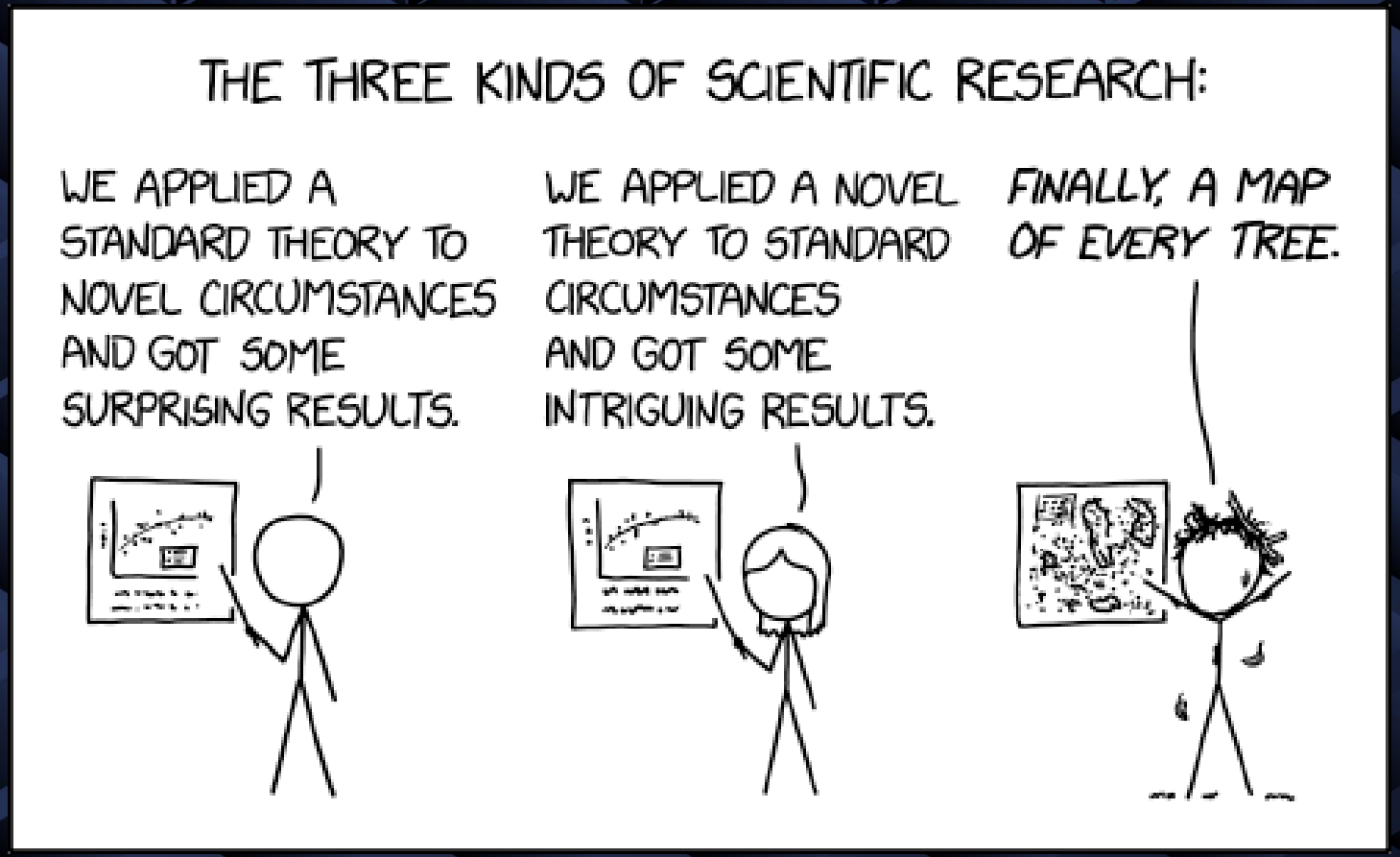
Getting started in research

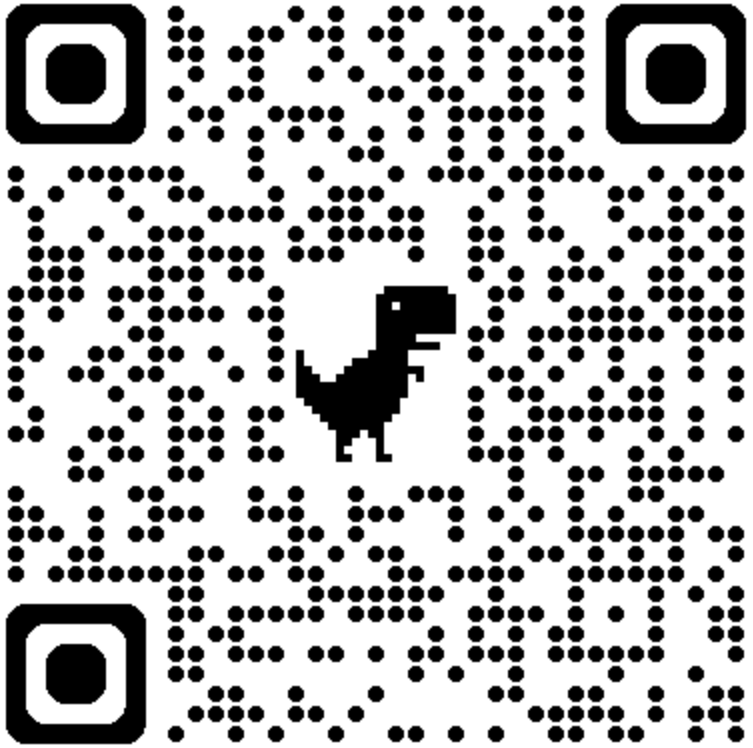


Xkcd comic #2977

McGill Physics

Oct 29, 2024

Shameless plug: McGill Physics Hackathon



- **Nov 15-17**
- In person
- No theme – work on something that interests you.
- Coding prep sessions
- Mentors
- Food, swag, prizes, sponsor networking

Today:

- What is research?
- Courses available

- The process:
  - Timelines
  - Finding/contacting a supervisor
  - What/how to prepare

What is research?

- What does research look like in different labs?

Can / do research?

- You should try
  - Required for some programs
  - A good idea if you want to keep grad school as an option
    - Do I *like* research?
  - You might like it. It's a lot different from coursework
  - Even if you hate it, do your best and learn everything you can

What are profs looking for?

- The potential to (or previous track record of) succeed at a research project
- If you took a class with the prof, did you:
  - Do well in the course?
  - Show some engagement with the material?

- If you did not take a course with the prof (and even if you did):
  - Do you have relevant skills and a genuine interest?
  - Do you have the potential to do well?
    - Did well in other courses?
    - Have useful research skills, even if gained from non-research things (technical skills, time management, problem solving, etc)?

Research in Physics:

- **Courses (credit):**
  - PHYS 449, PHYS 479, PHYS 489 (one semester)
