidic cell sorting** ... principles, with emphasis on the mechanisms of **cell** separation. The biochemical ...
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Note the citation counts

Journal “hierarchy”

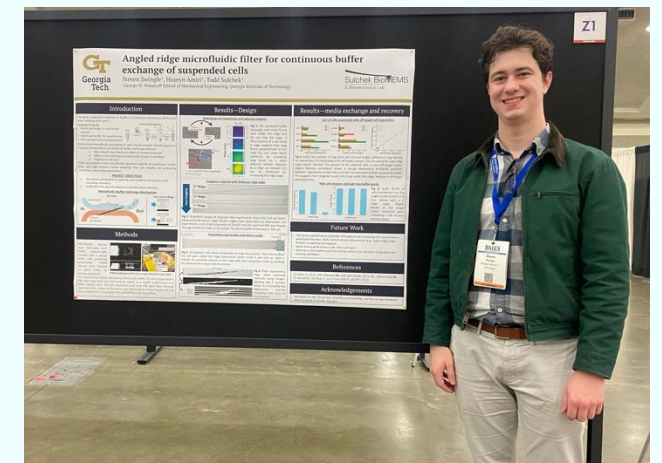


Note: higher journal doesn't mean better research. Sometimes impactful projects are split up into multiple publication in smaller journals



Conferences

- Field specific
- Students (sometimes profs.) submit abstracts & present their research
 - Oral presentation
 - Poster
- Networking



Starting Your Research Journey

I'm interested! Now what...?

- Learn about labs and their projects
 - Department website
 - Research
 - Research area
 - Faculty
 - Lab websites
- Reach out & apply
 - Email professors
 - Make sure you follow instructions on their website!
 - PairMe
 - Search “pairme gatech”

Advice

- Have an idea of what you're interested in
 - More specific than “wet lab”
- When emailing professors:
 - State what interested you and made you want to reach out
 - Don't feel impostor syndrome. Say “I found _____ interesting and am looking to learn more in your lab.”
- Be curious! Learn. Then steer your ship.

Questions?

If interested in RIC

- Fill out interest form!
- We'll reach out depending on what you select

