

Medical Student Involvement in Research: Where do I begin?

A document by medical students for medical students

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Background

There is great opportunity for learning that can stem from medical students becoming involved in research, concurrent to their formal education. Moreover, an increasing proportion of medical students are entering medical school with previous research experience, often as a result of graduate or work experiences.¹ In light of this increasing opportunity for medical students to become involved in academia, studies have suggested strategies for students to become successful in attaining a research position.²

Simultaneously, there is an increasing complexity and diversity in medical research environments, likely as a result of the rise of multidisciplinary research teams and technological advancement.³ This provides students with the ability to match their interests with opportunities in a variety of fields, from wet lab work to research involving the history of medicine, public health and more!

Considering this increasing complexity, it is important to ensure that students who become involved in medical research receive acknowledgement for the efforts and continue to benefit from their involvement.

One strategy towards ensuring students enjoy and benefit from their involvement is to help them navigate the myriad of research opportunities. As with any job search, students may be faced with matching their research experiences and interests to the opportunities present at their institution. The purpose of this document is to provide students a framework for understanding how their interests, experiences, and goals can help them decide on the research “fit” that is best for them. For students with little to no research experience, this document also provides them with a basic approach on how to find out and learn more about research opportunities in the Queen’s Medicine community, apply for these opportunities with an academic CV, and what to expect when engaging with research supervisors for the first time.

Questions to Ask yourself

1. Do I want to work in a dry lab or a wet lab?

A *wet* lab is typically thought of as doing lab bench works or basic sciences research (sometimes known as “test-tube” or “petri-dish” research). This can include working with biological materials (ie. human patient samples), animals, drugs and chemicals. These projects typically require longer time commitments to enable training and experiments.

A *dry* lab typically involves research that is more computational or statistical in nature and can be conducted through a computer, surveys and interactions with the participants you are investigating, and other *dry* (i.e. not animal-based or “test-tube” based) activities. Research using data extracted from large databases (i.e., ISIS) also falls into this ‘dry’ lab category, and generally involves in-depth analysis of large datasets (human health data, health-care costs, emergency room wait times, etc.).

2. Do I enjoy quantitative or qualitative research?

Dry lab research can use a quantitative (case-control studies, prospective cohort studies, retrospective cohort studies, randomized control trials), qualitative (focus groups, interviews, some questionnaires), or mixed methods approach. *Wet* lab research is generally quantitative (i.e, given some experimental manipulation (ie. a drug administration) what is the change in protein or mRNA?)

Quantitative research is typically for those who desire to learn about or have experience with research that is structured around one or more research questions (hypotheses) through using quantitative techniques such as definitive measurements and statistical tests or analyses.

Qualitative research, on the other hand, is not necessarily structured to answer a research question or to test a hypothesis, but rather is used to elicit opinions, feelings, or perceptions through various qualitative techniques such as narrative or thematic analysis to tease out themes and ideas. These may be the basis of future hypothesis to be tested using quantitative methods. For example, conducting a survey of students’ thoughts on the process of applying to medical school would be a qualitative type of study, whereas a survey of student preferences for different medical school programs would be a quantitative study.

3. How much autonomy do I want?

While everyone desires their research to be impactful, there may be a trade-off that is worth noting. Often in larger multi-center studies (e.g. such as randomized control trials or large prospective cohort studies) students may have limited autonomy in research design due to the number of protocol requirements and co-investigators involved. However, these large studies can also provide beneficial learning experiences, as they are sometimes the cornerstone studies in a field of medicine that paved the way for changes in clinical practice.

In contrast, smaller studies may provide students with more autonomy over the research being conducted, and thus may enable more effective and hands-on learning in that regard. These types of projects may enable a medical student to take the lead as first-author on the study.

4. Do I want the capacity to work remotely?

Wet-lab studies will likely not provide you the opportunity to work remotely. Similarly, some dry lab studies involving patient data (such as case-control studies, cohort studies, and cross-sectional studies) may require the student to be on-site at designated computers. Randomized control trials in particular will often not have the ability to grant you remote access to patient data thus you may be limited in your capacity to work remotely.

In contrast, a meta-analysis or systematic review, or a case report/series will likely provide you with the opportunity to work remotely should you desire. Similarly, editorials, opinion pieces, and ideas also allow you to work wherever you wish.