  - PHYS 459 D1+D2 (one year)
  - PHYS 396 (elective)
  - Any physics professor
  - Profs outside of physics (project must be physics-y)
  - A course coordinator keeps tabs on all the students in all the individual labs

- **Summer ($)**

The process 1: Look up potential supervisors

- Look up professors:
  - Physics: https://www.physics.mcgill.ca/research/ -> Research areas
  - Profs outside of physics too
  - Talk to profs after class, ask them about their research

What are you interested in?

- Experimental vs theory?
- What field?
- If you don't know, cast a wide net and try something!

What do they do?

- Build instruments? Pure theory? Simulations? Data analysis? Work with samples? What combinations of these things?

The process 1: Look up potential supervisors

- Look up professors:
  - Physics: https://www.physics.mcgill.ca/research/ -> Research areas
  - Profs outside of physics too
  - Talk to profs after class, ask them about their research

  - **What skills are listed as requirements for certain projects? (applies to summer projects that are listed)**

The process 2: Prep your CV

- Physics skills
  - Programs, instruments, techniques
- Non-physics skills
  - Leadership, problem-solving, teamwork
  - Prior jobs, hobbies
  - Is there something that might set you apart?

- Don't say, "I'm a hard-worker" or "goal-oriented" because these are self-proclaimed and hard to verify. **Show, not tell**.

The process 3: Contact supervisors

- Do I have to?
  - Yes.