5. Do I want to directly engage with human participants?

With randomized control trials, individuals delegated to interact with participants are usually pre-established thus your ability to do so will likely be limited. With case-control studies, retrospective cohort studies, cross-sectional studies, and case reports/series, there is likely limited opportunity for patient involvement given the retrospective or cross-sectional (i.e. “at one-point-in-time” designs).

Prospective cohort studies may provide you the opportunity to interact with participants. However, you may also be responsible for data collection from a chart review perspective. This would involve meticulously leafing through the paperwork or electronic medical records of individual patients for the information you want.

Qualitative studies are likely to provide you with the opportunity to engage with patients, if you are involved in data collection. This can be through delivering questionnaires in-person, conducting interviewing, or observing/moderating focus groups.

6. What experience do I bring to the table?

Certain types of research opportunities (animal research and basic sciences) often (not always) come with the expectation that students have prior experience and/or certifications relating to this area of research. This is because of the steep learning curve required for these types of research, and the limited amount of time that medical students generally have to devote to the project (ex/ over the course of the summer). Understandably, productivity during the summer months would be hindered if a substantial amount of time is spent gaining proficiency in a lab technique.

For other types of research, experience would be a bonus, but may not be required.

For editorials, ideas, and opinion pieces, and qualitative research, a non-science background (e.g. English, history, humanities) may be useful.

Some types of research do not require much prior experience. These include case reports, and surveys. This also includes systematic reviews and certain retrospective cohort studies, where it is possible for the student to learn study methodology independently.

7. What is my timeline for completing this project?

Randomized control trials typically take longer (potentially years) to complete. The time to completion of prospective cohort studies and qualitative studies depends on the study period of interest.

Case-control studies, retrospective cohort studies, cross-sectional studies, and case reports/series may be quite quick (relatively) to complete given how they all typically use retrospective data. Similarly, editorials, ideas, and opinion pieces will likely be quicker to complete.

Systematic reviews and meta-analyses may take longer to complete as a result of the volume of work, but this is largely dependent on how fast a student(s) works.

Animal research studies and basic science studies also typically take longer to conduct.

Editorial-type projects focused on the history of medicine, or current affairs in health sciences could be feasible in a short time, depending on one's journalistic abilities, such as efficiently gathering resources, reading, synthesizing ideas and writing concise and fluid essays.

Since medical students are usually constrained to summers or preclerkship to engage in research, it is important to be realistic when considering your time commitments and communicating this efficiently to supervisors so that the appropriateness of certain projects can be determined.

8. What are my goals in terms of authorship?

Randomized control trials and multicenter prospective cohort studies may have numerous co-investigators, reducing a student's authorship potential. That being said, these trials tend to be published in well-known peer reviewed journals, thus if a student does have the ability to be an author, it may provide them with a high level publication.

Case-control, cross-sectional, and retrospective cohort studies, in addition to meta-analyses, systematic reviews, and case reports/series may provide students the opportunity to be an author, and even a first-author, depending on the research team construction. Qualitative research studies may fit into this group as well.

Editorials, ideas, and opinion pieces often come with the expectation that the primary writer (likely the student) would be the first author.

9. Do I want to get creative or have specific tasks?

Student involvement in research can come with varying expectations. If the student is involved in the study design or manuscript writing phases, it may be possible for the student to take autonomy and get "creative" with regards to how the study is to be conducted, and how results are interpreted and written up. This could give students valuable experience.

However, some students prefer to have pre-established concrete “black and white” tasks to complete. These students may benefit from getting more involved in the data collection and analysis phases of research.

Of course, creativity and task-oriented efforts are not mutually exclusive. There may always be an opportunity to be creative in designing your own research question, conducting specific tasks to answer that question, and in writing a manuscript.

10. What kind of research team do I want to be a part of?

Some teams are small and provide students with a significant workload and/or autonomy. As a part of such a team, the student may have more direct mentorship from their supervisors and lab colleagues. For some students, this is preferable. Other teams are large and thus students can learn by interacting with these numerous individuals, but it may be more difficult to have one-on-one mentorship with the faculty lead.

What the composition of a research lab or team is should not be discounted as insignificant in terms of the student’s overall research experience.

Moreover, certain teams come with specific expertise – qualitative research, data informatics, public health, experience within a particular specialty – these should all be considered as the student may have interest in learning more about some of these individuals’ expertise.

11. Do I have unique interests/goals/experience?

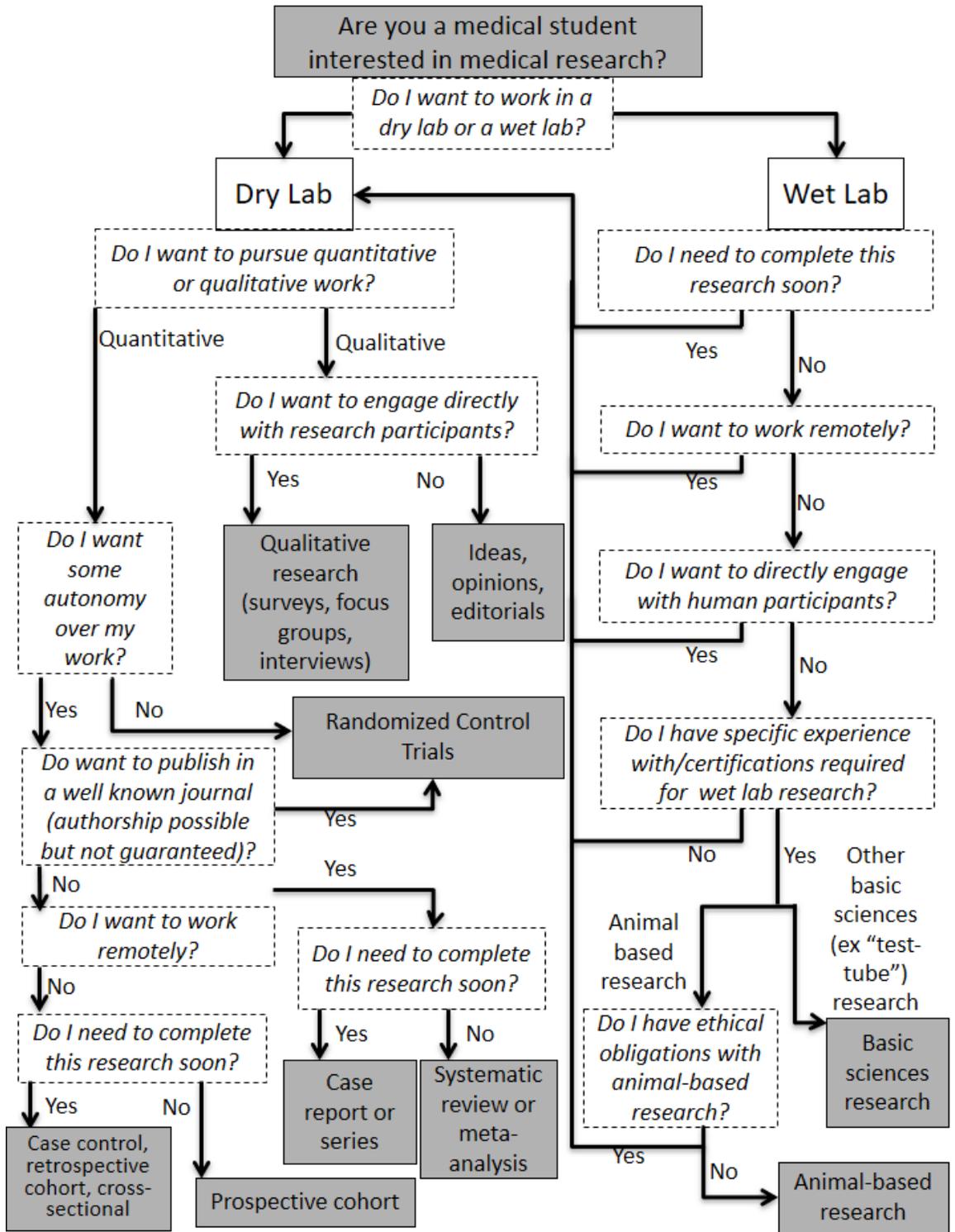
Certain students may choose to partake in other types of academia not listed above. The most notable of these are ideas, opinions, and editorials, which now often get published by academic research journals. Typically, a non-science background can be helpful if pursuing this type of work (e.g. English, history, humanities) but is not essential.

Key Questions by type of study

Note these questions are similar to those under FAQs and those that comprise the flow chart.