The process 3: Contact supervisors

- Email time!
    - Attach CV
    - Attach unofficial transcript
    - Email body - brief

The process 3: Contact supervisors

- First check:
  - Prof's website: does it say they are accepting students or NOT accepting students?
  - Check listed summer SURA/USRA projects by that prof to get an idea of general requirements

The process 3: Contact supervisors

Don't do this:

Hi Joe,

My name is Harry Potter and I am a Physics Major. Is there space in your lab for an undergraduate next semester? If so, what is the pay rate?

Thanks,

Harry

The process 3: Contact supervisors

Better:

(Subject: Meeting to discuss PHYS 479 project for Winter 2025)

Dear Prof. Smith,

My name is Harry Potter and I am a U2 Physics Major. I am hoping to conduct a research project next winter, and I am interested in learning more about particle detection. I learned a lot about electronics in CEGEP when I built a remote control car with my friends, and I would like to learn more about scientific instrumentation.

Are you available to schedule a short meeting to discuss potential projects in your lab? I'm free any afternoon after 2 pm.

I've attached by CV and unofficial transcript. Please let me know if there is any other information I can provide.

Thank you,

Harry

The process 3: Contact supervisors

- Follow the prof's lead:
  - If the prof responds
    - Do they want you to check back later?
    - Send them another document?
    - Meet with you?
  - If the prof does not respond
    - Does their website say they're not taking students? Or that they'll respond by a certain date?
    - Can follow up in a week – profs are busy and may have missed your email
    - Always be polite and if they turn down your request, bugging them won't help.

The process 4: Interview prep

- Have some idea of what the prof does
- Prepare general questions – what are you curious about?
  - You don't need to ask about specific equations in their papers

- You do not have to be an expert - profs know you are a student
- You do not have to have a project in mind – profs have projects in mind for undergrads

Other places to look for research

- Soup and Science
- https://www.mcgill.ca/science/research/undergraduate-research
- https://www.physics.mcgill.ca/ugrads/usra/ (Summer)
- Websites of other departments
  - Earth and Planetary Sciences
  - Atmospheric and Oceanic Sciences
  - Engineering
  - What else?
  - For credit, projects in other departments must be "physics-y"

FAQs

- **For a January start, when do I have to contact profs?**
- Ans:
  - For some profs, the earlier you reach out, the more time they have to figure out a project and coordinate with a lab member who would work with.
  - For some profs, even in December when classes end is OK, but that doesn't give them much time to plan/prepare for you.
  - For some profs/projects, January projects may not be ideal because the group's projects aren't well-suited to 4-month during-the-term course projects. Maybe committing to staying over the summer might help?

FAQs

- **For a September start, when do I have to contact profs?**
- Ans:
  - Some profs are pretty flexible – they are always happy to hear from interested students. The beginning of the summer is fine, closer to the end of summer is fine.
  - (Again, the same note as the previous question about giving profs time to think of a project and coordinate with lab members applies).
  - September starts give you the option of a one-term or full-year project.

FAQs

- **If I don't have a supervisor lined up at the start of the term, can the course coordinator help me find a supervisor?**
- Ans:
  - They can, for a few students or in cases where a plan falls through last minute for some reason. Leaving it up to the course coordinator (Brad Siwick in 2024/25) is generally unwise. These research courses work because students and supervisors do the legwork.

FAQs

- **Can I register for a research course even if I don't have a supervisor yet?**
- Ans:
  - For PHYS 449, 479, 489, and 459 D1/D2, yes. There is no urgency though, because these aren't the kind of courses that fill up in the same way as other courses.
  - For PHYS 396 (elective), no. You need to get a form signed by the supervisor and the PHYS 396 course coordinator.

FAQs

- **What do I put in my CV?**
- Ans:
  - **Show, not tell**. Don't put "I'm a hard worker"
  - Any research skills, but also non-"research" skills and hobbies too. This might apply in particular for profs that do experiments and instrumentation, but some theorists too!
    - If you play a sport or a musical instrument, for example, that shows that you probably started out being bad at something, but then improved with time and effort.
    - If you build models as a hobby or repair gear or whatever, that shows that you have practice solving problems and are comfortable working with your hands.
    - Some profs want to know that you are a person with interests.

FAQs

- **Is it better to do a one-term project or a full–year one?**
- Ans:
  - Some projects are better-suited to a full year, others are OK for one-term. If you have the option, you can talk with the prof.
  - What program are you in?
    - Physics Majors: can count max 6 cr of research courses towards program complementary credits. Additional research courses are electives. Can do PHYS 459 (6cr) or 0-2 one-term research courses.
    - Honours Physics: Can do up to 9 cr of research for program credit (required+complementary).
    - Joint programs: Check your requirements. Additional credits would be elective.
    - You can always check with Kim to confirm.