Question	Case-control, retrospective cohort, cross-sectional	Prospective cohort	Randomized control trial	Systematic review/meta-analysis	Case report/series	Qualitative (focus groups, interviews, surveys)	Ideas, opinions, editorials	Animal-based research	Other Basic sciences (“test-tube”) research
<i>Dry/ wet lab</i>	<i>Dry</i>	<i>Dry</i>	<i>Dry</i>	<i>Dry</i>	<i>Dry</i>	<i>Dry</i>	<i>Dry</i>	<i>Wet</i>	<i>Wet</i>
<i>Quantitative/ qualitative</i>	<i>Quantitative</i>	<i>Quantitative</i>	<i>Quantitative</i>	<i>Quantitative (elements of qualitative)</i>	<i>Quantitative</i>	<i>Qualitative</i>	<i>Qualitative</i>	<i>Quantitative</i>	<i>Quantitative</i>
<i>Student autonomy over work?</i>	<i>Possible</i>	<i>Possible</i>	<i>Unlikely</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Possible</i>	<i>Possible</i>
<i>Direct engagement with human participants?</i>	<i>None</i>	<i>Possible</i>	<i>None</i>	<i>None</i>	<i>None</i>	<i>Likely</i>	<i>None</i>	<i>None</i>	<i>None</i>
<i>Likelihood of authorship?</i>	<i>Likely</i>	<i>Likely</i>	<i>Possible</i>	<i>Likely</i>	<i>Likely</i>	<i>Likely</i>	<i>Very Likely</i>	<i>Likely</i>	<i>Likely</i>
<i>Likelihood of publishing in a well-known journal</i>	<i>Possible</i>	<i>Possible</i>	<i>Likely</i>	<i>Possible</i>	<i>Possible</i>	<i>Possible</i>	<i>Unlikely</i>	<i>Possible</i>	<i>Possible</i>
<i>Ability to work remotely</i>	<i>Possible</i>	<i>Possible</i>	<i>Unlikely</i>	<i>Likely</i>	<i>Likely</i>	<i>Possible</i>	<i>Likely</i>	<i>None</i>	<i>None</i>
<i>Timeline to completion</i>	<i>Medium</i>	<i>Long</i>	<i>Long</i>	<i>Medium</i>	<i>Short</i>	<i>Medium</i>	<i>Short</i>	<i>Long</i>	<i>Long</i>
<i>Need for prior experience/ certifications</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Unlikely</i>	<i>Likely</i>	<i>Likely</i>

Flow Chart



Tips when looking at scientist profiles

1. Look at the type of research in terms of area and study AND study type: To determine the study types they commonly use, you can go to their recent publications on PubMed. Once you know the study types they commonly use, the flow chart above is more useful.
2. Understand if they regularly accept students: Some researchers indicate this directly on their profile. For others, you may have to email to ask, or you can determine this based on the affiliations of co-authors on their recent publications.
3. Understand how involved their studies typically are: This can be inferred by the methods of recent publications.
4. Identify if they are part of a larger research group, or work independently: This can likely be determined from previous publications.
5. If they are a clinician, it would be nice to know how much of their time is protected for research: This information is unlikely available publically and you may have to infer this based on their research output.
6. If you get in touch with them, it may be helpful to ask to get in touch with past/current students who have worked with them.

Reading More about your Research of Interest

After compiling a list of research opportunities that you are interested in, it is helpful to read about them in greater detail to know whether they are suitable for you. For example, you may wish to know whether an investigator's research mainly involves wet lab research, which could require that you know certain lab techniques if you have never done them before, or retrospective chart review studies, which are more feasible for students to complete in a shorter period of time.

One quick way of learning more about investigators' research is by reading a few abstracts of papers that they have recently published. When looking up Queen's Faculty profiles on official Departmental websites, investigators will often have a list of "Selected Publications" in their research profile.

Here is an example list of Selected Publications taken from a Faculty Bio on the Queen's Department of Obstetrics & Gynaecology.



The screenshot shows the website for the Queen's University School of Medicine, Department of Obstetrics & Gynaecology. The page is for a faculty member named Romy Nitsch. Under the "Selected Publications" tab, there is a list of five research articles:

- Pham AT, Kives S, Merovitz L, Nitsch R, Tessier K, Yudin MH. Screening for bacterial vaginosis at the time of intrauterine contraceptive device insertion: is there a role? *J Obstet Gynaecol Can.* 2012 Feb;34(2):179-85.
- McKay DR, Fawzy HF, McKay KM, Nitsch R, Mahoney JL. Are chest compressions safe for the patient reconstructed with sternal plates? Evaluating the safety of cardiopulmonary resuscitation using a human cadaveric model. *J Cardiothorac Surg* 2010;Aug 18;5:64.
- Systonyuk S, Nitsch R, Wong H, Matthews J, Liu G, Niles J. Comparative cost analysis of total laparoscopic hysterectomy versus total abdominal hysterectomy. *The Journal of Minimally Invasive Gynecology* 2008 Nov;15(6),Suppl. 4S-5S.
- Lausman AY, Al-Yaseen E, Sam D, Nitsch R, Barrett JF, Chan WS. Intrahepatic cholestasis of pregnancy in women with a multiple pregnancy: an analysis of risks and pregnancy outcomes. *J Obstet Gynaecol Can* 2008 Nov;30(11):1008-13.
- Nitsch R. Disseminated leiomyomatosis and diffuse endometriosis following laparoscopic supracervical hysterectomies. *The Journal of Minimally Invasive Gynecology* 2005 Oct;12(5),Suppl. 106.
- Jung BP, Zhang G, Nitsch R, Trogadis J, Nag S, Eubanks JH. Differential expression of methyl CpG-binding domain containing factor MBD3 in the developing and adult rat brain. *J Neurobiol* 2003 May;55(2):220-32.

Below the list is a link: [All Departmental Publications](#)

For Faculty who do not have a list of "Selected Publications" available, you can search for articles by author on PubMed. This is done by entering the author's last name plus initials without punctuations in the search box. For example, if you were searching for articles by "Kevin Lee," you would enter "lee k"



The screenshot shows the PubMed search interface. The search box contains the text "lee k". The interface includes the NCBI logo, "Resources" and "How To" dropdown menus, a "Sign in to NCBI" link, and a "Help" link. The search box is labeled "PubMed" and "Advanced".

You may wish to read the abstracts of some of these publications by looking them up on PubMed. Abstracts provide useful information such as a study's general area of interest, and the study design used to carry out the research (RCT, case-control study, etc). If you are not yet familiar with different study designs used in clinical research, you will learn more about them in the *MEDS 112 (CARL)* course!

Preparing your CV

A *curriculum vitae*, or CV, is a comprehensive overview of a person's relevant qualifications and experience for a research opportunity. In academia, a CV highlights an individual's educational background, teaching experience, and research experience. While there are some similarities between a normal resume and an academic CV, there are some differences that are worth learning about if you have never written one for a research or academic position before.

An academic CV typically includes the following sections:

Educational Background

- Include any post-secondary education that you have attained

Relevant Experience

- Include any positions that highlight your skills and expertise pertaining to the research position you are applying for
- Even if you do not have previous research experience, you may also include any relevant Teaching experience, Professional experience, or Administration experience

Publications

- List bibliographic citations for any publications that you have co-authored and authored
- Publications do not necessarily have to be peer-reviewed papers; you can also include book chapters, articles, commentaries, research reports, etc. but this should be indicated.

Presentations (poster or oral)

- List any professional presentations that you have given, e.g. lectures or conference presentations

Honours and Awards

- Include any scholarships, fellowships, grants, certifications, and other honours and awards that you have received

Here is an example of what a simple CV could look like.

EG SAMPLE

123 Queen's Street East • Kingston, ON, A1A 1A1 • 613 575 1234 • egsample@qmed.ca

- EDUCATION** **QUEEN'S UNIVERSITY**, Kingston, ON
Doctor of Medicine, September 2018 – Present
- UNVIERSITY OF TORONTO**, Toronto, ON
Bachelor of Science, September 2014 – June 2018
- RELEVANT EXPEREINCE** **The Hospital for Sick Children**, Toronto, ON
Research Assistant, May 2016 – August 2018
Principal Investigator: Dr. Sabrina Brown
- Investigated the effects of chronic exposure to second-hand smoking on long-term lung function
 - Contributed to various projects through data collection, data analysis, and bio-specimen processing
- The Michener Institute for Applied Sciences**, Toronto, ON
Teaching Assistant, September 2016 – April 2018
- Delivered tutorial sessions to undergraduate students in small-group format
 - Planned and managed hands-on laboratory sessions
- PUBLICATIONS** **Sample, E.**, Desrochers, X., Colins, F., and Wu, J. (2017). Long-term pulmonary function follow-up of children exposed to second-hand smoke. *American Journal of Respiratory and Critical Care Medicine*
- PRESENTATIONS** **Sample, E.** (2017). The link between household smoking cessation and improved pulmonary function. *Canadian Thoracic Society Annual Conference 2017*.
- HONOURS AND AWARDS** **DEAN'S MULTIDISCIPLINARY UNDEGRADUATE RESEARCH LIST**
University of Toronto, 2018
- Awarded to undergraduate students who have participated in substantial and broad undergraduate research.
- LIFE SCIENCE TEACHING AWARD**
University of Toronto, 2018
- Awarded to undergraduate teaching assistants who have demonstrated substantial commitment and efforts to improving undergraduate education

Note that this is different from how you would format a CV for your CaRMS application!
What should I include on my CV if I don't have any previous research experience?