FAQs

- **Is it better to do a project in the winter or the fall term?**
- Ans:
  - It doesn't matter in terms of the programs when you do a course.
  - Things to consider:
    - Grad school applications usually happen in the fall of the year you will graduate. Having some research by then is good (can be summer or course research)
    - Winter projects may run into the summer or Fall projects might continue from the summer (with adjustments to the project), providing you and the prof both want to continue.
    - Projects continuing into the summer or from the summer doesn't *have* to happen.

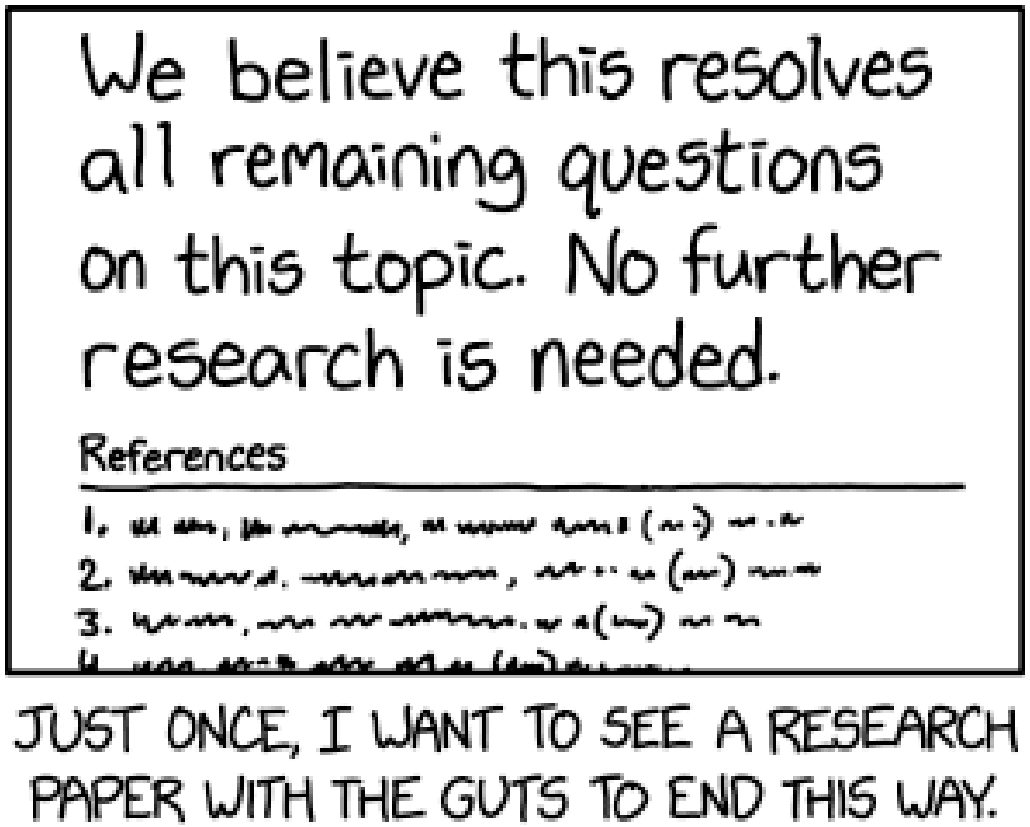
FAQs

- **What are professors looking for?**
- Ans:
  - Physics-related skills, and/or
  - Non-physics-related hobbies that demonstrate technical skills, and/or
  - Non-physics-related experience/hobbies that demonstrate important research traits such as:
    - Time management, problem solving, leadership, organization, responsibility, tenacity, etc.

Final thoughts

- Please remember that most profs want to hear from interested students, and most of them almost never bite!
- If the profs needs specific courses to be taken before you can reasonably work in their group, try again after taking those courses.
- It's totally OK if you don't know what you want to do – you can't know until you try something. That's how you learn what you're good at and what you like doing.
- Profs know you are a student and not an expert in their field. Most want to work with students who are interested, engaged, and show potential to learn.

Questions?



Xkcd comic #2268