While having previous research experience will certainly make your academic CV stronger, not having experience should not prevent you from seeking opportunities and developing your research skills while you're in medical school! Research emphasizes skills such as problem solving, ability to work independently, and time management. These are all skills that you could have acquired from other previous work experience, which you may wish to include in your CV. Likewise, even if you have never published in a peer-reviewed journal, you may wish to include any publication experience you have with editorials, journal articles, commentaries, etc.

Reaching Out to Investigators

There are different ways you can reach out to investigators to express your interest in a research position. Some researchers require a more formal avenue, such as when the position is linked to a formal studentship application. If this is the case, make sure you read the instructions on both the studentship application and the researcher's profile webpage. Other ways of reaching out include sending emails, calling, or in person.

MEdTech also features a Research Match community, which provides a platform for students to connect with investigators at Queen's University who have research opportunities available for Queen's medical students. To access the opportunities page, join the "Research-Match-UGME" community on MEdTech, and then check the following link:

https://meds.queensu.ca/central/community/research_match_ugme

Even though it sounds obvious, make sure you know the proper way to address the investigator (ex: Prof, or Dr?), and their gender. When emailing, include the following:

1. Brief self introduction-your name, year and school, purpose of email (summer research or during school year? Clinical or basic science research?)
2. Your interests and how they align to the investigator's interests
3. Your experiences or skills and how they make you an asset to the investigator
4. Method to contact you.
5. Your Academic CV

Sample Email

Dear Dr. Investigator,

My name is XXXI am a first year medical student at Queen's looking for a summer clinical research project in XXX. I am fascinated by your research on XXX and with a background in clinical research on XXX, I believe I am a suitable candidate.

More specifically, I conducted clinical research (20XX-20XX), specifically a retrospective study on XXX and completed a project identifying genetic variants correlated with changes in response to XXX. Prior to this, I completed my undergraduate thesis and master's thesis in cancer and genetic disease with the pathology department at the University of XXX.

My CV is attached; I hope you consider me for any suitable projects.

*Thank you,
XXX (XXX@queensu.ca, 999-999-9999)*

Guidelines for Following Up

If you receive a favourable response from an investigator inviting to speak with you further regarding your interests, make sure to prepare the following:

1. Read the abstracts of their latest relevant publication(s), most impactful publications, and publications in areas you are particularly interested in. Your investigator may be included as a co-author in many publications and it may be daunting to select the relevant papers to read. Generally, look for first author and last author publications in areas that match their description of "areas of interest".
2. Read at least one manuscript from beginning to end. This can help you have an understanding of the methodology involved in the research, and how you can fit in.
3. Read your own CV, and think back on any experiences and examples that demonstrate your interest and any useful skills or insights
4. Brainstorm for any new avenues of research. From doing the above, if there are any new ideas that the investigator has not evaluated yet, make note of it and think about how it can be carried about. This can show your interest, originality, and understanding of the research you are trying to pursue.

What to expect during the first meeting

Often the researcher will ask you for a brief self-introduction and for you to talk about your interests. Sometimes, the investigator already has an idea of what project(s) to put you on. Other times, it is more vague and you are expected to come up with something suitable. You may be questioned on your understanding of certain relevant aspects of their research.

Funding

Funding for research can come from many sources, with application times that may come before or after securing an interested investigator.

1. Hospital awards. Many large academic hospitals will advertise funded summer research positions. These are generally extremely competitive and have a rigorous application process. Due dates can start as early as December. Check the individual hospital websites for details.
2. Your home university. Queen's university offers its own studentships for the summer. Please check the website for more details:
<https://meds.queensu.ca/academics/undergraduate/current-students/summer-studentships/school-medicine-summer-studentships>
3. Your supervisor. Some supervisors are willing to pay you a research stipend.

References

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3. Getz KA, Campo RA. Trial watch: Trends in clinical trial design complexity. *Nat Rev Drug Discov*. 2017;16(5):307.